United States
Environmental Protection
Agency

Office of Water
(4607)

EPA 815-R-99-016
April 1999

EPA

Guidance Manual for Conducting Sanitary Surveys of Public Water Systems; Surface Water and Ground Water Under the Direct Influence (GWUDI) of Surface Water

CONTENTS

DISCLAIMER

This manual provides guidance on how to conduct a sanitary survey of surface water and ground water under the direct influence (GWUDI) of surface water drinking water systems. The U.S. Environmental Protection Agency believes that a comprehensive sanitary survey is an important element in helping water systems protect public health.

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ACKNOWLEDGMENTS

The Environmental Protection Agency gratefully acknowledges the assistance of the members of the Microbial and Disinfection Byproducts Federal Advisory Committee and Technical Work Group for their comments and suggestions to improve this document. EPA also wishes to thank the representatives of drinking water utilities, researchers, and the American Water Works Association for their review and comment. Finally, the Agency would like to recognize the following individuals for their contribution to this guidance manual:

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FIGURES

TABLES

ACRONYMS

ANSI/NSF	American National Standards Institute/National Sanitary Foundation
ASME	American Society of Mechanical Engineers
AWWA	American Water Works Association
CCP	Composite Correction Program
CFR	Code of Federal Regulations
CPE	Comprehensive Performance Evaluation
CT	Concentration of Residual Disinfectant multiplied by Time of Water Contact (Detention Time)
CTA	Comprehensive Technical Assistance
D/DBP	Disinfectants/Disinfection Byproducts
DHS	Department of Health Services
EPA	Environmental Protection Agency
GAC	Granular Activated Carbon
GIS	Geographic Information System
GLUMRB	Great Lakes Upper Mississippi River Board
GREP	Generally Recommended Engineering Practice
GWR	Ground Water Rule
HAA	Haloacetic Acids
IESWTR	Interim Enhanced Surface Water Treatment Rule
MCL	Maximum Contaminant Level
M-DBP	Microbial-Disinfectants/Disinfection Byproducts
NODA	Notice of Data Availability
NSF	National Sanitation Foundation
O&M	Operation and Maintenance
SDWA	Safe Drinking Water Act
SWTR	Surface Water Treatment Rule
TCR	Total Coliform Rule
TDT	Theoretical Detention Time
THM	Trihalomethane
TTHM	Total Trihalomethane
TNRCC	Texas Natural Resource Conservation Commission
UFTREEO	University of Florida Training, Research, and Education for Environmental Occupations
USGS	United States Geological Survey
VOC	Volatile Organic Contaminant
WFI	Water Facilities Inventory
WHPA	Wellhead Protection Area

1. INTRODUCTION

1.1 Objective of this Manual

This manual provides guidance on how to conduct a sanitary survey of surface water and ground water under the direct influence (GWUDI) of surface water drinking water systems. A comprehensive sanitary survey is an important element in helping water systems protect public health. Sanitary surveys are carried out to evaluate: (1) the capability of a drinking water system to consistently and reliably deliver an adequate quality and quantity of safe drinking water to the consumer, and (2) the system's compliance with federal drinking water regulations. Much of the information generated by a sanitary survey helps identify existing and potential sanitary risks. This guidance manual will identify **assessment criteria** to be evaluated for sanitary risks. The manual also describes how to identify **significant deficiencies** that represent an imminent health risk and require immediate correction.

This manual is intended to help state agencies improve their sanitary survey programs where needed and to help ensure consistency in how surveys are conducted and documented across state sanitary survey programs. In addition, owners and operators of public water systems may find the information useful in the operation and management of their drinking water systems and their sources. The U.S. Environmental Protection Agency (EPA) has promulgated specific sanitary survey requirements in the Total Coliform Rule (TCR) and the Interim Enhanced Surface Water Treatment Rule (IESWTR) and is considering expanding those requirements under future regulatory efforts (e.g., the Ground Water Rule).

The overall structure of the guidance manual centers around the four principal stages of a sanitary survey: (1) planning a sanitary survey; (2) conducting the onsite survey; (3) compiling a sanitary survey report; and (4) performing follow-up activities including responding to a sanitary survey. The manual is organized as follows:

- **Chapter 1 – Introduction.** This chapter provides information about the objective and regulatory context of this manual, as well as other sanitary survey background information.
- **Chapter 2 – Planning the Survey.** This chapter discusses the preparatory steps to be taken by inspectors before conducting the onsite portion of the survey.
- **Chapter 3 – Conducting the Survey.** This chapter discusses each of the elements of a sanitary survey as listed in *the 1995 EPA/State Joint Guidance on Sanitary Surveys* and IESWTR requirements. The chapter explains each element's importance to the effectiveness of the sanitary survey and presents general guidelines (assessment criteria) for evaluating important components of each element. Discussions within each element identify the components of high priority that may be considered significant deficiencies.

- **Chapter 4 – Compiling the Survey Report.** This chapter presents guidelines for preparing the sanitary survey report, maintaining adequate documentation, categorizing findings on deficiencies, addressing corrective action, and determining outstanding performance.
- **Chapter 5 – Report Review and Response.** This chapter provides information on follow-up activities for the system operator and the inspector/ inspecting agency (e.g., the state).

1.2 Background

In the preamble to the IESWTR, a sanitary survey is defined as:

> *"an onsite review of the water source (identifying sources of contamination using results of source water assessments where available), facilities, equipment, operation, maintenance and monitoring compliance of a public water system to evaluate the adequacy of the system, its sources and operations and the distribution of safe drinking water."*

Conducting sanitary surveys on a routine basis is an important element in preventing contamination of drinking water supplies. EPA recognizes the importance of sound sanitary surveys in helping water systems protect public health. Sanitary surveys are an opportunity to work and communicate with water systems in a preventative mode.

As stated in the December *1995 EPA/State Joint Guidance on Sanitary Surveys,* the primary purpose of a sanitary survey is: "to evaluate and document the capabilities of the water system's sources, treatment, storage, distribution network, operation and maintenance, and overall management to continually provide safe drinking water and to identify any deficiencies that may adversely impact a public water system's ability to provide a safe, reliable water supply." In addition, the joint guidance notes that sanitary surveys provide an opportunity for state drinking water officials or approved third party inspectors to establish a field presence at the water system and educate the operators about proper monitoring and sampling procedures, provide technical assistance, and inform them of any upcoming changes in regulations. Sanitary surveys also aid in the process of evaluating a public water system's progress in complying with federal and state regulations which require the improvement of the capabilities of the system to provide safe drinking water. Sanitary surveys provide the water system with technical and management information regarding the operation of the system from the water source, through the treatment facilities and the distribution system.

This draft guidance manual provides additional information about planning for, conducting, and reporting the results of a sanitary survey. As stated in the December *1995 EPA/State Joint Guidance on Sanitary Surveys*, EPA recommends that states work with EPA Regions in using sanitary survey guidance to improve their sanitary survey programs while still addressing the problems and issues specific to the state.

1.3 Regulatory Context

Under 40 CFR 142.10(b)(2), as a condition of state primacy, states are required to have "a systematic program for conducting sanitary surveys of public water systems in the State, with priority given to sanitary surveys of public water systems not in compliance with State primary drinking water regulations." Currently, the TCR requires a water system to periodically undergo a sanitary survey for all systems that collect less than five routine total coliform samples per month. Additionally, the Surface Water Treatment Rule (SWTR) requires an annual onsite inspection for surface water systems that do not filter (40 CFR 141.71(b)(3)). The IESWTR further elaborates on the sanitary survey requirements for all surface water and GWUDI of surface water systems.

1.3.1 Total Coliform Rule

The first regulatory requirement for the states to have a periodic onsite sanitary survey appeared in the final TCR (54 FR 27544-27568, 29 June 1989). This rule requires all systems that collect fewer than five routine total coliform samples each month to undergo such surveys. These sanitary surveys must be conducted by the state or an agent approved by the state. Community water systems were to have had the first sanitary survey conducted by June 29, 1994 and an additional survey conducted every five years thereafter. Non-community water systems are to have the first sanitary survey conducted by June 29, 1999, and an additional survey conducted every five years thereafter unless the system is served by a protected and disinfected ground water supply, in which case, a survey may be conducted every 10 years. (40 CFR 141.21(d))

As stated in the preamble to the IESWTR:

> *"EPA notes that it will consider sanitary surveys that meet IESWTR requirements to also meet the requirements for sanitary surveys under the TCR, since the definition of a sanitary survey under the IESWTR is broader than that for the TCR (i.e., a survey as defined under the IESWTR includes all the elements of a sanitary survey as required under the TCR). Moreover, with regard to TCR sanitary survey frequency, the IESWTR requires that surveys be conducted at least as frequently, or, in some cases, possibly more often than required under the TCR."*

1.3.2 Surface Water Treatment Rule

The SWTR does not specifically require water systems to undergo a sanitary survey. Instead, it requires that unfiltered water systems, as one criteria to remain unfiltered, have an annual onsite inspection to assess the system's watershed control program and disinfection treatment processes. The onsite survey must be conducted by the state or a party approved by the state.

This onsite survey is not a substitute for a more comprehensive sanitary survey but the information can be used to supplement a full sanitary survey. The elements of the onsite survey include:

- A review of the effectiveness of the watershed control program;
- A review of the physical condition of the source intake and how well the intake is protected;
- A review of the system's equipment maintenance program to ensure a low probability for failure of disinfection processes;
- An inspection of disinfection equipment for physical deterioration;
- A review of operating procedures;
- A review of data records to ensure that all tests are being properly conducted and recorded and that disinfection is effectively practiced; and
- Identification of any improvements that are needed in equipment, system maintenance and operation, or data collection.

As a supplement to the SWTR, EPA published a guidance document entitled *Guidance Manual for Compliance with the Filtration and Disinfection Requirements for Public Water Systems Using Surface Water Sources*, in 1991. Appendix K of the guidance suggests that in addition to the annual onsite inspection, a sanitary survey be conducted every three years for systems serving 4,100 people or less and every five years for systems serving more than 4,100 people for both filtered and unfiltered systems. According to the appendix, this time period is suggested "since the time and effort needed to conduct the comprehensive survey makes it impractical for it to be conducted annually."

1.3.3 Interim Enhanced Surface Water Treatment Rule

The IESWTR requires that a sanitary survey address each of the eight elements listed in the 1995 EPA/State joint guidance. These eight elements are source; treatment; distribution system; finished water storage; pumps, pump facilities, and controls; monitoring and reporting and data verification; system management and operation; and operator compliance with state requirements.

Under the preamble to the IESWTR:

> *"The State must complete sanitary surveys for all surface water systems (including ground water under the direct influence of surface water) no less frequently than every three years for community systems and no less frequently than every five years for non-community systems. The State may "grandfather" sanitary surveys conducted after December 1995 for the first set of required sanitary surveys if the surveys address the eight survey components of the 1995 EPA/State guidance. The rule also provides that for community systems determined by the State to have outstanding performance based on prior sanitary surveys, successive*

sanitary surveys may be conducted no less frequently than every five years. In its primacy application, the State must include: 1) how it will decide whether a system has outstanding performance and is thus eligible for sanitary surveys at a reduced frequency, and 2) how it will decide whether a deficiency identified during a survey is significant.

In the IESWTR, a sanitary survey is defined as an onsite review of the water source (identifying sources of contamination using results of source water assessments where available), facilities, equipment, operation, maintenance, and monitoring compliance of a public water system to evaluate the adequacy of the system, its sources and operations and the distribution of safe drinking water.

Components of a sanitary survey may be completed as part of a staged or phased State review process within the established frequency interval set forth below. A sanitary survey must address each of the eight elements of the December 1995 EPA/State Guidance on Sanitary Surveys including: source; treatment; distribution system; finished water storage; pumps, pump facilities, and controls; monitoring and reporting, and data verification; system management and operation; operator compliance with State requirements. In addition, sanitary surveys include review of disinfection profiles for systems required to comply with disinfection benchmarking requirements....

States must have the appropriate rules or other authority to assure that facilities take the steps necessary to address any significant deficiencies identified in the survey report that are within the control of the public water system and its governing body. A State must also, as part of its primary [primacy] application, include how it will decide: 1) whether a system has outstanding performance and is thus eligible for sanitary surveys at a reduced frequency, and 2) whether a deficiency identified during a survey is significant for the purposes of this rule. In addition, a State must have appropriate rules or other authority to ensure that a public water system responds to significant deficiencies outlined in a sanitary survey report within 45 days of receipt of the report, indicating how and on what schedule the system will address significant deficiencies noted in the survey."

Table 1-1 indicates the required frequency for conducting sanitary surveys under the IESWTR.

Table 1-1. Sanitary Survey Frequency for Public Water Systems under the IESWTR

System Type	Minimum Frequency of Surveys
Noncommunity Water System	Every 5 years
Community Water System	Every 3 years
Community Water System with Outstanding Performance Based on Prior Sanitary Surveys	Every 5 years

1.4 EPA/State Joint Guidance on Sanitary Surveys

EPA and the states (through the Association of State Drinking Water Administrators) have issued a joint guidance on sanitary surveys entitled *EPA/State Joint Guidance on Sanitary Surveys*. The guidance outlines the following elements as integral components of a sanitary survey:

- Source (Protection, Physical Components and Condition)
- Treatment
- Distribution System
- Finished Water Storage
- Pumps/Pump Facilities and Controls
- Monitoring/Reporting/Data Verification
- Water System Management/Operations
- Operator Compliance with State Requirements.

The IESWTR requires that sanitary surveys address all of the eight elements of the EPA/state joint guidance. These elements are described in Chapter 3.

1.5 Rationale for Sanitary Surveys

1.5.1 Goal of a Sanitary Survey

As stated earlier, sanitary surveys are a means by which a comprehensive inspection of the entire water delivery system and its operations and maintenance (O&M) can be performed. These surveys are structured to determine whether a system's source, facilities, equipment, operation, maintenance, and management are effective in producing safe drinking water. Sanitary surveys also evaluate a system's compliance with federal drinking water regulations, as well as state regulations and operational requirements. In addition, a sanitary survey evaluates water quality data and administrative issues and draws conclusions about the system's integrity and its capability for consistently and reliably delivering an adequate supply of safe drinking water to consumers. Conducting sanitary surveys on a regular basis is the best means of identifying potential problems and possible reasons for trends in finished water quality and demand that may need to be addressed by enhanced O&M or a system upgrade. Sanitary surveys play a fundamental role in ensuring that reliable and safe drinking water is provided to the public by public water systems.

1.5.2 Benefits of a Sanitary Survey

EPA believes that periodic sanitary surveys, along with appropriate corrective measures, are indispensable for assuring the long-term quality and safety of drinking water. Properly conducted sanitary surveys help public water systems protect public health. Sanitary surveys have many benefits for the operation and management of public water systems. Sanitary surveys may also provide support to enforcement actions by establishing a record of conditions and operations at a point in time.

The *1995 EPA/State Joint Guidance on Sanitary Surveys* lists the following specific benefits of conducting sanitary surveys:

- Operator education;
- Source protection;
- Risk evaluation;
- Technical assistance and training;
- Independent, third party system review;
- Information for monitoring waiver programs;
- Identification of factors limiting a system's ability to continually provide safe drinking water;
- Reduction of monitoring requirements;
- Reduction of formal enforcement actions in favor of more informal action;
- Reduction of oversight by state monitoring and enforcement personnel;
- Increased communication between state drinking water personnel and public water system operators;
- Provision of contact personnel to notify in case of emergencies or for technical assistance;
- Improvement of system compliance with state drinking water regulations;
- Identification of candidate systems for enforcement action;
- Identification of candidates for Comprehensive Performance Evaluations;
- Verification of data validity;
- Validation of test equipment and procedures;
- Reduced risk of waterborne disease outbreaks;

- Encouragement of disaster response planning; and
- Improved system security.

2. PLANNING THE SURVEY

This chapter describes some basic activities that the inspector should accomplish before conducting the onsite portion of the survey. These activities help the inspector determine what areas to focus on and how to divide up the limited time during the onsite inspection. Once onsite, the inspector may identify other priority areas that need more attention. If so, the inspector should then adjust the onsite schedule accordingly.

Prior to initiating other activities for a survey, an inspector should review the previous sanitary survey report and other relevant records to determine if a system has an outstanding performance designation. Since this designation affects the required frequency for a survey, it may impact whether that system will be inspected at the current time. When a system is being inspected, a review of the water system's file should be conducted to obtain pertinent information about the physical facility and water quality data before the actual site visit. Information that should be collected includes: the treatment process(es) in place, monitoring requirements, the compliance history of the facility, and the condition of the system during the previous sanitary survey. This information is used to compile a list of questions/assessment criteria for the onsite inspection. Familiarity with federal and state requirements (e.g., operational requirements, operator certification, design standards) can assist the inspector in preparing for the sanitary survey.

This chapter also includes a list of equipment which the inspector should take to the onsite inspection. A list of persons to contact before the inspection is provided with some suggestions for the types of topics to be discussed. The chapter concludes with an overview of the onsite inspection process.

2.1 Determination of Outstanding Performance

Community water systems that are classified as having outstanding performance are eligible for having sanitary surveys conducted less frequently than other community systems. Under the IESWTR, community water systems must have a sanitary survey performed by the state at least once every three years, unless the system has outstanding performance. If the state determines that a community system has outstanding performance, it must be surveyed at least once every five years.

Each state, as part of its application for primacy, is required to develop a means for determining whether a system has outstanding performance. A state should have defined outstanding performance and established certain specifications for determining outstanding performance. To determine if a system has outstanding performance, the inspector should review the report from the system's previous sanitary survey to see if the system was considered to have outstanding performance then. If the state includes information on outstanding performance designations in a tracking database, the inspector should check the system's listing in the database. The inspector should also examine the state's records on the facility collected since the last sanitary survey. The records of interest will depend upon the state's criteria for outstanding performance but may include: monitoring data, violation records, and notifications of changes to the physical facility or the operator personnel. This information will help the inspector to determine if there are any changes in performance since the previous survey that indicate the system no longer satisfies the state's definition of outstanding performance.

2.2 Review of Pertinent Files on Physical Facilities

Office files and files provided by the water system owner and operator will provide insight into the design, construction, operation, maintenance, management, and compliance status of the facility. The sanitary survey inspector should thoroughly review all pertinent documents before the onsite inspection in order to fully understand the site-specific issues. The following subsections describe important types of documentation which the inspector should review if possible. While not all-inclusive, the following subsections discuss significant types of information often available. Information to review includes:

- Previous sanitary survey reports;
- Water system plans;
- Water system schematic/layout maps;
- Project reports;
- Construction documents;
- Water source information; and
- Source protection information.

If available, cross connection control plans should also be reviewed.

2.2.1 Previous Sanitary Survey Reports

Previous sanitary survey reports provide valuable information on the system's history and compliance status. The sanitary survey report includes a record of system treatment processes, operations, and personnel and their compliance with SDWA requirements. Significant deficiencies identified in the previous sanitary survey indicate some of the areas the sanitary survey inspector should focus on during the inspection to determine if they have been corrected and have not become problem areas again. Review of several previous sanitary survey reports may reveal a pattern of noncompliance in certain aspects of the system. If so, the inspector should pay particular attention to these areas during the onsite inspection and ask appropriate personnel about these problems and how they are being addressed.

2.2.2 Water System Plans

Some states may require water systems to develop and maintain comprehensive plans describing the operations, financing, and planned improvements for the system. The level of detail in the plans depends on the size, complexity, past performance, and use of the water system.

The water system plans may include a description of the following items:

- A description of the water system;
- Basic planning data including population served, service connections, and land use and development;
- System analysis including design standards, water quality data, and a system inventory description;
- Water source analysis including water use data, water demand forecasts, a conservation program, source of supply analysis, water shortage response plan, water rights analysis, and water supply reliability analysis;
- A description of source protection measures;
- Monitoring plans;
- A description of the facility operation and maintenance program;
- An emergency response/preparedness plan;
- A description of capital improvements planned for the system; and
- Financial information, including demonstration of financial viability.

The water system plans should be reviewed by the inspector in advance of the sanitary survey. Review of these plans will assist the inspector planning for the survey to identify those portions of the system which require special attention during the survey. The state may require reports from water systems identifying the progress made in developing their water system plans. Water systems may also have to transmit their water system plans to adjacent utilities, and local governments having jurisdiction to assess consistency with ongoing and adopted planning efforts. These plans may require periodic update, depending upon the state regulations.

2.2.3 Water System Schematic/Layout Maps

A schematic or layout map of the public water system will enable the inspector to obtain a quick understanding of the complete drinking water system. If possible, prior to the site visit, the inspector should obtain a schematic or layout drawings of the portions of the facility that will be evaluated during the survey. The schematic or layout map should start at the source and continue through the treatment facilities and storage facilities to the distribution system.

The primary purpose of the schematic or layout map is to help the inspector quickly understand the basic operation of the system. Therefore, it should be drawn in enough detail to facilitate the inspector's understanding. A schematic typically provides general information on the basic system components and the direction of water flow in the system. Water system schematics should include an identification of source water supply facilities (e.g., source water body and intake, or well; pumping station; transmission line), the treatment plant, any booster plants, finished water storage (e.g., clearwells, elevated and ground storage tanks, pressure zones), the entrance to the distribution system, any associated facilities (e.g., pumping stations), and any interconnections with other public water systems. A schematic of a typical public water system is provided in Figure 2-1.

Layout maps are more detailed than schematics and contain more specific information on the location and orientation of physical facilities. In collecting the layout data, an inspector may easily obtain the latitude and longitude data of a public water system by using portable Geographic Positioning System (GPS) equipment. A water system may have separate layout maps for its treatment plant and distribution system.

For identification purposes, the name and identification number of the public water system, as well as the date of the sketch, should be included on each schematic and layout map. The dated schematics and layout maps will help future inspectors identify water system changes. The schematic and/or map should be current and reflect any changes that have been made since initial construction of the system and since the last sanitary survey.

Suggested criteria for assessing treatment plant schematic or layout map(s):

1. **Does the drawing(s) show the name of the facility and date of the last modification made to the drawing(s)?**

   This will help future inspectors know between which two sanitary surveys modifications took place. Taken together, a chronological set of schematics will help document a system's history.

2. **Does the schematic or map(s) contain a legend that explains key symbols used in the drawing(s)? Is there a numerical or a graph scale on the layout map?**

   With the aid of a legend, the inspector will get a better idea about the location of principal treatment units and appurtenant equipment. The drawing with its legend will provide the inspector with information useful for determining where to start and end the inspection, as well as areas that the inspector should focus on and inspect in particular detail.

3. **Does the schematic or map(s) identify source water type(s)?**

   Many treatment plants draw raw water from different sources (ponds, rivers, lakes, springs, and ground water). Some treatment plants use ground water to supplement scarce surface water during the summer season or occasionally during a dry year. Highly variable raw water quality greatly impacts treatment requirements and processes.

4. **Are influent, effluent, and residual disposal points clearly shown on the drawing(s)?**

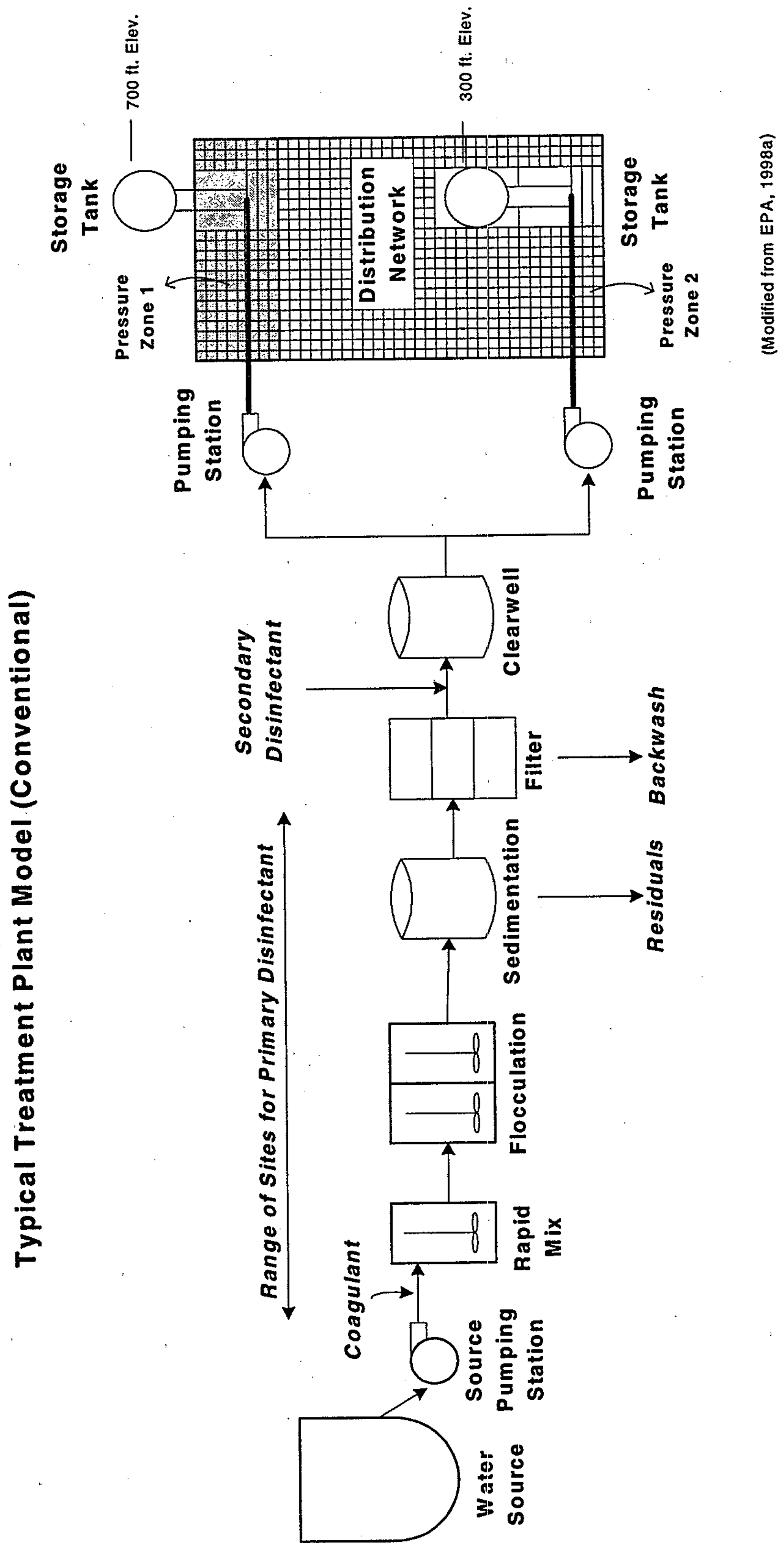

Figure 2-1. Schematic of a Typical Public Water System

If these points are not shown on the schematic or the layout map during the onsite inspection, the inspector should add sketches for these points to the drawing(s) or use a separate sheet and have inspection comments adjacent to the sketches.

5. **Does the schematic or map(s) show all the elements of the water system, from source facilities to the distribution system? Does the schematic or map(s) reflect the actual water system?**

   The inspector should review the schematic or map(s) to verify that all elements of the treatment system are shown and the drawings are complete. During the onsite inspection, the inspector should compare the drawings to the actual system layout to assess the accuracy of the drawings. Some systems do not update their maps to reflect system modification or have incomplete drawings, limiting their usefulness.

2.2.4 Project Reports

The water system may need to submit project reports to the state for approval before any change in equipment, chemical treatment, or operation, or installation or construction of any new water system, water system extension, or improvement, or when requested.

A project report should demonstrate consistency with the state design requirements for water systems and should include:

- A **project description**—Why the project is being proposed, how problems are to be addressed, the relationship of the project to other system components, and the impact of the project on system capacity and ability to serve customers. In some states a project description should contain "a statement of determination" related to the state environmental policy act, and include source development information and type of treatment;
- **Planning data**—General project background with population and water demand forecasts, how the project will impact neighboring water systems, construction schedule, estimated capital and annual operating costs;
- An **analysis of alternatives**—Description of options and the rationale for selecting the proposed option;
- A **review of water quality**—How water quality relates to the purpose of the proposed project, including analytical results of raw water and finished water quality;
- A **review of water quantity**—Applicable water rights as they relate to the project;
- **Engineering calculations**—Sizing justification, hydraulic analyses, physical capacity analyses, and other relevant technical considerations necessary to support the project; and

- **Design and construction standards**—Performance standards, construction materials and methods, and sizing criteria.

The inspector should review any available project reports for proposed, ongoing, and recently completed projects at the water system. These reports may describe upcoming activities that are already planned and may address some of the problems the inspector finds during the sanitary survey.

2.2.5 Construction Documents

Water systems typically are required to submit the construction documents to the state for approval prior to installation of any new water system, or any significant modification to an existing water system (e.g., change in treatment or water system extension or improvement). At the completion of construction, the water system may be required to submit an as-built or record set of the construction drawings and a certificate of completion.

Construction documents should be consistent with state required design standards and may include:

- Drawings, such as detailed drawings for each project component;
- Material specifications;
- Construction specifications, including a list of detailed construction specifications and assembly techniques for the project;
- As-built construction drawings with the latest updates on all significant modifications;
- Testing criteria and procedures;
- Disinfection procedures; and
- Inspection provisions.

The inspector should obtain and review construction documents, including for all significant modifications to the water system. These documents will provide the inspector with a description of how the system should exist, and will assist the inspector in locating components of the system.

2.2.6 Water Source Information

A water system seeking source approval may need to provide the state with sufficient documentation, in a project report or in supplemental documents, for demonstrating the feasibility of using the water source. These materials may show that:

- The source is reasonable and feasible, when compared with alternatives, based upon preliminary cost estimates of construction, conservation, vulnerability to contamination, and operation and maintenance costs;

- The system has adequate water rights sufficient to meet maximum daily demand without exceeding the maximum instantaneous or annual withdrawal limits specified by the water right;
- The source is physically and reliably available in the necessary quantities;
- Whether ground water is under the direct influence of surface water; and
- The source meets water quality criteria as required by the state.

The documentation may include: construction documents for the water intake or well (e.g., the driller's log); a copy of the water right or other written evidence of the existence of the right; a map showing the intake or well location and the vicinity; a map depicting topography around the source, and distances to the intake or well from property boundaries, buildings, potential sources of contamination, ditches, drainage patterns, and any other natural or man-made features affecting the quality or quantity of water. The system's water source information will provide the inspector with a preliminary assessment of the potential for contamination of the source. This information can be verified by the inspector during the onsite inspection, discussions with the operator(s), and document review.

2.2.7 Source Protection Information

The system may have prepared a plan to control sources of pollutants before they reach the source water under Source Water Assessment and Protection Programs (SWAP and SWPP), the Wellhead Protection Program (WHPP), and the Watershed Control Program.

The 1996 Amendments to the Safe Drinking Water Act (SDWA) expanded information gathered on source water to include systems using surface water sources. Under Section 1453 of the SDWA, states are required to develop and implement Source Water Assessment Programs (SWAPs). The SWAP must:

- Delineate the source water areas for all public water systems in the state,
- Identify the potential sources of contaminants within the areas, and
- Determine the susceptibility of the water systems to the contaminants.

In creating SWAPs, states should use information and analyses from previous related efforts such as developing Wellhead Protection Programs.

State SWAPs are intended to serve as a basis for developing, implementing, and improving source water protection efforts in source water protection areas and to encourage the development and implementation of local Source Water Protection Programs (SWPPs). Water systems may develop and implement SWPPs to protect the drinking water in a protection area. A local SWPP often incorporates the SWAP elements and adds the steps of developing a local team, monitoring source water quality, implementing management measures for sources of contamination, and planning for contingencies (EPA, 1997c).

State Drinking Water programs are required to develop Wellhead Protection Programs (WHPPs) under Section 1428 of the 1986 Amendments to the SDWA. Implementation of WHPPs is voluntary in many states. The WHPPs are to:

- Identify the members of a team to develop and implement the WHPP,
- Delineate a wellhead protection area surrounding the well based on "all reasonably available hydrogeologic information,"
- Identify all potential sources of contaminants,
- Describe a program to protect the water supply within the wellhead protection area (WHPA),
- Include contingency plans for providing drinking water in the event of contamination of the water supply, and
- Consider potential pollutant sources for all new wells.

State WHPPs provide guidelines and a framework for the development of local, system-based WHPPs. Many systems have used these guidelines to develop their own WHPP to address local water protection concerns.

Unfiltered systems are required by the SWTR (40 CFR 141.71) to satisfy a number of filtration avoidance criteria which include the preparation of a watershed control plan. The watershed control plan must minimize the potential for contamination of the source water by *Giardia lamblia* and viruses. The IESTWR also requires that the plan minimize the potential for contamination by *Cryptosporidium.*

The watershed control plan should include:

- A comprehensive review of the watershed,
- A description of activities to monitor and control detrimental activities in the watershed, and
- A description of the ownership or other land use controls within the watershed.

To the extent that they are available, an inspector should review the source water assessment and any source water protection plans, WHPP, and watershed control plan for a system in advance of the sanitary survey. This information will provide the inspector with a list of potential contamination sources which may require investigation. The information may also identify source control measures which may require inspection to determine if they are being implemented. In addition, the source water assessments will provide valuable information on well or intake integrity and hydrogeologic or hydrologic sensitivity.

2.3 Review of Pertinent Files on Water Quality

A review of pertinent files addressing water quality is a useful tool in identifying potential problems with a public water system. Monitoring plans and compliance reporting are the two primary sources of water quality information.

2.3.1 Monitoring Plans

EPA drinking water regulations and state equivalents establish minimum requirements for the contaminants to monitor and acceptable concentrations for each in the finished water stream. The monitoring frequency, requirements for re-testing, and sample location are also typically included in the monitoring plans.

Separate monitoring plans are typically prepared for:

- Total coliforms;
- Inorganic chemicals;
- Organic chemicals;
- "Unregulated" chemicals; and
- Radionuclides.

2.3.2 Compliance Reporting

The water system should submit reports to the state on a regular basis (typically monthly) detailing the system operations and identifying any problems encountered during the month. This monthly operating report (MOR) includes information about system flows, samples collected, sample analytical results, and any changes. Ideally, an inspector would review all of the MORs submitted since the last sanitary survey to ascertain any trends (e.g., changes in water quality, chemical usage, flow rates, or chlorine residuals) which may help to focus the inspection. Often there is not enough time available to review all of the reports. Therefore, the inspector should focus on violations or system problems which either the water system reported to the state or were identified during the previous sanitary survey, as well as water quality problems typical for the geographical area.

Federal regulations require the water system to issue notices to the public when the system:

- Violates an MCL or treatment technique requirement; or
- Fails to comply with monitoring requirements or analytical method requirements.

All public notices should include:

- A clear, concise, and simple explanation of the violation;
- A discussion of potential adverse health effects;
- A discussion of any segments of the population that may be at higher risk;
- A list of steps the water system has taken or plans to take to remedy the situation;
- A list of any preventive steps consumers should take;
- Any need for seeking an alternative water supply; and
- The water system's name and telephone number.

In some cases, depending on the severity of the violation, additional specific requirements (e.g., including mandatory health effects language in the notice) apply. The public notices are to be distributed by mail or hand delivered to all consumers served by the water system, or placed in newspapers widely-circulated in the area. Certain violations may also require announcements on radio and television stations serving the area. (40 CFR 141.32)

State regulations may also require the water system to submit a report to the state or issue a public notice under certain conditions [e.g., a system is identified as the source of a waterborne disease outbreak (surface water systems), experiences an unscheduled loss in pressure, or fails to comply with a state order].

2.4 Assessment Criteria

As part of planning for a sanitary survey, the inspector should prepare a set of criteria to evaluate during the onsite inspection. Inspectors should generally start with a standard set of criteria that are used for all sanitary surveys done by the state primacy agency. This standard set should then be tailored as appropriate based on water system-specific information obtained from the pre-survey file review and onsite observations. These criteria assist the inspector with evaluating key processes where potential significant deficiencies may exist.

The 1995 *EPA/State Joint Guidance on Sanitary Surveys* recommended that states develop assessment criteria for each of the eight minimum elements reviewed during a sanitary survey. The IESWTR reiterates the need to address these eight elements in conducting sanitary surveys. Assessment criteria are needed to ensure that deficiencies are evaluated consistently by sanitary survey inspectors. As part of this effort, states should identify the types of deficiencies that are considered to be significant and should provide appropriate follow-up actions for both significant and lesser deficiencies.

As outlined in the joint guidance, the eight essential elements of a sanitary survey are:

- Source (Protection, Physical Components and Condition)
- Treatment

- Distribution System
- Finished Water Storage
- Pumps/Pump Facilities and Controls
- Monitoring/Reporting/Data Verification
- Water System Management/Operations
- Operator Compliance with State Requirements.

Chapter 3 of this guidance manual provides assessment criteria that inspectors may use to evaluate each of the eight elements. The criteria include descriptions of what inspectors should look for and how the criteria are related to sanitary risk. Since states may have their own set of assessment criteria for sanitary surveys, inspectors should check with the primacy agency before preparing a list of criteria for a sanitary survey.

2.5 Inspection Tools

Prior to the onsite inspection, sanitary survey inspectors should ensure that their field equipment is in good working order. Preventive maintenance is essential for all types of equipment. Equipment which is broken, dirty, in disrepair, out of calibration, or otherwise improperly maintained will not provide dependable, reproducible, or accurate data. For best results, the inspector should follow the manufacturer's specifications for preventive maintenance. The inspector also should check expiration dates and keep up with and use current standard testing procedures and calibration methods. Recommended types of field equipment include but are not limited to:

- Portable pH meter with digital readout;
- Hand held colorimeter, portable spectrophotometer, or other mechanical residual chlorine test kit;
- Accurate pressure gauge;
- Portable Geographic Positioning System (GPS) equipment;
- Camera with automatic time/date stamp;
- Binoculars;
- Small mirror (to inspect areas that are not accessible or are not in the direct line of sight); and
- Flashlight.

The sanitary survey preplanning effort needs to address safety considerations, both for the field inspector and the system's operating staff. Safety hazards can include head injuries from low clearance piping, snake and spider bits, insect stings, electrical shock, chemical exposure, drowning, confined space entry, noise, lifting injuries, and slipping, tripping, and falling. Prior to the onsite inspection, the inspector should ensure that personal protective equipment is available. The most frequently used equipment includes safety hats, goggles, gloves, ear plugs, and steel-toed safety shoes. Respirators and a self-contained breathing apparatus may also be used in some cases.

2.6 Communication Activities

Coordination and communication between the inspector and the primacy agency, local health department, and water system management personnel are essential in preparing for a sanitary survey. The inspector needs to work with each of these entities to be properly prepared for the sanitary survey. Some of the information the inspector should exchange with each of these entities is listed in Table 2-1.

Based on the information collected and reviewed during survey planning and preparation, the inspector should make an assessment of which areas need particular attention during the onsite visit. The inspector can then establish a preliminary schedule for the onsite visit, allocating more time to the areas that seem to warrant greater focus. Once onsite, the

Table 2-1. Communication Activities

Entity	Activities
Primacy agency	The primacy agency should provide the inspector with information on which water systems to consider for sanitary surveys (based on when the previous survey was done), past sanitary survey reports, and other information in the agency files for the relevant water systems. The primacy agency should also provide the inspector with agency inspection requirements and guidelines, such as assessment criteria, a list of significant deficiencies, and any sanitary survey forms used by the agency.
Local health department	The inspector should contact the local health department to find out if the water system is in compliance with OSHA (Occupational Safety and Health Administration) requirements and has been issued a rodent/pest control permit. The inspector should also ask the health department if there have been any reported illnesses attributed to drinking water.
Water system management personnel	The inspector should contact the water system and first determine the appropriate personnel for further sanitary survey discussions. With the appropriate personnel, the inspector should describe the purpose of the sanitary survey and the steps of the survey, particularly the onsite inspection (described in the next section). Preliminary discussions should also include: – a review of previous sanitary survey reports and the system's historical records (including chemical and bacteriological data), – correspondence, – engineering studies, – past violations, and – any records that are needed for review but are not available from the primacy agency's files. The inspector should also schedule the onsite inspection with the water system.

inspector may observe problems in other areas that need detailed inspection and thus require changes to the preliminary schedule. Through these preparations, the inspector will be able to assemble and evaluate the proper information during the survey and make sound recommendations in the sanitary survey report.

2.7 Parts of the Onsite Inspection

The onsite inspection includes the following parts:

(1) **Opening interview**
- Introductions
- Review of the purpose of the sanitary survey
- Review of the parts of the onsite inspection and the schedule for the inspection
- Review of the facility layout and location of the intake(s) and treatment processes
- General discussion of basic system information; the condition of the system and its operation, staffing, and management; whether relevant plans and procedures have been developed and are adequate
- Discussion of deficiencies identified in previous sanitary survey reports and any violations/compliance problems since the last survey, and corrective actions taken and their effectiveness in addressing the deficiencies and problems.

(2) **Walk through**
- Physical inspection of all eight elements of a sanitary survey
- Asking questions of appropriate personnel for clarification, to determine the knowledge of system personnel, and to check information obtained during records review and other aspects of survey planning and preparation
- Note taking for documentation and writing up the findings in the sanitary survey report.

(3) **Organization of findings and documentation**
- Filling in any gaps in inspection notes and add detail where needed
- Completing sanitary survey checklists/forms (if used)
- Clarification of any remaining issues with water system personnel
- Obtaining any documentation still needed
- Preparation for closing interview.

(4) **Closing interview/debriefing the system on inspection findings**
- Presentation of findings, particularly any significant deficiencies, to the water system
- Informing water system management of next steps (i.e., writing and submitting the report, corrective action).

3. CONDUCTING THE SURVEY

Previous chapters of this manual have provided a definition of a sanitary survey, the regulatory framework for conducting a survey, and the critical steps for planning a sanitary survey. This chapter presents the essential elements for completing the walkthrough inspection of an onsite sanitary survey. The onsite sanitary survey includes visiting the water supply source and source facilities, pump stations, the treatment plant, storage facilities, the distribution system, and sampling locations. One of the most important functions of the onsite portion of the survey is to determine whether the existing facilities are adequate to meet the needs of the water system's customers at all times. Therefore, this visit should include review and verification of the capability and capacity, construction and operation, and physical condition of the water system's facilities.

There are eight elements that are considered essential for review in the proper conduct of a thorough sanitary survey. These eight elements are listed below:

- Source (Protection, Physical Components, and Condition)
- Treatment
- Distribution System
- Finished Water Storage
- Pumps/Pump Facilities and Controls
- Monitoring/Reporting/Data Verification
- Water System Management/Operations
- Operator Compliance with State Requirements.

This chapter presents a general description of each element and its importance as part of the sanitary survey, general guidelines for evaluating important components of each element, and a discussion of priority components under each element. The order of the eight elements is not intended to dictate the sequence of survey activities, but to provide a logical division of the essential elements for a sanitary survey. Each element is divided into components and includes a discussion of the issues that an inspector should consider when evaluating a particular component. Guidelines for evaluating the components are provided in the form of a list of assessment criteria. The assessment criteria identify areas that need to be reviewed during a sanitary survey. The criteria are intended to help the inspector identify sanitary risks that may arise due to deficiencies in a particular component.

At the end of the discussion for each element, a set of priority criteria are provided. Priority criteria are those criteria that generally have the greatest impact on health risks related to a given element and thus should be considered significant. Since states should develop their own lists of significant deficiencies, this guidance manual does not contain a standard list of what deficiencies all states should consider significant. However, Section 4.3 discusses the process of categorizing the findings of the sanitary survey and provides examples of potential significant deficiencies. In conducting the sanitary survey, the inspector should pay particular attention to those areas where deficiencies would be considered significant and thus warrant prompt corrective action. This format allows states flexibility in evaluating the components based on system type, size, and complexity. Appendix A includes examples of sanitary survey checklists used by several states and EPA regions. These checklists are from the *1995 EPA/State Joint Guidance on Sanitary Surveys.*

3.1 Source (Protection, Physical Components, and Condition)

The water supply source is the beginning of the drinking water system. As such, the source can provide the opportunity for the reduction of contaminants, pathogens, and macroparticles. Preventing source water contamination is the most effective means of preventing contaminants from reaching consumers. Source water protection also helps ensure that additional, potentially more costly treatment is not necessary to remove further contaminants. As the first opportunity for controlling contaminants, the reliability, quality, quantity, and vulnerability of the source should be evaluated during the sanitary survey.

The objectives of surveying the raw water source are to:

- review the major components of the source to determine reliability, quality, quantity, and vulnerability; and
- determine and evaluate data that define the potential for degradation of the source water quality.

To accomplish these objectives, the inspector needs to review available information on source water facilities, including watershed control plans, source water assessment reports and protection plans, and/or wellhead protection plans where they exist for a system. In the field, the inspector should discuss the water supply source with the operator(s) and verify the information received from the plans with field observations.

The following areas should be reviewed as part of the sanitary survey.

3.1.1 Watershed Management Program

The primary goal of watershed management programs are to maintain the highest quality feasible for a surface water source. For an unfiltered water supply, it is particularly critical to achieve the highest level of raw water quality practicable. A watershed management program is designed to protect the quality of a water system's surface water source by monitoring activities in the source watershed and minimizing their impact. An effective watershed management program will reduce the levels of pathogens, turbidity, organic compounds, and coliforms.

Development and implementation of a watershed management program is generally done by a team that may include water system staff, private consultants, planning agencies, cooperating agencies, and advisory committees. The water system often takes the lead, and can gain valuable contributions (e.g., expertise, resources) from the other agencies with jurisdiction over the watershed. Cooperative efforts are particularly valuable when the water system does not have the staff or expertise to fully develop and implement a program, and when difficult issues are involved. (EPA, 1999c)

A watershed management program should include a description of the watershed, identification and monitoring of activities in the watershed that may impact water quality, a program to control land use activities in the watershed, and annual reporting (EPA, 1991). Source water assessments should provide valuable information on the vulnerability of the source water(s) of a surface water-supplied public water system. Each component of the program is described in the following sections.

3.1.1.1 Watershed Description

A description of the watershed provides valuable information to both the inspector and the system personnel to evaluate the vulnerability of the source. The watershed description should include the geographical, geological, and physical features of the watershed; pertinent hydrology (e.g., annual precipitation patterns, stream flow characteristics, etc.); land use/ownership in the watershed; location of the surface water intake or well; as well as any open-air conveyances that carry water from the intake to the treatment plant.

It is important that the intake(s) or well(s) for a public water system be located as accurately as possible. The intake(s) or well(s) may have been located previously and the inspector need only verify that the location(s) is correct. The inspector may find that a new intake or well has been constructed since the last inspection, either authorized or unauthorized, and a previous one has been abandoned and/or plugged. The inspector should make note of this new condition and advise the system if they should report the new intake or well to the state. A U.S. Geological Survey (USGS) 7.5-minute topographic quadrangle or similar map can be used to plot the location of the water sources. The Global Positioning System (GPS) is a recently developed tool that can be used to determine the precise location of a surface water intake or a well.

3.1.1.2 Watershed Characteristics and Activities

The characteristics and activities that may affect the source water quality should be identified by the system. The naturally-occurring attributes that can affect the source water quality include terrain, soil types, land cover, precipitation and runoff, and animals. In particular, the animal populations that can be found in the watershed should be identified, so that potential contamination sources of *Giardia, Cryptosporidium*, and any other pathogens can be evaluated.

The man-made attributes that can affect water quality include point and nonpoint sources. Point sources of particular interest are discharges from wastewater treatment and industrial plants and runoff from barnyards, and feedlots. The nonpoint sources that can significantly impact source water quality are septic systems, construction activities, impervious cover runoff (i.e., runoff from a highway or parking lot); farming and ranching activities (e.g., the use of pesticides, animal husbandry); logging; recreational activities; and unauthorized or accidental discharges of contaminants.

Various techniques or plans can be developed to minimize the effect of watershed activities on source water quality. Some of the more common techniques used to control watershed activities include ownership of the land by the water systems, obtaining zoning restrictions from local governments, as well as entering into agreements with the present landowner(s). With zoning, the local government can control the degree of land development and require erosion control. Land ownership by the water system and agreements with landowners are discussed in the next section.

3.1.1.3 Land Ownership/Agreements with Owners

For a water system to have the best opportunity to realize the goals of a watershed management program, the water system should have complete ownership of the watershed. However, complete ownership is not practical for most water systems. Therefore, the water system should try to gain ownership of the critical elements in the watershed, such as reservoir or stream shoreline, highly erodable land, and areas providing access to the water supply source.

The water system should enter into agreements with landowners in the watershed that will allow the water system to have control of the land use so that activities having an adverse effect on water quality can be minimized. The agreement should also include a provision stating that the water system has the legal right to ensure that the land use complies with the agreement. As an example, the water system enters into an agreement with a logging company (man-made attribute) located in the watershed. The agreement states that the logging company will develop and implement procedures or practices, such as installing silt fences around all disturbed areas to control erosion, that will minimize the impact of logging on source water quality. With the logging company controlling erosion in disturbed areas, the elevated turbidity levels (caused by the erosion) in the source water will be reduced. The inspector should review the water system's plans to minimize the water quality impact of the various activities in the watershed.

3.1.1.4 Annual Reports

A watershed management report should be prepared annually that outlines the steps taken to acquire all or critical elements of the land within the watershed, efforts made to monitor the watershed activities, a list of activities that cause special concern, efforts to mitigate the detrimental affects to water quality, and known future activities that may impact water quality and a plan to reduce the potential impacts. This report should be submitted to the state primacy agency for review and approval.

Assessment Criteria

The following are suggested assessment criteria for the watershed management program:

1. **Is the entire watershed for the source protected? Is the water system trying to purchase all land within the watershed? If not, are the critical elements of the watershed protected or purchased by the water system?**

   The origin of most contaminants, either chemical or biological, found in drinking water can be traced to the watershed of the source. If the watershed, all or critical parts, for the source is protected, then potential sources of contamination can be reduced significantly. By reducing the level of contaminants in the water source, the water treatment process has to remove or inactivate less contaminants.

2. **If the water system cannot purchase portions of the watershed, does the water system have an agreement with the landowner concerning land use? If the water system does not have an agreement, what is the plan to acquire control of the land use within the watershed?**

   The water system should gain the highest degree of control possible of the watershed utilizing the means available. The typical means to secure watershed control is to either purchase the land or obtain an agreement with the landowner on the allowable use of the land. Purchasing the land is the most costly means for a water system to achieve control of the watershed. Depending on the resources of the water system, it may take a long time to obtain complete control of the watershed. Therefore, the water system should have a plan and schedule for acquiring the highest control of the watershed possible (if not the entire watershed, at least the critical parts).

3. **Are all activities within the watershed identified and located? If so, have there been any changes since the last sanitary survey?**

   The source(s) of contaminants in drinking water will be either naturally occurring or man-made. The water system needs to identify and locate the activities within the source watershed that are potential contaminant source(s). Based on the type and location of the activities in the watershed, the water system can develop a plan to mitigate the sources of contamination of the drinking water supply.

4. **What are the practices used to mitigate critical activities within the watershed that may degrade water quality? How are these practices monitored? Should there be any changes to the existing practices?**

   With the activities in the watershed known, the water system can develop a plan to mitigate the occurrence of contaminants. As with any plan, a means must be developed to measure the effectiveness of the plan through routine monitoring and evaluation.

3.1.2 Wellhead Protection Program

A Wellhead Protection Program (WHPP) is designed to protect the quality of a water system's ground water source by monitoring and minimizing the impact of the activities in the source recharge area as well as the portion of the aquifer that supplies the system. This program applies to ground water and the associated recharge area. The main components of a WHPP are delineating the wellhead protection area (WHPA), identifying and locating all potential sources of contaminants that could impact the well, and developing and implementing a strategy to manage the WHPA and protect the source from contamination. Since the WHPP has elements and requirements similar to the watershed management program, discussion of these elements and requirements will not be repeated here.

Due to the similarity of the wellhead protection program and the watershed management program, the suggested assessment criteria would be the same. However, the methods used to delineate the wellhead protection area for the wellhead protection program and the watershed management program may be different and should be evaluated. For example, recorded sanitary control easements can be used to help prevent contamination in a WHPA. The easements specify that sanitary hazards cannot be located within a specified distance (e.g., 150 feet) of a well.

3.1.3 Source Vulnerability Assessment

A vulnerability assessment is used to determine the likelihood that potential contaminant sources in the watershed or drinking water protection area will degrade the public water system's source water quality. The 1996 Amendments to the SDWA require that states determine susceptibility of all their public water systems to contamination. A susceptibility determination will include consideration of several factors: hydrogeologic or hydrologic sensitivity, contaminant source characteristics (e.g., persistence and mobility, toxicity, volume of discharge), contaminant source management, and well or intake integrity. A completed Source Water Assessment Program (SWAP) susceptibility determination may suffice as the source vulnerability assessment for a sanitary survey, and may be integrated with vulnerability assessments performed under monitoring waiver programs, pesticide management plans, or other programs.

Suggested assessment criteria for assessment of source vulnerability include:

1. **What is the sensitivity of the source water protection area (SWPA)? Has it's hydrogeologic/hydrologic sensitivity been adequately assessed?**

This refers to the transport of contamination from any point within an SWPA to a well or intake. Higher sensitivity ratings apply to geologic settings through which contamination can move more quickly and lower sensitivity ratings apply to settings through which contamination should move more slowly (i.e., sensitivity, like susceptibility, is local and relative). Sensitivity does not address the question of whether contamination or potential sources of contamination are present in the SWPA. Specific factors that should be included in a sensitivity assessment are:

Surface water:

Intake environment: Intakes in turbid water or near shore are more sensitive than intakes away from shore in clear water.

Slopes: Water fed from steep slopes is more sensitive than water fed from shallow slopes.

Plant coverage: Water fed from land with no vegetation is more sensitive than water fed from land with thick vegetation.

Soil permeability: Water fed from paved surfaces is more sensitive than water fed from highly permeable top soils.

Ground water under the direct influence of surface water:

Saturated zone: Aquifers close to the surface are likely to be more sensitive than aquifers further beneath the surface.

Well screen: Shallow well screens are more sensitive than deep well screens.

Unsaturated zone: Aquifers overlain by thin unsaturated zones are more sensitive than those overlain by thick zones.

Confining layer: Aquifers overlain by no confining layers are more sensitive than aquifers overlain by thick layers.

Conduits: Aquifers with many conduits to or near the saturated zone are more sensitive than those with no conduits.

2. What is the integrity of wells, intakes, and conveyances?

Source water structures, such as the well casing, joints, screened sequences, padding at the wellhead, conveyance structures, and equipment to move water from the well or intake to the distribution system should be assessed for integrity. Integrity means the quality of design, construction, maintenance, and the state of repair of the infrastructure. Factors that should be included in an integrity assessment are:

Design: Does the infrastructure design meet current state code? Is the infrastructure design appropriate for the hydrogeologic setting and pumping rate?

Construction: Is there a well log and does it adequately document how the well was built? Are the materials and equipment that were used appropriate for the hydrogeologic setting and pumping rate?

Maintenance: Has there been an operative maintenance schedule in place since construction? Is the maintenance schedule appropriate for the design and construction of the specific infrastructure?

State of repair: Has the infrastructure been operating reliably? If not, why not?

3. Are potential sources of contamination identified and managed?

Potential sources of contamination (PSCs) may be point source or nonpoint source and federally regulated, state regulated, locally regulated, or unregulated. A PSC may be a facility or activity, including or excluding human involvement. PSCs may or may not use infrastructure or management practices to prevent, reduce, or mitigate the likelihood of contaminant release into the SWPA and those efforts may or may not be effective. Factors that should be included in a PSC assessment are:

Acute health effects: Sources of acute contamination may present greater public health risk than sources of chronic contamination.

Distance to well or intake: PSCs located closed to drinking water wells or intakes usually present greater risk than PSCs further away.

Point/Nonpoint source: Point sources usually have greater disaster potential than nonpoint sources, but are also more easily managed.

Federal/State regulation: PSCs under federal or state regulatory programs are likely to be better managed than unregulated PSCs.

Containment infrastructure: Are there physical barriers to contaminant release?

Containment practices: Are the standard operating practices designed to prevent contaminant release?

Contingency plans: Are there contingency plans for accidental release and are operations personnel familiar with them?

3.1.4 Source Water Quality

Impurities can be found in any natural water source. Surface water can pick up impurities, including chemical and biological contaminants, as it comes in contact with soil, rock, and vegetation. The dissolution of minerals from the soil and rock is very common for ground waters.

EPA has established maximum contaminant levels (MCLs) for impurities that must be removed from or inactivated in raw water before the water can be classified as potable. The contaminants can be removed or inactivated naturally or by treatment. For ground water, many of the particles and microorganisms originally found in surface water are removed as it seeps into the ground and through the aquifer, due to the natural filtration effect as water passes through soils, and the potentially long travel times in the aquifer.

Surface waters are very different from ground water. Surface waters require a high degree of treatment to remove impurities and contaminants from natural and man-made sources. Some impurities in the water, such as large suspended solids, are easily removed. Smaller particles, including many pathogens, are more difficult to remove. Some pathogens, such as

Giardia and *Cryptosporidium*, also resist inactivation by chlorine. A discussion of water treatment systems is found later in this chapter (see Section 3.2).

The type of surface water source (i.e., lake, stream, etc.) is an important factor that can affect raw water quality. A stream with a large watershed in which a land use is predominantly farming, may experience large swings in raw water turbidity, particularly after a rainfall event. If the source is a lake or reservoir with the same general watershed characteristics, the potential for large raw water turbidity swings is greatly reduced, due to the dilution and settling that occur in a reservoir.

There are many potential raw water quality problems for a surface water source, including:

- Zebra mussels and Asiatic clams – can clog intakes reducing capacity;
- Algae – can cause taste and odor problems;
- Pathogens – can cause intestinal illnesses and other diseases;
- Turbidity –can be difficult to remove depending on the size and concentration of particles;
- Natural organic matter – difficult to remove and can form carcinogenic compounds in combination with certain disinfectants;
- SOCs (synthetic organic compounds) and IOCs (inorganic compounds) of anthropogenic origin – can cause adverse health effects and affect treatment decisions; and
- Iron and manganese – can cause discoloration and staining problems.

These are just a few physical, chemical, and biological elements found in a surface water that make treatment (filtration and disinfection) necessary to ensure a safe supply of potable water.

Historical information should be gathered from the operators. The inspector also needs records concerning the fluctuations of raw water quality for use prior to the survey and during the onsite inspection. The steps taken by the water system to mitigate significant changes should be evaluated to determine their effectiveness. Additional steps may be needed to further reduce water quality fluctuations if the mitigating measures do not sufficiently protect water quality.

The following assessment criteria are applicable to the inspection of source water quality:

1. **What is the quality of the source? Is the source water quality monitored by the system? What are the ranges of the required water quality parameters?**

   The quality of the water at its source will prescribe the treatment needed to produce safe, potable water. In particular, the historical range of constituents in the source water will dictate the level of treatment required. For example, the pH of a particular source water is typically 7.2, but it ranges from 6.5 to

8.0. If the pH of the potable water leaving the plant is less than 7.0, it is acidic and can be corrosive, which may result in increased levels of lead and copper in the consumer's water. Therefore, treatment should be provided to raise the pH of the water leaving the plant to an acceptable level and to assure that the water is noncorrosive. The water system should regularly monitor the quality of the source to identify any changes that may necessitate changes in the level of treatment required. The inspector should review the system's source water monitoring records to assess whether the source water quality is sufficient and does not pose significant sanitary risks.

Another example is the source water microbial quality, as represented by measurement of the indicator total coliform bacteria. The persistent presence of total coliform in source water requires removal and/or disinfection to the levels specified by regulations. In general, all regulated contaminants should be monitored, as specified, to determine treatment levels.

2. Is there an emergency spill response plan for events that are man-made which may affect water quality?

The source watershed may have crossing roadways and pipelines that carry hazardous chemicals. If a truck on the roadway had an accident or the pipeline develops a leak, a hazardous chemical could spill into the source water. If the plant operator is unaware of the accident, the hazardous chemical could pass through the water treatment plant and out into the distribution system. Therefore, a plan should be developed to respond to these types of situations. At the least, the plan should include notification of all water systems in the watershed of the chemical spilled as well as a listing of the options and alternatives for either treating the chemical at the water plant or using a temporary source until the threat is over.

3. Is the area around the intake restricted in accordance with primacy agency rules?

Typically, the intake for a water treatment plant is unmanned and may be visited once a shift or once per day. Therefore, there is no continuous means to observe all the activities around the intake. Restricting access to the area around the intake with fencing, signs, and buoys will limit the possibility of sabotage or accidental contamination.

4. Are there any sources of pollution at or near the intake? If so, what is the water system doing to mitigate the sources of pollution?

There are many sources of contaminants that can affect the raw water quality. Man-made sources would include publicly owned treatment works, industrial treatment works, private onsite septic systems, pesticide runoff from farming, fecal contamination from confined animal feeding operations, marinas, etc. Natural sources of contamination may include birds and hoofed mammals. Each source could release contaminants that end up in the source water and affect the potable water delivered to the consumer. If the contaminant source is near the intake, there is little or no time for the water system to respond to the accidental release of a contaminant. Therefore, the water system should know what pollution sources are close to their intake and what contaminant(s) could be released. If possible, the water system should try to either eliminate or significantly reduce the chance(s) of a contaminant release from each source.

5. **Have there been any significant fluctuations in water quality? If so, what was the cause and how is the water system preventing future fluctuations? If improvements are in place to mitigate the fluctuations, how well are they performing? Are any further improvements needed?**

   Rapid, significant changes to any water quality parameter will impact the ability of a water treatment plant to produce a safe, potable water. For example, if the raw water turbidity, which normally is 50 NTU, were to increase to over 500 NTU in a few hours, the efficiency of all treatment processes could be significantly impacted to the point that the quality of water produced is seriously compromised. In particular, the disinfection process could be compromised due to the interference caused by the high solids loading. Therefore, water systems need to review the historical raw water quality data to learn whether there have been instances of rapid, significant water quality fluctuations and investigate the cause of significant fluctuations. When the cause is identified, the water system should identify a means to mitigate future fluctuations. Once mitigation measures are in place, the water system should regularly evaluate the performance of the improvements to determine whether or not the raw water quality fluctuations are under control.

   A system's monitoring program can help the water system recognize any deterioration of water quality over time that may eventually make it necessary for the system to explore new sources. The inspector should review the system's source water monitoring records to assess whether there are any trends of deteriorating quality and if the water system has adequately addressed the problems. Inspectors can also compare raw water turbidities to finished water turbidities to assess whether changes in raw water quality are affecting finished water quality. If raw water quality changes are measurably affecting finished water quality, the inspector should ask the operator(s) about process control decisions being made and evaluate whether the operator(s) are making adequate process changes to address raw water quality changes.

3.1.5 Source Water Quantity

One of the most important requirements for any water system is the ability to meet the water quantity demands of customers at all times. This requirement means that an adequate quantity of source water should be available to meet the customers' needs. It is important to determine whether the water system has an adequate source of supply, because prolonged interruptions or reductions in the source water supply may cause low pressures or water outages in the distribution system that pose a public health hazard. When service pressure is insufficient, other liquids are much more likely to enter the system through cross-connections and contaminate the water supply.

In many places, particularly in arid and heavily populated areas, water conservation is necessary. Water systems should have a water conservation plan that includes short- and long-term goals, education plans, water rationing procedures in case of drought, and water conservation information available to the public. An aggressive water conservation plan can be a cost-effective alternative to the expansion of water production facilities.

Suggested assessment criteria for evaluating the adequacy of the source water supply are:

1. **What is the water quantity required to meet the needs of the water system?**

   The water system must be able to supply an adequate quantity of potable water to meet the highest anticipated demand of the customers. If not, then areas of the distribution system may experience little or no pressure due to the lack of water. With the loss of pressure, the contamination potential of the system is heightened significantly.

2. **What is the available water quantity of the source?**

   The quantity of source water available must be sufficient to meet the highest anticipated demand of the water system. In addition, the water system needs to plan for the continued growth of its service area and look ahead to obtaining an adequate quantity of water to meet those future needs. If operating records show decreasing water quantity over time, the system should be investigating additional supply.

3. **Is the source adequate to meet the current and future expected needs of the water system, even during times of drought? If not, what other sources are being investigated to meet the needs? Has the water system developed and implemented a water conservation plan?**

   Knowing the maximum water demand of the system and the quantity available from the source, a quick determination can be made of the system's ability to meet the present and future needs of its customers. The inspector can verify that an adequate supply is available by checking to see if the supply source has ever gone dry or if water ever had to be rationed because of a shortage of source water. A water system may have developed a water conservation plan as part of its overall water system master plan and may already be implementing the water conservation plan regardless of the adequacy of source water quantity. Implementation of a good water conservation plan can be a cost-effective alternative to the expansion of water production facilities as a result of increased demand. If the source water supply appears to be inadequate, the water system should be in the process of implementing further water conservation measures and/or obtaining an additional supply.

4. **Does the system have a meter to monitor production? Does the system measure usage by consumers?**

   The system needs to have meters in place to monitor overall production and water usage in the system to determine if supply is adequately meeting customer demand. Data from meters can be used to identify and track trends in both water supply and usage so that any potential future shortages can be noticed earlier and additional supplies obtained.

3.1.6 Location of Source Facilities

The location of source water supply facilities is an important factor in determining the ability of the water system to meet the customer needs at all times. For instance, the facilities should not be located in the flood plain, because the operation of the water system could be seriously impaired by flooding of the structure(s) and equipment necessary to supply source water. Source water quality also can be significantly impacted by location. If the intake is located on a river instead of a reservoir, it is reasonable to expect significant quality fluctuations over time. When locating the facilities on a reservoir, the prevailing wind direction may cause surface debris to be blown against the intake, which could cause mechanical failures if not accounted for in the design.

The following assessment criteria are suggested for the location of source water facilities:

1. **What is the flood level in the area of the source facility? What is the level of the floor for the source facility? Can the source facility be flooded?**

   The source water supply facilities should be able to operate at all times to produce safe, potable water to meet the customers' needs, regardless of the surrounding conditions, either man-made or natural. The source facility should be able to supply water to maintain an adequate pressure in the distribution system for safety purposes, which would provide water for fire fighting, pressure to keep contaminants out, and meet the basic consumer necessities. If the source facility is flooded, the ability to supply water to satisfy these demands may be compromised. Therefore, the flood level and floor elevations should be checked to determine whether or not the facility can be flooded.

2. **Has the source facility ever been flooded? If so, was the operation of the source facility impaired? If the source facility has been flooded and operation not impaired, what is the access to the source facility during a flood?**

   Depending on the design of the facility, portions of the plant could have been flooded, yet it was still able to produce potable water. In this situation, access to the source facility needs to be maintained to allow for the ingress/egress of personnel and equipment as needed.

3. What measures have been taken to prevent contamination of the raw water at the source facility during a flood event?

Flooding is a natural source of contaminants in the water supply source. Surface runoff, which is a major contributor to flooding, will transport dirt, oil, pesticides, fertilizers, and other contaminants that might be found in the watershed. Since flooding will introduce contaminants into the water supply source, the water system needs a means to mitigate the contamination of the raw water. For instance, some water systems in areas that have raw water sources subject to flooding have constructed raw water storage facilities onsite, so that no water needs to be taken from the water source during a flood event.

3.1.7 Capacity of Source Facilities

The initial step of the onsite visit should be determining the required capacity of the source facilities. The required capacity should be at least equal to the maximum daily demand of the water system over the previous several years or as determined by the rules and regulations of the state primacy agency. Reviewing the operating records of the plant should provide the maximum daily demand. The maximum daily demand typically occurs during the summer time, often due primarily to extensive lawn watering activities. However, there have been situations where the maximum daily demand occurred during hard freezes in the winter, when customers left faucets running to prevent their water pipes from freezing. Operating records for the last few years should be checked to determine the historical maximum daily demand.

The state primacy agency may have rules and regulations that specify the capacity requirements for the source facilities. The rules may require that capacity be based on design factors and the numbers of customers or connections served by the water system. The inspector should determine the required capacity for the source facilities before beginning the onsite portion of the survey.

The pumps and associated facilities at the source are critical components of the water supply system. The capacity of the source facilities (i.e., pumps, piping, metering, etc.) that deliver the source water to the treatment facilities or distribution system needs to be sufficient to deliver the quantity of water required to meet the treatment demands or those of the customers.

The existing capacity of the various units in the source facility can be checked to verify the adequacy of the units to meet the required capacity of the water system. The capacity of raw water supply pumps and transfer pumps are usually evaluated with the largest unit out of service since it is reasonable to assume that one of the pumps may be inoperable due to repair or maintenance when peak demand conditions occur. This is sometimes referred to as “firm” pumping capacity. For example, the “firm” capacity of a booster pump station with two 20-gpm pumps and one 30-gpm pump is 40 gpm. (Pump capacity is discussed further in Section 3.5.2.)

The following are suggested assessment criteria to determine the adequacy of the source facility capacity:

1. **What is the design capacity of the source water facilities? What is the historical maximum daily demand of the water system? What is the storage capacity of the system? Given service connections or population, are they reasonable?**

   The historic maximum daily demand of the water system can be found in the operating records of the facility. The source water supply capacity, the treatment plant capacity, and the treated water storage capacity of the water system can be determined from design and construction documents. Using this capacity information, the historic maximum daily demand, and information on population increase and decrease trends, the inspector can draw conclusions as to whether the source water supply facilities are capable of meeting the maximum daily demand of the water system, or whether the facilities need to be upgraded or expanded.

2. **If the state primacy agency has specific unit capacity requirements, does the system meet the requirements?**

   Some state primacy agencies have set minimum requirements for the capacities of source water supply pumps, based on historical water use data for the area, industry standards, and generally recommended engineering practices (GREPs). The state primacy agency criteria is usually established at levels adequate to ensure that capacity is available to meet any and all demands of the system's customers for normal as well as emergency use. Typically, the capacity requirement is based on the number of connections served and fire fighting demand (e.g., raw water pumping capacity of 0.6 gpm per connection served). With the number of connections served by the system, the state required capacity of the facility can be determined.

3. **Is the system structure silting up? Is the sump of the source water supply pumps silting up? Are there any dead fish or wildlife animals floating? Is there plant or manmade debris floating?**

   Silting and the accumulation of floating debris at the intake may negatively affect the source water supply by reducing pumping capacities, degrading raw water quality, or preventing variable level capability.

4. **Are the source water supply facilities capable of meeting the required capacity with the largest unit (e.g., raw water pump) out of service?**

   Since the equipment used in a treatment plant is mechanical, it will be necessary to take individual units out of service periodically for maintenance, repair, or replacement. During this time period, the facility should be able to satisfy the maximum daily demand of the system. To ensure that adequate capacity is available at all times, the capacity of the source water supply facilities should be determined with the largest unit out of service.

5. **Can the operating characteristics of the existing units be checked? If so, does the system check them periodically? How does the existing operational point compare to the original operational characteristics of the unit? Should the capacity of the unit be derated? If so, what is the new capacity?**

   As with most mechanical equipment, the equipment in a facility will degrade over time due to usage. For instance, the capacity of a raw water pump may decrease over time from the original nameplate capacity, due to wear of the impellers. Periodically, the equipment should be checked to compare the present to original capacity. A meter at the source facility provides a means to check the capacity of individual units and the capacity of all units operating at one time. The system should read the meter regularly under normal operating conditions, to determine volumes, rates, and current capacity. The results for a unit should then be compared to the original operating characteristics to determine the current operating performance. This check provides a means of determining the degree of wear of a unit. The capacity of a unit may have to be derated if the present operating capacity is significantly less than the original. If a unit's capacity is derated, the overall capacity of the facility may be reduced and the new capacity may be less than required. If the present capacity is less than the original, the equipment can either be repaired to obtain the original capacity or the actual capacity can be used in all further capacity determinations.

3.1.8 Design of Source Facilities

This section is divided into five subsections addressing different raw water sources, because each source has unique design characteristics. These different sources are grouped as ground water facilities; surface water facilities; infiltration galleries; springs; and catchments and cisterns.

Ground Water Supply Facilities

Ground water is water withdrawn from underground aquifers. To get the ground water to the distribution system, a well is drilled and a pump installed below the water level. A major concern in the design of a well is preventing contaminants from entering the aquifer. The major components of a typical ground water well are shown in Figure 3-1.

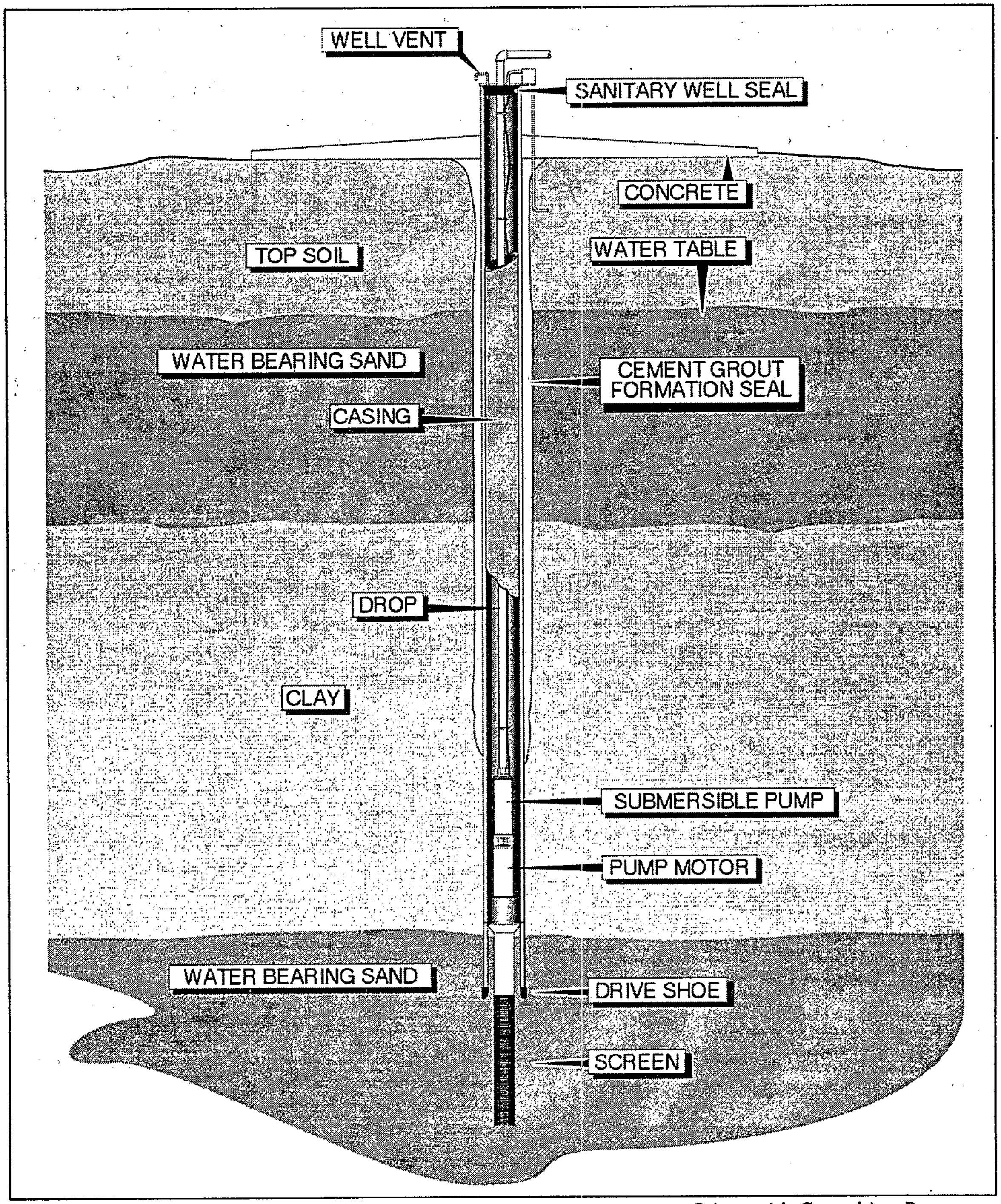

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Figure 3-1. Major Components of a Typical Ground Water Well

Because only the casing is above ground, it is not possible to visually inspect a ground water supply well to verify that the proper design and construction methods were followed for components below ground. The original well construction records (e.g., driller's log, material settling data) and records of after-construction modifications to the well, if available, should be used to verify that the well was properly constructed. The results of inspections and repair work performed by qualified technicians may provide additional information on the construction of the well. The inspector should verify that design and construction methods meet applicable state requirements for wells.

A well is started by drilling a hole in the ground into a water-bearing aquifer. The drilled hole is supported by solid casing installed to just below the water table. Screen material is installed below the casing to allow water into the casing while preventing the migration of sand and silt into the bottom of the well. The screen should be constructed of corrosion resistant material that is both strong and hydraulically efficient. A pump (usually submersible) and discharge line are lowered down the casing into the water.

The annular space between the drilled hole and the casing is filled with bentonite to prevent surface water and undesirable ground water from getting into the well and contaminating the aquifer. Grout or bentonite clay are used to fill the annular space. The well also needs to be sealed at the surface to prevent surface contamination from entering the well. This seal is usually a concrete pad poured around the casing and sloping away from the well, and a wellhead cover or a cap with a sanitary seal.

The following are suggested assessment criteria for a groundwater supply well:

1. **What is the depth of the well? Is the well encased the full length? If not, how long is the casing? Is the annular space around the well casing filled with grout or bentonite clay?**

   A well provides a direct conduit from the ground surface to the aquifer from which water is taken. If the well is not constructed properly, surface runoff and shallower aquifers can contaminate the aquifer chosen as the water source. Well casing is a very important part of proper well construction. The encasement of a well acts as a barrier to surface water and contamination from other aquifers. The encasement should be constructed of either steel or plastic, depending on the depth of the well and local regulations, and adhere to AWWA and NSF standards. The encasement should extend up a minimum of 18 inches above the natural ground level or finished floor elevation. The encasement should pass through all undesirable water bearing strata and extend down at least to the depth of the shallowest water bearing strata to be developed. However, the encasement will not completely fill the hole drilled for the well. The annular space around the casing needs to be filled with a material, such as bentonite or grout, that will prevent the leakage of water from the surface and intervening water-bearing layers down the outside of the casing into the aquifer. The bentonite or grout should be pumped to ensure that the annular space is completely filled.

2. What is the screen constructed of? What is the depth of the screen?

The water-bearing aquifer will typically consist of sand and gravel. A screen allows the maximum amount of water to flow into the well and prevents abrasive sand and gravel from reaching the pump. The screen should be constructed of a material that is strong and will not degrade over time due to exposure to water and surrounding environmental conditions. The material generally chosen for the screen is stainless steel. The screen should be checked periodically for corrosion and deterioration, especially if there is a reduction in pumping volumes.

3. Is the well properly sealed at the surface? Does the casing extend at least 18 inches above the well slab, floor, or ground surface? Does the well vent terminate above the maximum flood level with a turned down gooseneck and corrosion resistant bug screen?

As noted above, surface runoff can migrate down the annular space along the outside of the well casing and contaminate the aquifer. Therefore, all sources of leakage should be plugged to prevent contamination. The most visible point of leakage is the encasement at the surface. The construction of the well above the surface should prevent leakage down the outside of the well casing as well as through the casing cap, which is located on top of the casing. A concrete slab extending 2 to 4 feet around and sloping away from the well casing provides an effective seal of the casing. By extending the casing at least 18 inches above the well slab, surface runoff should not be able to enter the casing. The well casing cap has to be a watertight sanitary seal to prevent water from entering through it. In addition, the casing vent through the cap should extend above flood level to preclude surface runoff from entering the well directly and the end of the vent should be terminated with a down turned gooseneck and screen to prevent rain and bugs from entering.

4. Is there an acceptable tap for raw water sampling?

The discharge from the well should have a sample tap with a smooth nozzle to allow for sampling before the addition of any chemicals or disinfectants. A sample of the raw water will allow the water system to test for any contaminants that might be present or any changes in water quality.

5. Is the wellhead protected from vandalism and accidents?

There are numerous ways that the water supply for a system can be contaminated, including vandalism. Due to the location of the well, the wellhead may be vandalized, introducing contaminants down the well casing. If the wellhead is located near a street or highway, the wellhead could be damaged by a traffic accident. The location of the wellhead will dictate the measures required to protect it from vandalism or physical damage. For instance, a security fence and structurally sound buildings with locked doors would protect the wellhead from intentional vandalism or bollards would protect it from traffic accidents.

6. **What is the general condition of the piping and valving, the site, and the electrical system? Do they appear to be well maintained? Does the electrical system have lightning protection? Can the pump be maintained easily and the water for the system continually supplied?**

   As the source for the water system, the well should be in good operational condition to ensure that a dependable supply of high quality source water will be available at all times. Good operational condition means that the piping is not leaking or corroded, the valves and controls are operable, the electrical system is protected from the elements and is not corroded, the well site is graded to prevent ponding of surface water and to direct drainage away from the wellhead, and the housing and fencing is properly maintained. Valves and meters need to be fully functional and well-maintained to keep out contamination. Personnel should have sufficient access to these valves for cleaning. The electrical system should be protected from lightning since the sudden electrical surge caused by lightning striking the wellhead or nearby may cause the electrical components to burn out. If the electrical components of the well are not functional, then the well will not operate. The inspector should check for lightning protection and backup power supplies

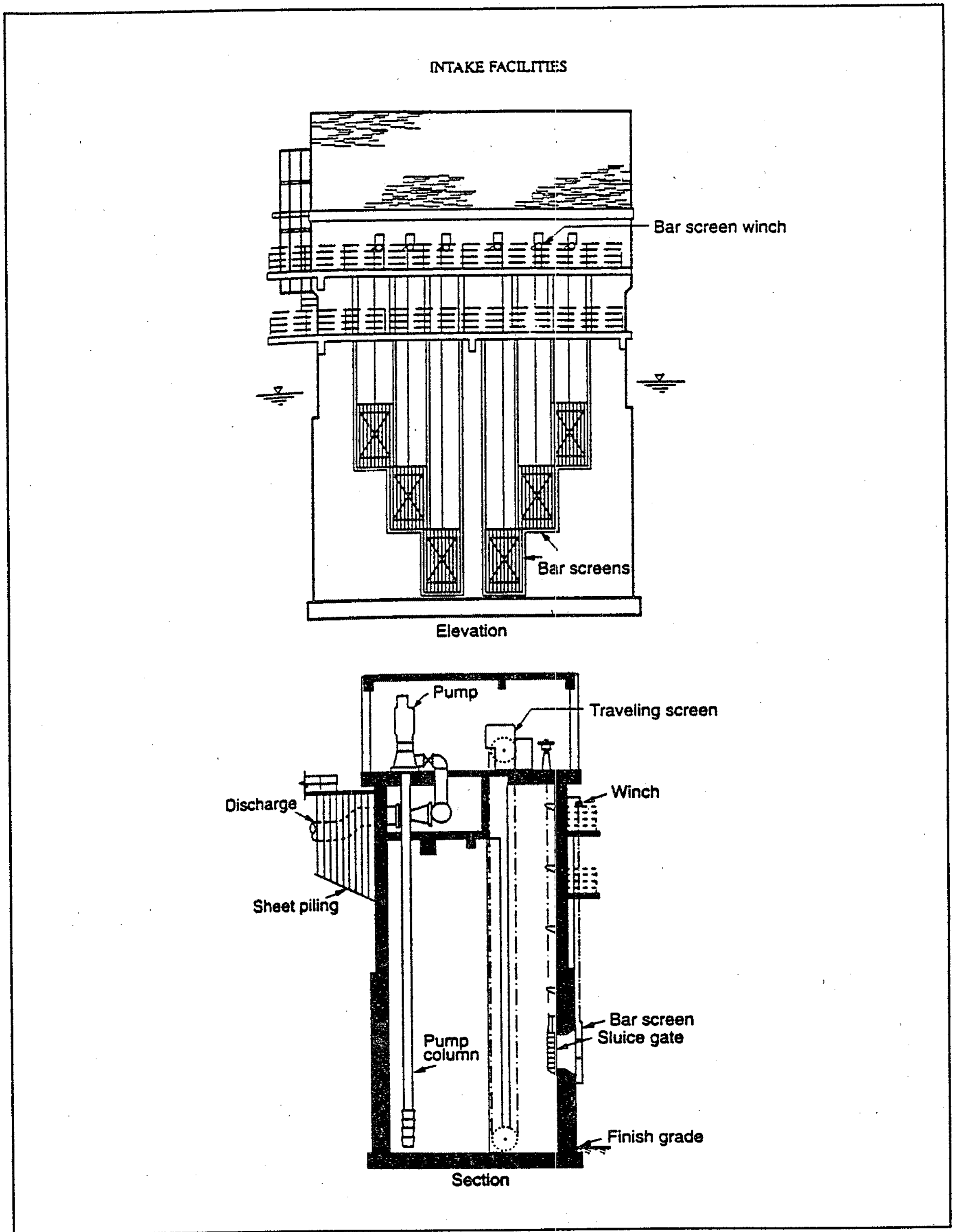
7. **Has the source been evaluated for GWUDI? If the well is under the direct influence of surface water, is proper treatment provided (filtration, disinfection)?**

   A ground water well may be under the direct influence of surface water. GWUDI of surface water has increased sanitary risks because of the additional opportunities for contamination to enter the water supply. A water system should evaluate its ground water supply to determine if it is GWUDI of surface water and, if so, apply appropriate treatment at the plant. The inspector needs to determine if a ground water supply is GWUDI in order to evaluate if appropriate treatment is provided.

Surface Water Supply Facilities

The design of a surface water source facility should provide some flexibility to accommodate fluctuating water quality. The location and position of the intake point in a river or reservoir can greatly affect the quality of water coming into the intake. Intake points should be located a sufficient distance (preferably upstream) from potential sources of contaminants. Water quality can vary with depth, and the elevation of a water surface changes over time. Intakes should be located at more than one depth so that the operator can draw water from the intake offering the best water quality (based on monitoring of water quality at different depths) and can withdraw water during times when the water level is very low. Figure 3-2 depicts the design of a surface water intake which can accommodate water quality variations with multiple level withdrawals.

There are several design methods that provide some flexibility to accommodate fluctuating water quality. The most common method for a surface source is to provide multiple levels of withdrawal. For instance, at a surface source, if the turbidity at a water depth of 20 feet



(Source: AWWA and ASCE, 1998; Used with permission)

Figure 3-2. Surface Water Intake with Multiple Level Withdrawals

is higher than at a depth of 5 feet, the design of the intake should provide the flexibility to withdraw at the 5 foot depth, which is the better quality level. The design of the source facility should be checked to determine whether water can be withdrawn at the lowest recorded or projected water level, and an appropriate range of levels. Water systems may also use bar screens and grates at their surface water intakes to prevent large debris from entering. Large debris, if allowed to enter, can damage supply pumps.

All mechanical equipment has to be maintained, either on a preventative basis or in an emergency. The design of the source facility should allow for the removal from service of a unit for maintenance. Typically, valves are provided on the discharge of pumps to take the unit out of service for maintenance and allow the facility to remain operational. Lockable breakers on the electrical service to the unit should also be provided to prevent the starting of the unit while it is out of service. Because all mechanical equipment has to be periodically maintained, it is very important that a means be provided to allow for maintenance while the facility remains operational at all times to meet the needs of customers. The onsite inspection of the source facility should check the design or features of the source facility to verify that it meets the needs of the water system and satisfies the regulatory requirements, if necessary.

The following assessment criteria are appropriate for a surface water supply facility:

1. **Is the source water quality the best possible? Can the best quality of water be withdrawn? If so, how? Is there an area around the source facility that is restricted? How is the area marked? Is the existing marking adequate? Are there any nearby sources of contamination evident? If so, what is being done to protect the source water?**

   The system should have the ability to withdraw water from several different depths within the reservoir, so that the operators can adjust the intake depth to obtain the best raw water quality. A single, fixed level intake point may be acceptable if historical records on the quality and use of source water indicate that there is no need for variable level capability. There should be no evidence of potential sources of contaminants such as septic systems, pit latrines, or fuel storage tanks in the area around the intake structure. Where contaminants are present, there should be spill containment or other measures in place to prevent the contamination from reaching the intake. There should be no debris or refuse accumulated around the intake structure. The area surrounding the intake should be clearly marked with signs, and if appropriate, buoys. Fencing may also be necessary to prevent unauthorized access to the surface water intake and supply facilities.

2. **What conditions cause fluctuations in the raw water quality?**

   Raw water quality may vary for surface water systems as a result of a number of factors, such as rainfall, snow melt, temperature, and changes in the watershed. The inspector should ask the system operators what factors cause changes in raw water quality for their system and if there are any steps that the system takes to minimize the impact.

3. Can a unit be taken out of service for maintenance and the facility remain operational? If so, how? Can the unit be locked out at the electrical service? If not, what is the method for preventing the starting of the unit during maintenance?

The ability to maintain the intake structure and raw water pumps is important to the water system's ability to provide a safe and reliable water supply. The system should have the ability to maintain an intake or raw water pump without having to take the entire water system off line.

4. Can water be withdrawn during a prolonged drought? What is the minimum projected water level? What is the level of the lowest withdrawal point?

The system operators should be able to show how they can adjust the intake depth during periods when the level of the surface water source is low.

Infiltration Galleries

An infiltration gallery is one means of using the natural filtration benefits of the ground to reduce water quality variances. The infiltration gallery, shown in Figure 3-3, consists of a perforated pipe in a gravel or sand bedding constructed along or beneath the source. Typically, sand backfill is placed over the bedding to improve the filtration of the natural soils in which the gallery is constructed. It is important that the embedment and backfill of the infiltration pipe be protected so that it is not washed out. The perforated pipe is connected to a well or caisson along the shore of the source. Raw water pumps lift the water from the well to the treatment facility. The wellhouse should be located at an elevation above the highest flood level of the source.

Infiltration galleries are often under the direct influence of surface water and therefor are frequently classified as GWUDI. The water system needs to determine if an infiltration gallery is classified as GWUDI and is considered to be a surface water source under the definition used by its state. If so, it should be treated as a surface water source.

The design and construction of an infiltration gallery is similar to a ground water well, therefore the assessment criteria for wells applies to an infiltration gallery; however, there are a few differences. The following additional assessment criteria are appropriate for an infiltration gallery:

1. Is the water system experiencing any significant fluctuations in water quality? If so, when and why?

Fluctuations in water quality from an infiltration gallery may indicate the overlying sand or other bedding material has washed out, and the water is not being filtered as it flows from the surface to the collector well. The system may need to excavate the infiltration gallery and replace the washed bedding.

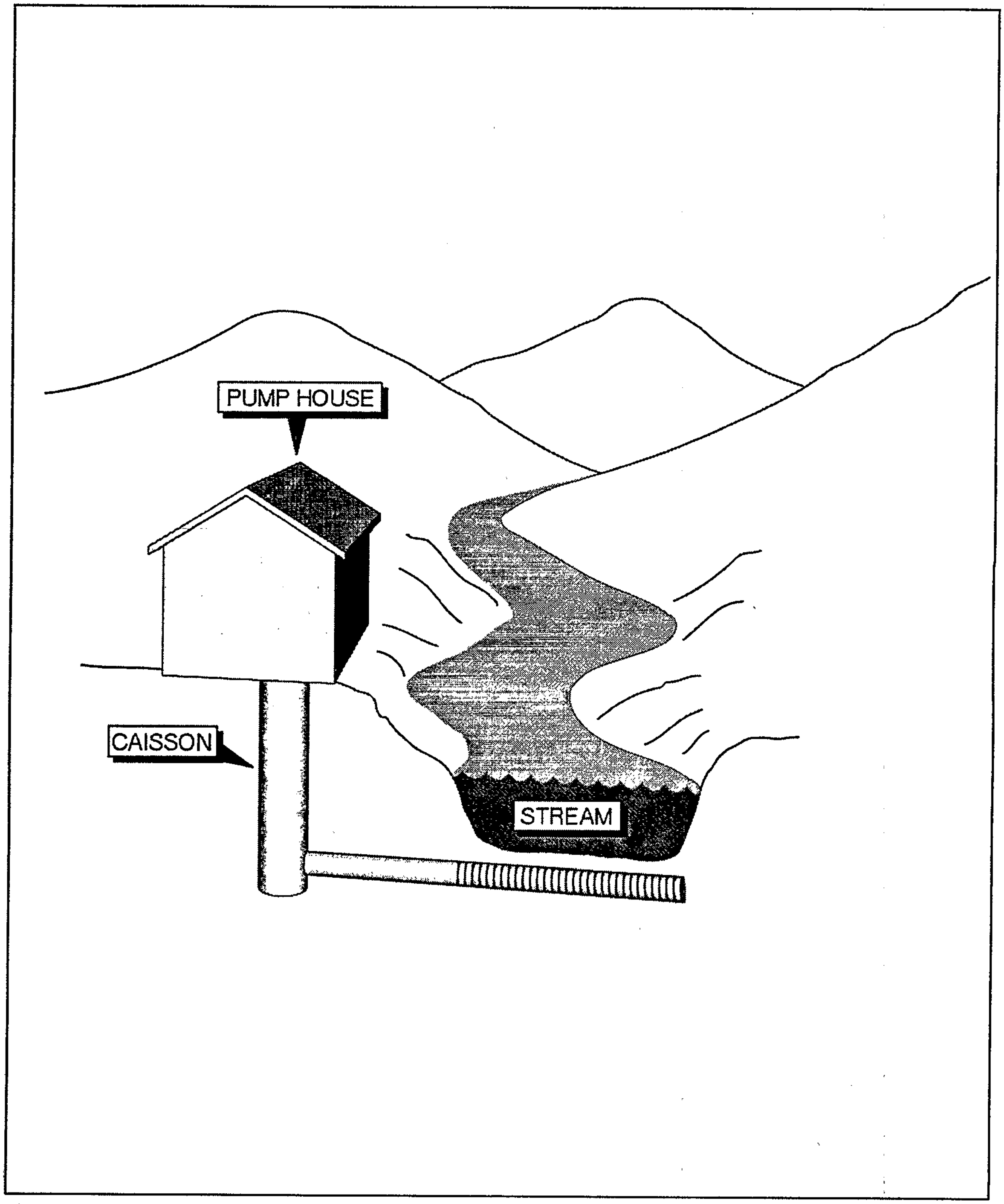


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Figure 3-3. Infiltration Gallery

2. **Is the infiltration gallery still providing an adequate supply of water? If not, when and why was the supply inadequate? When was the infiltration gallery last inspected? Was there any damage to the gallery—pipe, bedding, and backfill? Does it appear that the backfill and bedding, if visible, were clogged with silt? If so, how was it changed or cleaned?**

   The sand overlaying the infiltration collector pipes may become clogged with silt or other fine sediments, reducing the rate at which water can flow into the collector pipes. The system may need to excavate and replace the bedding.

3. **Has the source been evaluated for GWUDI? If the source is under the direct influence of surface water, is proper treatment provided (filtration, disinfection)?**

   Many infiltration galleries in certain geographic areas are under the direct influence of surface water. GWUDI of surface water has increased sanitary risks because of the additional opportunities for contamination to enter the water supply.

Springs

Springs occur where the natural flow of ground water rises to the surface. There are two types of springs, gravity and artesian. Gravity springs discharge from unconfined aquifers, which are water-bearing aquifers that rest on an impervious stratum and outcrop to the surface. Artesian springs discharge from artesian (confined) aquifers, which are aquifers that have both an upper and lower layer of impermeable material that forms a natural barrier of protection against contaminants. Artesian springs are under pressure because of the confining strata between which the water-bearing aquifer lies. Because of the upper confining layers, the water in the aquifer is at a pressure greater than the atmospheric pressure. An artesian spring occurs where the artesian aquifer either is cracked by a fault allowing the pressured water to escape or outcrops at a low elevation. The general geologic formations for each type of aquifer and spring are shown in Figure 3-4. (UFTREEO Center, 1998)

Springs may be considered either surface water or ground water sources, depending on their characteristics and on the way a state classifies springs. The water system needs to determine if the spring is under the direct influence of surface water and if it would be classified as a surface water source under the definition used by its state. If so, it should be treated as a surface water source.

When a spring is chosen for a water supply, the water system should determine that the water quality is acceptable, the quantity of water available is adequate to meet the needs of the water system, and the spring is protected from contamination. The quantity of water available from a spring can vary significantly due to changes in ground water storage. Depending on the type of spring, changes in ground water storage can come from seasonal variations such as dry periods and withdrawals of nearby wells. Special steps should be taken to prevent contamination of the spring during construction of the improvements necessary to supply the source water.

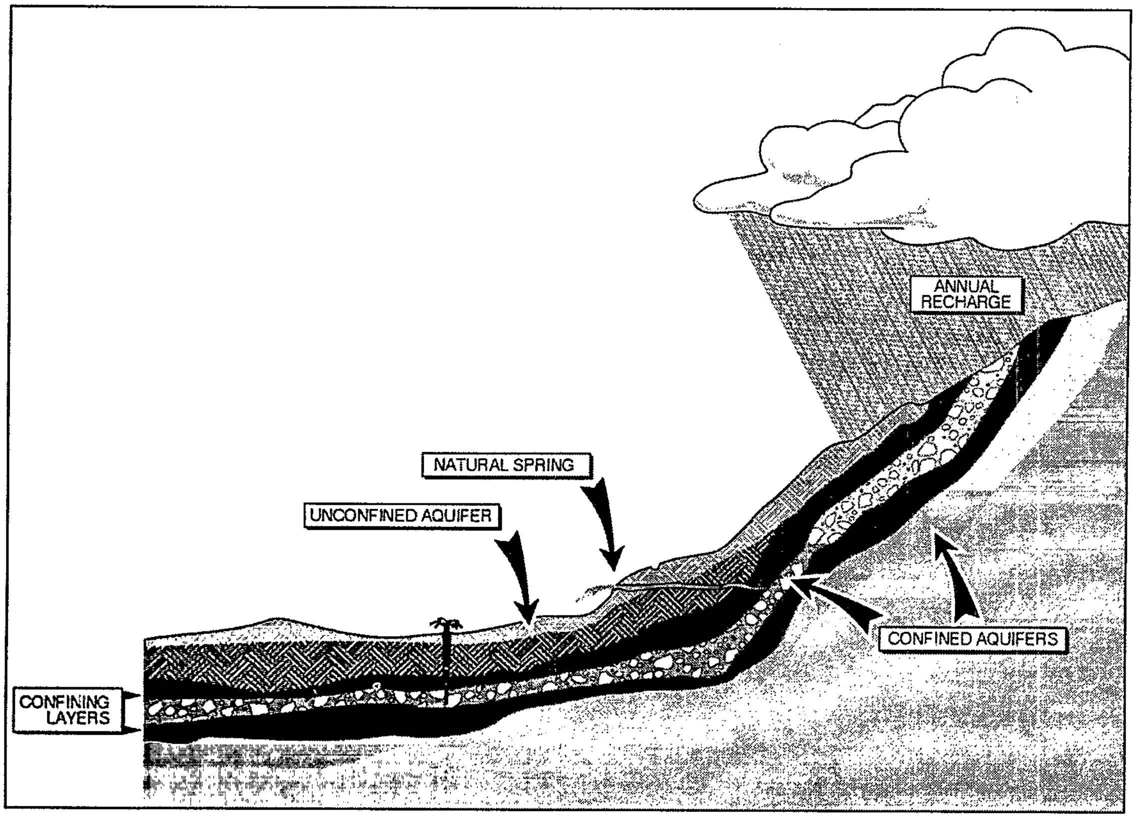

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Figure 3-4. Geological Formation for Springs

Many of the collection system improvements for a spring are similar to that for a well or an infiltration gallery (see above subsections), depending on the type of spring. If the spring is artesian, a vertical well is drilled into the aquifer (either directly at the spring or near the spring) and constructed in the same manner as a ground water well. Water rises in the well due to the pressure of the artesian spring, so unlike ground water wells, a pump may not be needed to raise the water in the well. However, pumps may be used to deliver the water to the treatment plant. If the spring is gravity driven, then a horizontal well (similar to an infiltration gallery) is constructed to collect the spring water before it exits at the surface.

Since water from a gravity spring outcrops to the surface by gravity, pumps may only be needed to feed the water to the treatment plant, instead of the pumps used to lift water from the infiltration gallery well.

Due to the similarity of the spring water collection system to a ground water well or an infiltration gallery, the assessment criteria for those facilities apply to the collection systems for springs; however, there are some differences. The following additional assessment criteria are appropriate for springs:

1. **Is the spring area protected from contact with animals and vandalism?**

   Protective devices, such as good fences and warning signs, deter human and animal activities that might disturb the spring area.

2. **Is the spring box or storage tank watertight, with a lockable, watertight, overlapping lid or cover? Does the springbox have a screened overflow? Is there a drain with a screen and shutoff valve? Is the supply intake properly located and screened?**

   The springbox or storage tank and cover need to be watertight to prevent undesirable water from entering. The cover should also be lockable to prevent the access of unauthorized parties. Since most springs never stop producing water, an overflow is needed to ensure that water pressure does not build up and damage the springbox. Springboxes need a drain to turn out the water in case the source water quality degrades. The end of the drain should have a screen to prevent the entrance of animals. The intake to the water system from the tank or springbox should be located about 6 inches above the bottom and screened to minimize the amount of sludge that is drawn into the intake from the chamber (UFTREEO Center, 1998).

3. **Is there a diversion ditch around the upper end of the spring area? Is there an impervious barrier over the spring area to keep out rainwater and surface contamination?**

   A diversion ditch keeps rainwater from flowing over the spring area and infiltrating the ground, and should be located at the uphill end of the site. A good impervious barrier, such as clay or a plastic liner, can help ensure high quality water by preventing potential contaminants from entering the collection facilities.

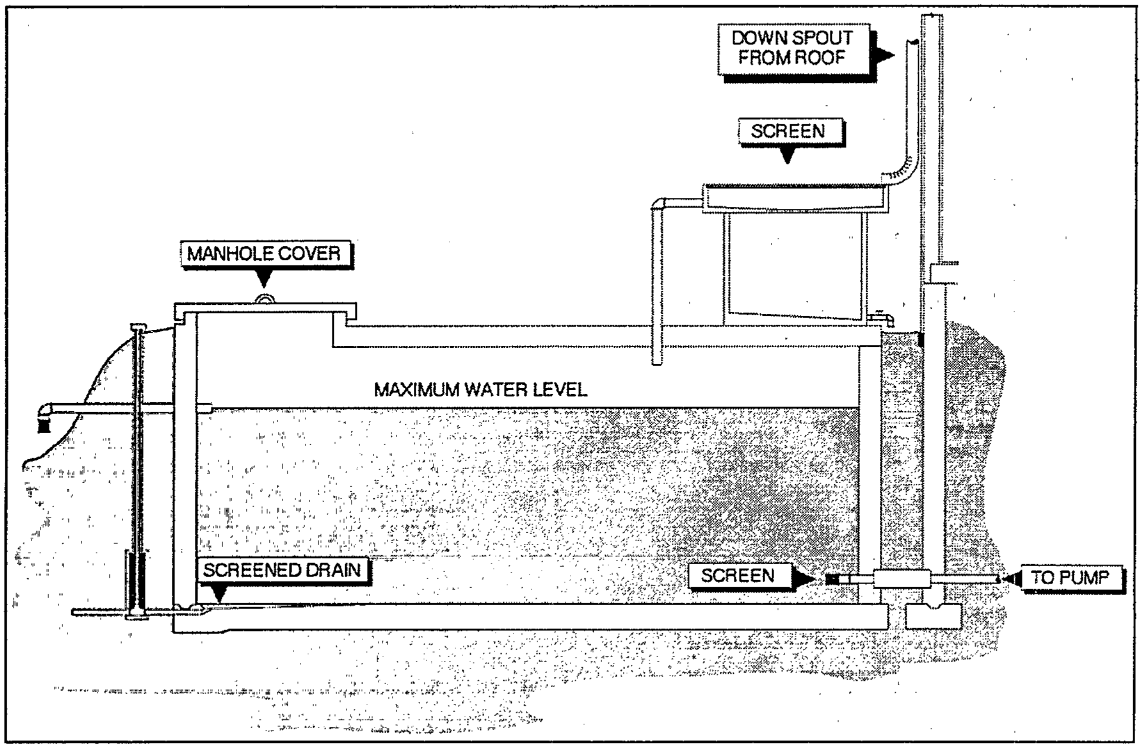
4. **Does the spring meet requirements for setbacks from sanitary hazards?**

   Springs should meet appropriate state requirements for setback distances from sanitary hazards.

Catchments and Cisterns

In some areas, catchments and cisterns are used to collect rain water from the roofs of structures. Sometimes, the quantity and quality of the collected rain water may be doubtful, but it may be the best (or only) source available for individuals or small communities (UFTREEO, 1998). The biggest factor affecting the quality of the water collected is the type of material used on the roofs, and the condition of the gutter system. The important factors for quantity are the collection and storage areas, annual rainfall, and per capita use.

Particular attention should be paid to the material and condition of the roof and gutters when reviewing the design of the catchment system (see Figure 3-5 for the major components). The roof and gutter system should be constructed of weather resistant material, such as metal or plastic. Debris from trees and brush should not be allowed to collect on the roof or accumulate in the gutter system.



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(Source: UFTREEO Center, 1998; Used with permission)

Figure 3-5. Catchment and Cistern System Components

Rain water flows off the roof into the gutters and then to a central collection point, a tank that is commonly known as a cistern. A diversion box should be provided at this central point to divert the first water that runs off the roof. This first flush typically contains the debris and bird droppings found on the roof and in the gutters at the time of the rain and should not be allowed to flow into the cistern. After the diversion of the first water, the diversion box is switched to allow the rain water to flow through a screen into the cistern. The screen is needed to collect the remaining debris.

Roof structures are often accessible to rats, raccoons, opossums, birds, and other animals and therefore are vulnerable to contamination from animal populations that carry protozoan cysts pathogenic to humans. As a result, there may be significant potential sanitary risks associated with the use of catchments and cisterns as public water supply sources without proper treatment (e.g., at least disinfection to treat for potential bacterial and viral contamination).

The cistern should be constructed of non-toxic materials that make it watertight. The access cover to the cistern should be at least 2 inches above the surface, heavy enough to prevent removal by children, and lockable. The piping for the cistern should include a drain for cleaning, an overflow to allow water to escape the tank, and an intake to the system pump. The drain and overflow should be screened on the end to prevent insects and animals from getting into the cistern. A free-flowing drain line with an isolation valve should be located at the bottom of the cistern. The intake to the system should be installed at least six inches above the floor of the cistern with a screen on it to prevent any debris that may have settled from entering the system.

To assess catchment and cistern designs, the following criteria are appropriate:

1. **Is the water supply adequate to meet the needs of the community? If not, what other sources are available?**

   The cistern should be capable of meeting the system's demand for water even during periods of drought or alternate sources should be provided. Inadequate capacity could lead to customers utilizing unsafe sources of water.

2. **What is the condition of the roof and the gutters? If signs of deterioration are evident, when will the system be renovated?**

   The condition of the roof and gutters can have an impact upon the quality of the water collected in the cistern. The roof and gutter should be constructed of weather proofed materials and should not have the potential to leach contaminants into the water supply. There should be no accumulated debris on the roof or in the gutter, which could be washed into the cistern.

3. **Is there a diversion box? Is the diversion operable?**

   The first flush of runoff typically contains the highest level of debris and other potential source of pollutants. A diversion box prevents the first flush from entering the catchment. The first flush tank should be emptied before the next rain.

4. **Is the cistern properly constructed? Does the water quality appear acceptable in the cistern (no floating debris, etc.)?**

   The cistern should be watertight. There should be an adequate cover for the cistern, which is secure. There should no way for contaminants on the surface to enter the cistern.

5. **Are there screens at the entrance to the cistern, at the drain overflow and intake to the system? Are the screens in good condition?**

   There should be a drain pipe to allow for cleaning of the cistern and an overflow pipe. Both the drain and overflow pipes should be screened to prevent animals or insects from entering the cistern.

3.1.9 Condition of Source Facilities

The physical condition of the source facility can be a good indicator to the inspector of how often the facility is visited and how well it is maintained. Regardless of the location, all critical facilities should be visited at least once a day to determine that all equipment is operating correctly. If the grass around the facility is knee high, with no apparent trails through the grass, a reasonable assumption can be made that the facility is not visited daily (or maybe even monthly). Another indication of the general visitation schedule by operation personnel is the amount of spider webs in the corners or dirt on the floor.

The overall condition of the equipment will provide some insight into the water system's philosophy towards preventative maintenance. If the equipment appears to be in good condition with little rusting, then the system places value on preventative maintenance. However, if the equipment does not appear to be in good condition (e.g., zinc fittings painted over), then the system either places little value on preventative maintenance, may have little money allocated for maintenance, or has an inadequate staffing level to perform maintenance.

Suggested assessment criteria for the physical condition of the source facility include:

1. **How often is the facility visited?**

   Source facilities should be checked by system personnel at least once a day.

2. **Does the facility appear to be well maintained – grass mowed, equipment painted, facilities kept clean, etc.?**

   The appearance of the facility does not directly impact the quality of the water, but it does provide an indication of the overall amount of maintenance which the facility receives.

3. **Is the facility required by the state or local government to have a rodent and pest control permit? Does the facility have one? Are there any visible places where wildlife can enter the facility and take shelter (including rodents, birds, and snakes)?**

   The inspector should evaluate the appropriateness of any rodent/pest control measures. The inspector should observe whether there are any signs of the existence of wildlife inside the facility. While at the facility, the inspector should look for any signs of earlier flooding in the facility or water marks on the walls that may be signs of equipment malfunctioning.

3.1.10 Transmission of Source Water

Untreated water travels from the source to the treatment plant through a transmission system of pipes. Some source water facilities are at a considerable distance from treatment facilities. The transmission lines present a potential opportunity for liquids and materials to both enter and leave the system. If the raw water is used before it receives treatment, it presents a sanitary risk and may be unsafe. If the transmission lines are not in good condition, they may allow contaminants to enter the raw water supply or may cause the supply to be interrupted. Transmission lines need to be assessed for sanitary risks during the sanitary survey. The inspector should travel along the raw water transmission lines and speak with the operators to verify information already obtained from maps and other records about the location of transmission lines, air release valves, pressure release valves, drain valves, and other pertinent information.

Suggested assessment criteria for the raw water transmission lines include:

1. **Do the transmission lines deliver all the raw water directly to the treatment plant?**

   The transmission lines should not contain connections directly to any customers or to the distribution system. All raw water should be delivered to the treatment plant and should not be able to bypass the plant. The transmission pipes should not contain any valves that could be activated to permit bypassing. The inspector should check for any connections that may deliver untreated water to customers. If there are any connections to customers directly from the transmission lines, the inspector should check if adequate treatment is being provided. If not, the inspector should inform the system that the connections present a serious sanitary risk and need to be removed.

2. **Are the transmission lines reliable for providing a continuous supply of raw water to the treatment plant?**

   If the system relies on a single transmission line, a failure of this line could leave the system and consumers without water. If transmission pipes are in poor condition due to age, deterioration, or natural events (e.g., weather conditions, earthquakes), the inspector should assess the potential for failure and subsequent interruptions to the water supply.

3.1.11 Priority Criteria

The following criteria related to the source water element of the sanitary survey are considered high priority based on their potential for impacting public health:

- **Source Water Quality** – The quality of the raw water source can have a significant impact on treatability, due to rapid fluctuations in the physical, chemical, and biological characteristics of the source water (Section 3.1.4).

- **Source Water Quantity** – The quantity of water available should be checked to determine that there is a long-term supply available (Section 3.1.5).
- **Location of Source Facilities** – The location of the raw water facilities can impact the operation of the water system and can affect how much water quality varies over time, particularly due to nearby sources of contamination and natural causes such as flooding (Section 3.1.6).
- **Capacity of Source Facilities** – The capacity of the source facilities should exceed the potential demands even when equipment is down for maintenance (Section 3.1.7).
- **Condition of Source Facilities** – If the physical condition of the facility is poor, this can be an indication of inadequate preventative maintenance by the system and can have a negative impact on system reliability (Section 3.1.9).
- **Transmission of Source Water** – All raw water needs to be properly treated before use. If the transmissions lines can bypass the treatment plant or there are connections directly to consumers from the transmission line, a serious sanitary risk exists (Section 3.1.10).

3.2 Treatment

The type of treatment processes and facilities used to achieve safe drinking water are dictated primarily by the quality of the source water and the regulatory requirements that must be met. In general, most surface water sources require complete conventional treatment which includes coagulation/flocculation, sedimentation/clarification, and filtration processes to physically remove pathogens and other particulates, and disinfection to inactivate any pathogens that are not physically removed. The physical facilities at a conventional surface water treatment plant typically include chemical feed equipment, rapid mixing basins, flocculation basins, sedimentation/clarification basins, filters, and treated water storage facilities. The chemical feed facilities usually include storage and feed equipment for coagulants, disinfectants, and stabilizers.

In some cases, specific source water conditions may require supplemental treatment processes and facilities. For example, aeration is used to remove undesirable gases such as radon and VOCs from source water. Carbon adsorption (GAC) is used to control taste and odor problems and to remove organic contaminants including VOCs, pesticides, color- and turbidity-causing compounds and some inorganic contaminants such as radon and some heavy metals. Chemical oxidation is used to facilitate precipitation and improve the filtration process. Softening is used to reduce scale forming tendencies. In the case of high quality source water, complete surface water treatment may not be necessary. For example, the treatment facilities for a GWUDI may consist only of direct filtration and disinfection.

The sanitary survey inspector should evaluate all water treatment processes in use at the water system. This evaluation should consider the design, operation, maintenance, and management of the water treatment plant to identify existing or potential sanitary risks.

Water treatment facilities are the primary means of preventing unacceptable drinking water quality for public consumption. The treatment facilities and processes should be capable of removing or inactivating physical, chemical, and biological impurities in the source water. The new regulatory requirements related to the IESWTR and disinfection byproduct control place additional demands on the treatment facilities. The treatment facilities and processes should be evaluated to determine their ability to meet these regulatory requirements and to provide an adequate supply of safe drinking water at all times, including periods of high water demand and poor source water quality.
A sanitary survey of a treatment facility should:

- Analyze all the distinct parts of the treatment process, including but not limited to coagulation/flocculation, sedimentation, filtration, disinfection, chemical feed systems, hydraulics, controls, and wastewater management;
- Review source water quality data that may impact the treatment process, such as turbidity, pH, alkalinity, and water temperature;
- Identify features that may pose a sanitary risk, such as cross connections in the plant; and
- Review the criteria, procedures, and documentation used to comply with regulatory requirements – adequate disinfection based on CT study, individual filter turbidities, finished turbidities, post backwash turbidity profiles, etc.

The inspector will need to review the design criteria, plant records, and compliance strategies in addition to performing the actual inspection of the facility. The following sections discuss specific portions of the treatment facility to be evaluated during an inspection.

3.2.1 Location of Treatment Facilities

Theoretically and preferably, all water treatment plants should be located above 100-year flood levels. However, in some locations this is not the case, particularly for some old treatment facilities. Also all treatment plants and their raw water sources should be located at a safe distance from potential sources of contamination. The sanitary survey inspector should evaluate the location of the treatment facilities with respect to any state regulations regarding potential flooding and required distances from potential sanitary hazards. Onsite, the sanitary survey inspector should confirm the location and elevation of the treatment facilities using a topographic map. The inspector should ask about the activities carried out in nearby facilities and buildings. The inspector should also ask the plant operator(s) about any old water marks evident on the outside walls of any building within the facility and about underground storage and farm tanks in the area and how long they have been there.

Suggested criteria for assessing the location of treatment facilities:

1. **Is the treatment plant located at a level below the 100-year flood line?**

   A treatment plant located in a flood plain should have measures in place to avoid a shutdown during flood events.

2. **Are there any sources of contamination in the vicinity of the treatment plant?**

   Treatment plants located near farm industries, chemical and petroleum industries, open mine pits, downstream from a wastewater discharge point, or near or in an unsewered area may have a higher risk of having a contaminant end up in the water than treatment plants located far away from contamination sources.

3.2.2 Treatment Plant Schematic/Layout Map

A schematic or layout map of the public water supply treatment plant will enable the inspector to obtain a quick understanding of the treatment type(s), what water quality problems the plant was designed to treat, and how the plant is laid out. If possible, before the site visit, the inspector should obtain a schematic or layout drawings of the treatment plant. An example of a layout map of a water treatment plant is shown in Figure 3-6. The layout map should show the major treatment processes and should be drawn in enough detail to facilitate the inspector's understanding.

For identification purposes, the name and identification number of the public water system, as well as the date of the sketch, should be included on the schematic. The dated schematics will help future inspectors identify water system changes. The schematic should be current and reflect any changes that have been made since initial construction of the system and since the last sanitary survey.

Suggested criteria for assessing treatment plant schematic or layout drawing(s) are:

1. **Does the drawing(s) shows the name of the facility and date of the last modification made to the drawing(s)? Are the drawings up-to-date?**

   This will help future inspectors know between which two sanitary surveys modifications took place. Taken together, a chronological set of schematics will help document a system's history.

2. **Does the schematic or layout map(s) contain the proper information (e.g., a legend that explains key symbols used in the drawing(s), a numerical or a graph scale on the layout map)?**

   With the aid of a legend, the inspector will get a better idea about the location of principal treatment units and appurtenant equipment. The drawing with its legend will provide the inspector with information useful for determining where to start and end the inspection, as well as areas that the inspector should focus on and inspect in particular detail.

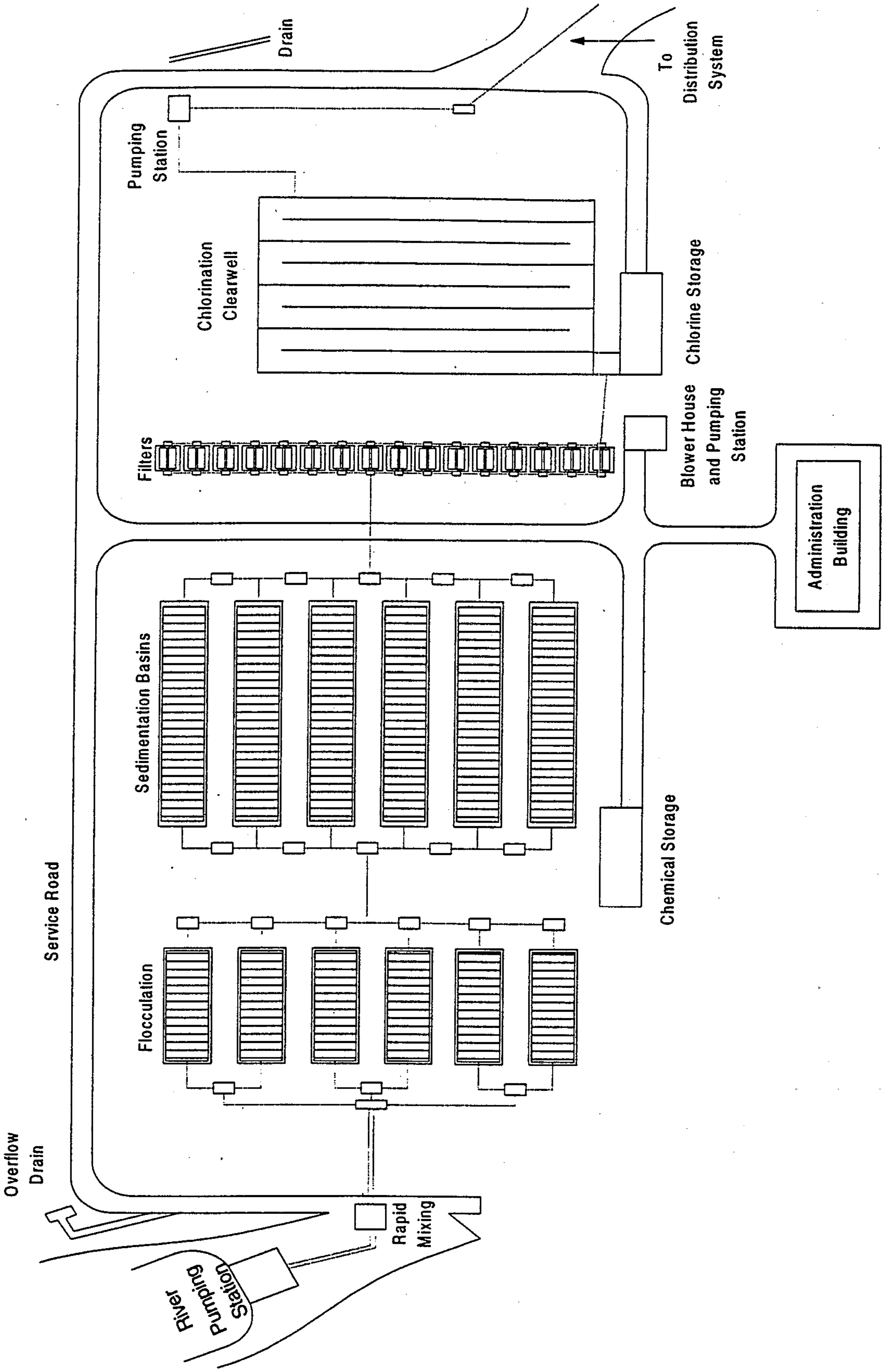

Figure 3-6. Water Treatment Plant Layout Map (not to scale)

3. **Does the schematic or layout map(s) identify treatment type(s)?**

   The identification of treatment type(s) will give the inspector an indication about what the treatment plant was designed for and whether bypassing or bringing certain treatment units on-line in response to raw water quality changes is appropriate. A list of the types of treatment plants and information specific treatment processes and facilities are included in Section 3.2.4 Treatment Processes and Facilities.

4. **Are all treatment units shown on the schematic or layout map(s)? Is there a treatment unit (including chemical injection points) that appears to be out of place?**

   Examples of out-of-place treatment are alum added at a clearwell and disinfectant only added ahead of a GAC filter. Treatment plant schematics and layout maps may not reflect the actual treatment plant configuration. Some design errors are corrected during construction and are not reflected in the layout drawings. In addition, construction errors or drafting errors can should verify whether any treatment that appears to be out-of-place on the drawings is out-of-place in the actual plant.

3.2.3 Capacity of Treatment Facilities

One of the initial steps of the onsite visit should be determining the required capacity of the treatment facilities. The required capacity should be at least equal to the maximum daily demand of the water system over the previous several years or as determined by the rules and regulations of the state primacy agency. Reviewing the operating records of the plant should provide the maximum daily demand. Generally, the maximum daily demand occurs during the summer time. However, there have been situations where the maximum daily demand occurred during hard freezes in the winter, when customers left faucets running to prevent their water pipes from freezing. Operating records for the last few years should be checked to determine the historic maximum daily demand.

The state primacy agency may have rules and regulations that specify the capacity requirements for source water supply facilities and individual treatment units. The existing treatment facilities should be evaluated to determine if the capacity requirements are met. The capacity of sedimentation basins is usually evaluated based on surface overflow rate and hydraulic detention time. The capacity of filter units is usually evaluated based on the hydraulic loading rate. The inspector should identify the component of the treatment process that most limits the production capacity of the plant (i.e., the unit that reaches maximum capacity first and thus prevents production of treated water at a higher rate).

The following are suggested assessment criteria to determine the adequacy of the treatment facility capacity:

1. **What is the design capacity of the treatment facilities? What is the historical maximum daily demand of the water system? What is the**

storage capacity of the system? Given service connections or population, are treatment facilities reasonable?

The historical maximum daily demand of the system can be found in the operating records of the facility. From design and construction documents, the system capacity can be determined. From the design capacity and maximum daily demand and population increase or decrease trends, the inspector can determine whether the source water supply facilities are close to meeting its design capacity and whether expansion plans or upgrades need to be established.

Based on storage capacity and the hourly consumption rate record over 24 hours during the day when maximum daily demand occurs, the inspector can draw conclusions on whether the source water capacity can meet the maximum daily demand.

2. **If the state primacy agency has specific treatment unit capacity requirements, does the system meet the requirements?**

   Some state primacy agencies have set minimum requirements for the capacities of major treatment units, based on historical data for the area, industry standards, and GREPs. The state primacy agency criteria is usually established at levels adequate to ensure that capacity is available to meet any and all demands of the system's customers for normal as well as emergency use. Typically, the capacity requirement is based on the number of connections served and fire fighting demand (e.g., raw water pumping capacity of 0.6 gpm per connection served). With the number of connections served by the system, the state required capacity of the facility can be determined.

3. **Are treatment facilities capable of meeting the required capacity with the largest unit out of service?**

   Since the equipment used in a treatment plant is mechanical, it will be necessary to take individual units out of service periodically for maintenance, repair, or replacement. During this time period, the facility should be able to satisfy the maximum daily demand of the system. To ensure that adequate capacity is available at all times, the capacity of any major treatment process should be determined with the largest unit out of service.

4. **Can the treatment process be interrupted by power outages, etc.? What backup or standby provisions are available? If a generator is provided for emergency power, how often is the generator used? Can the operator demonstrate that the backup systems are operational?**

   Backup power generators should be checked on a weekly basis. They need to be exercised under load, rather than simply having the power turned on and off. Backup power generators should have sufficient power to run all essential treatment processes.

5. **Can the operating characteristics of the existing units be checked? If so, does the system check them periodically? How does the existing operational point compare to the original operational characteristics of the unit? Should the capacity of the unit be derated? If so, what is the new capacity?**

   As with most mechanical equipment, the equipment in a facility will degrade over time due to usage. For instance, the capacity of a raw water pump may decrease over time from the original nameplate capacity, due to wear of the impellers. Periodically, the equipment should be checked to compare the present to original capacity. A meter at the treatment unit provides a means to check the capacity of individual units and the capacity of all units operating at one time. The system should read the meter regularly under normal operating conditions, to determine volumes, rates, and current capacity. The results for a unit should then be compared to the original operating characteristics to determine the current operating performance. This check provides a means of determining the degree of wear of a unit. The capacity of a unit may have to be derated (lowered) if the present operating capacity is significantly less than the original. If a unit's capacity is derated, the overall capacity of the facility may be reduced and the new capacity may be less than required. If the present capacity is less than the original, the equipment can either be repaired to obtain the original capacity or the actual capacity can be used in all further capacity determinations.

3.2.4 Treatment Processes and Facilities

The specific treatment processes and facilities at a surface water treatment plant and a GWUDI of surface water treatment plant depend on the quality of the source water and the regulatory requirements that must be met. The various combinations of these processes and facilities are sometimes classified based on the overall treatment objective of the plant as follows:

- *Conventional Filtration* – consists of facilities for rapid mixing, flocculation, sedimentation, filtration, and clearwell. Typically has chemical addition points to provide for coagulation, oxidation, pH adjustment, fluoridation, and disinfection. Also should include facilities for residuals (e.g., wastewater and sludge) management (e.g. treatment, disposal).

- *Direct Filtration* – consists of facilities for rapid mixing, flocculation, filtration, and clearwell storage. Typically has chemical addition points to provide for coagulation, oxidation, pH adjustment, fluoridation, and disinfection. Also, should include facilities for residuals management.

- *In-Line Filtration* – consists of facilities for rapid mixing, filtration, and clearwell storage. Typically has chemical addition points provide for oxidation, pH adjustment, fluoridation, and disinfection. Also, should include facilities for residuals management.

- *Slow Sand Filtration* – consists of a slow sand filter and clearwell storage . Typically has chemical addition points to provide for oxidation, pH adjustment, fluoridation, and disinfection.
- *Single Stage Softening* – consists of facilities for rapid mixing, flocculation, sedimentation, filtration, and clearwell storage. Typically has chemical addition points to provide for coagulation (including the addition of chemicals such as lime and soda ash), oxidation, pH adjustment (including the addition of chemicals such as sodium hydroxide to increase pH and carbon dioxide for recarbonation), fluoridation, and disinfection. Also should include facilities for residuals management.
- *Two Stage Softening* – consists of facilities for lime rapid mixing, flocculation, sedimentation, lime rapid mixing, flocculation, sedimentation, filtration, and clearwell storage. Typically has chemical addition points to provide for coagulation (including the addition of chemicals such as lime and soda ash), oxidation, pH adjustment (including the addition of chemicals such as sodium hydroxide to increase pH and carbon dioxide for recarbonation), fluoridation, and disinfection. Also should include facilities for residuals management.
- *Conventional Filtration/Softening* – consists of facilities for rapid mixing, flocculation, sedimentation, lime rapid mixing, flocculation, sedimentation, filtration, and clearwell storage. Typically has chemical addition points to provide for coagulation, oxidation, pH adjustment (including carbon dioxide addition), lime addition, fluoridation, and disinfection. Also, should include facilities for residuals management.
- *Split and Complex Treatment Trains* – treatment plants with parallel treatment trains that may consist of identical or different treatment units. Typical examples would be where the influent is split directly or through an equalization basin into two parallel trains, with one treatment train consisting of one process (such as conventional coagulation, sedimentation, and dual media media filtration), and the other treatment train consisting of a different process (such as a upflow clarification and deep bed GAC filtration). Other complex treatment trains may contain aeration units and/ or membrane filtration units. In addition, the treatment plant should include facilities for residuals managment.
- *Membrane Filtration* – typically consists of pressure-driven membranes. These technologies are employed in drinking water treatment facilities to remove various contaminants. Micro-filtration membranes are used to filter out particulates including pathogenic cysts. Ultrafiltration membranes are used to remove specific dissolved organics such as disinfection byproduct precursors and to remove particulates. Nano-filtration is used to remove calcium and magnesium ions (hardness) and disinfection byproducts precursors. It is also used to remove microbial contamination including viruses. Reverse osmosis (RO) membranes are typically used to remove organic and inorganic contamination.

- *Greensand Filtration* – consists of a pumping station, a continuous or intermittent potassium permanganate chemical feed system, the greensand filter itself, and a disinfection unit following the filtration process. Typically employed in ground water systems with iron problems.
- *Simple Aeration Plant* – consists of facilities for aeration, followed by disinfection treatment units. These units are found in ground water systems, including some ground water under the direct influence of (GWUDI) surface water systems.
- *Disinfection Treatment* – consists of a disinfection unit. Surface water, GWUDI of surface water, and ground water systems employ this type of treatment.

The treatment processes and facilities being used at a treatment plant should be evaluated with respect to the regulatory requirements of the state primacy agency. If the required treatment processes are not in place, then the files and information gathered before beginning the survey should be checked for waivers and/or exceptions granted by the state primacy agency, to determine if the existing treatment facilities are acceptable. A more detailed discussion of specific treatment processes and facilities found at surface water treatment plants is included below. The inspector should make certain that individual unit treatment processes are being operated within their design specifications.

3.2.4.1 Presedimentation

Presedimentation basins are typically used at treatment plants with raw water sources that are highly turbid. In such cases, the presedimentation process allows the removal of larger suspended matter and provides a more uniform quality of raw water. Presedimentation basins also provide an important buffer in the event that the primary source of supply is temporarily impacted by a chemical spill or other source of contamination. The presedimentation process is sometimes supplemented with aeration equipment to help control taste and odor problems.

Presedimentation basins are typically designed with large storage volumes that can meet the design capacity of the treatment plant for several days or weeks. In cold regions, these basins are usually designed with depths of greater than 15 feet and have additional capacity to account for surface freezing. In very hot climates, the basins are designed to account for excessive evaporation and some evapotranspiration.

Suggested criteria for assessing presedimentation facilities include:

1. **Is the total capacity of the presedimentation basins large enough to accomplish the purpose of reducing turbidity?**

   The main function of the presedimentation basin is to reduce turbidity by causing elements such as silt, clay, and other collodial material to settle out of the water to the bottom of the basin. The inspector should review and compare the turbidity levels of water drawn from the inlet and the outlet of the presettlement basin(s) to conclude if it is functioning adequately.

2. **How often are the presedimentation basins cleaned?**

   The inspector should look at the records and ask the treatment plants operator(s) about the frequency of cleaning the presedimentation basins and how it is done.

3. **Do waterfowl cause a problem during certain periods and how does the plant operator(s) deal with this problem?**

   Waterfowl take refuge in ponds and settled water basins like presedimentation basins. In some areas they rest in large numbers on the water surface where they feed and excrete, posing a serious source of microbial and organic contamination.

3.2.4.2 Flow Control and Metering Systems

Two types of flow measurement are encountered in a water treatment plant: open channel flow measurement and closed pipe flow measurements. There are various types of flow control and metering devices. Open channel flow measurement includes Parsall flume and weir flow measurement. Flow measurement devices for full flow closed pipes are diverse. These include turbine meters, positive displacement meters, metering pumps, electromagnetic flow meters, ultrasonic flow meters, drag-force flow meters, and variable pressure-drop flowmeter such as the Venturi type tube flow meter (Doebelin, 1983).

Suggested criteria for assessing flow control and metering systems are:

1. **Are flow measurement devices installed at source water inlet and finished water outlet? Are they functioning? Are they calibrated to assure accuracy?**

   The sanitary survey inspector should take note of any out of service on-line flow measurement meter. The inspector should also note any missing flow measurement devices. This is important because flow rate is an important factor in determining required chemical additions. Having inaccurate flow measurement will result in under or over dosing of chemicals that might cause serious sanitary risks to water consumers.

2. **Are there adequate flow measurement devices thoughout the treatment process?**

   Flow meters should be installed at least at points where filter backwash is recycled, where a split in the treatment train occurs, and before and after major treatment units such as a clearwell.

3.2.4.3 Rapid Mix

In a typical water treatment plant, the coagulant chemicals are introduced into the raw water ahead of or directly in the rapid or flash mix unit. The purpose of the rapid mix unit is to provide a thorough and complete mixing of the raw water and coagulant chemicals. Mixing can be achieved by the use of mechanical mixers, diffusers or baffles in a basin(s), or a static mixer in the raw water line. Figure 3-7 shows three different configurations for rapid mix units.

Diligent operation and process control are important for good performance of rapid mix units. One of the biggest problems with rapid mix units is providing enough energy to completely mix the coagulant chemicals with the particulates in raw water.

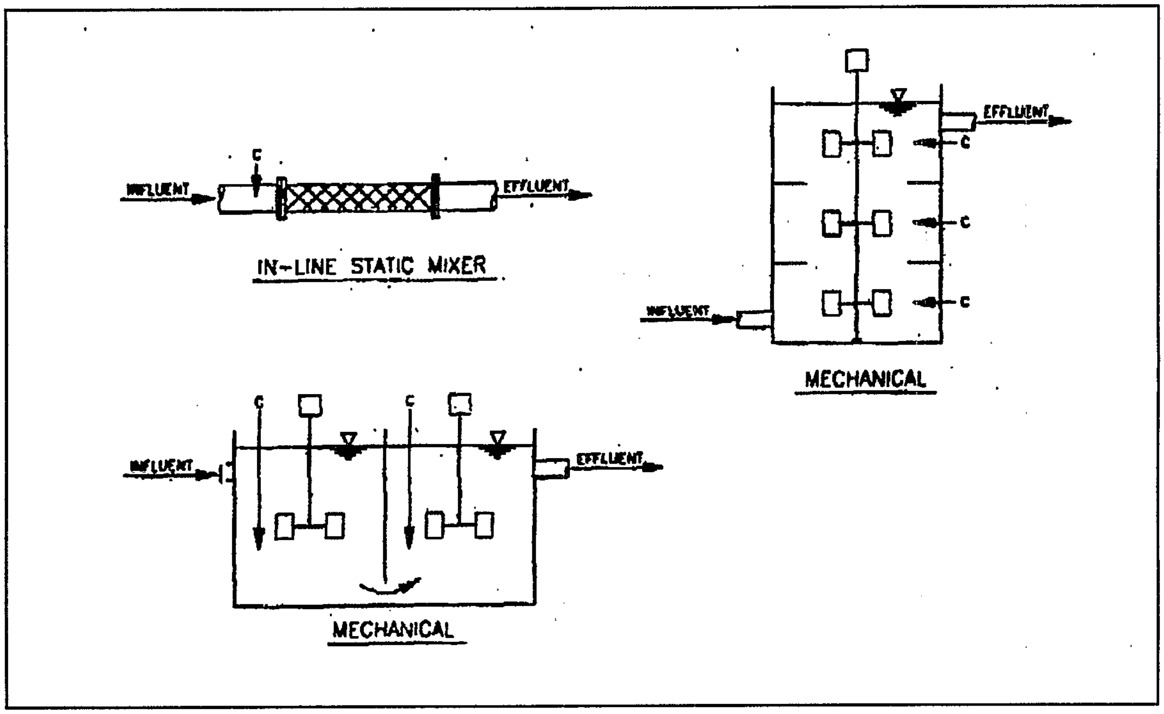

Figure 3-7. Schematic Drawings of Types of Rapid Mix Unit Configurations

One means of estimating the mixing energy used for the rapid mix is calculating the velocity gradient, *G*. The velocity gradient is a function of the energy used (water horsepower) and the volume of the basin.

The formula for velocity gradient is as follows:

$$G = \sqrt{\frac{P}{V\mu}}$$

in which

G = Velocity gradient, in feet per second per foot (fps/ft) or sec^{-1}
P = Power to the water, ft-lb/sec

V = Volume of basin, in cubic feet
μ = Viscosity (0.273×10^{-4} lb-sec/ft^2 at 50 °F)

The G for the rapid mix process should range from 700 to 1,000 fps/ft, depending on the detention time of the basin (Reynolds, 1982).

The design detention time in a typical mechanical rapid mix unit ranges from 15 to 60 seconds. Recent developments in treatment technology are focused on providing more mixing energy with less detention time. For instance, the static in-line mixer has a very short detention time, but imparts tremendous mixing energy into the water.

Plants should have more than one rapid mix unit at the treatment plant. With two or more units, depending on the design flow, one unit can be removed from service for maintenance and the plant can remain in operation. If the plant has to be shutdown to perform maintenance (e.g., if there is only one rapid mix unit), maintenance may be performed less often and the condition of the unit may suffer. Based on generally recommended engineering practices and the Ten State Standards of 1997 (GLUMRB, 1997), there should be at least two rapid mix units if the design flow of the plant is greater than three mgd.

Suggested assessment criteria for the rapid mix process include:

1. Does the rapid mix unit visually appear adequate?

The inspector should look for signs of equipment deterioration that might negatively affect the treatment process and the sanitary condition. Examples of inadequate equipment conditions include rusting on the inside and/or the outside of the mixer. Rust areas are signs of potential or imminent equipment break down and a source of concern, because they are potential breeding grounds to many microorganisms that might end up in the drinking water distribution network.

The inspector should also look for signs of corrosion if oxidants are injected into the raw water just before the rapid mixing process. The inspector should note any signs of leaks around chemical injection points and should note if early signs of leaks exist. The inspector should also look for signs of calcium buildup where water softening is practiced. Excessive calcium buildup can adversely impact both the effectiveness and efficiency of the mixing unit.

The inspector should look for signs of cracks or breaks in the hopper of dry feed rapid mixers. If liquid coagulants, coagulant aids or oxidants are used, the inspector should inspect liquid lines for signs of clogging. The inspector also should ask about the preventive maintenance program and the schedule. The inspector needs to examine the last entries in the repair log as to when the last preventative maintenance of the rapid mixer occurred and when unscheduled repairs had to be made and under what circumstances. This will give the inspector an idea about whether more frequent inspection and preventive maintenance ought to occur.

The inspector should look at the general sanitary condition of the housing of the rapid mix unit. Moldy, dusty, and dirty walls and floors are signs of unsanitary conditions. The inspector should note the existence of wildlife taking shelter inside and even outside the housing unit and should note if there is a possibility that a wild animal or its feathers, hair, or droppings may end up inside the rapid mixing unit.

2. Are coagulant chemicals being fed continuously during treatment plant operations?

Intermittent chemical feed can lead to uneven treatment of the whole volume of water entering the treatment plant. The inspector should look for signs of intermittent chemical feed and should note any discussions with the plant operator about the causes of intermittent chemical feed and potential solutions to this problem. The inspector should determine if the water system has a mechanism for monitoring coagulant feed and providing an alarm if any interruptions in coagulant feed occur.

3. Does the plant have multiple mix units? How often is maintenance done?

Rapid mixing units should be kept clean, well maintained, and ready for use. They should be rotated in service with the other mixing units. The inspector should note whether these idle units are put in service routinely following a rotation schedule or only when the operational unit is out of service.

4. Is the mechanical equipment working? Are there any hydraulic inadequacies?

Hydraulic inadequacies such as overflowing of the rapid mixing unit or rise of water level in the unit to the point where it splatters are signs of improper operation, clogging of water inlet and/or outlet, or improper design.

The sanitary surveyor should ask that idle units be run during his visit even for a short time to ensure that the mechanical equipment is working. The inspector should note if all the mixing units are well lubricated (e.g., operation is smooth and vibration is minimal) and appear to be well maintained. The surveyor should note whether moving parts of mixing units are causing unusual noises. The surveyor should conduct visual inspection of the mixing blades and note signs of chipped, broken, or missing blades. He should also note if clumps of coagulants are attached to the mixer shaft or blade surfaces. Coagulant clumps on the mixer blades or shaft will reduce the efficiency of the mixer and hence will result in a lower velocity gradient and impair the desired uniform mixing of coagulants with influent water. The inspector should look for any visual signs of inadequate mixing, such as dead zones and low mixing velocity.

5. **Is the rate of mixing adjustable, so that the correct mixing can be provided at all flows? If so, can the operator adjust the rate of mixing?**

   Mixing units with adjustable mixing rates can be used with different types of coagulants and chemicals. Flow-paced adjustable mixing rates ensure that adequate energy is being delivered during different flow conditions, particularly at the design flow rate.

6. **What is the design *G*? Is it within the generally accepted range? What is the detention time? Is it within the generally accepted range?**

   Knowing the design G value and the detention time at which the unit was designed, the inspector should make sure that the velocity gradient G and the minimum detention time are met if the system operates at design flow. During low flow periods, the inspector needs to make sure that all the mixer blades are fully immersed in water (otherwise inadequate mixing may occur).

   The inspector should look further for signs of inadequate rapid mixing at the influent entry point to the flocculator. Signs such as clumps of dry coagulants and immediate precipitation may imply that rapid mixing is not occurring at the desired level and/or the coagulant being used is not of the grade it is supposed to be, or the coagulant being used is incompatible with the quality of the water being treated.

7. **Have rapid mix units been evaluated for cross-connections?**

   Cross-connections, particularly from submerged inlets for chemical feeds, are common. The inspector should check for cross-connections to help ensure the integrity of the water supply.

3.2.4.4 Chemicals and Chemical Feed Systems

The type of chemicals that are used at a surface water treatment plant and a GWUDI of surface water treatment plant depend on the specific treatment facilities and objectives. The two most common chemicals that are used in surface water treatment process are coagulants and disinfectants. GWUDI of surface water treatment processes are likely to use disinfectants and coagulants, and many also use lime or soda ash for softening. Coagulants are used to condition the water for effective particle removal through sedimentation and filtration. To accomplish this a primary coagulant, such as aluminum sulphate or ferric sulphate, is added at the rapid mixing basin. Coagulant aids, such as polymers, are sometimes used to supplement primary coagulants at different points between the rapid mixing basin and filters. Disinfectants are used to inactivate pathogens that may not be physically removed during sedimentation and filtration. Chlorine, chloramines, and chlorine dioxide are the most common disinfectants, although there is growing interest in ozone and ultraviolet (UV) light. Both the coagulation/flocculation process and the disinfection process are described in more detail in subsequent sections. Chemicals are also used at a surface water treatment plant for oxidation, corrosion control, pH adjustment, softening, taste and odor control, iron and manganese removal, organics and inorganics removal, and fluoridation.

Oxidation is used for taste, color, and odor control, iron and manganese removal, sulfur removal, and removal of synthetic organics like herbicides and pesticides. For water treatment, the oxidants used include chlorine, chlorine dioxide, permanganate, oxygen, and ozone. The oxidant used in a particular situation is determined by the contaminants present, the raw water quality, and local issues (e.g., costs). (AWWA and ASCE, 1998)

Water stabilization is used at many surface water treatment plants to prevent water conditions that are either corrosive or scale forming. Corrosive water can deteriorate water system piping and degrade the quality of drinking water delivered to the customer. In most cases, the corrosive conditions can be corrected by adjusting the pH and alkalinity of the water with the addition of lime or caustic soda. Corrosive conditions can also be controlled by adding a corrosion inhibitor to the water. Hard water can cause scale forming problems due to relatively high levels of dissolved minerals, mainly calcium and magnesium. In these cases, a softening process involving the addition of lime is used to reduce the scale forming tendency of the water.

In addition to oxidation, carbon adsorption is also used to remove organics. Organics can cause taste and odor problems and can contribute to the formation of THMs. Activated carbon, either in powder or granular form, is used to adsorb the organic substances. Fluoridation is the addition of fluoride—either sodium fluoride or sodium silicofluoride (both dry powders) or hydrofluosilicic acid (liquid)—to the water supply in order to achieve the desired level of fluoride in drinking water. Fluoride is generally added to drinking water to help reduce dental problems in consumers. (UFTREEO Center, 1998)

The systems used for handling, storing, and applying treatment chemicals are dependent on the chemical characteristics, the quantity used, and control system needed. A typical liquid chemical feed system would include: (a) a storage tank; (b) a metering pump with a suction line into the storage tank; (c) a discharge line with a check valve and injector at the application point; and (d) a flow switch to control the metering pump operation. If the flow switch is automatic, it must be tied to a flow meter or another control sensor. This type of liquid chemical feed system is shown in Figure 3-8.

The feed system for a dry chemical is very different from that for a liquid chemical, due to the difference in physical characteristics of the chemical being fed. A dry feed system would include: (a) a gravimetric or volumetric feeder to meter the dry chemical; (b) a mixing tank or solution chamber with a mixer; and (c) a gravity discharge line to the application point. Typically an open line or channel is used to carry the mixed "liquid" chemical to the application point for ease of cleaning and maintenance. The general equipment arrangement for a dry chemical feed system is shown in Figure 3-9. The sanitary survey inspector should be aware that some states do not consider the vacuum breaker shown in Figure 3-9 to be adequate protection. Therefore, the sanitary survey inspector should consult relevant state regulations on what constitutes acceptable equipment for water treatment.

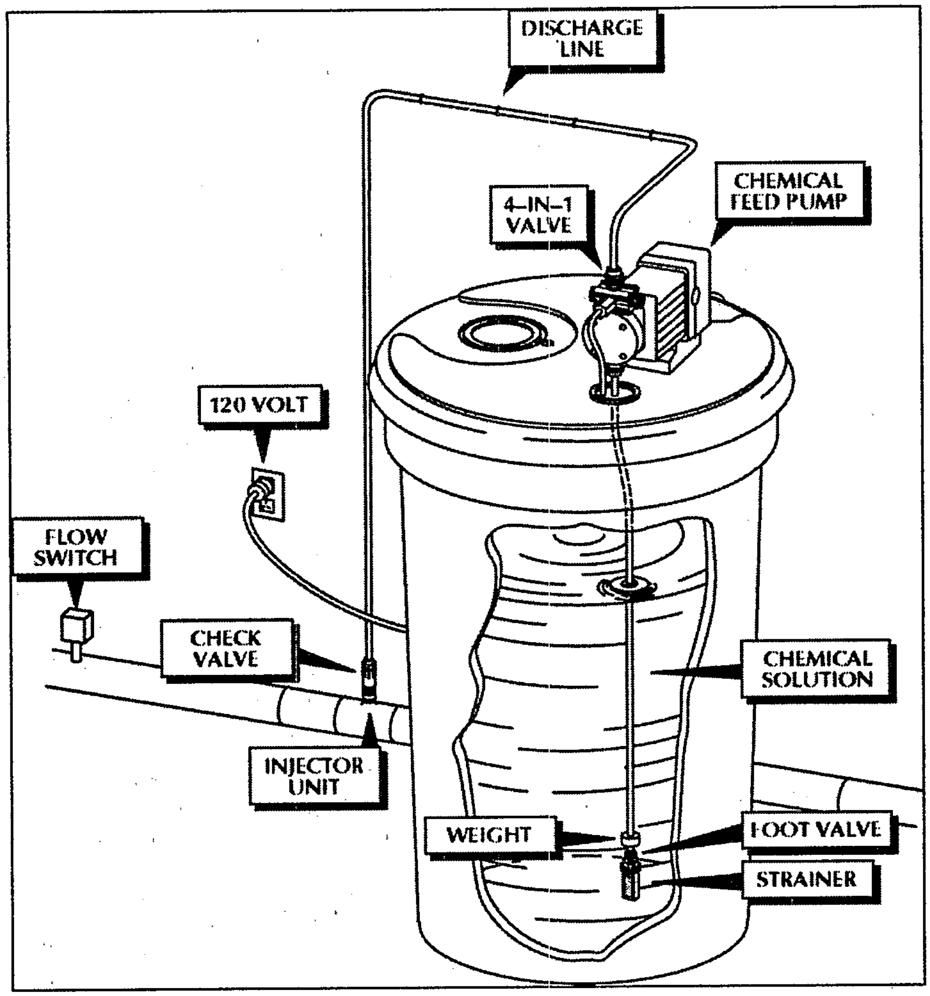

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Figure 3-8. Liquid Chemical Feed System

These chemical feed systems also may include bulk storage facilities that need to be inspected. Day tanks should be used for liquid chemicals that are bought in large quantities and stored in bulk tanks. The use of day tanks helps to limit the amount of chemicals that can enter a water system if pump failure occurs and chemicals siphon into the water supply. Chemical feed systems should be carefully inspected for potential cross-connections with potable water. All potable water make-up or delivery lines connected with chemical feed systems should be equipped with non-return flow valves.

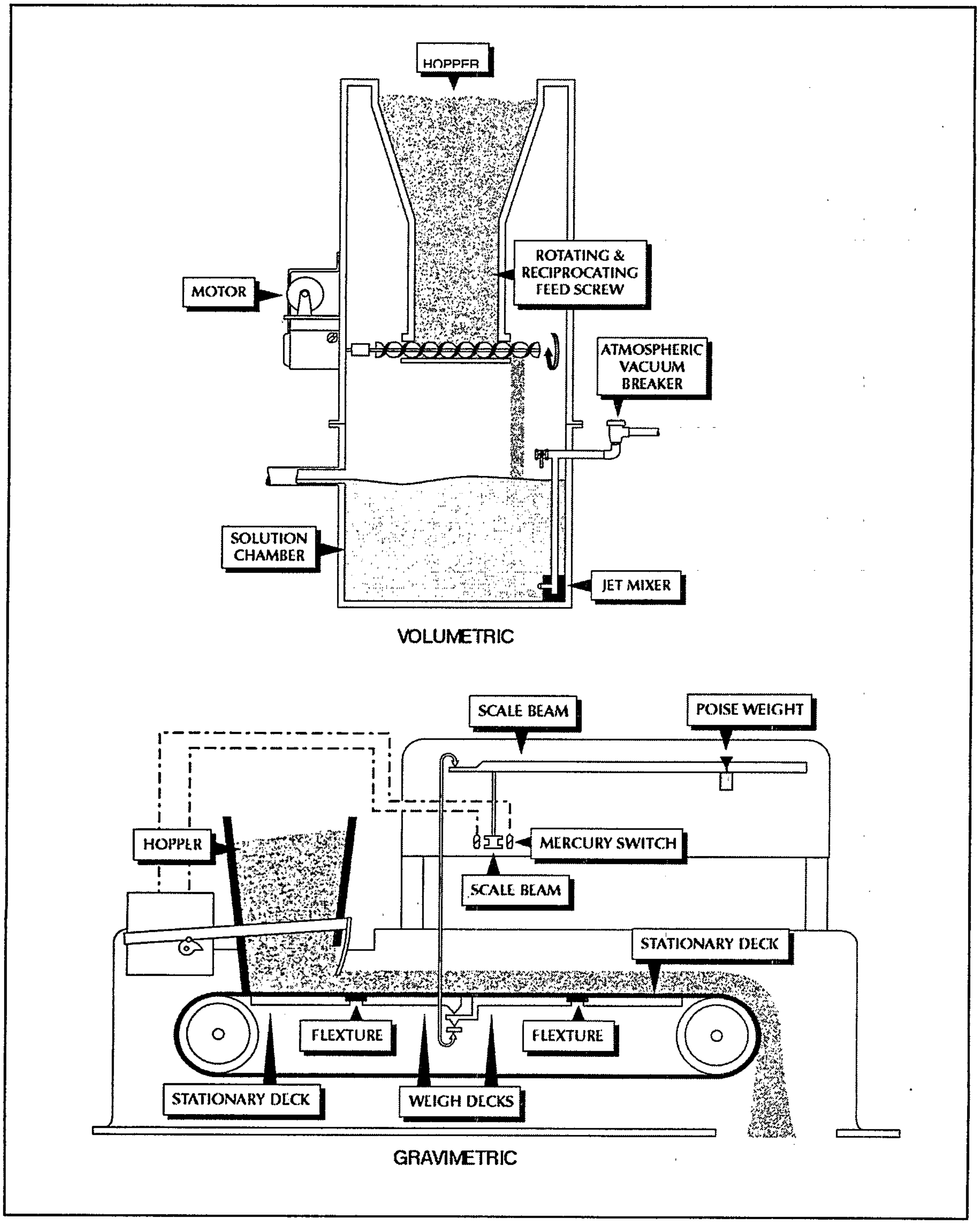

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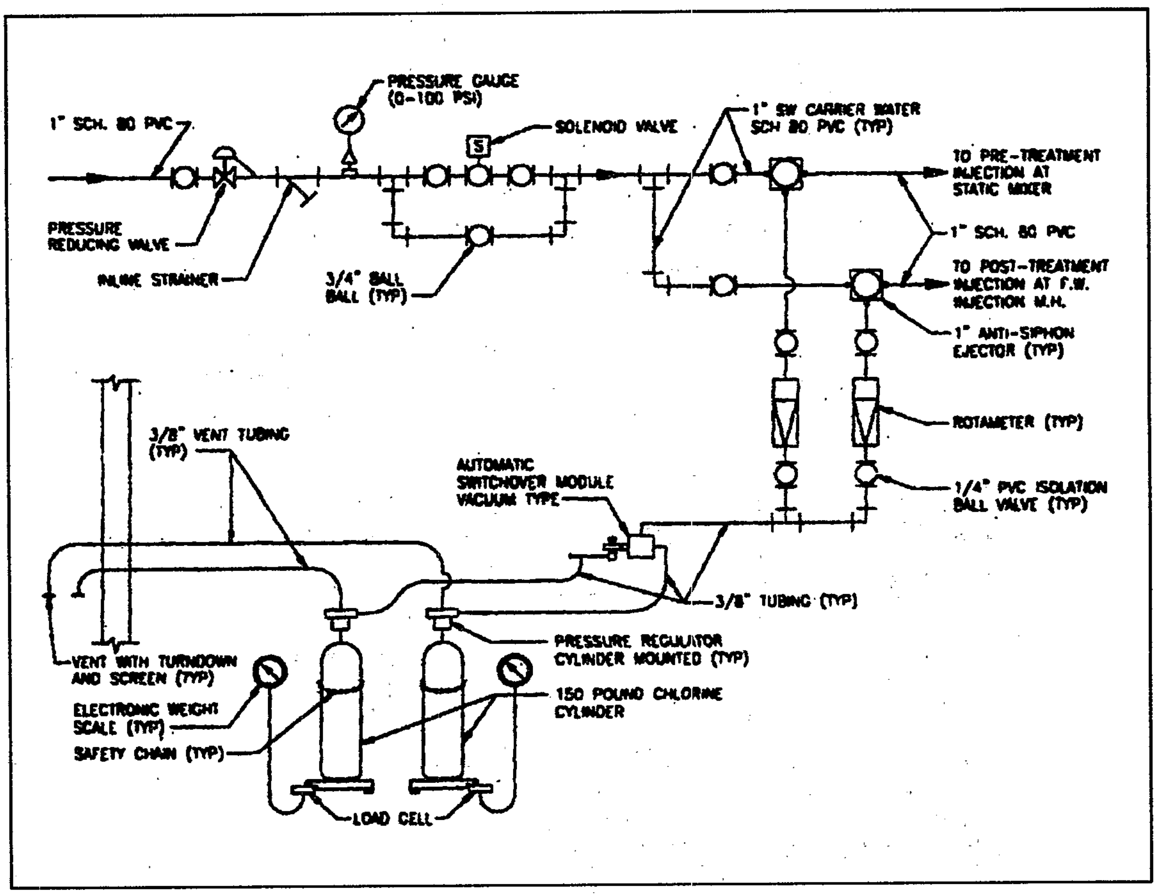
Figure 3-9. Dry Chemical Feed System

The feed system for a gaseous chemical can be either a vacuum or pressure feed system, depending on the hazardous nature of the gas. For example, a vacuum feed system is used for chlorine, which is very hazardous, while a pressure feed system is used for ozone and carbon dioxide. For both systems, there is: (a) a gas storage tank; (b) a line to a feeder with a pressure regulator; (c) a feeder with a rotameter to measure and control the amount of gas fed; and (d) a discharge line from the feeder to either an injector for a vacuum system or the application point for a pressure system. For a vacuum system, water flows through the injector creating a vacuum on the gas feed line that causes the gas to flow. The vacuum system is considered less hazardous than the pressure system, because of the reduced potential for high volume gas leaks. High capacity feed systems may also use vaporizers. The general equipment arrangement for a gaseous chemical feed system is shown in Figure 3-10. All the valves for a system like the one in Figure 3-10 should be non-return valves to provide protection against backsiphonage and back pressure backflow.



All valves are non-return valves.

Figure 3-10. Gaseous Chemical Feed System

Suggested assessment criteria for chemical feed systems include:

1. **What chemicals are used? Are the chemicals approved for use in drinking water?**

   Check for a National Sanitation Foundation (NSF) or Underwriters Laboratories (UL) determination that chemicals used conform to all applicable requirements of NSF Standard 60: Drinking Water Chemicals – Health Effects. Treatment plant operators may be using compounds or chemicals that are not NSF approved. These plants may have used these chemicals before the EPA established the Drinking Water Additives program and continued using them after EPA established that program. Starch is an example of a compound that was formerly applied as a coagulant in drinking water treatment and is no longer approved for use in water treatment.

2. **Are the chemicals that are used for treating water appropriate for meeting the water quality goals of the system?**

   Water systems may purchase and use chemicals that are not appropriate for the plant or its treatment objectives (e.g., an operator may be convinced by a chemical company sales person that a particular product is the best and should be used at the plant, even though it is not appropriate for the specific application). The inspector should assess whether the chemicals used in treating the water are appropriate.

3. **What chemical amounts are used – average and maximum? Are the various systems sized to feed more than the maximum amount required?**

   It is important that the treatment plant have a capacity to apply chemicals above the current maximum daily use. One hundred and fifty percent of maximum use is recommended. The treatment plant should always have excess capacity to deal with unexpected deterioration in raw water quality resulting from natural and man-made causes, and should maintain excess chemical feed capacity to respond to a period of unusually high water demand.

4. **Where are various chemicals applied?**

   The inspector should inspect chemical feed points and note where and how the chemicals are added, whether the feed points are active or standby, whether the application points are appropriate, and the compatibility of the feed points with other chemicals used at the plant. The inspector should note whether the point of application can be used to supply other chemicals with different chemical and physical characteristics, and make the determination if the feed points can be used inappropriately. Any signs of previous or current leaks at the chemical feed points and its equipment should be noted. The inspector should ask and note down answers as to when any leaks occurred, why they occurred, and how they were contained.

5. **What type of chemical feed equipment is used? Are the materials used for each chemical feed system compatible with the chemical? What is the general condition of the chemical feed equipment?**

The inspector should note the type of chemical feed equipment and its ability to feed chemicals on a continuous basis. The chemical feed equipment should be clean and free from dust, oil, dirt, and vapor. Pipes should be free from signs of cracks and leaks. The equipment should be rust free, and the inspector should record and inquire about any unusual noise emanating from any moving parts. The inspector should review the preventive maintenance program for the chemical feed equipment and check the repair log.

6. **How often is the feed rate checked for each chemical? How does the operator determine the amount of chemicals used on a daily – weekly – monthly basis? Is a measurement device provided – flow meter or calibration cylinder for liquid chemicals and scale for dry chemicals? Are there provisions to calibrate the chemical feed equipment?**

The chlorine feed rate is usually measured by a rotameter, while the feeding rate of liquid chlorine is measured using a valve meter. All chemical feed equipment is calibrated at the time of installation, however as equipment ages and as flow regimes change, the equipment requires re-calibration. In addition, when replacement parts are installed, and other treatment equipment is attached to the treatment train, feeding equipment should be re-calibrated. Therefore, the inspector needs to note if the treatment plant periodically tests and recalibrates chemical feed equipment and whether re-calibration took place following changes to the treatment process or maintenance to the chemical feeding equipment itself. The inspector should inquire about calibration checks and how they are done, and review any calibration records for the feed equipment.

7. **Is the chemical feed equipment adjustable? Is the control of the chemical feed equipment manual or automatic? What is the control parameter (e.g., raw water flow rate) for each chemical feed system? Does the system use day tanks for liquid chemicals bought in large quantities?**

The majority of chemical feed equipment is adjustable. Chemical feed equipment adjustment can be manual and/or automatic. If the adjustment is automatic, the inspector should note whether the operator can override the automatic adjustment in cases of malfunctioning. The method for controlling chemical feed quantity is important. The inspector should note the conditions that cause accidental overfeeding of chemicals and the steps that are necessary to protect against it. The use of day tanks is one method for limiting accidental overfeeding.

8. **Is a standby feeder and/or metering pump provided for each chemical? Is it operable? Is it large enough to replace the largest unit that might fail?**

According to generally recommended engineering practices and the Ten State Standards (GLUMRB, 1997), essential equipment, such as chemical feed equipment and feed pumps, should be redundant. Redundant equipment should be of a capacity equivalent to the largest unit.

9. Is backflow prevention provided on the water lines used for chemical feed makeup?

All lines supplying water for chemical feed makeup should be equipped with backflow prevention devices to prevent cross-connections and contamination of potable water.

10. What type of storage facilities are provided? Is the storage area for each chemical adequate and safe? Is containment provided for a potential spill? What provisions are provided for cleanup of a spill? If a drain is provided, where does it discharge? Are incompatible chemicals stored together? Are facilities properly labeled?

Chemical storage area capacity should be adequate to allow space for free access for loading and unloading of chemicals. The bulk storage facility should have indicators for chemicals storage levels. The storage containers should have a convenient method for determining the amount of chemical in each container. The storage facility should have safeguards against accidental spills, and like every other treatment space, should have a clean water source under high pressure and a drain for effective cleaning and decontamination. In the case of some gaseous chemicals, like chlorine, special ventilation equipment and the availability of OSHA approved breathing apparatus may be required. Breathing equipment and other personnel safety equipment and gear should be stored outside the storage area where the equipment can be safely accessed. Incompatible chemicals should be stored separately. For example, strong acids should not be stored near chlorites. The chemicals storage and the storage facility itself should be located so as to not allow a chemical spill to reach the raw water source, the treated water, or water being treated. In addition, every container in the storage area should be labeled and every storage area should be labeled to identify what chemicals supposed to be stored in it.

11. How much storage is provided at average/maximum usage? What is required by the state primacy agency? If storage provided is less than required, what is the local resupply availability?

The inspector should be able to assess, from the information provided on chemical use rates and water demand, whether the chemical storage capacity is adequate and in compliance with state regulations or with the Ten State Standards (30 days supply at the average chemical consumption rate) (GLUMRB, 1997). If the state requires more storage or allows less storage, the inspector should note the basis for the required storage capacity. Some water systems are reluctant to store as much as the recommended 30-day supply of chlorine gas or other highly dangerous chemicals onsite since they pose a safety risk to operators and the community. If the system keeps less than the required supply onsite, the inspector should document why and ask the operator about resupply options. The inspector should ask about reliable sources of chemicals resupply and whether local alternative suppliers are available.

12. **What is the general condition of the building/room housing the chemical feed equipment? Are dusty and dry chemicals, and feed equipment housed separately? Is proper and adequate ventilation provided?**

    The general condition of the building housing the chemicals is an indicator of the standard of maintenance the operator upholds. Adequate ventilation, heating, and air conditioning are important in maintaining the sanitary conditions within the storage facility and the treatment plant as a whole. The equipment for controlling and removing dust and vapors in the chemical building/room should be functional and effective.

3.2.4.5 Coagulation/Flocculation

The coagulation/flocculation process at a surface water treatment plant is essential to properly condition raw water for effective particle removal through sedimentation and filtration. Although coagulation/flocculation is sometimes referred to as a two step process, coagulation is generally understood to begin at the point of coagulant addition and continue during the flocculation process. Coagulation is initiated by rapidly dispersing a coagulant, such as aluminum sulphate, in the raw water under high energy mixing conditions to cause the destabilization and initial contact of small particles suspended in the raw water. The particles attach to each other, the coagulant, or coagulant aid to form settleable particles (floc). This is followed by gentle mixing, or flocculation, to improve the contact of the particles and encourage the destabilized particles to form into larger, denser solids that are more easily removed during sedimentation and filtration. The size and quality of the larger floc particles formed in the final stage of flocculation are indicators of the overall effectiveness of the coagulation/flocculation process.

The coagulant dose that is required to treat raw water is determined based on various chemical, physical, and biological tests conducted both onsite and offsite of the treatment plant. Of particular importance are the onsite jar tests. These tests are conducted to determine the type and dose of coagulant to be used in response to a change in key raw water quality parameters such as turbidity, temperature, and alkalinity. The sanitary survey inspector should ask the operators how often they conduct jar tests and how the current coagulant dose was determined. If time allows, the inspector should have the operators perform a jar test during the inspection.

The physical facilities required for coagulation/flocculation include chemical feed equipment, rapid mixing facilities, and flocculation facilities. Chemical feed equipment and rapid mixing facilities were covered in previous sections.

There are two basic types of flocculation units - baffled and mechanical. Baffled flocculation units usually include a system of serpentine channels, ported walls, or diversion plates that allow gentle hydraulic mixing as the water flows through. Mechanical flocculation units usually include chambers or basins equipped with mechanically driven mixing devices. Figure 3-11 shows examples of two mechanical flocculators - a horizontal paddle flocculator and a vertical paddle flocculator. For the vertical flocculator, water enters through the ports on the left and then goes into the compartment on the right side; the exit compartment is not shown.

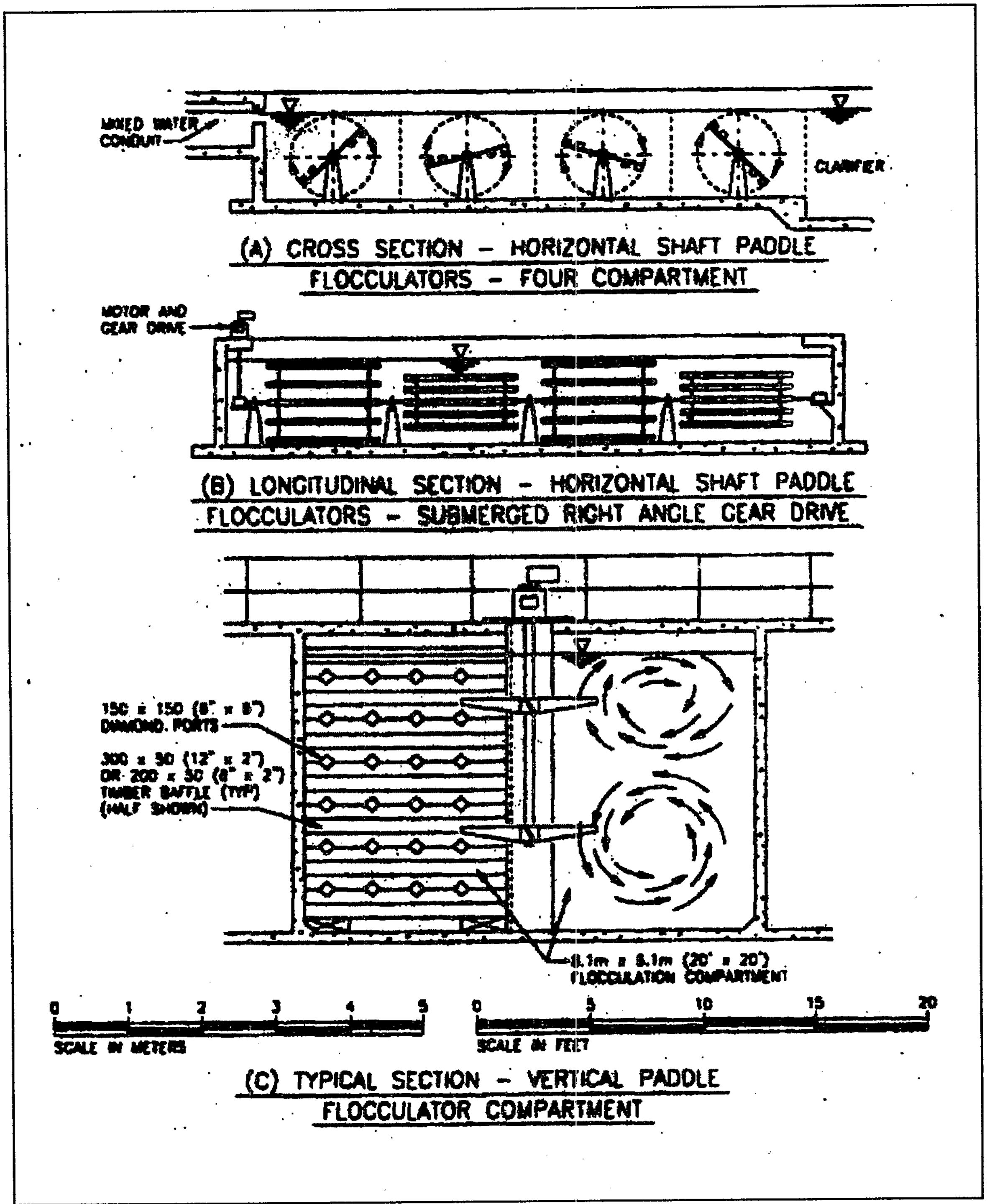
Diligent operation and process control are important for good performance of the flocculation process. Adequate mixing energy is needed to promote the collision of destabilized particles to form floc that will precipitate in the sedimentation basins. Tapered mixing energy is frequently used to keep large particles in suspension, promote particle collisions and growth, and prevent shearing of floc. The optimum configuration for tapered mixing depends upon the type of mixing equipment number of stages, water temperature and turbidity, and plant flow rate. The velocity gradient, G, provides a means to calculate the mixing energy used for the flocculation process. For most water treatment plants, the G for the flocculation process should start at 50 to 100 fps/ft in the first stage of flocculation, depending on the detention time of the basin, and decrease to 20 to 50 fps/ft in the second or third stage (JMM, 1985).

Controlling the tip speed on mechanical mixers is another method for minimizing the shearing of floc during the flocculation process. If the tip speed of the mixer is too high, then floc particles will be sheared. For most water treatment plants, the peripheral tip speed of the mixers should be between 0.5 to 2.0 fps (Sanks, 1978). The inspector can roughly estimate the tip speed by means of a stop watch and observing the distance cut by the tip of the paddle. This might not be attainable in the first stage because of the poor visibility of the mixing paddles moving in the very turbid waters.

For most water treatment plants, the design detention time in the flocculation basin ranges from 20 to 60 minutes (JMM, 1985). The sanitary survey inspector should be aware that waters with low turbidity require longer detention times than waters with higher turbidity levels. To reduce attenuation time in the flocculation and sedimentation basins, coagulant aids and polymers are used.

Another design parameter for flocculators is *GT* (*G* times detention *T*ime), which is used as an indicator of the capability of the flocculation process to cause particle collisions. For most water treatment plants, the *GT* for the flocculation process should range from 30,000 to 120,000, depending on the characteristics of the water (JMM, 1985).

Most plants today have more than one coagulation/flocculation unit at the treatment plant. With two or more units, one unit can be removed from service for maintenance and the plant can remain in operation. In general, there should be at least two coagulation/ flocculation units.



(Modified from AWWA and ASCE, 1998; Used with permission)

Figure 3-11. Mechanical Flocculator Types

Suggested assessment criteria for the coagulation/flocculation process include:

1. **What type of flocculation facilities are being used? Does the coagulation/flocculation process visually appear adequate?**

   The inpector should note the type of flocculation facilities (baffled units or mechanical mixers). If the water system is using baffled units, the inspector should identify whether the units have serpentine channels, ported walls, or diversion plates. The inspector should be able to visually determine good floc formation prior to sedimentation. Best floc size ranges from 0.1 to 3 mm in diameter.

2. **Is there any evidence of clumps of coagulants in the first compartment of the flocculator?**

   The inspector should watch for any clumps being discharged into the flocculator. Also, if possible, the inspector should look for signs of sediments in the first compartment of the flocculator.

3. **Is the mechanical equipment working? Are there any hydraulic inadequacies?**

   All mechanical equipment should be functional. Standby equipment should always be in a ready-to-operate state. Instrumentation to monitor motor speeds, flow rates, pH, and temperature also should be functional and calibrated. Hydraulic inadequacies may be visually detected in the flocculation, sedimentation, and filtration stages. Indications of hydraulic inadequacies include visible surges of water through the flocculation basins, short circuiting of floc particles through the basins, stationary flocs in dead zones, and unusual and buildup of sludge in the basins.

4. **Does a preventive maintenance program exist?**

   Manufacturers and equipment suppliers provide preventive maintenance schedules. The treatment plant operators should adhere to these schedules.

5. **Is the rate of mixing adjustable, so that the correct mixing can be provided at all flows? If so, can the operator adjust the rate of mixing?**

   Adjusting flocculator mixing rates can be done either automatically or manually. Mixing rates can be changed by removing and adding planks onto the arms of the rotating shaft. The inspector should ask the operator about the frequency of adjusting mixing rates and how it is done.

6. **What is the *G*, *GT*, and tip speed? Is it within the generally accepted range? What is the detention time? Is it within the generally accepted range?**

   If available, values for G, detention time, GT, and tip speed need to be collected for both design values and operation values at the time of the sanitary survey. Acceptable G values should range between 100/sec to 20/sec (JMM, 1985); GT values should range between 20,000 to 120,000 (JMM, 1985); detention time may range between 20 to 60 minutes (JMM, 1985); and tip speed between 0.5 ft/sec to 2 ft/sec (Sanks, 1978).

3.2.4.6 Sedimentation/Clarification

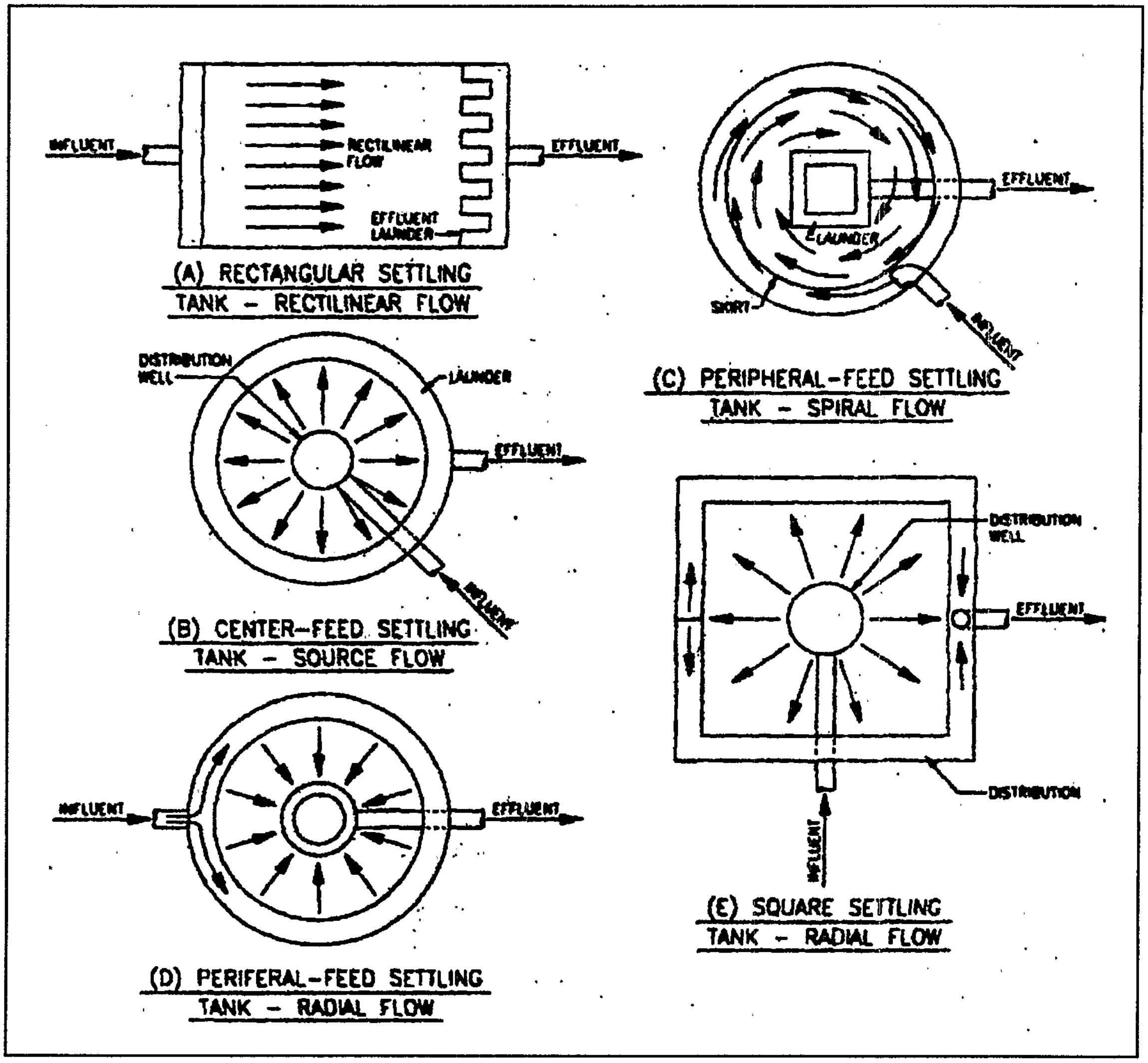
One of the most important processes in a water treatment facility is the settling of flocculated particles following coagulation/flocculation, called sedimentation or clarification. Floc removal occurs during a protracted quiescence period of a continuous flow in a sedimentation basin or clarifier. Today, essentially all continuous flow sedimentation basins include continuous sludge removal with mechanical equipment and the old fill and draw basins are obsolete. Efficient operation of the clarification process allows the filtration process, which follows, to operate longer between backwashing and with fewer problems.

Typically, a clarifier will have four zones, each with a characteristic function. The four zones and their associated functions are:

- <u>Inlet zone</u> – A transition zone that converts the influent flow to the uniform, steady flow desired in the settling zone;
- <u>Settling zone</u> – The section of the clarifier in which settling occurs. This zone should be free of interference from the other zones;
- <u>Outlet zone</u> – A transition zone that converts the steady flow from the settling zone to the effluent flow; and
- <u>Sludge zone</u> – The section of the clarifier that the floc particles settle into. The sludge accumulates in this zone to prevent interference with the removal of particles in the settling zone.

Clarifiers can be classified based on their configuration and type of flow. Types of clarifiers include horizontal flow units, inclined flow units, and upflow clarifiers. Horizontal flow units are generally rectangular or circular in shape, although square tanks are also used. Water flows through the unit in a horizontal manner, but can follow various types of flow patterns. These units are considered conventional clarifiers and are the most commonly used type for drinking water treatment. The various shapes and flows of conventional clarifiers are shown in Figure 3-12. (AWWA and ASCE, 1998; AWWA, 1990)

Inclined flow units include tube or plate settlers, which are generally mounted in rectangular or circular basins. These units are high-rate modifications of conventional clarifiers. They are considered high-rate clarifiers because they can generally be loaded at higher rates than the conventional clarifiers decscribed above. Tube settlers are designed with several shallow parallel tubes at an incline and adjacent to one another. Plate settlers consist of vertically inclined plates onto which solids first settle and then slide down into a basin below. The designs for both tube and plate settlers increase the surface area and decrease the distance for particle settling, and also reduce flow through velocity to reduce scouring. All of these factors enhance solids removal. (AWWA and ASCE, 1998; AWWA, 1990)



(Source: AWWA and ASCE, 1998; Used with permission)

Figure 3-12. Different Clarifier Shapes

Upflow clarifiers are units that generally have chemical mixing, flocculation, and sedimentation in a single tank. Some units may have a separate rapid mixer, rather than feeding chemicals directly to the clarifier inlet pipe for mixing within the unit. Upflow clarifiers include solids-contact units such as sludge-blanket clarifiers and slurry recirculation clarifiers, which are often used for water softening processes. These units are designed to provide more efficient flocculation, greater particle contact, more uniform flow, and less short-circuiting. Because of these factors solids-contact units can often handle three or four times the hydraulic loading of conventional clarifiers. (AWWA and ASCE, 1998; AWWA, 1990)

Clarifier characteristics which significantly impact floc settling efficiency include the tank surface area (dependent on overflow rate), depth (dependent on detention time), and the velocity of the flow through the clarifier, which is dependent on the cross-sectional area and configuration of the basin. The weir loading rate at the effluent launderers is also important to prevent the breakup of any floc particles that may reach the launderers.

The surface overflow rate should be equal to the settling velocity of the floc particles entering the basin. The detention time should be adequate for the removal of all solids. The velocity through the basin should be uniform over the cross-section of the basin. The effluent launderer overflow rate should be small. The values for the various design factors should be conservative to allow for site specific circumstances. General design value ranges are shown in Table 3-1.

Special consideration should be given to the inlet and outlet flow conditions in evaluating the performance of clarifiers. The inlet flow should be distributed uniformly between sedimentation basins and the flow to each basin should be distributed uniformly over the full cross section of the individual basin. In general, the performance of the basin is controlled more by the inlet condition than the outlet condition.

Table 3-1. Clarifier Design Factors

Surface Overflow Rate (gpm/ft^2)	
Alum floc	0.4 – 0.7
Lime softening	0.4 – 1.4
Tube settlers (overall basin rate)	1.0 – 3.0
Plate settlers (overall basin rate)	2.0 – 6.0
Upflow units	0.7 – 1.8
Lime softening/Upflow units	0.7 – 2.2
Detention Time (hour)	1.5 – 4
Velocity (fpm)	1.0 – 3.0

(Modified from AWWA and ASCE, 1998)

To evaluate the performance of the clarification process, the best criteria is the turbidity of the settled water leaving the clarifiers. In general, the turbidity of the water leaving a clarifier should be no greater than 10 times the acceptable turbidity level of the finished (i.e., filtered) water. Filters are assumed to remove at least 90% of the remaining particles in the water. Some states require that settled water turbidity be less than 5 NTU. For optimized turbidity removal goals, settled water with a turbidity of less than 2 NTU is expected when the average raw water turbidity is greater than 10 NTU, and 1 NTU when average raw water turbidity is less than 10 NTU. Under the Comprehensive Performance Evaluation (CPE) process EPA has established an optimization goal of 2 NTU for water leaving the sedimentation basin.

Sludge accumulation in the clarifier has to be removed to maintain the clarification process at peak efficiency. Sludge should be removed on a continuous or time-controlled basis. In plants with a low solids loading, sludge is typically removed from the basin intermittently for 5 to 15 minutes every hour, which is called a time-controlled basis. For those plants with a high solids loading, sludge is typically removed continuously.

Similar to the previous treatment processes, many plants have more than one clarifier/ sedimentation basin at the treatment plant. With two or more units, depending on the projected water demands, one unit can be removed from service for maintenance and the plant can remain in operation. There should be at least two clarification units. If a plant has only one unit, then maintenance of that unit may suffer, because the plant has to be shutdown to perform maintenance.

Suggested assessment criteria for the clarification process include:

1. **What type of sedimentation/clarification process and facilities are being used? Does the sedimentation/clarification process visually appear adequate?**

   The inspector should determine what type of process and facilities (e.g., cross flow sedimentation basin, radial flow sedimentation basin, upflow solids contact clarifier) are used and whether they appear adequate. Near the outlet of the sedimentation basin, water should be visibly clear.

2. **Is the flow distributed evenly to all basins? Is the inlet flow distributed uniformly over the full cross section?**

   The inspector should look for signs of bridging or short circuiting and should look for signs of flocs breaking up at the sedimentation basin inlet. The inspector should inspect the mechanism through which the flow is evenly distributed among the multiple basins. Uneven flow distribution may result in the basins receiving disproportionately high flows and this may cause less than optimum sedimentation.

3. **Does the plant have multiple units with some that are not in use? Are the idle basins in a condition to be used if needed?**

   Not all sedimentation units are used during low demand. Standby sedimentation basins should be inspected for their readiness to be used. The inspector should check the condition of any empty basin for cracks, cleanliness, and paint condition, and should note whether plants, moss, or other botanical forms are growing inside the basin. The inspector should also note whether the in-service sedimentation basins contain any larvae, toads, or fish.

4. **Is the mechanical equipment working? Are there any hydraulic inadequacies?**

   Sludge removal equipment should be functional. Manual controls for overriding automatic controls should be inspected and tested. A turbulent flow regime is an obvious sign of hydraulic inadequacies. Turbid water at the basin outlet during high flow conditions may indicate hydraulic overloading.

5. **What is the surface overflow rate, detention time, and the velocity flow? Is it within the generally accepted range?**

   The inspector should record the plant flow rate and confirm the basin dimensions during the inspection. From this information, the inspector may calculate the surface overflow rate, detention time, and velocity flow. If the values of these parameters are outside the generally acceptable range, the inspector should try with the help of the operator to determine if there is a specific reason or reasons for operating at the calculated parameters. Poorly maintained weirs may cause short circuiting that might affect both the overflow rate and the sedimentation process.

6. **Does there appear to be too much sludge in the basin(s)? Is it impacting settled water performance? How is sludge removed from the clarifier(s)? How often is sludge removed?**

   Too much sludge in the sedimentation basin is an indication of inadequate sludge removal rate. An indication of inadequate sludge removal is when the settled material appears to be in a colloidal suspension with upward movement occurring. Excessive sludge accumulations in a clarifier may interfere with the solids removal process and lead to anaerobic conditions in the basin. The inspector should record the frequency of sludge removal during the period of inspection and should ask about seasonal fluctuations and extreme operational conditions.

7. **What is the settled water turbidity? Does it meet the general criteria?**

   Settled water turbidity should not exceed a level of 5 NTU. This is assuming that filtration will drop this turbidity level to less than 0.5 NTU. If the settled water NTU levels are higher than 5 NTU, the inspector should pay closer attention to the subsequent treatment barriers. For optimized turbidity removal goals, settled water with a turbidity of less than 2 NTU is expected when the average raw water turbidity is greater than 10 NTU, and 1 NTU when average raw water turbidity is less than 10 NTU. The CPE process uses 2 NTU as an optimization goal for water leaving the sedimentation process. For further information on turbidity levels, see EPA's *Handbook: Optimizing Water Treatment Plant Performance Using the Composite Correction Program* (EPA, 1998b).

3.2.4.7 Filtration

The filtration process is the final barrier for physical removal of particles at a surface water treatment plant. Without it, the suspended particles that remain in the water following the sedimentation/clarification process would be delivered to the customers. Depending on the quality of the source water, these particles may include pathogens that are resistant to disinfection and significantly increase the risk of waterborne disease. To minimize this risk, water from the sedimentation/clarification process should to be passed through a properly designed and operated filtration system. Filtration in a water treatment plant is an adaption of the natural process that occurs as water moves through granular soils. Over time, filtration enhancements for solids removal have been developed to include the use of coagulants, and various types of filter media, underdrain design, and backwashing techniques.

Filtration systems are divided into two general categories - gravity and pressure. Pressure filters are typically used at small water treatment plants. These filters usually consist of a pressure vessel or tank that contains a porous filter media, an underdrain system, and piping for inlet and outlet flow and backwash. Pumping facilities are used to force settled water through the media in the pressure filter and into a clearwell. A major disadvantage of pressure filters is that the media cannot be visually observed during backwash or easily inspected for the formation of mudballs.

Gravity filters are the most common filtration system found at surface water treatment plants. These units differ significantly from pressure filters in that the media and underdrain system are contained in a filter box that is open to the atmosphere, and water flows through the media by gravity. There are two types of flow control systems for gravity filters - constant rate and declining rate. Constant rate filters are generally equipped with an effluent rate-of-flow controller that includes a flow measuring device and an automatically adjusting valve. A constant filtration rate can also be accomplished by splitting the influent flow to each filter. Constant rate filters can be further divided into those that operate under a relatively fixed water level common to all the filters, and those that operate under rising water levels that vary in each filter depending on the filter headloss.

A declining rate filter, on the other hand, usually includes submerged inlets that allow diversion of influent flow from a dirty filter to a clean filter. There are no effluent rate-of-flow controllers, although an orifice plate is sometimes used to establish a maximum filtration rate for a clean filter. Declining rate filters start with a high filtration rate that declines as the filter begins to plug with filtered solids. Although the initial filtration rate of the declining rate filter is usually higher than that of a constant rate filter, the overall production rate of a constant rate filter will usually be greater assuming the filter run of the two filters is the same.

Filter media systems are usually identified according to the number of media layers (e.g. single, dual, or multiple media) and the type of media (e.g. sand, anthracite). Single or mono media filters usually consist of sand, although anthracite and GAC beds are also used. When single media sand filters were first developed, they were referred to as rapid sand filters to distinguish them from the older slow sand filtration systems that were common at the time. Filtration rates have increased even more with the development of dual and multiple media filtration systems. Dual media is the most common and consists of a layer of anthracite over a layer of sand. Multiple media usually includes anthracite and sand layers over a third layer of denser material such as garnet.

Media depths vary with the type of filter and media. Total media depths of 30 to 36 inches are typical with a minimum depth of 24 inches. Single media filters that utilize anthracite or GAC may have deeper beds of 48 inches. Typical maximum filtration rates for the more common filters and media types are shown in Table 3-2.

Table 3-2. Typical Maximum Filtration Rates

Filter/Media Type	Filtration Rate (gpm/ft^2)
Pressure – All media types	2
Gravity – Rapid Sand/Constant Rate	2
Gravity – Rapid Sand/ Declining Rate	3
Gravity – Dual or Multiple Media/Constant Rate	5
Gravity – Dual or Multiple Media/Declining Rate	6.5

(Source: TNRCC, 1997)

A variety of underdrain systems are used to support the filter media, allow collection of the filtered water, and distribute backwash supply water. The most common underdrain systems include perforated laterals, perforated support blocks, and false floors with nozzles. In cases where the underdrain openings are larger than the media to be supported, a layer of graded gravel is installed between the underdrain system and the media. Some underdrain systems include features that allow for air scour as well as the distribution of washwater during backwash.

The filtration units should include the features and controls necessary to assure proper monitoring and operation of the filter. The specific features and controls will depend on the type of filter and how the filtration rate is controlled. Loss-of-head gauges are used to provide the difference between influent and effluent pressure or head, so that the condition of the filter media can be monitored. Rate-of-flow controllers or flow limiting devices are used to control the filtration rate and prevent surges through the media that may cause particle breakthough. On-line turbidimeters on the filter effluent lines are used along with loss-of-head data to monitor the condition of the media and determine when the filter should be backwashed.

Filtration units should also be equipped with facilities to clean the filter media when it becomes dirty. The typical approach to cleaning or backwashing a dirty filter is to force potable water back up through the media at a high rate causing the media to expand 20 to 30 percent. As the media expands, the particles adhering to the media grains are flushed out of the filter to waste. The facilities and equipment that are used to clean filters include backwash supply pumps or elevated washwater tanks, surface wash or air scour equipment, associated piping and controls, and wastewater management/disposal facilities.

The operational procedures that are used to backwash a filter depend on the design of the filter, the condition of the filter media, and the temperature of the backwash supply water. If a plant has a dual or multiple media filter, the media should be restratified before the completion of the backwash. In order to restratify these types of media correctly, backwash practices using surface wash or simultaneous air-water application should be followed by a backwash. A multiple media filter, for example, may restrict the use of surface wash or air scour to the beginning of the backwash cycle in order to assure proper restratification of the media layers. If the filter media is a mono media type, then no restratification is needed and the backwash method is not restricted (AWWA and ASCE, 1998). In addition, higher washwater temperatures result in lower water viscosities, so higher washwater supply rates may be required in the summer than in the winter to achieve the same bed expansion.

An effective backwash procedure usually includes the following steps: adjusting the raw water flow rate (to prevent hydraulic surges in the remaining filters), gradually increasing the washwater supply rate, restricting surface wash or air scour to the beginning of the backwash cycle (to allow proper media restratification and minimize media loss), maintaining the maximum washwater flow rate until the water on the top of the filter is visibly clear, gradually decreasing the washwater flow rate, observing idle time before reactivating the filter, and gradually increasing the filtration rate when the clean filter is reactivated. Table 3-3 includes more specific information on filter backwash procedures. Operators should be following the backwashing method described in the written operational procedures for the specific filter. In all cases, the filter backwash procedure that is used should provide effective cleaning of the media, protect the structural integrity of the media and underdrain system, and minimize post backwash turbidity spikes in the filtered water. The backwash water should be evenly distributed throughout the filter during a backwash. The turbidity of the backwash waste should be measured during the inspection to determine if the length of the backwash is adequate.

The criteria that are used to initiate a filter backwash impact the effectiveness of the backwash, the condition of the media, and the filtered water quality. In the past, filter run time and headloss have been used as the primary criteria for backwashing a filter. Filter run times range from 12 to 72 hours with 24 hours being typical. A filter headloss of 8 to 10 feet has also been used as a trigger for filter backwash. More recently, and with the increasing use of individual filter turbidimeters, the turbidity of the water leaving the filter has become the overriding criteria for initiating backwash. Some plants use an individual filter turbidity goal of 0.1 NTU as a trigger for backwash before target levels for loss-of-head or filter run time have been reached (AWWA and ASCE, 1998).

An increasing number of facilities are adding filter aids and using filter-to-waste piping to improve the effectiveness of the filtration process. The filter aids usually consist of a polymer or coagulant that is added in small dosages to the settled water prior to the filters.

Filter aids can also be added to the backwash supply water at the end of the backwash process to help minimize particle breakthrough when the filter is restarted. Filter-to-waste is used at many facilities to eliminate problems with post-backwash turbidity spikes, but requires the installation of special piping that is not possible at all plants.

Table 3-3. Recommended Backwash Rates

Backwash Method	Water Wash Rate (gpm/ft^2)	Water Wash Duration (minutes)	Air Scour Rate ($scfm/ft^2$)	Air Scour Duration (minutes)
Upflow Water Wash (1step)	15–23	3–15	–	–
Upflow Low Rate Water Wash with Initial Air Scour (2 steps)				
(1) Air Scour	–	–	1–2	3–5
(2) Low Rate Water Wash	5–7.5	3–5	–	–
Upflow High Rate Water Wash with Initial Air Scour (2 steps)				
(1) Air Scour	–	–	2–5	3–5
(2) High Rate Water Wash	15–23	3–5	–	–
Concurrent Upflow Water Wash and Air Scour (2 steps)				
(1) Concurrent Air and Water First	6.3–7.5	5–10	6–8	5–10
(2) Water Wash only	6.3–15	5–10	–	–
Upflow Water Wash with Surface Wash (3 steps)				
(1) Surface Wash only	0.5–2.0	1–3	–	–
(2) Low Rate Water Wash*	5–7.5	5–10	–	–
(3) High Rate Water Wash*	15–23	1–5	–	–
*with concurrent surface wash				

(Source: AWWA and ASCE, 1998)

In addition to the conventional filtration systems described above, several other filtration technologies are used in the water treatment industry. Some are older systems, such as slow sand filtration and diatomaceous earth filtration. One of the more recent technologies that is receiving increased attention is membrane filtration. These filtration units use pressure driven membranes to achieve levels of particulate and contaminant removal that are not possible with conventional filtration systems. Micro-filtration membranes are used to filter out particulates including pathogenic cysts. Ultrafiltration membranes are used to remove specific dissolved organics such as disinfection byproduct precursors and to remove particulates. Nano-filtration is used to remove calcium and magnesium ions (hardness) and disinfection byproducts precursors. It is also used to remove microbial contamination including viruses. Reverse osmosis (RO) membranes are typical used to remove organic and inorganic contamination. Typically RO membranes are used to purify raw waters containing high levels of total dissolved solids such as brackish water and sea water. All membrane technologies require some kind of pretreatment. Pre-screens are commonly used with micro- and ultra-filtration. Cartridge filters are commonly used with nano-filtration and RO membranes. Typically ultra- and micro-filtration units consist of a number of modules mounted on skids. Nano-filtration and RO units consist of a number of elements housed in pressure vessels which in turn are mounted in trains.

Suggested assessment criteria for filtration include:

1. **What type of filtration system is being used (gravity or pressure; constant or declining rate) and what kind of media has been installed (mono media, dual media, or multi media)?**

   - *What is the maximum filtration rate at design capacity with one filter out of service? Is it at or less than the maximum water demand?*

     Overflowing filters are a sign of inadequate hydraulic conditions. If the maximum water demand is at or higher than design capacity, then the system should have expansion or water conservation plans prepared.

   If a ***pressure filtration system*** is installed, then the following should be checked:

   - *When was the last internal inspection of the filters performed? Is the inspection frequency in accordance with local/state requirements? Were the media and depth, internal piping, and interior surface of the pressure vessel checked? Can the operator provide copy of the inspection report? Were there any deficiencies noted in the inspection report? If so, have the deficiencies been corrected?*

     Manufacturers, equipment suppliers, and many states require periodic inspection of pressure filters. Many operators will not be able to inspect the intervals of the pressure filter, but should be monitoring whether the filter is functioning properly or not. The litmus test for any filter during the sanitary survey visit is to observe whether the turbidity of the finished water is acceptable and that the drop in turbidity level between the influent to the filter and the effluent is at least 90 percent. This can be easily determined using an accurate turbidimeter. If operationally possible at the time of inspection, the inspector should ask that the filter be operated at peak hourly rate and design flow rate. Otherwise, the inspector should ask the operator how the filters performed the last time the peak hourly flow rate and design flow rate occurred at the plant.

   - *Ask the operator to backwash a filter. What are the means and method for backwashing a filter? Is the correct backwash procedure followed based on the filter media type and appurtenances? What is the high rate backwash flow? Is it adequate?*

It is useful to observe the backwash operation to determine if proper backwash procedures are followed. The inspector should note how the wastewater from backwash operations is managed or disposed of.

- *What is the turbidity of the backwash waste?*

  The turbidity of the backwash waste should be measured by the inspector during the inspection to determine if the backwash length is adequate. The turbidity of backwash waste at the end of the backwash process should be very close to the turbidity of the water used in the backwash.

- *What is the turbidity level of the effluent water following the backwash?*

  The inspector should measure the turbidity of the filter effluent water to determine if the filter is functioning as it is supposed to after backwashing. In addition to turbidity, underdrain flow rate should be measured. A post-backwash turbidity profile using on-line turbidity meter is important in indicating filter performance. In addition to turbidity measurements, the filter effluent flow rate should also be recorded from the filter control panel of from a flow meter, if available.

If a ***gravity filtration system*** is installed, then the following should be checked:

An inspection of the filters should be completed. Note that it may not be possible to check on all filters in a plant; therefore, the inspector should determine which filter or two should be checked based on the available on-line instrumentation and discussions with the operator(s).

After completely draining the filter(s) that will be checked and backwashed, the inspector should visually check the filter.

- *Is there any visible indication of problems on the surface of the filter?*

  Visible evidence of problems would be particulate matter remaining on the surface; mudballs, mounding, cracks, holes, depressions in the media surface; and an uneven media surface.

- *Are there any pressure relief vents from the underdrain through the filter media? What are the construction means and method of the vent system? What is the condition of the piping? Is protection from insects and animals entering the vent provided? Can the vent be flooded by water – filtered, unfiltered, or other?*

  The inspector should look for signs of poor sanitation in the underdrain area (filter piping gallery). These include the presence of mold, smut on the walls and floors, and insect and animal droppings.

- *Obtain information on the subsurface condition of the filter media and underdrain system based on depth measurements and limited excavations. What are the type, depth, and condition of the filter media? Is the support gravel level?*

  Depth measurements using a steel rod provide information on the depth of the filter media and the levelness of the underdrain support system. Limited excavations provide information on the subsurface condition of the media, and in the case of dual or multiple media, provide information on the stratification of the media layers. The inspector should note problems such as mudballs or support gravel within the media, improper stratification of media layers, inadequate media depth, and significant variations in the elevation of the support gravel. A core sample of the filter media can also be used to evaluate subsurface media conditions, but usually does not provide as much information as depth measurements and limited excavation. Additional information on the collection and interpretation of core samples of filter media can be found in EPA's manual addressing CPEs (comprehensive performance evaluations) (EPA, 1998b).

  Written inspection procedures and training should be provided to inspectors who are expected to perform subsurface media evaluations to assure the personal safety of the inspector and to minimize the potential for damage to the filter media and underdrain system. The media in some filters (such as constant rate, rising level filter banks) are deep enough to be designated as confined spaces and pose special safety hazards. There are other safety issues such as the slippery surfaces down in the filter unit. In some cases, there are also structural concerns related to walking on the media surface or in the backwash troughs. The results of a recent inspection conducted by a qualified filter contractor may provide the necessary information without the inspector having to perform a subsurface media evaluation.

- *After completing the inspection of the filter, the inspector should ask the operator to prepare the filter for backwashing. What are the means and method for backwashing? Is the correct backwash procedure followed based on the filter media type and appurtenances? What is the high rate backwash flow? Is it adequate?*

  Note the means and method used. Filtered water (not settled water) should be used to flood the media before backwashing. All air should be expunged from the underdrain and media by this flooding before backwashing the filter.

  The inspector should also note if the correct backwash procedure is followed based on the filter media type and appurtenances, and the high rate backwash flow. The inspector should note if the high rate backwash flow is adequate, and if there is even distribution of water/air across the filter. Any boiling of the media and any explosions of the media due to trapped air should be noted. When refilling the drained filter, the media should be slowly flooded with backwash supply water to protect against damage that can be caused by entrapped air in the media and underdrain system.

Backwash troughs should be inspected for levelness. In addition, surface wash arms and nozzles should be operational and functioning appropriately.

- *What is the turbidity of the backwash waste?*

  The turbidity of the backwash waste should be measured by the inspector during the inspection to determine if the backwash length is adequate. The turbidity of backwash waste at the end of the backwash process should be very close to the turbidity of the water used in the backwash.

- *What is the turbidity level of the effluent water following the backwash?*

  The inspector should measure the turbidity of the filter effluent water to determine if the filter is functioning as it is supposed to after backwashing. In addition to turbidity, underdrain flow rate should be measured. A post-backwash turbidity profile using on-line turbidity meter is important in indicating filter performance. In addition to turbidity measurements, the filter effluent flow rate should also be recorded from the filter control panel of from a flow meter, if available.

2. **Is the monitoring instrumentation (loss-of-head, effluent flow rate, and filtered water turbidity) working for all filters? What condition is the instrumentation in?**

   The monitoring instruments should be present and functional. The inspector should ask the plant operator about the frequency of monitoring equipment calibration and should note if the calibration frequency and procedures are in accordance with manufacturers' recommendations and state regulatory requirements.

3. **What criteria are used by operators to determine when a filter requires backwashing? Do all operators of the treatment plant use the same criteria? Are filters ever stopped, then started-up again without backwashing them first? Are filters ever "bumped" to extend filter runs?**

   The inspector should note how the operators determine the need to backwash the filter. It is important to note whether the backwash is triggered by measuring head loss or rise of water levels in the filters, by an increase in turbidity levels in the finished water, or other reasons that might be as simple as an automated preset-backwash timing based on manufacturer or salesman recommendation. The inspector also should note if all operators at the plant adhere to the same criteria. Some operators "bump" their filters to extend the length of the filter run. Bumping is done by opening the backwash valve during the filter run to dislodge trapped solids. This is a bad practice that results in an immediate increase in filtered water turbidity.

4. **What equipment is included in the backwash system? What is the capacity of this system? Is there a backup backwash system? What is its capacity? Is it operable? Is there a means of measuring the backwash flow rate? Is it working? What is its condition? When was the flowmeter calibrated last? Can the backwash flow be varied to allow for varying conditions? If so, can the operator adjust the rate of flow?**

   Backwash pumping system and piping capacity should be recorded. The inspector should make sure that the pipes and valves of the backwash system are properly color coded, the backwash flow meter is functional, and the last calibration date is available. The inspector should note if the backwash flow rate has been adjusted and for what reason.

5. **Are newly backwashed filters brought back into service at low rates that are gradually increased (ramped-up) in order to minimize post-backwash turbidity spikes? Are operating filter flow rates reduced when another filter is backwashed?**

   Newly backwashed filters should be brought back online at a low loading rate and then the loading rate gradually increased to the pre-wash loading rate levels. This practice will prevent compaction of the filter media and will allow the filterable material to attach to the filter media. The practice of gradual increase in filter loading rate reduces the levels of post-backwash filter effluent turbidity spikes.

6. **What is the condition of the piping in the filter gallery? Is it color coded for the use or service in accordance with local/state requirements? Are there any cross-connections?**

   All pipes in the filter gallery should be color coded and marked in accordance with local and state regulations.

7. **Is there a floor drain to remove all leaking water from the filter gallery floor?**

   The inspector should note any leaks from valves and pipes and check the floor drain to determine if it is partially or totally clogged. The inspector should also determine the point of discharge for the floor drain and any other drains in the filter gallery. Some plants are designed with the clearwell located underneath the filter gallery. Drains should not discharge to the clearwell and drain piping should not pass through the clearwell.

3.2.4.8 Disinfection

The practice of disinfection has proven to be one of the most important advances in reducing the incidence of waterborne disease. In this regard, disinfection is an essential component of the surface water and GWUDI of surface water treatment process to assure the destruction or inactivation of disease causing organisms that may not be physically removed during sedimentation and filtration. Two sets of regulations affect the type of disinfectants that are used and where they are applied in the treatment process. First, the disinfection process should assure specific reductions of *Giardia* and viruses required by the Surface Water Treatment Rule (SWTR). Second, the disinfection process is restricted by regulations limiting the formation of certain disinfection byproducts (DBPs). With the enacment of the Stage 1 DBP Rule in December 1998, any public water system that treats its water with a chemical disinfectant must meet MCLs or treatment techniques for several disinfectant residuals (chloramines, chlorine dioxide, chlorine) and their byproducts [TTHMs (total trihalomethanes), haloacetic acids (HAA5), chlorite, bromate]. It is important that the inspector evaluate whether the disinfection system is adequate to ensure compliance with current drinking water standards.

Although the primary purpose of disinfection is to inactivate disease-causing organisms that may not be physically removed during sedimentation and filtration, the disinfection process often provides other benefits related to improved coagulation, oxidation and precipitation and/or filtration of iron and manganese and hydrogen sulfide compounds, taste and odor control, algae control, and a measurable disinfectant residual in the distribution system. These benefits depend on the type of disinfectant being used and the point at which it is being applied in the treatment process. Types of disinfectants include chlorine, chloramines, chlorine dioxide, ozone, and ultraviolet (UV) light.

Chlorine is the most widely used disinfectant for drinking water because of its proven effectiveness, low capital and operating costs, and established history in the water industry. Free chlorine provides a high level of disinfection at the treatment plant and a measurable residual in the distribution system. Unfortunately, free chlorine also combines with organic precursors that may be present in the source water to form DBPs, such as trihalomethanes (THMs). As a result, many treatment plants use chlorine in combination with ammonia to establish a chloramine residual and minimize THM formation. A chloramine residual is a weaker disinfectant than free chlorine, but is more durable and easier to maintain in the distribution system. At plants where THMs are not currently regulated, chlorine is often added at the raw water pump station or the rapid mixing basin to establish a free chlorine residual through the entire treatment process. This approach provides a high level of disinfection, improves the coagulation process, and minimizes algae growth in the treatment units. However, it may also result in high THM levels.

Chlorine dioxide is being used as an alternative to chlorine at a growing number of treatment plants. Even at low concentrations, chlorine dioxide provides both a high level of disinfection at the treatment plant and a measurable disinfectant residual in the distribution system. Chlorine dioxide residuals rapidly dissipate in sunlight and often cannot be maintained through the sedimentation process. Chlorine dioxide does not form the same DBPs associated with the use of chlorine, but does form chlorite which is regulated under new disinfection byproduct regulations.

Ozone is another disinfectant that is used as an alternative to chlorine. Ozone provides a high level of disinfection, does not form chlorinated byproducts, and improves the coagulation process. It is also very effective in controlling taste and odor problems. Ozone is usually added at the beginning of the treatment process. It dissipates rapidly and does not provide a suitable disinfectant residual in the distribution system. The expense and complexity of ozonation facilities have prevented serious consideration of the process at many small and medium size treatment plants.

Ultraviolet (UV) light treatment, at sufficient intensity and appropriate wavelength and exposure time, is an effective disinfection agent for drinking water. The process involves the direct exposure of the water stream to UV light. UV systems come in two types, closed and open, with closed systems more commonly used in potable and sterile water applications. The effectiveness of UV disinfection depends on the intensity of the radiation, proper wavelength, exposure time, water quality, flow rate, type and source of the microorganisms (natural or culture), and the distance from the light source to the targeted microorganisms (EPA, 1996). UV disinfection is more suitable and effective for clean water sources with little suspended matter. Therefore, water often should be pretreated (e.g., for iron and manganese removal) before reaching the UV light disinfection unit. UV disinfection does not provide a disinfectant residual in the distribution system.

Disinfectants are added at a particular point in the process for specific reasons. When a disinfectant such as chlorine or chloramine is used, the disinfectant usually is added at two general areas in the treatment process. The first area is at the rapid mix and prior to filtration, which is called pre-disinfection. The second area is after filtration and before the distribution system, and is called post-disinfection. A disinfectant may be added to either location, or both. However, pre-disinfection may cause DBPs at levels that might cause adverse health effects. It is important to establish the need and the expected results when evaluating the disinfectant addition location. For example, pre-chlorination assists in iron and manganese removal by facilitating precipitation prior to filtration. If the only disinfectant addition point is at the post-disinfection zone, then the iron and manganese particulates would enter the distribution system, leading to customer complaints and concerns about water quality. Since pH must sometimes be increased to effectively precipitate manganese, disinfection credit may be impacted.

The effectiveness of the disinfection process in inactivating disease causing organisms is measured by compliance with the disinfection requirements in the SWTR. With the enactment of the SWTR, surface water treatment plants were required to demonstrate the removal and/or inactivation of 3-log *Giardia* and 4-log viruses. If the quality of the water leaving the plant meets the minimum requirements of the SWTR, then the facility with conventional filtration is credited with removing 2-log *Giardia* and 2-log viruses. A well-operated and maintained treatment plant with a conventional filtration process can receive a

2.5-log removal for *Giardia* and 3-log removal for viruses. The remainder should be inactivated (killed) by the disinfection process. To provide a reasonable means for demonstrating that the required level of inactivation is obtained, the *CT* concept was developed. *CT* is residual disinfectant concentration (in mg/L) times the water contact (detention) time (in minutes). The detention time used is T_{10}, which is the detention time at which 90 percent of the design flow passing through a basin is retained.

The *CT* values for different disinfectants at various water quality conditions are provided in the SWTR guidance manual (EPA, 1991). There are two different approaches in the SWTR for demonstrating compliance with the disinfection requirements. The first method is to demonstrate that the facility has maintained a minimum disinfectant residual through the disinfection zone (i.e., between the disinfectant injection point and the residual measurement point), based on the projected worse case water quality conditions at the facility. The second approach is to compare the actual *CT* to the required *CT* using actual conditions (flow, temperature, water quality, etc.) for that day. To determine the actual *CT* required to inactivate *Giardia* and/or viruses for a given day, the disinfectant residual concentration and the detention time of the water T_{10} must be known.

The concentration of the residual disinfectant is determined by measuring the concentration of the treated sample. The detention time is measured either using a tracer study or by estimating using baffling conditions. The SWTR Guidance Manual provides full details on how to conduct both measurements, how to calculate the actual *CT* for various disinfectants, and how to look up the required *CT* for different levels of *Giardia* and virus inactivation. Inspectors should evaluate whether the plant is operating within the operating parameters for its *CT* requirements.

The SWTR also requires that the disinfectant residual entering the distribution system be at least 0.2 mg/L and that there be a detectable residual in all parts of the distribution system (specific requirements are given in 40 CFR 141.72 and the assessment criteria below). Therefore, a higher residual may be necessary at the entrance to the distribution system to assure that an acceptable residual is maintained throughout the distribution system. A state may have a more stringent requirement. Some states have minimum requirements for disinfection residuals at the far end of distribution systems, in addition to the minimum residuals at the entrance to the distribution system.

The general assessment criteria for the disinfection process equipment were presented earlier in this section and will not be repeated here. The assessment criteria listed here will be strictly related to the disinfection process. Suggested assessment criteria for the disinfection process include:

1. **What type of disinfection process and facilites are used at the treatment plant? Does the operator understand the disinfection process?**

   The operators should be knowledgable about the disinfection process and facilities used at the treatment plant so that the disinfection process can be properly managed and adequate disinfection treatment provided. The capabilities of the operators concerning the disinfection process should be explored with questions. When the operator is not knowledgeable about the process and equipment, equipment failures and problems in the effectiveness of the process may not be resolved in a timely manner. Operator training in the use and maintenance of disinfection equipment is important. Since an operator's lack of knowledge in this area can pose a serious sanitary risk, it may be considered a significant deficiency.

2. **How was T_{10} determined – calculated or field tracer study? How was *CT* determined at this facility? How many inactivation logs are required? What are the disinfection zones in the plant? How is compliance with this requirement demonstrated – minimum disinfectant residual level or calculated? Is continuous disinfectant monitoring being done? Are adequate records kept showing compliance with the *CT* requirement?**

   Plant operators should be able to calculate the sum of the actual *CT* for each disinfection segment under actual operating conditions (i.e., $\Sigma C \times T_{10}$). The operator should be able to tell the inspector if the T_{10} values are based on tracer studies or on the use of the baffling conditions as directed by the state or SWTR guidance manual. Generally, T_{10} is calculated using (peak hourly rate/volume) $\times$ baffling factor. The state provides credit removal to plants with filtration processes. Determining residual free chlorine should be done in the lab using one of the EPA-approved methods for analysis. However, the inspector should use an accurate field kit for on-the-spot measurement of free chlorine and total chlorine residuals. The sanitary survey inspector should refer to EPA's guidance manuals on alternative disinfectants and oxidants (EPA, 1999a), and disinfection benchmarking (EPA, 1999b) for evaluating *CT* credit for disinfectants other than chlorine. The inspector should make sure that water quality parameter measuring equipment (including temperature and pH meters) are operational, well-maintained, and properly calibrated.

3. **What is the chlorine residual leaving the treatment plant? Does it meet SWTR requirements? What is the chlorine residual at the first customer and throughout the distribution system? Does the residual provide adequate protection out in the distribution system? Do disinfectant residuals meet state requirements?**

   The SWTR requires that finished water leaving the treatment plant have a chlorine residual that is not less than 0.2 mg/L for more than four hours. The SWTR also requires the presence of detectable residual in the distribution system, specifically that the chlorine residual cannot be undetectable for more than 5% of the samples each month for any two consecutive months (40 CFR 141.72). The residual leaving the plant may need to be higher than 0.2 mg/L to ensure that an adequate minimum residual is maintained out in the distribution system. The state may have more stringent requirements.

3.2.4.9 Waste Streams

Waste streams (primarily backwash water) from a water treatment plant have been historically discharged either to a receiving stream or the nearest sanitary sewer. More facilities are recycling all waste streams to conserve water as much as possible. In such cases, the recycled waste streams are returned to the head of the plant. The method of returning this flow can have a significant impact on the treatment plant performance. One of the major concerns with recycled waste streams is the concentration of microbials, particularly protozoa such as *Cryptosporidium* and *Giardia*. The inspector should check if the water system's practices for recycling backwash water are in accordance with applicable federal and state requirements.

Wastewater from the filter backwash process is usually pumped from a holding pond(s) back to the raw water line coming into the plant. It is important that the recycled stream enter far enough upstream of the treatment process to allow for proper monitoring of raw water quality prior to chemical addition. In some cases, the pumping rate to return the waste streams as quickly as possible is fairly high (≥ 25 percent of treatment rate). In others, the pumping rate is low (≤ 10 percent of treatment rate). A variable pumping rate (approximately 5 percent of treatment rate) that provides a continuous flow based on the treatment rate of the plant is preferable. If the recycle return rate is high (compared to the treatment rate), hydraulic surges within the facility may result causing a significant disruption of the treatment process and ultimately leading to a degradation of the finished water quality. The recycle return rate should be low compared to actual treatment rate to minimize hydraulic surges.

Another concern of recycling the waste streams is the additional solids added to the existing raw water. In some plants, the additional solids are needed to enhance the coagulation and sedimentation process. In others, the additional solids would upset the treatment process, because the feed rates for the coagulant chemicals may not be set right to accommodate the higher loading. Solids may not settle in the clarifiers if the coagulant chemical dosages are not set properly. Therefore, the coagulant chemical dosages should be adjusted to consider the solids from the recycle stream. Finished water used in backwashing tends to have a lower pH (0.5–1 unit), a higher temperature (0.5–1°C), and a lower alkalinity than raw water. The coagulation/flocculation dosages need to be adjusted to account for these changes in pH, temperature, and alkalinity.

Suggested assessment criteria for recycling of waste streams include:

1. **How are wastewater from the backwash process and sludge from the sedimentation process managed? Is filter backwash water wasted or recycled? Are all discharge and disposal activities in accordance with applicable requirements?**

   It is important to note the conditions under which wastewater and sludge are discharged or disposed of. The inspector should also note if the waste stream is disposed of into a sewer line, french drain, or pond. It is also important to note whether the backwash water is wasted or recycled. The inspector should determine if the plant has an NPDES (National Pollutant Discharge

Elimination System) permit to dispose of backwash waters into surface water. Additional information on addressing wastestreams can be found in *Technology Transfer Handbook-Management of Water Treatment Plant Residuals* (EPA, ASCE, and AWWA, 1996).

2. **If recycled, does backwash water receive any treatment to decrease pathogen densities?**

   Many water plants use settling ponds in series and add oxidants and disinfectants to recycled waste streams to reduce pathogen population and to improve coagulation.

3. **Do the recycle pumps operate manually or automatically? What is the recycling rate of the waste streams? How does this compare to the normal treatment rate (percentage basis)? Is it constant or variable flow?**

   To avoid disrupting the hydraulic regime of the treatment plant, waste stream holding tanks are used. The inspector should note the volume of the holding tank and the volume of the waste stream being recycled and the portion that is being wasted.

4. **How much solids are in the recycled waste streams? How does this compare to the solids in the raw water?**

   The solids content of the recycled waste stream is important in determining the coagulant dose needed. The plant should use jar tests to determine the necessary coagulant dose.

5. **Are the coagulant dosages adjusted to accommodate the recycle flows? If so, how? Are any jar tests performed to determine the impact of the recycle stream and what changes to the coagulant dosages are needed?**

   When a plant recycles its waste stream, very often coagulant dose is reduced. However, in some cases different coagulant is used or a coagulant aid should be added to the process. Jar tests are crucial in determining coagulation needs (both quantity and quality).

3.2.4.10 In-Plant Cross-Connection Control

Cross-connections are links between a potable and a non-potable water supply and/or waste water or chemical supply line, through which contaminating materials may enter a potable water supply. Cross-connections present a serious sanitary risk to a drinking water supply since they can be the source of contamination of drinking water, leading to illness and disease. At a cross-connection, contaminants can enter the potable water when the pressure of the contaminated, non-potable stream is greater than the pressure of the potable water. This situation causes backflow to occur. There are two types of backflow: back pressure backflow and backsiphonage backflow:

- **Back pressure backflow** is the flow of non-potable, contaminated water toward a potable water supply because the contaminated water has a greater pressure.
- **Backsiphonage backflow** occurs when there is a vacuum in the distribution pipes of a water system, causing untreated, non-potable water to be sucked out toward the potable water. (EPA, 1989)

The potential for cross-connections is very high within water treatment facilities. Typical examples of cross-connections at a water treatment plant are described below and are shown in Figure 3-13. For example, the check valve near the boiler in Figure 3-13 does not provide adequate protection since the potable water is not protected against backflow from the chemical feed line. Back pressure backflow is a potential problem in buildings where there are two or more piping systems that are not fully separated. A common situation for a back pressure cross-connection is when the potable water supply for the plant is tied into the water supply for the chemical feed system. Water containing chemicals under a higher pressure may backflow into the high water demands that result in a backflow of untreated water into the distribution system. This is one reason that it is important for a system to maintain adequate pressure in its distribution system.

A backsiphoning scenario that is found throughout many water treatment plants is the carrier water supply for a coagulant chemical that may be connected to the plant water system. A high service pump discharging into the distribution system may cause a negative pressure and result in backsiphoning of some of the chemicals into the potable supply. Common cross-connections occur within the plant from high pressure hose bibs without vacuum breakers. Since negative pressures can also occur within the plant as a result of using high-pressure hoses supplied by the plumbing system, all hose bibs at the plant (particularly those that might hang down into chemical tanks or treatment basins) should be equipped with vacuum breakers. An example of a back pressure cross-connection is a hot water boiler connected to the plant water system. If the boiler creates a pressure that is greater than the system pressure, backflow can occur. Other examples of in-plant cross-connections include unprotected connections between filtered and nonpotable water in the filter piping gallery and the potable water lines that are used to provide makeup water and carrier water for chemical feed equipment. A very common cross-connection at surface water systems is backflow from the raw water source into the clearwell through a split feed (pre- and post-chlorination) chlorination system.

When surveying the plant; it is important to determine the source of water for all areas (chemical, water flush for pump bearings, etc.) that could potentially contaminate the potable water supply. The water system should eliminate potential cross-connections with an air gap or the appropriate backflow prevention device (see Figure 3-15). If the plant has a single plant water supply connection, installing a backflow prevention device on this line at the connection to the potable water supply will solve the problem. If the piping is such that a single device will not solve the problem, then a control device will have to be installed at all uses that pose a potential cross-connection.

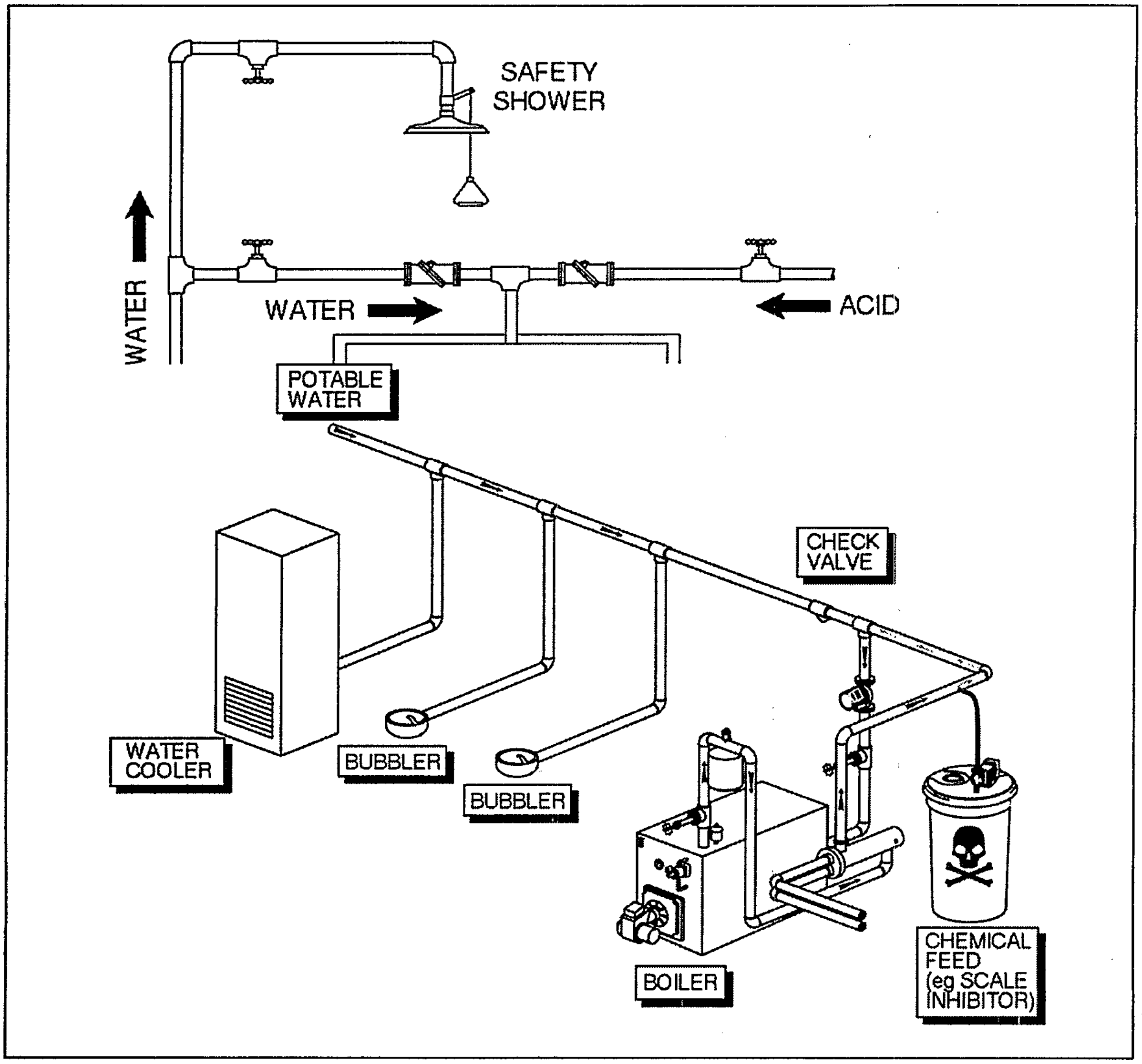


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Figure 3-13. Examples of In-Plant Cross-Connections

Suggested assessment criteria for cross-connection control in-plant include:

1. **Does the water system have a cross connection control plan for the plant? Is the program active and effective in controlling cross connections?**

   Treatment plants should have a cross connection control plan for the plant. The plan should include testing various cross connection prevention devices for proper functioning. All pipes in the treatment plant should be color coded. Hookups to various types of pipes should be different. For example, a hose that is used to clean the grounds using clear water should not fit on the outlets of a coagulant or waste pipeline. All pipes should be labeled as coagulant line, clear waterline, waste line, gas line, etc. Also, flow direction should be marked on these pipes.

2. **What are the water uses in the plant? Where does the supply for these uses come from? Are proper backflow prevention devices installed to protect potable water at the plant?**

   All water uses in the plant should be verified. All potable water lines should be equipped with the necessary air gaps or proper backflow prevention devices to assure protection against the backflow or backsiphonage of contaminants. All hose bibs should have a vacuum breaker installed that cannot be easily removed.

3. **Are the appropriate backflow preventers used for all existing cross connections?**

   The inspector should have a copy of EPA's *Cross-Connection Control Manual* (EPA, 1989) or any equivalent state manual for verification of which devices ought to be used to prevent backflow.

3.2.5 Priority Criteria

The following criteria related to the water treatment element of the sanitary survey are considered high priority based on their potential for impacting public health:

- **Capacity of Treatment Facilities** – The capacity of major treatment processes needs to be sufficient to produce enough finished water to meet customer demands (Section 3.2.3).
- **Rapid Mix, Chemicals and Chemical Feed Systems, and Coagulation/Flocculation** – The proper use of coagulant chemicals can aid the sedimentation/clarification and filtration processes (Sections 3.2.4.3–3.2.4.5).
- **Sedimentation/Clarification** – The clarification process allows the particulates to precipitate and be removed by sedimentation (Section 3.2.4.6).

- **Filtration** – Filtration is the last physical barrier for the removal of particulates, organic and inorganic contaminants, and pathogens in the water (Section 3.2.4.7).
- **Disinfection** – Disinfection has proven to be the one treatment process that has had the most significant impact on public health due to the inactivation of pathogens (Section 3.2.4.8).
- **Waste Streams**– Recycled waste streams may have a high concentration of microbials and solids and may have a lower pH, higher temperature, and lower alkalinity than raw water. High recycle return rates can cause hydraulic surges that disrupt treatment processes. Treatment processes need to adequately account for these factors if waste streams are recycled (Section 3.2.4.9).
- **In-Plant Cross-Connection Control** – Connections between contaminated and potable water sources at the treatment plant can lead to contaminated water supplies, if not controlled. Cross-connections can be present in water treatment plants and are usually made unintentionally or are made because their hazards are not recognized or are underestimated (Section 3.2.4.10).
- **Treatment Plant Schematic/Layout Map** – Modifications to treatment processes can have a major impact on water quality and should be clearly identified on treatment plant schematics and layout maps (Section 3.2.2).

3.3 Distribution Systems

The water distribution system is the final link between the water source and the consumer. The distribution system is the primary means of delivering drinking water produced at the water treatment facility to the water system's customers. A typical water distribution system comprises miles of water pipes constructed in a network which includes numerous valves, fire hydrants, pumps, storage tanks, meters, and other appurtenances.

Water distribution systems are generally considered to be a composite of three basic elements: treated water storage facilities (ground storage tanks, elevated storage tanks, standpipes, hydropneumatic tanks), pumping facilities (booster pumps, piping, control, pump building, etc.), and the distribution lines (piping, valves, fire hydrants, meters, etc.). These components should be integrated in order to function as a comprehensive system that can meet various schedules of demand. A thorough inspection of the water distribution system is needed to determine whether the distribution system can provide a safe, reliable, and adequate supply of drinking water to the customers.

The objectives of surveying the water distribution system are to:

- Determine the potential for degradation of the water quality in the distribution system;
- Determine the reliability, quality, quantity, and vulnerability of the distribution system; and

- Ensure that the sampling and monitoring plan(s) for the system conform with requirements and adequately assess the quality of water in the distribution system.

To meet these objectives, the inspector will need to review system mapping, design and construction criteria, system operation and maintenance records, and sampling and monitoring plan(s) in addition to the actual inspection of the system. The following sections discuss the specific portions of the water distribution system that need to be evaluated during an inspection. Finished water storage and pumps/pump facilities are discussed further in Sections 3.4 and 3.5, respectively.

3.3.1 Distribution Maps and Records

The inspector will need to review the mapping and other records for a distribution system to assess the components and size of the system to be evaluated. Maintaining accurate mapping and records of the distribution system is essential for a water utility to repair and maintain the existing system, as well as to plan for future improvements or expansion. The mapping should show the location, size, and material of all pipes, valves, and fire hydrants in the distribution system. The mapping should also show any pressure zone boundaries, pumping facilities, storage tanks, and interconnections with other public water systems. A distribution system map for a small system could just be one map showing all the pertinent details. For a large system, the mapping could include an overall system map at a large scale with many smaller-scale, detailed maps showing the location of all utilities (including water and other utilities also) and valves at street intersections, on roadways, and other important areas. The maps should be updated regularly to record any changes or additions to the distribution system.

In addition to the distribution system mapping, an inspector should also review the historical records for a system. A good record system provides a history of the distribution system, including normal and emergency operation, maintenance, and repair. The records should include the standards used for construction, repair, and disinfection of new and repaired components of the system. Documentation of the inspection, operation, and maintenance of all valves and fire hydrants as well as leak detection and repairs completed should be in the record system. Customer complaints and investigation reports with the findings and actions should also be included in the record system.

Suggested assessment criteria for mapping and records include:

1. **Are there maps of the distribution system? Are all major features shown – line and valve location, size, and material; fire hydrant location; dead end mains; pressure zone(s) boundary, (if any); ground and elevated storage tank(s); and booster pump station(s)?**

   An accurate distribution system map enables systems to locate water mains and appurtenances for repairs and for maintenance. A distribution system map also permits the systems to accurately plan for improvements or expansions. Lack of an accurate map may be an indication that a system does not perform maintenance on its distribution system. Particularly for large systems, the inspector should check if system problem areas are identified on a system map.

2. **When were the maps last updated? How are changes or additions reported and the map(s) updated?**

   The distribution map should be updated to reflect the most recent modifications to the distribution system. Typically the date of the last revision to a map is noted in the title block or map key.

3. **Is there a record system? Does it include documentation of operation and maintenance repairs, leak detection, and construction standards?**

   Maintenance and repair records for a water distribution system can provide an indication of the portions of the distribution system which need to be rehabilitated or modified. The records should include reports upon repairs made to the distribution system as well as maintenance activities such as water main flushing. The other reports which should be maintained are the results of any leak detection and repair activities. A record of distribution system standards should also be maintained so that they are readily available to system personnel and contractors. These distribution system standards should include standard operating procedures (SOPs) for the repair of broken mains, as well as the standard details and specifications for pipelines and materials used in the construction of new water mains. The lack of standard operating procedures or construction specifications may indicate that repairs or extensions to the distribution system are not being properly completed.

4. **Are customer complaints and investigation reports kept? Is there an apparent/common problem indicated by the customer complaints?**

   Customer complaints can provide an indication of where water quality may be suffering. For example, a high number of stagnant water complaints on a dead end main may indicate the need for increased flushing or looping the main back into another part of the distribution system. Systems which maintain records on complaints an analyze them by mapping or other means, are proactively addressing potential sources of contamination in their distribution systems.

3.3.2 Field Sampling/Measurements

Some of the most important data collected by the inspector to evaluate the distribution system for sanitary risks are found in the field. The inspector should take measurements and samples for analysis at representative locations throughout the system to determine that an adequate disinfectant residual and pressure are being maintained.

The disinfectant residual should be measured at the points of lowest potential residual (e.g., areas of stagnant water) because these areas represent the greatest challenge for maintaining a residual. When taking the sample, proper procedures should be followed to prevent contamination which may influence the final results. If the disinfectant residual is less than that required, then the cause for the low residual should be investigated and solved quickly. The low residual could be caused by the disinfectant feed equipment not being properly adjusted and set. Excessive chlorine demands in the system could also cause low residual levels, which may indicate a more serious condition. Line breaks or leaks, backflow or back-siphonage due to low pressures, and biofilm growth may be responsible for the excess chlorine demands.

Of the conditions identified that could cause an excessive chlorine demand, biofilm growth is the least serious from a public health standpoint, but biofilm growth is usually the most difficult to treat. Besides compromising the disinfectant residual, the growth could also jeopardize routine microbiological samples. Systems that use chloramines as the secondary disinfectant to maintain the residual in the distribution system are susceptible to biofilm growth under certain conditions, such as high temperature and high total organic carbon (TOC) levels. The disinfectant may be consumed by the biofilm growth, leaving the water unprotected.

When taking the disinfectant residual test, the pressure available at that point in the distribution system should also be checked. The pressure in a distribution system varies due to the changes in water demand, changes in pressure head (e.g., as a result of transmitting water to consumers living on high hills or in deep valleys), and friction losses in the pipe. As such, there are several pressure zones in a distribution system commonly referred to as pressure planes. A pressure plane is the portion of a water distribution system served by the same elevated storage tank or booster station. Additional pressure checks should be performed at the highest and lowest points of a pressure plane or the distribution system. The pressure at all points should be at least as high as the normal operating pressure required by state rules (typically 35 psi). When the pressure is lower than 20 psi, that area of the distribution system is vulnerable to backflow or back-siphonage of contaminated water into the system. Excessive pressures (greater than 100 psi) may damage consumer facilities and plumbing fixtures.

Suggested assessment criteria for data collection include:

1. **What are the maximum and minimum residuals at the extremities of the distribution system or pressure plane? What is the normal residual range in the distribution system or pressure plane?**

   The lack of a disinfectant residual in distribution systems which are required to maintain a residual can be an indication of excessive chlorine demand or improperly set disinfectant feed rates. Excessive chlorine demand may be caused by cross connections, backflow into the system, biofilms or line breaks. Systems with surface water and ground water under the influence of surface water are required by the SWTR to maintain a minimum disinfectant residual concentration at the point of entry to the distribution system of 0.2 mg/L (EPA, 1991).

2. **What are the maximum and minimum pressures at the high and low points in the distribution system or pressure plane? What is the normal operating pressure in the distribution system or pressure plane?**

   A system must maintain positive pressure at all times to prevent contaminants from being drawn into the water mains from outside sources. The lowest pressure in the system should be approximately 35 psi (this depends upon State Standards) and should almost never be lower than 20 psi. Excessively high pressures can cause damage to the system and may result in high water use. The inspector should check to see that the system operators check and record the operating pressure at representative locations throughout the system (CDOHS and EPA, 1996).

3. **How often are pressure readings taken in the distribution system? Are they representative of the system?**

   The frequency of pressure readings depends on the size and complexity of the system. At a minimum, pressure should be checked in the distribution system when chlorine residual concentrations are checked, and in response to customer complaints about water pressure. In addition to checking the pressure in the area near where the customer complaints were received, the pressure at the highest point in the distribution system or pressure plane should also be checked. This high point is where you would expect to find the lowest water pressure.

3.3.3 Distribution System Design and Maintenance

The integrity of the distribution system should be maintained at the highest level possible to protect public health. Since almost all of the distribution system components are located underground, they cannot be easily checked to verify that the system integrity is being maintained. Therefore, standards and procedures for design, material selection, plumbing code, operation, and maintenance should help maintain the integrity of the system.

3.3.3.1 Design/Material Standards

The major component of the distribution system is the underground pipe. As the largest element, a design standard should be established that specifies the minimum requirements for all water lines. To protect the integrity of the distribution system, these standards should apply regardless of who pays for or installs the line(s). The design standard should specify the following items:

- Minimum pipe size (typically there should be no lines less than 2 inch);
- Minimum line size criteria (either maximum water velocity or number of connections served for a given line size);
- Minimum line size where fire hydrants are to be provided (6 inch is the minimum);

- Minimum line size for a specific requirement of the distribution system (e.g., transmission line should be at least 12 inches);
- Design flow for each type of connection (residential, commercial, industrial, etc.);
- Design fire flow for specific areas of development (residential, commercial, industrial, etc.);
- Location of line relative to other utilities (sanitary sewer, in particular) and right-of-way limits;
- Location or spacing of valves;
- Direction of valves (right or left opening);
- Type of valves to be used (vacuum/air release, butterfly, or gate valve);
- Location or spacing of fire hydrants;
- Type of fire hydrants to be used (dry or wet barrel);
- Pipe material, including requirements for internal as well as external corrosion;
- Appurtenances required for flushing of dead-end lines;
- Minimum cover or depth of bury requirements;
- Pressure testing to determine that there are no leaks in the line;
- Construction or installation requirements; and
- Location and construction of appurtenances in the floodplain.

Suggested assessment criteria for design/material standard include:

1. **What kind of piping materials are in the distribution system?**

   The kind of pipe used may provide an indication of the condition of the pipe, and the amount of corrosion which may be occurring in the pipe. Certain types of pipes such as ductile iron, cast iron, steel, concrete and asbestos cement are more susceptible to corrosion when exposed to aggressive soils or water (CDOHS and EPA, 1996). Often times these types of pipes are lined internally with mortar or bituminous materials and are sometimes protected externally. Corrosion of pipes may lead to contamination of the drinking water by leaks or by the corroded pipe material.

2. **Does the water system have a construction standard for water mains? If not, what are the criteria for sizing water line, selecting pipe materials, installing the lines, etc.?**

   The use of a construction standard by water systems in the construction of water mains ensures that the pipes and appurtenances in the distribution system meet minimum acceptable specifications.

3. **Is the standard or method adequate to protect the integrity of the distribution system initially, as well as over time?**

   The construction standards will be protective of the water quality if they are appropriate for the conditions (e.g., aggressiveness of the soil and water) for the specific system. They should also ensure that the pipe and other appurtenances are manufactured in accordance with accepted practices.

4. **Are standards actually followed?**

   Construction standards are only effective if they are followed and enforced. An inspector should ask how the system ensures compliance with the standards. Pipes and appurtenances should be inspected by the system prior to installation. The system should periodically inspect its installation contractors or crews to ensure that they comply with the standards.

3.3.3.2 Maintenance Procedures

Even if the installation of a new waterline and its appurtenances are completed in accordance with the design standards, the integrity of the distribution system could be compromised if it is not properly maintained. Procedures and schedules should be created for the maintenance of all parts of the distribution system. The maintenance procedures for piping systems would include line flushing at a regular interval. For valves, verifying location and regularly exercising the valve between the open and closed positions will help maintain the valve, and keep it ready for an emergency.

Suggested assessment criteria for maintenance procedures include:

1. **Does the water system have a maintenance procedure for all components of the distribution system? If not, is anything being done to maintain the system components? What?**

   A system should have a set of distribution system maintenance procedures to ensure reliable service, to minimize emergency repairs, and to minimize the potential introduction of contaminants. The distribution maintenance procedures should address water main flushing, valve operation and fire hydrant flushing as described below.

2. **Does the system regularly flush the water mains within the distribution system?**

   Flushing of water mains removes sediments or other contaminants which can accumulate in pipes over time, and can lead to taste and odor problems. The system should develop a schedule for flushing mains before taste and odor problems develop. Dead end sections of the system may require more frequent flushing than other portions of the system.

3. **Does the system have a program for inspecting and exercising valves?**

   The system should have a program for inspecting and maintaining all valves. Generally, the valves in the system should be operated at least once a year. The system should have a program under which all valves are opened and closed (or closed and opened). The system should maintain a record of each opening and closing which includes the number of turns of the valve and the date it was exercised. The valve should also be examined to note the condition of the valve packing stem, stem, stem nut, and gearing (CDOHS and EPA, 1996). Because large valves that have been in service for many years may be more prone to breakage, it may be appropriate to exclude them from the valve exercise program (AWWA, 1999). A system's valve exercising program should follow AWWA-recommended practices.

4. **Does the system regularly inspect and operate its fire hydrants?**

   The system's maintenance procedures should include a program to inspect and operate fire hydrants at least two times each year. The hydrants should be inspected for leaks, and dry barrel hydrants should be checked to ensure the barrel drains after use. Nozzles and caps should be cleaned and lubricated. The hydrant should be opened fully and flushed to waste (CDOHS and EPA, 1996).

3.3.3.3 Disinfection of New Water Lines

The distribution system integrity could be compromised if procedures are not followed to protect it from contamination when installing new lines or repairing existing lines. The primary barrier to contamination in the distribution system is the initial disinfection of new or repaired water lines. Following an adopted procedure or standard ensures that the barrier is created to protect the system. AWWA Standard C-651, which is a recognized, national standard, specifies the means and methods for using the various forms of chlorine to disinfect water lines.

Reducing the sources of contamination in the new or repaired pipe will enhance the effectiveness of the disinfection and flushing process. The first step of the installation procedure to reduce contamination sources is to keep the pipe as clean as possible before it is installed and placed into service. Special care should be taken to prevent or minimize the amount of deleterious material entering the new pipe.

Once the installation is complete, the new water line is filled with water and pressure tested for leaks. The pressure should be at least one and a half times the maximum operating pressure of the system. The time period for the test is dependent on the test pressure used. The higher the test pressure the shorter the time period can be. Typically, the test pressure is 150 to 200 psi, and the time period is at least 6 hours.

Flushing the line, once it is completely installed and tested, will help remove the dirt and debris that was not cleaned out during installation. As a general rule, the velocity of the water during this flushing period should be at least 5 feet per second to scour out the remaining dirt. In addition, the flushing period should last long enough to turn the water in the pipe over two or three times.

A sufficient amount of the chosen disinfectant is added to the water line that results in a disinfectant residual 50 to 100 times the normal operating residual. The high level of the disinfectant inactivates any microbiological contamination that may have occurred in the pipe. To ensure that the pipe is thoroughly disinfected, the high disinfectant residual water should remain in the pipe for a designated holding period in accordance with the standards.

After the required holding period, the pipeline should be flushed to remove the water with the high disinfectant residual, and any debris or harmful matter that might be left in the pipe. A sample of the water is collected for a bacteriological test after the high disinfectant level water is purged. One bacteriological sample should be collected for every 1,000 feet of new pipe laid. The bacteriological test will show if any contamination sources remain in the pipe. If the tests are negative, then the new water line can be placed into service. If the test proves positive, then the waterline should be disinfected and flushed until the test is negative. The procedures for the disinfection of a new water line should include a contingency if the bacteriological tests are found to be positive for more than two or three times.

Suggested assessment criteria for disinfection and flushing procedures for new water lines include:

1. **Does the water system have a procedure for disinfecting and flushing new water lines? If not, what steps does the system follow when installing new lines?**

   Disinfection of newly constructed water mains prior to placing it into service prevents the introduction of microbial contaminants that may have accumulated inside the pipe during the construction process. A system should require disinfection and flushing of its newly constructed mains in accordance with AWWA Standard 651 or its own equivalent standard.

2. **Are there reports or test results which document the flushing and disinfection of new water mains and the subsequent testing?**

   A system should maintain records of the disinfection and flushing of new water mains. The records should include at a minimum the results of the bacteriological testing done to ensure the new main was disinfected.

3.3.3.4 Disinfection of Repaired Water Lines

The disinfection and flushing procedures for new lines typically cannot be used when repairing existing water lines, because of the need to minimize the disruption of service to customers. Repairs can range from the easy, such as installing a repair clamp, to the very difficult, such as replacing a joint of pipe in a very deep hole where there is a lot of erosion due to the leaking water. Procedures should cover the extreme as well as all the various situations in between.

Leaks or breaks that can be fixed with a repair clamp while the main is in use under normal operating pressure pose little danger of contamination and require no disinfection of the line. The repair clamp should be sprayed or swabbed with a chlorinated solution to clean it before installation. Following these procedures should allow the line to be returned to service as soon as the leak is repaired.

When there is a leak on an existing water line, the ground in the area will likely be wet. If there is a sanitary sewer line in the area, the open area could be contaminated by the nearby sewer. Workers should sprinkle liberal quantities of sodium or calcium hypochlorite around the open area to reduce the danger of pollution from the sewer line. All fittings, pipe, or clamps required for the repair should be sprayed or swabbed with a concentrated solution of chlorine to thoroughly clean them. The distribution system should be thoroughly flushed to remove any sediments that may have been disturbed.

Wherever possible, the section of the water line where the break or leak is located should be isolated by closing distribution valves and turning off all service connections. After repairing the line, the section should be flushed and disinfected in accordance with acceptable procedures or standards, such as AWWA Standard C-651 or the Ten State Standards (GLUMRB, 1997). The line should then be flushed until all discolored or chlorinated water is eliminated. If possible, a bacteriological test should be taken to determine that there is no contamination. For disinfection of main repairs, the use of sodium or calcium hypochlorite may not always be appropriate. Since granular or tablet forms of chlorine can be slow to dissolve and main repairs are done as quickly as possible, careful use is necessary to avoid sending highly chlorinated water out to customers.

Suggested assessment criteria for disinfection and flushing procedures for repairing water lines include:

1. **Does the public water system have a procedure for disinfecting and flushing repaired water lines? If not, what steps does the system follow when repairing existing lines?**

   Disinfection and flushing of repaired water lines is more difficult than for newly constructed mains but equally important. The system should have in place standard procedures to minimize the contamination of line during the repair. The procedures should include sprinkling calcium hypochlorite in the area surrounding the main break, swabbing the fittings, pipe and clamps with chlorine and flushing the section of the line to remove sediments.

2. **Are there adequate repair materials on hand?**

   In addition to reviewing the procedures for disinfecting repaired mains, the inspector should ensure the system has sufficient quantities of disinfectant powder, repair sleeves, and other materials necessary to implement the disinfection and repair procedures.

3. **Are there reports or test results which document disinfection of repaired water mains and any subsequent bacteriological testing?**

   A system should maintain records of the disinfection and flushing of repaired water mains. If any bacterialogical testing was done, the system should have a record of the results. Repairs are often done on an emergency basis and as quickly as possible, so in some cases there may not be sufficient time for water quality sampling.

3.3.3.5 Flushing Procedures

Flushing is normally used to clear up colored water or to remove sediment and biofilm in an existing main and improve the disinfectant residual in dead-end lines. For most distribution systems, it is only necessary to flush out sediment that may have been deposited in areas where the water velocity is insufficient to keep it in suspension. Customer complaints about water quality will provide an indication of the area(s) that need(s) flushing. A good maintenance procedure would include flushing different areas of the distribution system on a regular basis to reduce the potential for water quality degradation.

Suggested assessment criteria for flushing procedures include:

1. **Does the public water system have a procedure for flushing a portion of the distribution system on a regular basis?**

   The system should have procedures to flush water mains in the distribution system regularly. Flushing of water mains removes sediments or other contaminants which can accumulate in pipes over time, and can lead to taste and odor problems. The system should develop a schedule for flushing mains before taste and odor problems develop. Dead end sections of the system may require more frequent flushing than other portions of the system. Flushing procedures should ensure that a minimum flushing velocity of 2.5 feet per second (CDOHS and EPA, 1996).

2. **Are there reports or records which document the portions of the system which have been flushed and the date of the flushing?**

   A system should maintain records of the flushing of water mains. The records should include at a minimum the portion of the system flushed and the date of the flushing event.

3.3.3.6 Cross-Connection Control

A piping cross-connection is defined as an actual or potential physical connection between a water system and another water source of unknown or questionable quality. The physical connection could allow water of a questionable quality to backflow into the water system either as a result of backpressure or backsiphonage backflow. Backflow is the unwanted reversal of water. Backpressure backflow refers to the flow of water toward a potable supply when the contaminated water's pressure is greater than the potable water's pressure. Backsiphonage backflow is a result of a vacuum in the distribution pipes of a potable water supply. If a negative pressure develops in the distribution system, water can back-siphon. Therefore, if there is a cross-connection with a questionable source, a potential for contamination of a water system exists. An example of a cross-connection in the distribution system is shown in Figure 3-14. (UFTREEO Center, 1998)

In the past, the best means of eliminating cross-connections was constant surveillance and inspection of new and existing buildings. Presently, most cities have adopted a plumbing code that requires the builder of a new or remodeled facility or building to eliminate all cross-connections. In addition, the code usually allows local building officials to inspect the facility or building to look for cross-connections during construction, and annually thereafter.

The preferred method for cross-connection control is an air-gap. An air-gap is a separation between the pipe or fixture supplying the water and the receiving fixture (i.e., at the water outlet). An air-gap should be twice the diameter of the water outlet pipe (UFTREEO Center, 1998). Air gaps cannot be installed in pressurized systems. Other backflow prevention devices are necessary when an air gap cannot be made, or to provide additional protection.

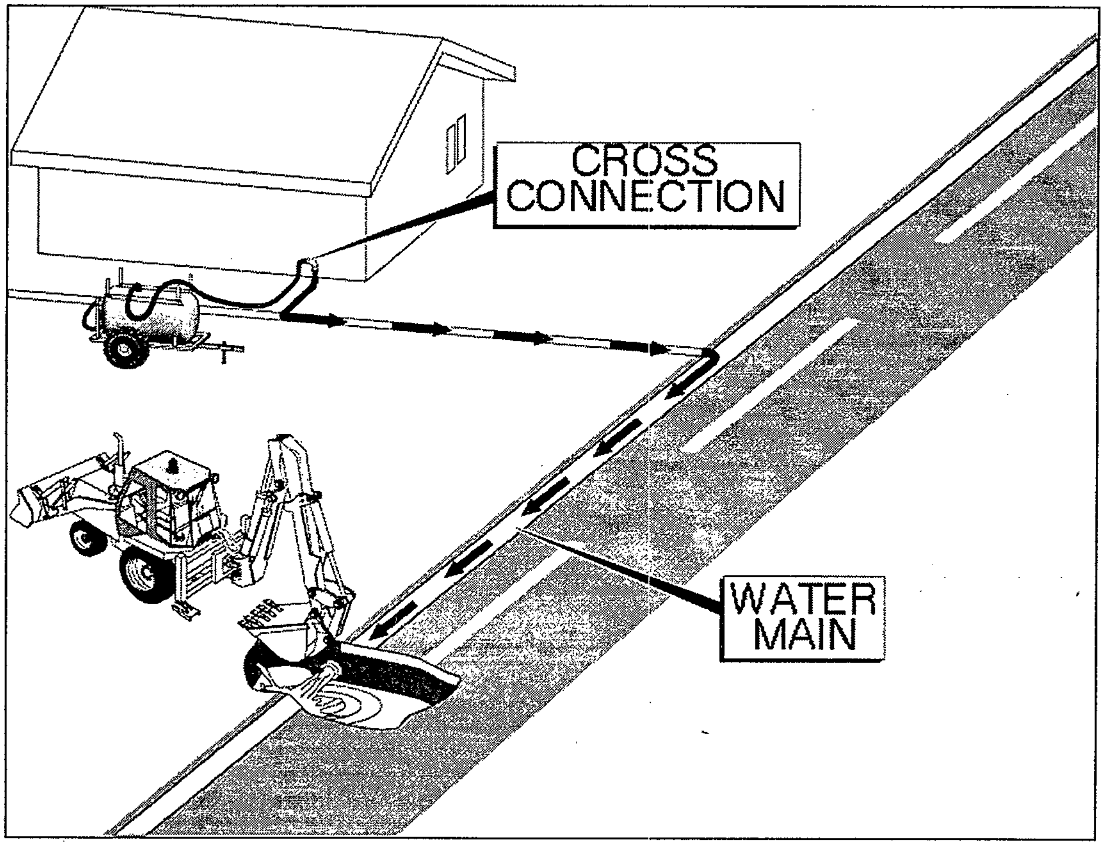
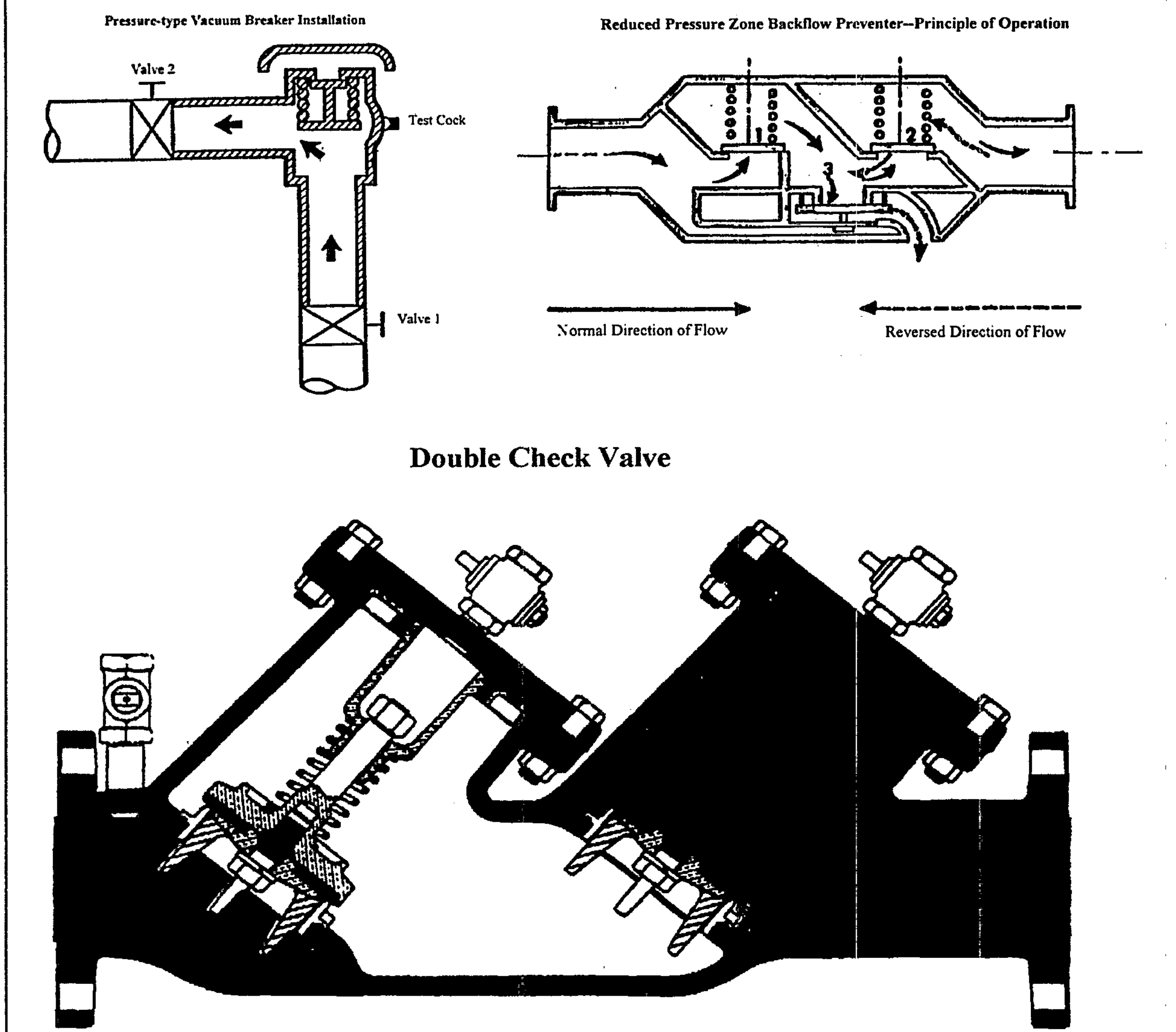


Figure 3-14. Example of a Distribution System Cross-Connection

The most common backflow prevention devices for the control of cross-connections are vacuum breakers, double check valve assemblies, and reduced pressure principle (reduced pressure zone) devices as shown in Figure 3-15. For outside fixtures, such as a hose bib (an outdoor faucet to which a hose may be connected), the plumbing code may require that vacuum breakers be installed. Each device has a specific application and protects against a different type of contamination hazard.



(Source: EPA, 1989a; EPA, 1989)

Figure 3-15. Common Devices for Cross-Connection Control

A plumbing ordinance requiring the control of cross-connections is the first step of the process to eliminate the potential contamination of the distribution system. The system should have a program to inspect or locate actual or potential cross-connections. Backflow prevention devices should be tested after installation and repair. Testing should be required and performed by certified testers.

Additional information can be found in the *Cross-Connection Control Manual* (EPA, 1989) and from other industry sources such as *The Manual of Cross-Connection Control*, ninth edition from the University of Southern California (USC) Foundation and the AWWA M-14 Manual, *Recommended Practice for Backflow*.

Suggested assessment criteria for cross-connection control include:

1. **Does the water system have a formal program to address cross-connections? If not, what steps does the system take to eliminate cross-connections?**

   A system should have enforceable provisions in the plumbing or building ordinance which require the builder of a new or remodeled facility to install backflow prevention devices on all cross connections. The system should set minimum standards for backflow prevention devices and should actively work to inform plumbers and mechanical contractors of its cross connection control policies.

2. **Is there an inspection of new construction as well as follow-up inspections? How often do follow-up inspections occur? Is there a log or documentation of these inspections?**

   There system should ensure that inspections are conducted of all new construction or remodeling projects within its service area to ensure that all potential cross connections are eliminated by the installation of a backflow prevention device.

3. **Is there a requirement for the annual testing of the installed backflow prevention devices? What documentation is available? What qualifications must a tester have? How many certified testers of cross-connection devices are available?**

   The inspector should check to see if the system inspects backflow prevention devices or requires its customers to inspect and maintain backflow prevention devices.

3.3.3.7 Elimination of Water Loss

Water systems are currently able to, or should be able to, meter all sources and uses of treated water. The metering of all sources and end users allows the system to account for the water from production to the end user. This accounting of water provides valuable information, such as per capita water use, and determination of unaccounted water or water losses.

When a system compares the water pumped into the distribution system from its source(s) to the water billed to customers, typically the amount billed is less than that pumped. The difference is the water loss. There are numerous reasons for loss of water in the distribution system. The two biggest causes of water loss are meter inaccuracy and leaks in the distribution system. Other sources of losses normally not accounted for by metering is the water used for fire protection and construction.

Generally, if the water loss for a system is 10 percent or less, then that system is considered a "tight system," meaning that there are very few sources of water loss that the system can identify. If the water loss for a system is greater than 10 percent, then a program should be instituted to eliminate the "excessive loss" of water. A systematic program should be followed to eliminate the source(s) that are easiest to identify and the least costly to correct.

Evaluation of Service Meters

Normally, the first step of a program to reduce water losses should start by checking the accuracy of the meters at the source(s) and end user or customer. Checking these meters will require the use of another calibrated meter with known accuracy, so a comparison can be made between the two meters.

The main meter at the source(s) should be checked and recalibrated at least annually. The size of the meter and the amount of water used by a specific customer annually dictates how often these meters should be checked. Large meters (the definition of large is system specific) should be checked at least annually, while individual residential meters should be checked every five to seven years. Typically, a system will establish a program to replace all residential meters over the five to seven year period suggested, because it is easier to rebuild these meters in a shop than to recalibrate them in the field.

As the process of recalibrating meters proceeds, the new data obtained about meter accuracy should be compared to the original water loss data. If recalibrating the meters reduces water losses sufficiently to designate the distribution system as tight, then the public water system does not need to continue with its program to reduce water losses. However, all systems should adopt a goal to continually reduce unaccounted for water.

Detection of Leaks

If the main meter(s) have been checked and recalibrated, but water losses are still too high, then the system should begin looking for leaks in the distribution system. The first step of a leak detection procedure should be comparing the water usage for designated areas of the distribution system. These areas should be defined to allow for the easy determination of per capita or per connection water usage. If one area has a higher usage than normal and there is no reasonable explanation for the difference, then this area would be one that should be checked for leaks.

All customers in the area should be checked to determine that there are no unmetered water users that may cause the higher than expected water usage. If all customers are metered, then the distribution system should be checked for leaks. It is expected that the water from a leaking pipe will rise to the surface providing an easy means of locating the leak. Because this type of leak is easily located and corrected, it is not counted in the leaks that cause a significant water loss.

The leaks that account for most of the water loss in a distribution system are the ones that are not easily located by rising to the surface. Different means or methods are needed to locate these types of leaks. With the technology available, there are numerous methods to detect leaking pipes in the ground. The most commonly used technology to locate these leaks is a hydrophone. With this instrument, leaks can be located by the sound of water rushing out of the pipe. Once located, the leaks can be fixed as they are found.

Suggested assessment criteria for the elimination of water losses in the distribution system include:

1. **Is all source water metered at the point of entry into the distribution system? Are all customers metered? How often are the meters checked and recalibrated, if necessary?**

   The system should have meters at all points at which water is supposed to enter and exit the distribution system. This includes all water supplies and all customers. These meters should be read by the system on a regular basis. The system should also check and calibrate meters to ensure the data collected is accurate.

2. **Is the water loss for the system calculated?**

   The system should take the water meter readings and calculate the average volume of water pumped into the distribution system by the water sources and the average volume of water withdrawn from the distribution system. The difference between these two average values is the water loss within the distribution system.

3. **Is the water loss for the system greater or less than 10 percent? If greater than 10 percent, what is the system doing to reduce its water losses?**

   There will always be a certain amount of water loss within a system due to the un-metered withdrawal of water from the system for activities such as water main flushing, fire hydrant testing and fire fighting activities. However, experience with well operated systems indicates that these losses should not exceed 10 percent of the total amount of water supplied to the system. Systems with greater than 10 percent loss should undertake a leak detection and repair program.

3.3.4 Priority Criteria

The following criteria related to the distribution systems element are considered high priority based on their potential for impacting public health:

- **Field Sampling/Measurements** – Adequate disinfection residuals and water pressures in the distribution system are essential for preventing contamination of finished water as it is delivered to consumers (Section 3.3.2).
- **Disinfection of Repaired Water Lines** – If the water distribution system is not properly cleaned and disinfected, system personnel cannot prevent the contamination from spreading to the consumer (Section 3.3.3.4).
- **Disinfection of New Water Lines** – If the water distribution system is not properly cleaned and disinfected, system personnel cannot prevent the contamination from spreading to the consumer (Section 3.3.3.3).
- **Cross-Connection Control** – Connections between contaminated and potable water sources, if not controlled, can lead to contamination of entire water system (Section 3.3.3.6).
- **Elimination of Water Loss** – Excessive leakage can lower water pressure in the distribution system and increase the opportunity for contamination (Section 3.3.3.7).
- **Distribution Maps and Records** – Modifications to the distribution system can impact water quality and should be identified clearly on distribution system maps (Section 3.3.1).

3.4 Finished Water Storage

Prior to the field inspection, the inspector should obtain the information available on the storage facilities for the subject water system from the state's files or the last sanitary survey. The information on storage facilities should include the type of storage (ground, elevated, or hydropneumatic) included in the system, and the volume and location of each storage tank.

Finished or treated water storage facilities provide the following benefits to the operation of a distribution system:

- Allow treatment facilities to operate at or near uniform rates, even though the demands of the system may greatly fluctuate;
- Supply the peak and emergency needs of the system;
- Maintain an adequate pressure in the system, when designed for that purpose;
- Provide extended contact or detention time for disinfection;
- Allow for the sedimentation of settleable particles that may have passed through the treatment facility; and
- Serve as reservoirs for the blending and mixing of water from different sources that may have varying water qualities.

The objectives of surveying the finished water storage facilities are to:

- Review the design and major components of storage to determine reliability, adequacy, quantity, and vulnerability;
- Evaluate the operation and maintenance and safety practices to determine that storage facilities are reliable; and
- Recognize any sanitary risks attributable to storage facilities (UFTREEO Center, 1998).

To accomplish these objectives, the inspector needs to review the information available from state files for the system's finished water storage facilities. In the field, the inspector should perform an inspection to verify the information and to determine that the finished water storage facilities are adequate and in acceptable condition. To verify some of the storage tank information and adequately assess facility conditions, the inspector may need to climb storage tanks as part of the inspection (particularly if the water system uses elevated tanks and standpipes). Since this can pose safety hazards (e.g., slipping, wasps), inspectors who are expected to climb storage tanks as part of the tank inspection should receive written inspection procedures and training in appropriate safety procedures (e.g., use of safety belts and cables). In some cases, the results of a recent inspection done by a qualified tank contractor may provide the inspector with any necessary information without climbing the tank. Some states do not allow their staff to climb water towers, so inspectors may need to rely on information from tank contractor inspections, ground level observations, and conversation with water system operators to verify file information and assess the adequacy and condition of storage facilities.

3.4.1 Type of Storage

The inspector should determine the types of storage facilities in the system. Storage facilities are designed to provide for the (1) storage of treated water (ground storage) that can be pumped into the distribution system or (2) maintenance of an adequate service pressure (elevated, hydropneumatic, or ground storage that is built at a location to act as elevated storage). Storage facilities may be closed tanks or reservoirs.

The first treated water storage tank in a water system is typically the clearwell, located at the treatment plant. The clearwell provides both a treated water reserve for delivery to the distribution system and additional detention time for more effective disinfection. These tanks are sometimes located partially or completely below grade to allow gravity flow from the filters to the clearwell. While this approach reduces operational costs by avoiding additional pumping facilities, those portions of the tank that are below grade cannot be easily inspected and the tank may be vulnerable to seepage from shallow ground water.

Depending on the complexity and size of the distribution system, the next storage tank will probably be designed to provide pressure maintenance for the distribution system. If the system serves a small number of customers, a pressurized tank called a hydropneumatic tank (controlled by both water and air pressures) will most likely be used to maintain the system pressure, because it is cheaper to build than an elevated tank. For larger systems, an elevated tank, which is a tank constructed on structural supports, would be used to maintain an adequate pressure as long as the height is adequate. Different sections of the distribution system are maintained at different pressures (commonly referred to as pressure planes), depending on the water demand and pressure head requirements. For the largest systems, or a system with significant topographical variation such that pressure planes are required, a ground storage tank could be used to provide the system pressure maintenance for a lower area or pressure plane and act as storage for an upper plane. Figures 3-16 and 3-17 depict the various types of storage facilities and pressure maintenance facilities, commonly used in a water system.

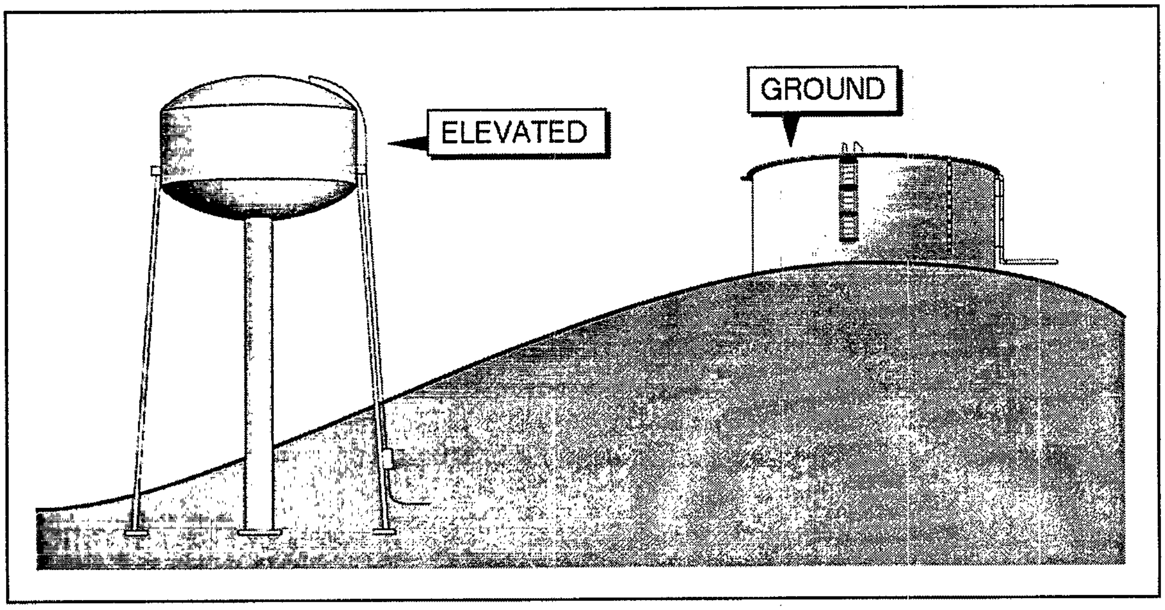


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Figure 3-16. Types of Storage Facilities

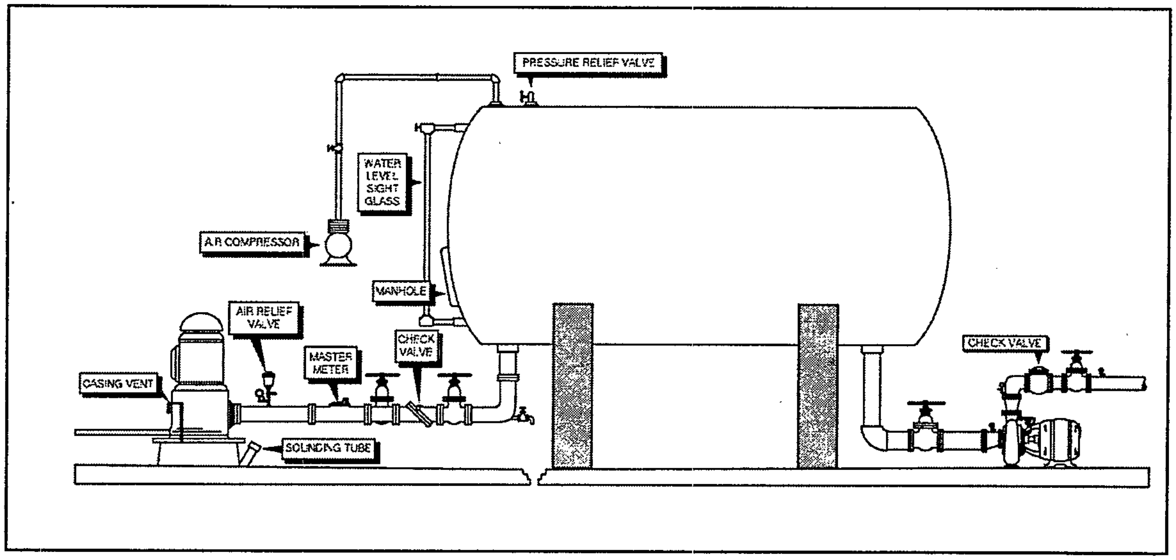

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Figure 3-17. Typical Hydropneumatic Tank Installation

Suggested assessment criteria for the type of storage facilities include:

1. **Are the storage facilities covered or otherwise protected?**

   The IESWTR prohibits the development of new uncovered finished water reservoirs, so any storage facilities constructed after IESWTR promulgation must be covered. EPA recommends that any uncovered finished water storage facilities in existence at the time of IESWTR promulgation either be covered or eliminated from use. Covers prevent airborne contamination from insects, birds, and mammals, and also prevent algal contamination. Covers must be watertight to prevent contamination from entering. Where covering or eliminating uncovered reservoirs is not possible, there are measures that a water system should take to prevent contamination. Development and implementation of these measures is covered in EPA's *Uncovered Finished Water Reservoirs Guidance Manual* (EPA, 1999d).

2. **Where do the overflow pipes end? Do they discharge to a splash pad? Are they equipped with hinged and weighted flaps?**

   Overflows should not be discharged to the ground or to any storm or sewer line. The overflow line should drain 12 to 24 inches above the ground to an open basin or splash pad. A splash pad prevents erosion of the area below the line and around the tank supports or foundation. Overflow pipes should be equipped with a hinged and weighted flap to prevent the entrance of small mammals, birds, insects, and contaminants.

3. **Do the air and roof vents have a screen? Are they protected from rain?**

   A fine mesh screen prevents the entrance of birds, insects, and small debris into the tank. However, a fine screen must be designed to fail in the event of clogging, to prevent the tank from imploding in the event the clogged screen causes a vacuum effect. Vents should be covered or face downward to protect the tank from rain.

3.4.2 Location of Storage

The inspector should determine the location of storage facilities to assess their potential to compromise the integrity of the delivery system. The surrounding area needs to be inspected for sources of potential contamination and sources that may cause physical damage to the tanks. The location and size of the storage tanks can be obtained from the distribution system maps discussed previously. In addition, the tank location should be shown on a United States Geological Survey (USGS) topographical quadrangle map so that coordinates can be determined and placed in the state's Geographic Information System (GIS) to be used for identifying potential sanitary hazards that might be located nearby.

If the state does not have a GIS, the inspector should use the topographical map during the site visit to assess the potential impacts of nearby sanitary hazards. The inspector should discuss the characteristics of the surrounding area with the operator to find out if there have been any changes since the last survey that may pose a sanitary hazard or if there are any questions or concerns about the site itself. The location of the tank on the site should be assessed relative to trees and buildings that could fall on the tank and cause damage. In addition, it is important to assess the general maintenance of the site (e.g., grass mowed and free of trash and debris).

Suggested assessment criteria for the location of storage facilities include:

1. **Are there any potential sanitary hazards in the area? If so, what and where are the hazards? Are the hazards close enough to be of concern to the storage facilities?**

   These hazards include sewage treatment facilities, septic tanks, and absorption systems, sanitary landfills, fuel tanks, industrial pollutant discharges, livestock, surface runoff and poor drainage. Identification of the hazards in relation to the location of the storage tanks or reservoir is important in determining the potential threat to public health. These hazards could contribute to pollutant seepage into the storage tank. Surface runoff and underground drainage should be away from the structure.

2. **Are there any physical features on or around the site that could damage the tank?**

   Trees or other natural features around the tank should not be situated near enough to damage the tank if they fall or are moved by forces of nature.

3. **Is the site well maintained?**

   A well-maintained site, with proper grading to facilitate drainage and free of debris and other potential contaminants, prevents damage to the tank.

3.4.3 Capacity of Storage Tanks

Storage tank capacities should be adequate to meet the water demands of the system, should meet applicable state requirements and industry standards, and be consistent with accepted engineering practice. For example, the total capacity of both ground and elevated storage tanks could be based on a recommended level of 200 gallons per connection. For elevated storage tanks alone, a recommended capacity of 100 gallons per connection is often used. For systems using hydropneumatic tanks instead of elevated tanks, recommended capacities are 20 gallons per connection with ground storage and 50 gallons per connection without ground storage. Capacities for pumps and pumping equipment associated with storage tanks are discussed in Section 3.5.

Suggested assessment criteria for the capacity of storage tanks include:

1. **Is the storage capacity adequate?**

   It is important to determine whether the type of storage facilities provided are sufficient for the distribution system. If a large system uses a hydropneumatic tank, for example, the storage may not be sufficient for the pressure head requirements of the distribution system. Water facilities should have at least one day of reserve capacity to allow for power outages and fire control. Facilities without backup storage may lose system pressure in the event of a power surge.

2. **In case of elevated storage tanks, are tanks properly sized and elevated to assure adequate pressures throughout the distribution system?**

   The water tank should be properly sized and elevated to produce pressures of at least 35 psi at the lowest operating level of the tank. Operating pressures in the distribution system should not be allowed to exceed 100 psi.

3.4.4 Design of Storage Tanks

The inspector should examine the design criteria of the storage tanks to assess their potential to meet the water demands of the distribution system and retain structural integrity. Design and construction standards need to be appropriate for the intended use of a storage tank.

3.4.4.1 Storage Tank Components

The series of standards used to design tanks with all the necessary components identified is the AWWA D-100 series. The construction material for the tank should also be examined for structural integrity as well as for any sanitary hazards. For example, opportunistic pathogens, such as Klebsiella can grow to high levels in wooden storage tanks. Figure 3-18 provides a schematic of the various components of a storage tank. The following is a listing of the minimum criteria for a treated water storage tank, whether it is a ground or elevated storage tank:

- Roof sloped to prevent standing water;
- No leakage through the roof;
- A lockable access hatch on the roof, with a raised curb;
- Vent on the roof with openings that face downward, with a fine corrosion resistant screen;
- Water level measurement device;
- Overflow that terminates above ground with a hinged and weighted flap on the end;
- Inlet and outlet piping located to ensure proper circulation of water;
- Drain to remove accumulated silt from the bottom of the tank;
- Access openings on the side (at least 2);
- Access ladder with proper safety equipment;
- Valves on inlet and outlet for isolation;
- Bypass around the tank for maintenance;
- Control system to maintain water level in tank; and
- Alarm system for high/low water levels.

Suggested assessment criteria for the minimum design components for storage tanks include:

1. **Does the tank have all the minimum components listed above? Are these components in good condition?**

The inspection items listed above are important for maintaining the structural integrity of the tank, thereby minimizing contamination of the water.

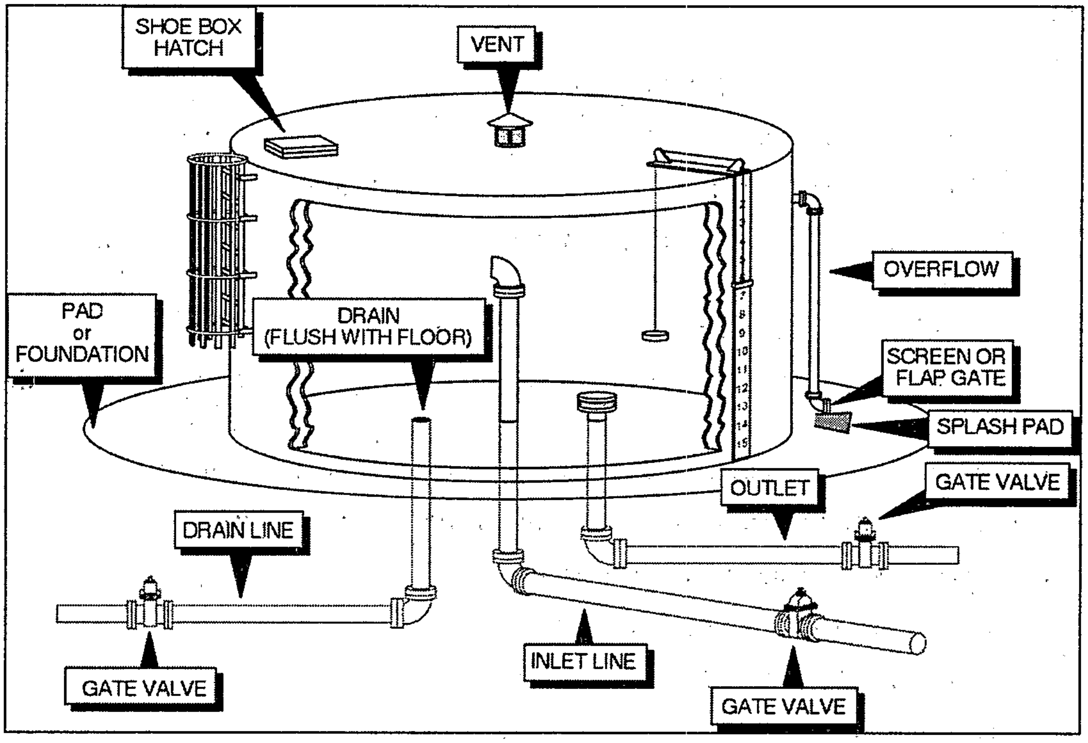

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Figure 3-18. Components of a Storage Tank

3.4.4.2 Hydropneumatic Tank Components

Hydropneumatic tanks are specially designed storage tanks which provide pressure maintenance for the system. Hydropneumatic tanks are not storage tanks, technically speaking, but are pressure maintenance facilities. It is important that an auxiliary power source such as a backup generator or separate power supply be provided to ensure that the hydropneumatic tank and associated service pumps continue to operate in the event that the primary power source fails. The minimum design components for this type of tank are significantly different than a ground or elevated storage tank. Figure 3-17 provides a typical hydropneumatic tank installation. Hydropneumatic tank systems can use any of several types of pressure storage tanks. Figure 3-19 depicts the various types of pressure tanks available. While hydropneumatic tanks can be either horizontal or vertical, most that are used in public water systems are horizontal.

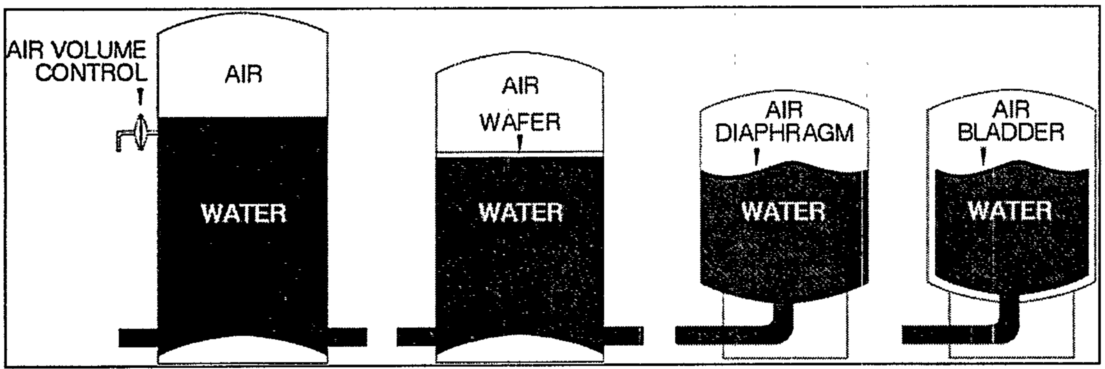

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Figure 3-19. Types of Pressure Tanks

For a hydropneumatic or pressure tank, the design criteria should include the following:

- Tank is located completely above ground
- Tank meets ASME standards with a ASME name plate attached
- Access port for periodic inspections
- Pressure relief device with a pressure gauge
- Control system to maintain proper air/water ratio
- Air injection lines equipped with filters to remove contaminants from the air line
- Sight glass to determine water level for proper air/water ratio
- Slow closing valves and time delay pump controls to prevent water hammer.

Suggested assessment criteria for the minimum design components for hydropneumatic tanks include:

1. **Does the tank have all the minimum components as required? Are these components in good condition? Is the tank capacity adequate?**

   The inspection items listed above are important for maintaining the structural integrity of the tank, thereby minimizing contamination of the water.

3.4.5 Painting of Storage Tanks

The inspector should assess the painting of storage tanks to determine the potential for lead to enter the water. Historically, the best type of coating for a tank included lead, because it adhered very well to the metal substrate forming a bond that was hard to break. In addition, coal tar coatings were applied to the inside of many older elevated storage tanks. Currently, lead may not be used in any paint system that comes in contact with potable water. The paint used on storage tanks must be approved for potable water use and must be certified to conform with ANSI/NSF Standard 61 and applied by an accredited organization. Paint coating systems are important for assuring that the interior and exterior surfaces of the tank, as well as the tank appurtenances, are adequately protected from corrosion and structural damage.

Suggested assessment criteria for the painting of storage tanks include:

1. **When was the last time the tank was repainted? What type of paint was used? Was it a lead-based paint? Was the paint in conformance with ANSI/NSF Standard 61 for potable water use?**

   Paint used for surfaces in contact with potable water should be approved under ANSI/NSF standards. Lead-based paints are prohibited for use with potable water and other unauthorized paints or coatings can create water quality problems and cause organic or inorganic contamination of the stored water that might cause adverse health effects (EPA, 1989a).

2. **Is the paint in good condition?**

   Chipping, cracking, or fading of the paint coating on the tank surfaces and appurtenances indicates the potential for contamination, corrosion, and structural damage.

3.4.6 Cleaning and Maintenance of Tanks

The inspector should assess the frequency of general cleaning and inspection of the tanks. On a daily basis, the operator should be checking the general condition and operating level of the tank. On a weekly basis, the sanitary and structural condition of the basic tank components should be checked in more detail. (In the case of elevated storage tanks, some inspection activities may have to be done as part of the annual inspection.) On an annual basis, the entire tank and all appurtenances should be thoroughly inspected by qualified personnel and the results documented in a written report.

Suggested assessment criteria for the cleaning and maintenance of tanks include:

1. **Does the tank appear structurally sound?**

   The inspector should look for signs of cracks, leaks, rust, corrosion, failure in steel supports, and other indicators that the tank has not been properly maintained and may not be structurally sound.

2. **How often are inspection and cleaning performed? How often does the water system have its storage tanks inspected by a qualified contractor?**

   The operator should inspect tanks on a daily basis. As noted above, basic tank components should be checked in more detail each week, and the entire tank and appurtenances checked annually. In addition to general inspections, a thorough structural and coating inspection should be done by qualified personnel at least every five years (UFTREEO Center, 1998).

3. **How is the water supply continued when the storage tank is out of service for maintenance?**

   The inspector should ensure that the system has a plan for maintaining the distribution system pressure when the tank needs to be removed for maintenance.

4. **When interior maintenance has been performed, are storage tanks disinfected before being used?**

   Storage tanks should be disinfected to ensure water quality before being returned to service.

3.4.7 Site Security

The inspector should assess the site security of the water system to determine the potential for intruder access. Any potable water storage tank should be enclosed by an intruder-resistant fence with lockable access gates. In addition, all access hatches should be locked. To be intruder-resistant, the Texas Natural Resource Conservation Commission recommends that the fence around the storage tank be at least six feet tall with three strands of barbed wire extending outward at a 45° angle, and be constructed of wood, masonry, concrete, or metal.

Suggested assessment criteria for site security include:

1. **Is the fence surrounding the tank site intruder-resistant?**

   Site security should be part of the operational monitoring program of the plant. The inspector should determine if the tank or plant fence is in good condition, specifically that the fence is structurally sound and not sagging. There should not be any gaps between the ground and the bottom of the fence and the fence gates should be securely locked when the plant is not attended. The inspector should note any evidence of unauthorized access and vandalism, which tend to be a more common problem at elevated storage tank sites.

2. **Are access hatches locked?**

   Hatches should have a watertight cover and be locked with a sturdy device that cannot be easily clipped or opened.

3.4.8 Priority Criteria

The following criteria of the finished water storage element are considered high priority based on their potential for impacting public health:

- **Capacity of Storage Tanks** – The storage facilities should be adequately sized to meet minimum acceptable capacity requirements and the maximum daily demand of the system (Section 3.4.3).
- **Design of Storage Tanks** – The proper components should be provided for storage facilities to allow for proper operation (Section 3.4.4).
- **Cleaning and Maintenance of Storage Tanks** – Storage tanks should be maintained for storage facilities to allow for proper operation (Section 3.4.6).
- **Site Security** – The facilities should be protected from vandalism to protect public health (Section 3.4.7).

3.5 Pumps/Pump Facilities and Controls

In a water system, there are many applications that require a pump(s) to move a fluid (water, chemical, etc.) from one point to another. In addition to transporting water through the system, pump applications include chemical feed systems, sludge removal, air compression and sampling (UFTREEO Center, 1998). Normally, there are several types of pumps that could be used for an application. However, there are usually only one or two types of pumps that will be the best fit for the intended use. In this section, the prime movers of water will be discussed. There are numerous applications for other types of pumps in other sections of this document.

The objectives of surveying the pumps/pump facilities and controls are to:

- Review the design, uses, and major components of water supply pumps;
- Evaluate the operation and maintenance as well as safety practices to determine that water supply pumping facilities are reliable; and
- Recognize any sanitary risks attributable to water supply pumping facilities (UFTREEO Center, 1998).

3.5.1 Types of Pumps

Before going into the field, the inspector should obtain the information available on all the pumping facilities for the water system from the state's files, including the last sanitary survey. The information on pumping facilities should include the type, location, age and installation date, and design conditions of the system's pump(s), pumping facilities, and controls.

In addition, the inspector should review the regulatory requirements for pumps, if any, to assist in the evaluation of the pumping facilities. The regulatory requirements could include, but not necessarily be limited to, state rules and regulations, ANSI/NSF Standards 60 and 61, as well as appropriate guidance manuals.

Upon arriving at the facility, the inspector should review the available data on pumps with system personnel to determine if the information is current. If there have been any changes, the inspector should obtain an updated listing of the pumps used within the system, so that they may be all inspected during the survey. For most systems, the inspector will either have a list of pumps or pump data from a previous sanitary survey or have a list supplied by the system operator. If a system does not have a pump listing, the inspector should work with the system operator to develop a new listing so that all pumps may be inspected during the survey.

There are three types of pumps used in a water treatment plant facility. They are: positive displacement, centrifugal, and ejector.

Positive displacement pumps deliver water at a constant rate regardless of the pressure it must overcome (USEPA 1991a). Typical positive displacement pumps that can be found in a treatment plant are:

- **Helical or Spiral Rotor Pump** – This pump consists of a shaft with a spiral surface which rotates in a rubber sleeve. Water is trapped between the shaft and the sleeve and is forced to the upper end of the sleeve as the shaft turns.
- **Regenerative Turbine Pump** – This pump contains an impeller or a rotating wheel with fins or little buckets on its outer edge. The rotating wheel is inside a stationary enclosure (cast). As the wheel rotates at a high speed, it forces water through the pump cast (also called raceway) at a pressure that is several times that which can be generated by centrifugal mechanisms (USEPA, 1991a).
- **Reciprocating Pump** – This pump consists of a piston moving back and forth in a cylinder. As the cylinder is driven back and water is driven into the cylinder, the intake valve closes and forces the water through the check valve. As the cylinder is driven forward, the water is discharged through a discharge pipe while the check valve is closed (USEPA,1991a).
- **Positive Displacement Pump** – This pump is typically used for online chemical application (i.e., application of chemicals into pressurized water line).

Centrifugal pumps are used when an even flow rate is needed to meet the demands placed on it. The operating curve for a centrifugal pump shows that the pumping rate varies with the discharge pressure of the water at discharge from the pump (i.e., as the discharge pressure increases, the rate of pumping decreases).

With a rotating impeller (i.e., rotor blade) driven by a power source, such as a motor, a centrifugal pump increases the velocity of the water and discharges it into the pump casing. In the pump casing, the velocity of the water is converted to pressure. Typically, a centrifugal pump has only one impeller, and it is called a single-stage pump. If more pressure is needed, multiple impellers or multi-stages are used to generate the necessary discharge pressure at the pump. Multiple impellers only increase the discharge pressure, not the pumping rate (UFTREEO Center, 1998).

A centrifugal pump cannot create a negative pressure at the suction inlet to pull water into the pump, like a self-priming pump. Therefore, the pressure at the impeller must be positive (i.e., water level is higher than the impeller) in order for the pump to operate.

There are four types of centrifugal pumps that are normally used in a water system for the many pumping applications: submersible, vertical (lineshaft) turbine, split case, and end suction (close coupled). Figure 3-20 shows some of the types as well as the basic components of a centrifugal pump. The most common application of each pump is provided in Table 3-4.

The four types of centrifugal pumps are described below:

- **Vertical Turbine Pump** – This is a multistage centrifugal pump. The pumping unit must be located below the drawdown level of the water source. A vertical shaft connects the pumping assembly to a drive mechanism located above the pumping assembly. The discharge casing, pump housing, and inlet screen are suspended from the pump base at ground surface.
- **Submersible Pump** – This is a centrifugal pump driven by a closely coupled electric motor constructed for underwater operation as a single unit.
- **End Suction and Split Case Pumps** – These are single-stage pumps. The end suction pump is a vertically split case pump, while the split case pump is horizontally split. The advantage of the split case pump over the end suction pump is that it is easier to open and repair. The advantage of the end suction pump is its lower cost.
- **Ejector Pump** – This is a type of vacuum pump. In this pump, gas is removed from a container (e.g., chlorine cylinder) by passing water at a high velocity through a connecting chamber. The high-velocity water creates a vacuum that draws the chlorine into the water stream. This type of a pump is similar to a jet pump; however, in a jet pump, gas (air in water applications) forces water through a venturi into an area of reduced pressure where a centrifugal pump sucks the water and jets it into the distribution system (USEPA, 1991a).

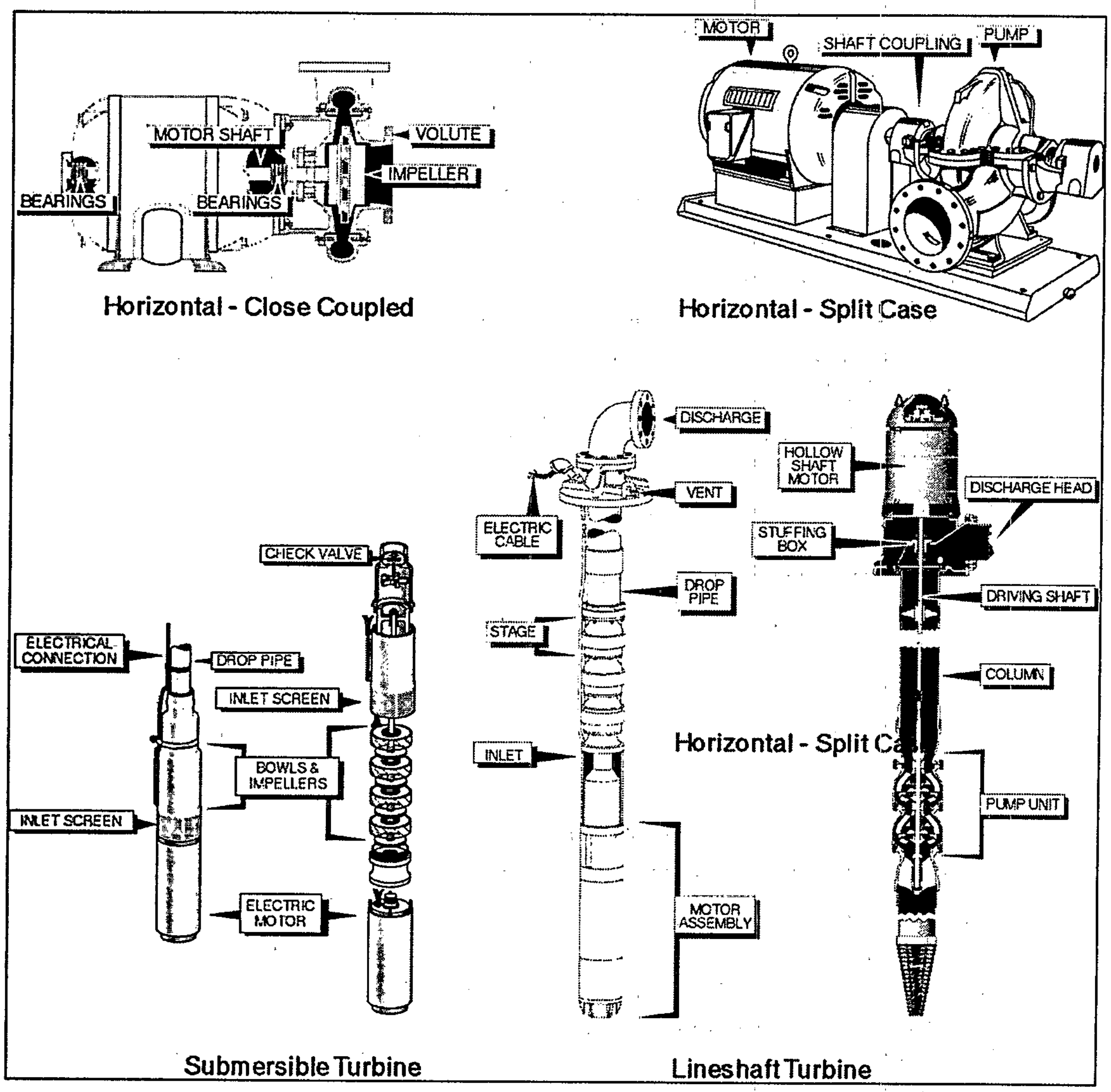

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Figure 3-20. Common Centrifugal Pump Types and Components

Table 3-4. Applications for Centrifugal Pumps

Application	Type of Pump
Well Pump	Submersible or vertical turbine
Raw Water Pump	Submersible or vertical turbine
Backwash Pump	Vertical turbine or split case
Transfer Pump	Vertical turbine, end suction, or split case
Finished Water Pump	Vertical turbine, end suction, or split case
Booster Pump	Split case or end suction
Sludge Pump	End suction
Backwash Recycle Pump	End suction

Suggested assessment criteria for the types of pumps include:

1. **What type of pumps are provided for the system?**

   The inspector should check the types of pumps used by the water system to ensure they are appropriate for the intended use. Typically, the pump selection is reviewed by the primacy agency at the time of installation; however, the inspector should confirm that the pump has not been replaced with another type of pump without approval from the primacy agency.

2. **Does the information in the files reflect the actual type, number, and capacity of pumps in the system? If not, is there a potential problem?**

   If the inspector finds that the actual type, number or capacity of the pumps is different from the design which was approved by the primacy agency, then the inspector should note the actual configuration for the sanitary survey report. The operators should be questioned as to why and when the modification to the pumps took place, and advised to submit the revised plan to the primacy agency for their review, if necessary.

3.5.2 Capacity of Pumps

The pump capacity or size required is typically dependent on the application or purpose, as well as vulnerability of the pump(s). Typically, state rules will specify the sizing criteria for each critical application. For example, Table 3-5 provides the sizing criteria for different pump applications used by the Texas Natural Resource Conservation Commission (TNRCC) for many water systems. These criteria are in general agreement with standard engineering practice.

Table 3-5. Pump Sizing Criteria

Application	Sizing Criteria
Raw Water Pump	0.6 gpm per connection with the largest pump out of service
Backwash Pump	Dependent on filter size
Transfer Pump	0.6 gpm per connection with the largest pump out of service
Finished Water Pump	Two or more pumps that have a capacity of 2.0 gpm per connection, or that have a total capacity of at least 1,000 gpm and the ability to meet peak hourly demands with the largest pump out of service, whichever is less
Booster Pump	Two or more pumps that have a capacity of 2.0 gpm per connection, or that have a total capacity of at least 1,000 gpm and the ability to meet peak hourly demands with the largest pump out of service, whichever is less

(Source: TNRCC, 1997)

When designing or checking a pumping facility, the maintenance (preventative or emergency) of the pumps should be anticipated. For instance, a system has two raw water pumps, and each is sized to pump one-half the capacity of the water treatment facility. If one pump has to be taken out of service for repairs, then the supply for this system is reduced substantially. During the summer, when the peak demand typically occurs, this system may not be able to meet that demand for a time, because of the repairs to the pump. During this time, the system may experience pressure problems in the distribution system due to an inadequate supply, which could lead to greater problems, such as backsiphonage. The number of pumps for any application is an important consideration that cannot be overlooked. In general, there should be at least two pumps (usually more) for any critical pumping application to allow for maintenance.

With two or more pumps, how should the capacity of a pump or pumping facility be determined? The firm capacity of any pumping facility should be determined with the largest pump out of service to ensure that adequate capacity is available to meet all expected demand/supply conditions. The firm capacity of a pumping facility is the capacity that is available at any time assuming any one pump is out of service for maintenance or repairs. The total capacity of a pumping facility, then is the sum of the capacities of all associated pumps and is larger than firm capacity.

Suggested assessment criteria for the capacity of pumps include:

1. **What are the capacities of the pumps? How many pumps are located at each facility?**

   The capacity of a pump is sometimes listed on the motor plate along with the horsepower, motor speed and other pertinent information. The inspector should note the capacity or other information provided on each pump and compare this information to the approved design for the pump station. The actual capacity of the pump may be less than the rated capacity as a result of wear or an increase in the operating head. Actual pump capacity can be measured if an accurate flow metering device is installed on the pump discharge line.

2. **What is the firm capacity and the total capacity of each pumping facility?**

   The inspector should confirm that the firm capacity of the pumping facility, or the capacity of the facility with its largest pump out of service is consistent with the minimum capacity approved by the primacy agency.

3. **Are the pumps compliant with state rules?**

   If the inspector finds that the actual type, number or capacity of the pumps is different from the design which was approved by the primacy agency, then the inspector should note the actual configuration for the sanitary survey report. The operators should be questioned as to why and when the modification to the pumps took place, and advised to submit the revised plan to the primacy agency for their review, if necessary.

3.5.3 Condition of Pumps

In addition to confirming that the pump facility complies with the approved design, the inspector should also evaluate the condition of each of the pumps in the facility to ensure that it is operating as designed. It is extremely important that all pumps in a system be operational to ensure the continued supply of drinking water to the customers. The pumps should not be vibrating excessively, making loud noise, be overheating or creating odors. Any of these may be a sign that the pump requires repairs or maintenance.

The inspector should review available maintenance records for the pumps. The pumps should be regularly lubricated and maintained in accordance with the manufacturers recommendations. Any lubricants which may contact the water should be ANSI/NSF approved.

The inspector should confirm that each pump has working check valves, and pressure gauges on the discharge side of the pump. There should also be working isolation valves on the intake and discharge sides of the pump to permit taking the pump out of service for repairs or maintenance (UFTREEO Center, 1998).

Suggested assessment criteria for the condition of pumps include:

1. **Are all the pumps operational? If not then when does the system intend to repair or replace the pump?**

   A system should maintain the capacity to provide drinking water to its customers and should have the reserve capacity available for pump malfunctions. Systems should take steps necessary to repair or replace pumps which are not operational as quickly as possible.

2. **Are the pumps vibrating excessively, overheated, making excessive noise, or producing an odor?**

Inspectors should briefly examine each pump to see if there are obvious signs of the need for maintenance or repair. Appropriate safety precautions should be taken around open, spinning shafts.

3. **Are pumps regularly maintained and lubricated in accordance with the manufacturers recommendations?**

   The inspector should ask to see records which show the dates the pumps were lubricated and maintained. The inspector should also ensure that all lubricants which come into contact with the potable water are NSF/ANSI approved.

3.5.4 Pumping Station

Most pumping applications rely on a pumping station that includes a pump(s), a structure to house or support the pump, piping – suction and discharge, lighting, ventilation, an electrical center and control panel for the pump(s) and lighting, and appurtenances. The inspector should determine if there are any sanitary risks by thorough inspection of all pumping facilities. Appurtenances of a typical pumping station are shown in Figure 3-21.

3.5.4.1 Location of Pumping Facilities

The structure for a pumping station can be as simple as a slab that supports the pump(s) to a building that houses the pump(s) and all appurtenances. However simple the structure, the location of the pump station is probably one of the most important factors to evaluate for sanitary risks. If the pump station is located in an area that is subject to flooding or electrical outage, then the pump station will be out of service for a time. If the pump station is down for a time, the system may experience problems with providing an adequate supply of treated water or pressure in the distribution system.

One of the first things an inspector should do upon entering the station is to look for evidence of past flooding. If there is no evidence, the inspector should ask system personnel if there has been any flooding in the past. The pump station should be located so that the finished floor elevation is at least one foot higher than the known 100-year flood elevation for the area. If the floor elevation is lower than the flood elevation, then berms or dikes should be constructed around the station to prevent flooding.

Since most pumping facilities require electricity for power, the electrical service reliability should be verified. If the station is located in a remote area with only one incoming service, a documented plan should be available for keeping the pump station in operation during electrical outages. The plan could include the use of an emergency generator or oversizing of storage to accommodate the power outage at the station.

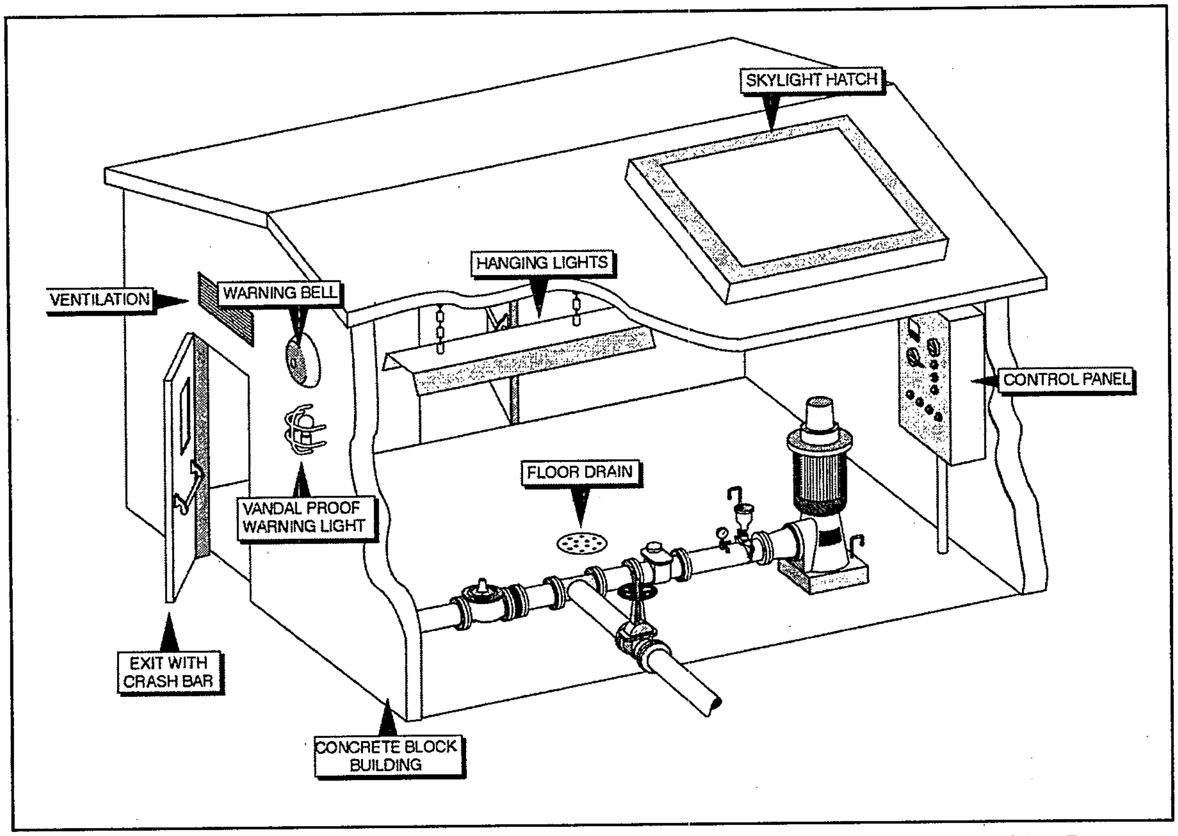

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Figure 3-21. Typical Pumping Station

The purpose and vulnerability of the pumping facility location should be evaluated to determine the measures needed to maintain its reliability.

Suggested assessment criteria for pumping station/location include:

1. **Is the location subject to flooding? If so, what provisions are provided to accommodate the flooding?**

   If the pump station is adjacent to a stream, river or other water body, the inspector should check for evidence of flooding such as stains on the floors or walls. Typically, a pump station is located above the 100-year flood plain, however, if the station is susceptible to flooding, the inspector should make certain that electrical controls and motors are high enough to avoid flood waters.

2. **Is the location subject to electrical outages? If so, what provisions are provided to accommodate the electrical outage?**

The inspector should ask the operators how often there is a power outage in the area serving the pump station. If the operators indicate there are frequent outages, or if there is little or no elevated storage within the system the inspector should ask if the system has emergency standby power.

3.5.4.2 Pumping Station Structure

The type of structure provided for a pumping station is somewhat dependent on the site-specific requirements, but there are general similarities for all facilities. When visiting the site, the inspector should assess the security and maintenance of the structure as well as the pumps and piping.

The station should be protected from unauthorized entry and vandalism by having the doors and windows locked when unattended. The electrical service to the structure should be checked to see that unauthorized persons cannot either cut off power to the station or access outside panels, switches, or valves. All drain and vent openings should be screened to prevent the entry of animals and insects.

The structure should be sized to provide adequate room to maintain the equipment within the structure. Certain building codes will specify some maintenance area requirements; for example, the electrical code may require at least a 3-foot clearance in front of all electrical panels. However, most of the area needed for maintenance is not restricted by building codes and will therefore vary within a particular structure. In general, the size of the structure should be such that at least 3 to 4 feet (or more) of area is provided around all major pieces of equipment and piping to allow for ease of maintenance.

Suggested assessment criteria for pumping station/structure include:

1. **Is the structure secure from unauthorized entry and vandalism? Are all drains and vents screened to prevent the entry of animals?**

   A system should take steps to prevent unauthorized entry of humans and animals to the pump station. The pump station should be located within a secure area such as a locked building or fenced area.

3.5.4.3 Pumping Station Appurtenances

The pump station appurtenances that should be evaluated include lighting, heating, ventilation, interior drainage, signs/labeling, and controls. The following is a listing of the appurtenances and reason to be included in this evaluation:

- Lighting – should be adequate (both inside and outside) for ease of maintenance and security;
- Heating – systems should be adequate to prevent pipes from freezing;
- Ventilation – should be adequate to maintain acceptable temperatures and air flow for personnel safety and proper operation of equipment;
- Interior drainage – floor drains should be provided to eliminate standing water on the floor from leaks that may pose a safety hazard;

- Signs/labeling – proper signs and tagging of equipment improve the ability of system personnel to maintain the equipment; and
- Controls – should be simple and easy to maintain. In addition, all instruments and wiring should be labeled and tagged.

Suggested assessment criteria for pumping station/appurtenances include:

1. **Is the lighting adequate for security and maintenance?**

   The inspector should check the lighting inside the pump station to ensure that the operators have sufficient light to operate the pumps and outside the facility to deter vandalism.

2. **Is the area subject to freezing? Can the piping in the station freeze? If so, is heating provided?**

   The inspector should ensure that the pump stations located in frost prone areas have heaters or other means to prevent freezing of the water in the pipes or pumps.

3. **Is the station equipped with ventilation? If so, does it work and is it adequate to maintain a reasonable temperature?**

   The inspector should ensure that the pump station has adequate ventilation (louvers, fans, etc.) to maintain acceptable temperature and air flow for personnel safety and proper operation of equipment.

4. **Is there a floor drain to collect all leaks? Is the floor drain operable?**

   There should be no standing water in the pump station. The floor should be sloped to an operating drain.

5. **Are the pumps, valving, and other major equipment items tagged? If not, how does the system number the equipment for maintenance purposes?**

   The system should have a system to identify the equipment for maintenance purposes. The inspector should see if the pumps and valves in the station are tagged to identify them, and if the tags correspond to the maintenance records.

3.5.5 Priority Criteria

The following criteria related to the pumps/pump facilities and controls element of the sanitary survey are considered high priority based on their potential for impacting public health:

- **Capacity of Pumps** – The capability of the facilities must exceed the potential demands so that even when one pump is out of service, adequate capacity is still available to meet all expected demand/supply conditions. Otherwise, the system may experience pressure problems in the distribution system that could lead to greater problems like back-siphonage (Section 3.5.3).

- **Pump Station Location** – The location of the facilities can impact the operation of the water system. For instance, if the facilities are located in a flood plain, then the facilities will be flooded on a regular basis and be out of service for a period (Section 3.5.4.1).

3.6 Monitoring/Reporting/Data Verification

An important part of any industry that produces a product for the consumer is quality control. Quality control is a defined method of checking the product to ensure the consumer that it meets or exceeds regulatory requirements as well as their minimum expectations. For the water industry, quality control consists of monitoring the product, drinking water, from the source to the tap, with in-house as well as outside laboratory testing for confirmation. A monitoring plan provides the operator with data to assist in identifying potential problems and adjusting treatment processes accordingly. It is important that all water systems create a water quality monitoring plan and document monitoring results. For most water systems, regulatory requirements, either state or federal, dictate the minimum scope of a water quality monitoring plan.

The objectives of surveying the water quality monitoring/reporting/data verification are to:

- Review the water quality monitoring plan of the public water system for conformance with regulatory requirements;
- Verify that the water quality monitoring plan is being followed by checking test results;
- Verify that all in-house testing as well as equipment and reagents being used conform to accepted test procedures;
- Verify the data submitted to the regulatory agency; and
- Evaluate the procedures an operator follows to identify any problems with the process, determine the changes needed to correct the problem, and how adjustments to the process are approved and performed as needed.

3.6.1 Regulatory Records Review

Before the inspector goes into the field, the data available in the regulatory agency's files concerning the subject water system should be reviewed carefully. Reviewing the files of the subject system will indicate to the inspector how well the system is meeting its responsibilities. The inspector should look for the following information:

- Violations of MCLs, treatment techniques, monitoring, or reporting, as well as a compliance plan to correct any violations;
- Regulatory agency orders and compliance plans that apply to the system;

- Regulatory agency approval of mandated sampling plans, such as for TCR and disinfection by-products (e.g., THMs);
- Regulatory approval of any changes to the system since the last sanitary survey; and
- Reported water quality monitoring data where required (UFTREEO Center, 1998).

If there are no violations or orders, and the required monitoring data are available, it is an indication that the water system has accepted its assigned responsibilities and is trying to complete its duties accordingly. In general, the inspector will only have to verify that all sampling and monitoring plans are up-to-date based on the latest regulatory changes, if any. In addition, the inspector will verify that the data reported to the agency are accurate based on the records kept by the system. Self-monitoring data, monthly operating reports, and daily logs should be reviewed to determine if data are of questionable quality and to evaluate the potential for data falsification.

If there are no violations or orders, but the required monitoring data are not available, it may be difficult to determine if the water system is in compliance with all requirements. Laboratory results for bacteriological, chemical, and radiological monitoring must be kept for specific time periods. The inspector should review the records to determine if they are kept for the required time period in accordance with each regulation.

If there are violations or orders, and all the required monitoring data are not available, it is a general indication of possible troubles at the public water system. The inspector should carefully review the compliance plans required by the violations or orders, and verify that the plan is being followed by the system. If all the required monitoring data are not available, the inspector should determine the reason. Sometimes the cause may be simple, such as the report was being mailed to a wrong address. However, if the problem is persistent, then the inspector should develop a plan with the system to remedy the problem.

Suggested assessment criteria for data collection include:

1. **Are there any violations or orders for the subject system? If so, is there a compliance plan? If so, what documentation is there to verify compliance?**

   If the treatment plant has submitted a compliance plan, the inspector should take copies of the plan to verify that the compliance plan is being properly implemented.

2. **Have the required sampling plans been submitted and approved? If no, what action is being taken to prepare and submit the plans?**

   Every water system has to submit a sampling plan to be approved by the state. Such a plan should include the number of samples for each parameter, where samples are taken, at what time and frequency, who is the person in charge of taking the samples, how they are going to be handled, and who is going to analyze them.

3. **Are all the required monitoring data submitted? If so, do the data appear reasonable? Do the data reported match field log books?**

   If a plant has complete, up-to-date, reasonable monitoring data, this is an indication that it is well managed. However, it is still necessary to verify field log books with submitted reports to rule out any human error in copying the data.

3.6.2 Water Quality Monitoring Plans

For all water systems, there are two levels of water quality monitoring plans: (1) the water quality monitoring plan(s) that the system institutes for quality control purposes (non-regulatory monitoring); and (2) the water quality monitoring plans required by regulation (e.g., disinfectant residual and turbidity). Typically, the water quality monitoring plan for quality control is carried out in-house by the system operator. For the monitoring plans required by regulation, samples are collected by system personnel in accordance with the approved plan and are then often sent to a certified laboratory for analysis. However, for some regulatory monitoring such as turbidity tests, samples are analyzed at the treatment plant rather than an off-site laboratory. The water system needs to have a properly equipped laboratory to perform these tests, as well as non-regulatory quality control tests, at the treatment plant.

3.6.2.1 Non-Regulatory Monitoring Plans

The in-house plan provides the operator with a means of monitoring and evaluating the operation of the system, normally the treatment facilities. This plan allows the operator to control processes on a continuous basis and make adjustments in treatment (e.g., chemical feed rates) as needed. Since this plan will be system-specific, the inspector will have to check each plan individually. The plan should include the location, number, and frequency of various tests that are needed to verify the process. A typical water quality monitoring plan layout for a surface water treatment facility is shown in Figure 3-22. When reviewing the plan, the inspector should assess whether the location and frequency are adequate to identify problems that may occur. Monitoring needs to provide data that can help the operator(s) quickly identify problems so that adjustments can be made in a timely manner. In addition, the timing and methods for monitoring used should be in accordance with accepted test methods. The inspector should ask the operator(s) if monitoring results are used to make adjustments in the treatment process. So, the inspector should ask the operator(s) to describe how the data are used.

All test methods require that the equipment used is calibrated on a regular basis. This regular calibration ensures that the results obtained are reasonable and accurate. Laboratory test equipment manufacturers will provide the calibration procedures as well as calibration standards that should be followed for each piece of equipment. As part of checking the methods and procedures used for in-house monitoring, the inspector should check the procedure for and the frequency of calibration. In addition, the calibration standards should be checked to determine whether or not the standard is usable based on the date of preparation. In some cases, calibration procedures and frequencies may be dictated by the state primary agency.

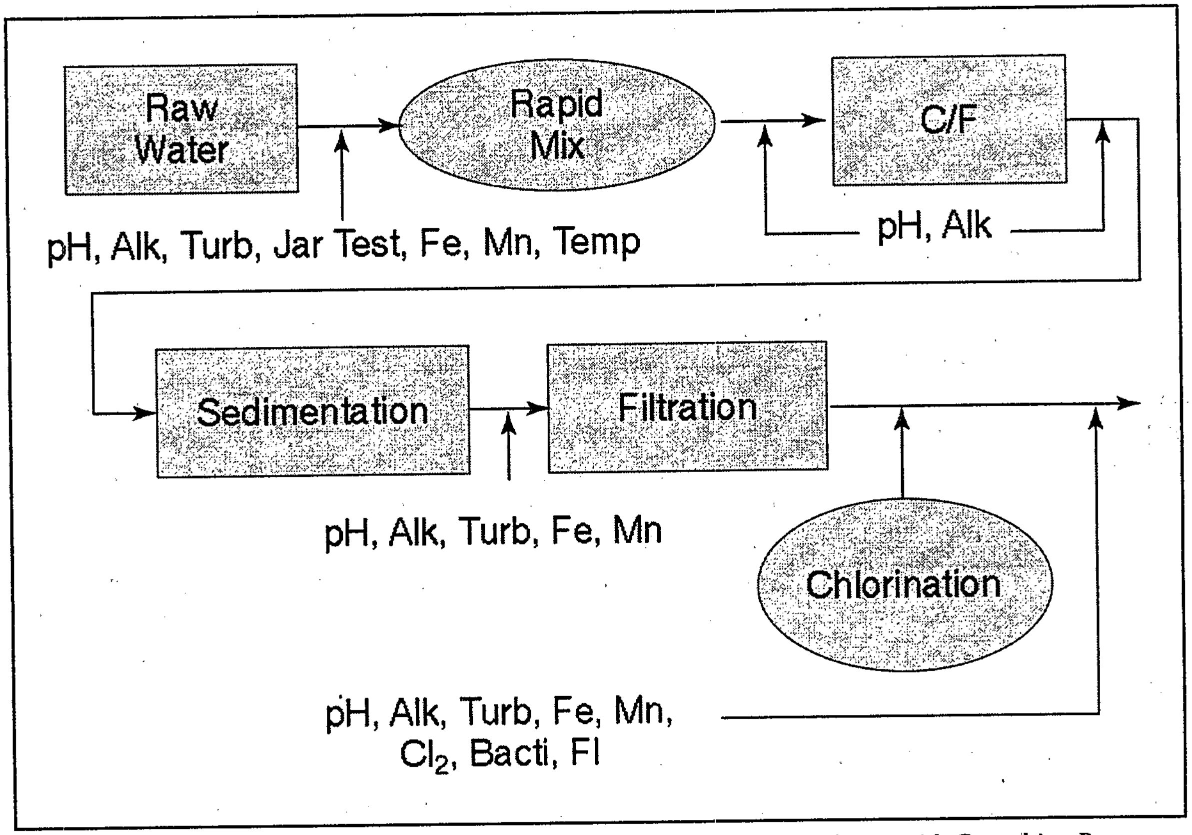

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Figure 3-22. Typical Water Quality Monitoring Plan Layout for a Surface Water Treatment Facility

Suggested assessment criteria for in-house water quality control monitoring plan include:

1. **Does the plan appear to be adequate for this system? If not, what changes should be made and why?**

   The inspector should compare the plant's water quality monitoring plan with the treatment processes being used. Plants with poor raw water quality tend to have extensive water quality parameter testing between the intake and the clear well. As the number of chemicals and processes increase, the inspector should expect an increase in the number of testing sites and in the number of parameters tested.

2. **Are proper testing procedures being followed?**

   The inspector should compare the testing methods being used in the treatment plant with those approved by EPA.

3. **Are the equipment and facilities for monitoring adequate? Are the reagents out of date? How are test results logged? Where are past logs stored?**

   Old testing equipment might be suitable for measuring contaminants and water quality parameters. However, the inspector should verify when the laboratory was certified and whether old equipment was used to run the tests. Laboratory certification may not be required to perform specific monitoring tests. In these cases, the equipment that is being used must be evaluated to ensure that it is in good condition, is properly calibrated, and provides the necessary degree of accuracy.

4. **Does the operator use test results to identify treatment adjustments?**

   The inspector should verify from the operator how treatment is adjusted based on water quality tests. Adjustment may include the addition of an oxidant, increase or decrease in chemical dose, backwashing filters, and increasing or decreasing underdrain flow.

5. **Is there a procedure, and what is the frequency, for calibrating monitoring equipment, both laboratory and on-line? Is it in compliance with manufacturer's recommendations, and is the procedure adequate? Are the calibration standards acceptable?**

   Cleaning and calibrating monitoring equipment is vital to good water quality control. The inspector should verify that the calibration is done in accordance with the manufacturer's recommendation. The inspector should look for variances between his field test kit (for example pH) and those recorded by on-line probes. To obtain meaningful results from this comparison, the inspector should ensure that the field testing equipment that is used is properly maintained and calibrated.

3.6.2.2 Regulatory Monitoring Plans

With the enactment of the recent amendments to the SDWA, various monitoring plans have been required of a public water system to verify that the consumer is receiving safe drinking water. The monitoring plans that are required and the associated rules are as follows:

- Volatile Organic Contaminant monitoring (Phase I Rule);
- Synthetic Organic Contaminant (regulated and unregulated)/Inorganic Contaminant monitoring (Phase II/V Rule);
- Coliform monitoring plan (TCR);
- Lead and copper monitoring plan (Lead and Copper Rule);

- Turbidity and disinfection monitoring plan (SWTR); and
- Disinfection and filter profiles, if necessary (Proposed IESWTR).

The inspector should verify that each system has an approved plan, and that the plan is being followed. Note that for all the analyses required by these plans except the disinfectant residual and turbidity analyses, the analyses must be performed by a certified laboratory.

Suggested assessment criteria for regulatory monitoring plans include:

1. **Are all required monitoring plans approved by the state or other primacy agency and are these monitoring plans being followed? If not, why?**

   All water quality monitoring plans have to be approved by the state. Systems without an approved plan should work closely with the state on developing such a plan.

2. **Is a certified laboratory being used for all testing?**

   All regulatory water quality tests except disinfectant residual and turbidity have to be conducted by a laboratory certified for testing specific contaminants. Multiple laboratories may be used to conduct all necessary tests. The inspector should verify the certification of the laboratory(ies) being used by the treatment plant.

3.6.3 Priority Criteria

The following criteria related to the monitoring/reporting/data verification element of the sanitary survey are considered high priority based on their potential for impacting public health:

- **Non-Regulatory Monitoring Plans** – This plan is the quality control of the final product, which is the drinking water. If no quality control is completed, then the quality of the water is not known (Section 3.6.2.1).
- **Regulatory Monitoring Plans** – The regulations require this monitoring plan because it addresses parameters that are critical to public health (Section 3.6.2.2).

3.7 Water System Management/Operation

Management and/or administration is a major factor that affects the performance of a water system. Management provides the direction, funding, and support that is needed for a public water system to continually supply safe drinking water. For instance, if management does not understand the requirements to produce and provide the quality of drinking water demanded by the consumer, policies may be implemented that hinder the performance of the system and its ability to provide what the consumer wants. Therefore, management and staff need to work together to create an environment that facilitates meeting the goal of providing the best possible quality of drinking water to the consumer.

The objectives of surveying the water system management/operation are to:

- Review the water quality goals and evaluate any plan(s) the system has to either accomplish or maintain the stated goals;
- Identify and evaluate the basic information on the system, management, staffing, operations, and maintenance;
- Review and evaluate the plan(s) for safety, emergency situations, maintenance, and security to maintain system reliability; and
- Evaluate the system's revenue and budget for drinking water to establish the long-term viability of meeting water quality goals (UFTREEO Center, 1998).

3.7.1 Administrative Records Review

While much data have been collected concerning the physical features of the system, in this section, the data needed concern the management (people) area of a public water system. If the data are not already on file with the regulatory agency, then the inspector needs to obtain the information during the survey. The information needed is as follows:

- Past sanitary survey reports (the latest one typically, but others can be helpful to see what changes have been made over time);
- Pertinent correspondence concerning compliance monitoring, plans of the system that show changes made since the last survey, sampling plans, compliance plans, and other management related issues;
- Management structure as well as people in these positions for the system;
- Budgetary information to include bond indebtedness, rate structure, and specific budgetary information pertinent to the water system; and
- Capital improvements program for the water system.

Suggested assessment criteria for data collection include:

1. **What changes have been made since the last sanitary survey in the system management, personnel, budget, etc.?**

   The inspector should note any changes that have been made in the system's management, personnel, and budget, and ask the appropriate staff about any changes that could have a detrimental affect on system performance. Changes in personnel since the last sanitary survey may mean that the inspector needs to work with different members of the system staff for this sanitary survey. The inspector needs to be sure to work with the most appropriate personnel both on the operations and management staffs so that the most complete and accurate information possible is obtained during the survey.

2. **Are the system's files up-to-date with the latest correspondence on compliance monitoring, plans of the system showing changes made since**

the last survey, sampling plans, compliance plans, and other management related issues?

The general organization, timeliness and completeness of a system's files provide the inspector with an indication of the system's approach to data management and how much its data are available for use in decision-making. The water system should have procedures and tools (e.g., paper filing system, computer databases) for managing information such as maintenance and repair records and plans, compliance monitoring plans, system maps, budgets, financial data, and operating reports. The information management system should provide for updating the information at regular intervals.

3.7.2 Water Quality Goals

Water quality goals provide a target that the public water system should strive to attain to produce the best quality product possible. The water quality goals for a system should include all parameters that have a regulatory level established, as well as other quality parameters that are deemed appropriate. For parameters with established regulatory levels, the system should set goals to achieve a higher (or at least equal to) quality of drinking water than what is required by regulations. By striving to reach a goal that is higher than required, the system will be more assured of meeting the regulatory requirements at all times. For instance, if the turbidity regulatory requirement is 0.3 NTU for finished water, setting a goal of 0.2 NTU or lower and operating the system to meet that goal will provide greater assurance that the regulatory requirement is consistently met. Some surface water treatment plants have adopted optimized performance goals associated with the highest level of protection against waterborne disease. These goals include a filtered water turbidity of less than 0.1 NTU from each individual filter.

The system should set other, non-regulatory water quality parameters, as appropriate, to help it achieve its overall goal of producing a reliable, high-quality water supply. Examples of some of these other water quality goals include the number of customer complaints for a month, threshold odor number, or flavor profile analysis.

Suggested assessment criteria for water quality goals include:

1. **Has the system established any water quality goals? If not, why?**

   Water quality goals can provide overall direction to water system management staff and operations staff. The inspector should assess whether a system's goals seem reasonable (e.g., achievable, measurable) and appropriate for the system.

2. **Should there be any other parameters included in the goals? If so, which parameters, and what level?**

   There are important considerations other than specific regulatory requirements in providing customers with a reliable, high-quality water supply. For instance, customer complaints can provide a means of determining whether a water supply not only meets regulatory requirements, but also satisfies consumers' needs (e.g., taste, color, odor).

3. **Do the operators know what the plant goals are, and why the levels were established? Do operators monitor to assess whether goals are being met and then make any appropriate process control adjustments and measure the results of the adjustments?**

   Water quality goals are of little value if they do not impact both day-to-day plant operations and long-term planning. Operators need to be aware of the system's water quality goals and understand the goals in order to make decisions about plant operations that lead to achieving the goals.

3.7.3 Water System Management

The direction of the system is controlled by the system's management through the implementation of the budget and policies. During the inspection, the knowledge and experience of these individuals concerning drinking water should be verified. As an example, if the individual at the top of the management structure has little or no experience with a water system, then the implemented budget and policies may reflect that lack of knowledge in determining how the system is operated and maintained. If the individual has the knowledge, then the water system will probably be operated and maintained differently. Therefore, the knowledge and experience that management has with water systems plays an important role in how a system is operated and maintained.

Another impact that management can have is on the morale of the personnel. A positive atmosphere is generated if the management encourages an open dialogue between all levels. This open communication allows the workers to express their opinion without fear of reprisal. Encouraging the training and advancement of personnel will also foster a positive morale. Although, there will be some expenses incurred on the part of the utility, this effort shows that management wants their employees to gain the knowledge necessary to further their careers. With the positive attitudes of personnel, the operation and maintenance of the system will probably be at a higher level. Mistrust between management and the O&M personnel will have an adverse effect, so if personnel have a negative attitude, system operation and maintenance will likely be affected.

Suggested assessment criteria for system management include:

1. **What is the management structure, and who are the individuals at the various levels? What is their experience level with water systems?**

   If the water system has an organizational chart, the inspector should review the chart to gain an understanding of the system's management structure and which individuals are responsible for the different elements of system operation and management. The system needs to have a means of clearly indicating to its own staff who has the responsibility for various functions and who has the authority to make decisions and approve changes to policies, procedures, system operations, and other areas pertinent to treatment plant performance and water supply quality. Personnel in positions of responsibility and management should be experienced with and knowledgeable about drinking water systems and their operation, and have detailed knowledge about their own system and its performance and needs, as well as the regulatory requirements that apply to their system.

2. **Does the water system have a planning process? Does the planning process appear to be implemented?**

   Water system management should be actively involved in planning for the system. Efforts should include both short-term and long-range planning horizons. The system should have a process for developing and updating plans required under applicable regulations, such as compliance monitoring, source protection, and cross-connection control, as well as other plans integral to a well-functioning water system, such as annual and long-term budgets, equipment purchases, and facility expansion.

3. **Does open, effective communication occur between management and system personnel?**

   Open, effective communication between management and operations staff is integral to the achievement of a system's water quality goals for the production of a reliable, high-quality water supply. System personnel should have a means of adequately conveying to management the need for additional equipment and personnel and changes in facility policies and procedures, and for providing input to budgeting and system expansion plans. Management needs to be receptive to staff input and committed to seeking it and using it.

4. **What kind of attitude is portrayed by the system personnel?**

   If system personnel portray a negative attitude, it may be an indication of poor relations between system management and operations staff. Negative employee attitudes may stem from inadequate investments in employee training or compensation, or inadequate investment in facilities/equipment used or operated by employees. The inspector should attempt to determine the reason(s) for a negative attitude to the degree that such attitudes may adversely affect system performance.

3.7.4 Water System Staffing

The inspector should determine if a list of job descriptions for system personnel is available. The inspector can use this information to assess whether or not the system seems to have an adequate number of qualified personnel to perform all the necessary work within the system from operations to maintenance. One indicator of sufficient personnel is that little or no overtime is required to adequately perform operations and maintenance. The inspector should also evaluate the relative distribution of personnel between operations and maintenance positions. If a system has only one individual to maintain the water treatment facilities and distribution system and 10 operators with no maintenance responsibilities within their job descriptions, there are too many operators and not enough maintenance personnel and a lack of maintenance is likely to be very noticeable. To have a well operated and maintained facility, there should be a good mix of responsibilities and personnel, and personnel should have some cross-training between operations and maintenance.

Suggested assessment criteria for system staffing include:

1. **Is the number of personnel adequate to perform the work required?**

   The size of the facility and the types of treatment largely determine what level of personnel is sufficient. The system should have enough personnel to enable continuous operation of the treatment plant at all times, including periods when some staff are absent (e.g., vacations, weekends, holidays). Staff should be able to perform operations and maintenance tasks regularly with little or no overtime hours. In addition to having an adequate number staff overall, the system should have staff appropriately assigned to operations tasks and maintenance tasks.

2. **Is plant coverage adequate given the alarm systems used by the plan? Do variations in finished water quality when the plant is unattended indicate the need for additional plant coverage?**

   During periods when the plant is unattended or treatment processes are monitored by alarm systems rather than personnel, fluctuations in finished water quality may increase. The inspector should evaluate whether the system's personnel and its use of alarm systems are adequate to promptly address variations in finished water quality.

3. **Do staff have clearly defined responsibilities and the decisionmaking authority necessary to carry out their responsibilities?**

   System staff need to clearly understand their responsibilities and have the authority to make any decisions, such as hiring and scheduling personnel and altering elements of treatment plan operation (e.g., equipment shutdowns for maintenance, changes to chemical doses), that are necessary to fulfill their responsibilities in a timely manner. System staff should also sufficiently understand the responsibilities of other personnel so they know who to approach with issues or questions.

4. **Is there cross-training required of the individuals within the system?**

   Some cross-training of employees between operations and maintenance provides the facility with staffing options during unexpected periods of staff absences (e.g., illnesses) and times when the work load balance between operations and maintenance shifts. Cross-training may also enable staff to better carry out their responsibilities because they have a better understanding of other aspects of water treatment.

3.7.5 O&M Manuals and Procedures

Operation and maintenance (O&M) manuals, standard operating procedures (SOPs), and standard maintenance procedures (SMPs) provide direction for the operation and maintenance of system facilities. They can also provide a quick means of teaching new staff about the system, how it operates, and what should be done to keep the system operating successfully. The O&M manual contains a general discussion of system components and their operation and maintenance, while SOPs and SMPs provide a more detailed, step-by-step description of the procedures that should be followed to carry out operations and maintenance tasks. Many O&M manuals also contain the SOPs and SMPs for a system.

The O&M manual, SOPs, and SMPs should include the following information:

- General description of all components within the system/facility, and its purpose;
- Performance goals for the plant;
- Design criteria for all components;
- Detailed description of the operation of each component (step-by-step);
- Procedures for monitoring and adjusting plant performance;
- Detailed description of the maintenance of each component (step-by-step), including emergency and preventative maintenance;
- Laboratory requirements – equipment, test procedures, and calibration methods;
- Safety program – spill response, emergency telephone numbers, procedures, etc.;
- Education and training responsibilities and opportunities;
- Procedures for communicating problems; and
- Records – plant and regulatory requirements.

The O&M manual, SOPs, and SMPs should be written by the staff, when possible, because they are the ones that best know the system and its requirements. They should be written in a manner that provides a clear and accurate understanding of the operation and maintenance of facilities.

Suggested assessment criteria for operation and maintenance manuals, SOPs, and SMPs include:

1. **Is there an O&M manual for the system? Are there SOPs and SMPs for the system? Are these documents complete and accurate?**

   The system O&M manual and associated SOPs and SMPs are vital to ensuring consistent operation and maintenance of the facility from operator to operator and across maintenance staff. The inspector should assess whether the documents appear adequate (e.g., are sufficiently detailed) and address all aspects of the facility treatment processes. Information on the facility (e.g., system maps) and all equipment (e.g., literature received from the manufacturer or supplier) should be organized and easily accessible so that equipment can be properly operated and serviced.

2. **Do system personnel use the documents and implement the practices described in them? Where are copies of the manual, SOPs, and SMPs kept?**

   O&M manuals, SOPs, and SMPs are of little value if they are not used by system personnel. The documents need to be readily available to all staff, and staff need to be aware of where the manuals are kept and encouraged to use them.

3.7.6 Water System Funding

When reviewing the budget and rate structure, one of the most important questions to consider to determine adequacy is "Is the system a self-supporting utility?" A self-supporting utility means that the revenues are such that all budgetary requests are met, with some excess reserves remaining for future improvements or emergencies. These reserves would normally stay within the utility budget. However, some systems may apply these reserves to other portions of the overall budget of the city or board. In other words, the water system may subsidize other departments within the city or board.

After reviewing the budget and revenues to determine if the system is self-supporting, the budget should be reviewed to determine that there is adequate funding allocated to the maintenance of the equipment within the system, as well as for providing an adequate number of personnel to operate and maintain the system properly. Data from other systems may help in this analysis. In comparing two similarly sized systems, any significant differences between the two systems can be evaluated to see if they may be part of the reason for any problems being experienced.

Suggested assessment criteria for adequacy of revenues/budget include:

1. **Is the system self-supporting?**

   Water rates should be set at a level such that fees collected adequately cover operating, maintenance, and replacement costs. If there is an imbalance, the inspector should evaluate how the imbalance may be impacting the system's performance and its ability to provide a reliable supply of high-quality water.

2. **Are there adequate monies to provide the appropriate maintenance and to support the number of personnel to operate the system correctly?**

   System funding needs to adequately support facility operation and maintenance, and should include funding for an appropriate level of staff that are properly trained. Funds need to be budgeted for future expenses such as equipment purchases and facility expansion, as well as current expenses associated with staff salaries and training, electricity, chemical stocks and equipment replacement parts, and other day-to-day expenses. The system should have a method for prioritizing its needs so that funds are expended on the most essential items first. The inspector should ask operations and maintenance staff about its procedures for and past experiences with obtaining needed supplies, equipment, and staff to determine if staff encounter difficulties due to budget problems. The system should have a reserve or sinking fund where excess revenues are held and accumulated for use on future purchases and improvements and emergencies.

3. **Does the water system subsidize other departments within the city or board? If so, is funding that is returned to the water utility sufficient to meet operation and maintenance requirements and address future growth?**

   To assess this, the inspector should interview personnel that are responsible for the water system budget, ask operator about plant funding, and examine the budget.

4. **How does this system compare to others?**

   If the inspector has financial data on other systems, comparisons can be made that may aid in determining the adequacy of a system's budget/revenues.

3.7.7 Priority Criteria

The following criteria related to the water system management/operation element of the sanitary survey are considered high priority based on their potential for impacting public health:

- **Water System Management** – Management provides the direction, policies, and budget for the staff to work by and with to meet regulatory requirements and produce quality drinking water. Management can foster a positive morale that can lead personnel to strive for excellence in operation and maintenance tasks and thus higher quality water. Management that is knowledgeable about water systems is likely to make better decisions about policies and expenditures for staff and equipment (Section 3.7.3).
- **Water System Staffing** – Adequate staff is required for the proper operation and management of the system (Section 3.7.4).
- **Water System Funding** – Adequate funding for operation, maintenance, and expansion is required to assure system viability (Section 3.7.6).

3.8 Operator Compliance with State Requirements

The need for qualified professionals to operate and maintain water systems is becoming increasingly important in the water supply industry. This need is because the operation of a water system is becoming more complicated and difficult with ever changing regulations that require the quality of drinking water to improve. System personnel must be aware of any deteriorating conditions from the source water supply to the consumer's tap, know what changes are required to correct the conditions, and be ready to implement the change at a short notice. The overall goal of a water system is to provide an adequate supply of safe drinking water to the consumer at an acceptable pressure. To meet this goal and the associated challenges, surface water system personnel need to be adequately trained.

3.8.1 Certification of Operators

Personnel involved in providing consumers with drinking water need to know what is required to provide a safe and adequate supply of water. One of the ways to assure the consumer that trained and knowledgeable individuals are working in the water system is through operator certification. Most states require a certain level of operator certification befitting the size of the system.

The requirements for operator certification vary from state to state, but they all require a certain amount of in-class (school) as well as on-the-job training and experience. As an individual advances, the training requirements increase also. In addition, operator certification is renewable and a certain degree of training is required just to maintain a level of certification.

Suggested assessment criteria for operator certification include:

1. **Does the system employ an operator(s) of the appropriate certification level(s), as specified in state requirements?**

   Proper operation and maintenance of a water system requires staff that are trained and knowledgeable about the facility and water treatment. One means of ensuring that system personnel have a certain minimum level of knowledge is through operator certification. States establish operator certification requirements so that operators without this knowledge are prevented from posing a potential health risk to consumers through improper treatment plant operation resulting in poor quality water. A system should have an operator(s) that possesses certification at the level(s) specified in state requirements. The inspector should ask for proof of certification if it is not openly displayed.

2. **Are operator certifications current for all system personnel? Are all personnel meeting the minimum renewal requirements for operator certification?**

   In reviewing the system's proof of certification, the inspector should verify that all operator certifications are current and that operators are meeting any state requirements for certification renewal.

3.8.2 Competency of Operators

Like all professions, some people know all the right answers according to the book and others know what the right answer is based on experience. Operators need to know both. During the survey, the inspector should question the operators about various aspects of the operation and maintenance of the system. Through this questioning, the inspector should be able to determine if system personnel are adequately trained, as well as informed about the system.

The inspector can also see how well the system is operated and maintained. Generally, if the system is well operated and maintained, the operators are competent and know what is needed to operate the system correctly.

Suggested assessment criteria for competency of operators include:

1. **Do the operators know how to operate and maintain the various components of their water system from the source to the tap? Does the system appear to be well-operated and maintained?**

   The inspector should evaluate the competency of operators throughout the entire site visit, both by visual observation and by asking the operators questions about water treatment and distribution, the facility and equipment, and procedures for operations and maintenance tasks. Questions the inspector cannot ask to probe the operator's knowledge include, "Show me how you...," "What does this do?," and "How often do you...?" The appearance of the facility is an indication of whether the operators properly operate and maintain the system.

2. **Are system personnel appropriately trained?**

   The system should have a regular training program that includes both new personnel and existing staff. Training can be done both in-house and through training classes offered by the state, EPA, universities, and drinking water associations. Operators should be trained in applicable operations and maintenance procedures, water treatment concepts, drinking water regulations, safety procedures, emergency response, and other essential issues that have a direct impact on plant personnel and the quality of drinking water.

3.8.3 Priority Criteria

The following criterion related to the operator compliance with state requirements element of the sanitary survey is considered a high priority based on its potential for impacting public health:

- **Competency of Operators** – Competent operators are essential to a well run, operated and maintained water system. Operators make operation, maintenance and administrative decisions that affect plant performance and system reliability (Section 3.8.2).

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4. COMPILING THE SANITARY SURVEY REPORT

This chapter provides guidelines for preparing the sanitary survey report and suggestions for keeping adequate documentation of the sanitary survey. The sanitary survey report is a final written report that is used to notify water system owners and operators of the system's deficiencies and assists in facilitating corrective action where deficiencies are noted. Final written reports should be prepared for every sanitary survey in a format that is consistent statewide. Once a sanitary survey has been conducted, appropriate documentation is needed for follow-up activities and for development of reports. Not only does documentation need to be complete, but the results of surveys should be interpreted consistently from one surveyor to another. Specifically, as part of documentation and follow-up, the inspector should complete the following activities:

- Complete documentation and prioritize sanitary risks that were identified during the onsite investigation;
- Notify the water utility of any variances in the sanitary survey report from that provided in the oral debriefing at the site;
- Complete the formal sanitary survey report;
- Notify appropriate organizations of the results;
- Provide options for correcting the sanitary risks, including sources of technical assistance;
- Follow-up on questions asked by water utility personnel; and
- Assess whether the system should be considered to have outstanding performance.

The remainder of this chapter provides additional detail on compiling the sanitary survey report. Areas addressed include: preparing the sanitary survey report; preparing adequate sanitary survey documentation; categorizing the findings; developing corrective actions; and determining outstanding performance.

4.1 Sanitary Survey Report

The sanitary survey report officially communicates the results of the survey to the owners and operators of the water system. The purposes of the survey report are to:

- Notify the water system owners and operators of system deficiencies;
- Request corrective action under a specified schedule;

- Provide a written record for future inspections (including a recommendation on outstanding performance since this can affect the frequency of future surveys);
- Provide important information that may be useful in emergencies.

The report can be as brief as an extensive letter, but should be detailed enough to provide the water utility with sufficient information on what deficiencies exist and what corrective actions are needed. The survey report should indicate why corrective actions are necessary. Compliance schedules are required for all sanitary survey reports that identify significant deficiencies.

The survey report provides a record for future inspecting parties and provides technical information that may be useful during emergency situations. It is also an important tool for tracking compliance with the SDWA and for evaluating a particular system's compliance strategy. The sanitary survey report needs to contain adequate documentation of survey results. Types of documentation are discussed in Section 4.2.

The report should be completed promptly and reflect the information provided to water utility personnel at the end of the onsite evaluation. If the written evaluation is different from the oral debriefing, the water system manager should be notified of such changes.

At a minimum, the survey report should include the following elements:

- Date and time of survey;
- Name(s) of survey inspector(s);
- Name(s) of those present during the survey, besides the inspector(s);
- A schematic drawing of the system and, where appropriate, photographs of key system components;
- A statement of system capacity, including source, treatment, and distribution;
- A summary of survey findings, with the signatures of survey personnel;
- A listing of deficiencies based on a regulatory reference;
- A summary of all analyses and measurements done during the sanitary survey;
- Recommendations for improvement, in order of priority, with a timeline for compliance;
- A copy of the survey form; and
- A recommendation on whether a system has outstanding performance.

The report needs to identify all the deficiencies noted during the inspection. The sanitary survey report should provide more detailed information when a system has a significant problem that could affect human health. The report should also provide options for corrective actions that the system may take to address any significant deficiencies. As part of the follow-up activities for sanitary surveys, the system must respond to deficiencies outlined in the state's sanitary survey report within 45 days, indicating how and on what schedule the system will address significant deficiencies noted in the survey. The system may also provide its own recommendations for corrective action. The sanitary survey report should describe the actions that the state will take if the deficiencies that require action by the system owner/operator are not corrected within the timetable provided.

The state should develop standard language ("boilerplate") for use in sanitary survey reports and correspondence with water systems after a sanitary survey. This standard language includes the text which will not change significantly from report to report. The standard language should be used, when applicable, to save report preparation time and to maintain uniformity in correspondence between the state agency and water systems. Standard language could be developed for sanitary survey report discussions pertaining to each of the eight elements of a sanitary survey. For example, a state could develop standard language that describes its operator certification requirements and says whether or not the water system operator(s) meets those requirements. The inspector would insert the applicable language based on the results of the inspection. A state should consider consulting with its legal staff to ensure that the standard boilerplate language is accurate within its authorities.

4.2 Sanitary Survey Documentation

Adequate documentation of survey results is essential in the sanitary survey process, especially if the survey may result in corrective or enforcement actions. It is the inspector's responsibility to the water system and to the public to provide an accurate and detailed description of improper operations or system deficiencies in the sanitary survey report. Detailed documentation should be recorded in a sanitary survey report and sanitary survey forms. Some example forms are included in Appendix A.

The suggested minimum documentation for sanitary survey record files includes:

- A cover memorandum or letter with a list of deficiencies, if any, and pertinent information and recommended actions. The list of deficiencies should be accompanied by references to regulatory provisions pertaining to the deficiencies. The first page of the list of deficiencies should begin with the header below. The items shown in italics should be provided for the particular system. Following the header, each deficiency should be ordered by number. The list should be prioritized by severity from the most critical to the least critical.

LIST OF DEFICIENCIES

System: *System's Name*	**Survey Date:** *Inspection Date*
I.D.#: *Water System's ID Number*	**Surveyed By:** *Inspector's Name/Affiliation*
Location: *County Name, State*	**Region:** EPA *Region Number*

- A completed survey form or checklist for the water system (if used by the state).
- Any necessary additional pages of comments, drawings or sketches, and water sampling data.
- A copy of the USGS 7.5 minute topographical quadrangle map showing the location of the system.
- A summary of the components of the water system. This summary should identify any modifications made to the system.
- A listing of system operators, including the certification status.

4.3 Categorizing the Findings

The findings of a sanitary survey can range in severity from minor administrative deficiencies to situations where continued operation of the water delivery system could pose a serious health threat to the population. The inspector needs to determine which deficiencies are significant and thus require the system to take immediate corrective action (all deficiencies should ultimately be addressed). In general, significant deficiencies include those defects in a system's design, operation, or maintenance, as well as any failures or malfunctions of its treatment, storage, or distribution system, that the state determines to be causing or have the potential to cause the introduction of contamination into water delivered to customers.

For statewide consistency from survey to survey and inspector to inspector, a state should establish its own definition of a significant deficiency and a list of what deficiencies it generally considers significant. An inspector should determine which deficiencies of a system meet the state's definition of significant, and should also identify any other deficiencies that may pose a serious threat and should be considered significant for that system. The priority criteria provided in Chapter 3 can help the inspector determine which deficiencies pose a serious health threat and therefore need to be considered significant.

Table 4-1 illustrates one possible approach to categorization of some of the common deficiencies by the degree of their threat to public health. The below listing includes examples of deficiencies that may be considered significant public health issues. This list is not intended to be comprehensive, but serves as a guide to the state for categorizing significant deficiencies. Other deficiencies could be deemed significant public health issues.

Table 4-1. Example of Sanitary Survey Deficiencies*

Finding	Minor	Moderate	Significant
No approved construction drawings		✓	
Failure to update the water distribution map	✓		
Stopping work on system improvements		✓	
Failure to meet distribution system pressure requirements			✓
Failure to meet water treatment requirements			✓
Failure to meet water quality MCLs			✓
System continues to operate in a noncompliance mode			✓
System has reached the maximum number of services allowed		✓	
System not operating in compliance with water system plan		✓	
System violated coliform or VOC MCLs			✓

* This table is for illustrative purposes only and does not represent any federal or state policy.

The following list presents some additional examples of potential significant deficiencies that may be identified during a sanitary survey. Significant deficiencies of surface water and ground water under the direct influence of surface water systems may include, but are not limited to, the following types of deficiencies:

- Source
  - Location of intake is near pollution source (e.g., POTWs, CSO discharges)
  - Not having a secured protective radius around a reservoir
  - Wells of improper construction
  - Springs of improper construction.
- Treatment
  - The hatch to a pressure filter has not been opened on a yearly basis to clean the media, and to check for media loss and the condition of the underdrain system
  - Filter does not have adequate depth of media (è.g., less than 24 inches)
  - No SOP for taking a filter out of service for backwashing, for performing the backwash or returning the filter to service
  - No process control plan for coagulant addition
  - Inadequate application of treatment chemicals
  - Chemical feed rates not adjusted for varying raw water quality conditions or changes in plant flow rate
  - Inadequate disinfection CT.

- Distribution Systems
  - TCR sampling plan not representative of distribution system
  - Negative pressures at any time
  - System not flushed periodically
  - No disinfectant residual, or HPC levels greater than 500/ml, repeatedly at same sites
  - Inadequate monitoring of disinfectant residual, when required
  - Inadequate cross connection controls, either at the treatment facility or in the distribution system (or failure to have a cross connection control program, when one is required)
  - Unacceptable system leakage that could result in entrance of contaminants.

- Finished Water Storage
  - Inadequate internal cleaning and maintenance of storage tank
  - Improper venting of tank
  - Lack of proper screening of overflow pipe and drain
  - Inadequate roofing (e.g., holes in the storage tank, improper hatch construction).

- Pumps/Pump Facilities and Controls
  - Ponding of water in pump housing
  - Inadequate pump capacity
  - Lack of redundant mechanical components.

- Monitoring/Reporting/Data Verification
  - Failure to properly monitor water quality
  - Failure of system operator to address customer complaints regarding water quality or quantity issue
  - TCR sampling plan not available or not being followed
  - Chronic TCR coliform detections with inadequate remediation.

- Water System Management/Operation
  - Lack of properly trained or licensed staff as required by the state
  - Lack of approved emergency response plan
  - Failure to meet water supply demands/interruptions to service (inadequate pump capacity, unreliable water source, lack of auxiliary power)
  - Inadequate follow-up to deficiencies noted in previous inspection/sanitary surveys.

- Operator Compliance with State Requirements
  - Operator does not have the correct level of certification as required by the state.

If a significant public health issue is determined to exist, compliance action must be required. State inspectors may judge other problems as significant enough from a public health viewpoint to require establishment of a compliance schedule with follow-up action.

4.4 Corrective Action

There are a number of problems or deficiencies that may be considered significant public health issues. If a significant public health issue is determined to exist, corrective action must be required. At a minimum, the sanitary survey report should identify the deficiencies noted during the inspection and notify the system of the actions that the state may take if the deficiencies that require action by the system owner/operator are not corrected. To ensure that the sanitary risks are minimized, the sanitary survey report should provide the water utility with options for correcting significant defects. The suggestions for corrective actions should not be overly specific and should be sufficiently conservative, since the inspector does not have the detailed knowledge of the system's engineer or other plant personnel.

Depending upon the nature of the defect, there may be a number of adequate corrective actions that may be applied to a significant defect. The system should be given discretion in selecting the most appropriate corrective action, and made ultimately responsible for selecting an appropriate action(s).

There are three basic approaches which may be taken to ensure significant defects are corrected:

- ***Correction of problems by the water system staff, their consulting engineers, and/or contractor***

  Many deficiencies can be addressed by water system staff and their consultants. The inspector should assess whether the water system appears to have trained and competent staff available before suggesting approaches that involve water system personnel in alleviating most deficiencies. The inspector should consider the cause of the deficiencies (how and why they developed) and judge whether it is reasonable to expect the water system operator or manager to correct the problems promptly.

- ***Technical assistance to the water utility by the regulatory agency, organizations that specialize in training and technical assistance, and/or peers at other water systems***

  Many water systems may need assistance in determining the cause(s) of their performance problems and in developing a set of actions to eliminate the problems. The inspector may be able to offer approaches the water system can use to assess and address problems. Assistance may result in training, onsite system specific technical assistance, and referrals to other available resources at the state and federal levels (at the primacy agency, other organizations, and at state environmental training centers).

- ***Implementation of a composite correction program (CCP) applicable to surface water treatment plants***

  The CCP is a type of technical assistance that is specific to surface water systems. A CCP consists of a comprehensive performance evaluation (CPE) and a comprehensive technical assistance (CTA) program. A CPE determines inadequacies and performance limiting factors, and prioritizes deficiencies. A CTA attempts to correct the deficiencies and involves onsite, system-specific technical assistance.

A combination of these approaches may be appropriate, based on the type and severity of the sanitary deficiencies.

4.5 Outstanding Performance

As noted in Chapter 1, community systems that are classified as having outstanding performance are eligible for having future sanitary surveys conducted at the less frequent interval of at least once every five years, rather than at least once every three years. Based on the findings of a sanitary survey, an inspector should include in the report a recommendation on whether a system should be considered to have outstanding performance at the time of the survey. This recommendation should be based on the state's specifications for determining if a system has outstanding performance. The state was required to develop these specifications as part of its application for primacy. Along with the inspector's recommendation, the report should include standard state language ("boilerplate") noting that the recommendation for outstanding performance status is contingent upon the system continuing to meet the states' specifications for that status.

In general, outstanding performance means that a system is well-operated and managed, has a good record of performance in past sanitary surveys, and has not had any violations (at least in recent years). A state's specifications for outstanding performance may include factors such as the following:

- No violations of MCLs since the last sanitary survey;
- No violations of monitoring and reporting requirements since the last sanitary survey;
- No violations of primary drinking water regulations during the past five years (or similar time period);
- No waterborne disease outbreaks attributable to the water system during a specified period;
- Past sanitary surveys containing no significant deficiencies;
- Existence of emergency preparedness measures and backup facilities;

- Meeting exceptional performance standards (e.g., 0.1 NTU) a specified high percentage of the time;
- Expert management of system (e.g., managers are knowledgeable about providing quality drinking water; low staff turnover and positive staff morale; well-established water quality goals);
- Expert operation of the system (e.g., skilled, certified personnel) in adequate numbers; existence of quality O&M manuals that are used by the staff; adequate budget and revenues);
- Success under the Partnership for Safe Water Program, Phase III program;
- Effective cross-connection program developed and implemented;
- Recognized in-house research programs applicable to improved system performance;
- Active public outreach programs (e.g., citizen participation committees);
- Stable water source (no interruptions in supply);
- Source water supply drawn from a reservoir or pre-sedimentation facility that effectively dampens raw water quality variations;
- No identified significant risk of future violations or problems (e.g., equipment past its service life);
- System capacity sufficient to meet anticipated growth; and
- CPE has been performed by a third party during the past three years, and the water system has adequately addressed all Performance Limiting Factors identified by the CPE.

As noted above, each state should have its own specifications for determining if a system has outstanding performance. The state may choose to use some or all of the above factors, different factors that have been developed by the state, or a combination of both.

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5. REPORT REVIEW AND RESPONSE

The previous chapters of this guidance manual described how to prepare, conduct, and report the results of a sanitary survey. This chapter describes the follow-up actions that should be undertaken by the water system operator and the state in response to the findings of a sanitary survey, including those actions that must be taken to correct any identified deficiencies. In general, the findings of the inspector should be transmitted to the system owner or operator soon after completion of the inspection. In turn, the system operator must respond to the sanitary survey findings within 45 days of state notification. The state then needs to monitor the water system's implementation of corrective actions to ensure that deficiencies are resolved. The remainder of this chapter discusses these follow up actions.

5.1 State Actions

For a state to be granted primacy authority, it must submit evidence to EPA that the state has met the requirements for a determination of primacy enforcement responsibility found in 40 CFR 142.10. These requirements are summarized in Figure 5-1. This regulatory authority effectively outlines the range of options that the state possesses in responding to the findings in a sanitary survey report.

Deficiencies of a minor nature may require no more response than to notify the system operator of the violation and set a time frame for the operator to correct the situation. A moderate deficiency could prompt the state to require the operator to respond within 30 days with a proposed solution to the deficiency and a schedule for correcting the situation. For significant deficiencies, the state must immediately inform the system operator of the deficiency. In some cases, the deficiency may be such that a boil water notice must be issued to the customers in order to protect public health. In all cases, the state should indicate the required time frame for a response, the required action for the response, and the consequences of failing to respond. The consequences could include revocation of the operating permit, suspension of the permit until the deficiency is corrected, and fines or penalties levied against the system operator. When significant deficiencies exist, a consent agreement, administrative order, or litigation by the appropriate court may be necessary to ensure prompt and proper correction. The state should make regular and continued inspections of the facility until all deficiencies have been corrected.

Other state activities include maintaining a tracking system for enforcement. The 1995 *EPA/State Joint Guidance on Sanitary Surveys* states that the deficiencies disclosed in a survey must be followed up on to ensure that timely corrective action is taken, especially to correct deficiencies that have the potential to substantially affect public health. States should develop a program for following up on recommendations made in their sanitary surveys. A computer tracking system of deficiencies may be a useful tool for states to use in tracking follow-up and enforcement actions.

Summary of CFR 142.10

Requirement for a Determination of Primacy Enforcement Responsibility

1. State has adopted drinking water regulations which are no less stringent than the National Primary Drinking Water Regulations.

2. State has adopted and is implementing adequate procedures for the enforcement of such state regulations, including:

   - maintenance of an inventory of public water systems;
   - a systematic program for conducting sanitary surveys of public water systems in the state, with priority given to sanitary surveys of public water systems not in compliance with state primary drinking water regulations; and
   - the establishment and maintenance of a state program for the certification of laboratories conducting analytical measurements of drinking water contaminants.

3. The establishment and maintenance, by the state, of an activity to assure that the design and construction of new or substantially modified public water system facilities will be capable of compliance with the state drinking water regulations.

4. The state has the statutory or regulatory enforcement authority adequate to compel compliance with the state primary drinking water regulations in appropriate cases, such authority to include:

   - authority to apply state primary drinking water regulations to all public water systems in the state covered by the national primary drinking water regulations;
   - authority to sue in courts of competent jurisdiction to enjoin any threatened or continuing deficiency of the state primary drinking water regulations;
   - right of entry and inspection of public water systems;
   - authority to require suppliers of water to keep appropriate records and make appropriate reports to the state;
   - authority to require public water systems to give public notice; and
   - authority to assess civil or criminal penalties for violations of the state primary drinking water regulations.

5. The state has established and will maintain record keeping and reporting of its activities.

6. The state has adopted and can implement an adequate plan for the provision of safe drinking water under emergency situations.

Figure 5-1. Summary of 40 CFR 142.10 – Requirements for a Determination of Primacy Enforcement Responsibility

5.2 Water System Actions

As stated above, the severity of the deficiency in a sanitary survey should dictate the appropriate response required from the water system operator. When a water system applies for an operating permit, the system operators agree to operate the water system in accordance with state regulations, and to deliver water of adequate volume, pressure, and quality. A state approves the operating permit with the same understanding and with the authority to enforce against any deficiency.

The system operator, upon receipt of the sanitary survey report, should prepare a response to the state addressing the survey findings which may include deficiencies of varying degrees of severity. The water system's response should be returned to the state within 45 days, and must be returned within the 45-day timeframe when the sanitary survey findings include significant deficiencies. The response should include:

- A statement of the deficiency, including any real or potential impacts to delivered water quality;
- The approach to correcting the deficiency;
- The time required to correct the deficiency;
- The source of funding, if capital construction is required;
- Measures put in place to prevent the situation from recurring; and
- Additional follow-up actions planned.

The IESWTR does not change the requirement for a water system to maintain copies of sanitary survey written reports and correspondence associated with sanitary surveys for a period of at least 10 years, as specified in 40 CFR 141.33 (c). In addition to this requirement, the water system should follow any applicable state implementing regulations related to sanitary survey record keeping.

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APPENDIX A

Examples of Sanitary Survey Checklists From States and EPA Regions

(Taken from the *1995 EPA/State Joint Guidance on Sanitary Surveys)*

EPA/STATE JOINT GUIDANCE ON SANITARY SURVEYS

DECEMBER 1995

A sound sanitary survey program is an essential element of a State's drinking water program. Sanitary surveys provide a first line of defense in helping public water systems protect the public health.

EPA recognizes that the quality of sanitary survey programs has suffered due to competing resource requirements associated with new drinking water regulations. The draft revised State Programs Priorities Guidance places renewed emphasis on the importance of sanitary surveys and identifies this activity as a high priority.

EPA recommends that the States work with Regions in using this guidance to improve their sanitary survey programs into State-specific programs that are tailored to meet each State's needs. Improving these programs may not happen immediately, depending on the current status of the program. States therefore need to negotiate with their respective Regions to determine appropriate timeframes for program improvements.

PART I. INTRODUCTION

A. DEFINITION OF A SANITARY SURVEY

A sanitary survey, as defined in CFR 141.2 (Definitions), means an on-site review of the water source, facilities, equipment, operation, maintenance, and monitoring compliance of a public water system for the purpose of evaluating the adequacy of such source, facilities, equipment, operation and maintenance for producing and distributing safe drinking water.

B. PURPOSE OF A SANITARY SURVEY

The purpose of a sanitary survey is to evaluate and document the capabilities of a water system's sources, treatment, storage, distribution network, operation and maintenance, and overall management to continually provide safe drinking water and to identify any deficiencies that might adversely impact a public water system's ability to provide a safe, reliable water supply.

Sanitary surveys also provide an opportunity for State drinking water officials or approved third party inspectors to establish a field presence with the owners and operators of water systems in order to educate them about proper monitoring and sampling procedures, provide technical assistance, and inform them of any upcoming changes in regulations.

They also aid in the process of evaluating a public water system's progress in complying with Federal and State regulations promulgated to protect public health. A survey can significantly reduce the potential risk of consumers ingesting contaminated drinking water. Sanitary surveys also aid in assessing a system's capacity and provide an opportunity to evaluate whether operators are adequately trained to test for water quality parameters, and are properly reporting water quality data to the State primacy agency.

C. POTENTIAL BENEFITS OF A SANITARY SURVEY

Sanitary surveys play an essential role in ensuring safe drinking water. Some of the many benefits of conducting sanitary surveys are:

- operator education;
- source protection;
- risk evaluation;
- technical assistance and training;
- sampling plan evaluation;
- independent, third party system review;
- information for monitoring waiver programs;
- identification of factors limiting a system's ability to continually provide safe drinking water;
- provision of updated water system information to State program personnel;
- provision of useful information for planning and capital improvements to system owners/operators;
- reduction of monitoring requirements;
- reduction of formal enforcement actions in favor of more informal actions;
- reduction of oversight by State monitoring and enforcement personnel;
- increased communication between State drinking water personnel and public water system operators;
- provision of contact person to notify in case of emergencies or for technical assistance;
- improvement of system compliance with State drinking water regulations;
- identification of candidates for enforcement action;
- identification of candidates for Comprehensive Performance Evaluations;
- verification of data validity;
- validation of test equipment and procedures;
- reduced risk of waterborne disease outbreaks;
- encourage disaster response planning; and
- improved system security.

PART II. GUIDANCE ON SANITARY SURVEY IMPLEMENTATION

A. FREQUENCY IN CONDUCTING A SANITARY SURVEY

Under 40 CFR, 142.10 (Requirements for a determination of primary enforcement responsibility), each State, pursuant to appropriate State legal authority, must establish, as a requirement for primacy, a systematic program for conducting sanitary surveys of public water systems in the State, with priority given to sanitary surveys of public water systems not in compliance with State primary drinking water regulations.

EPA recommends that the frequency with which a State conducts a sanitary survey of a water system be based on, but not limited to, a negotiated State/EPA number per year, or based on a state sanitary survey plan completed by the State. System selection can be based on a number of factors, including the following: source type, treatment technology(ies) used, the type of system, system size, date of last survey, whether the system has any violations, whether the system is a new system, whether the system has added a new source, whether the system has a new operator, whether the system has a waiver program, and whether the system has had a prior sanitary survey based on the minimum requirements of the Total Coliform Rule. This rule allows sampling to be reduced for small groundwater systems if the system undergoes a sanitary survey every five years and is certified to be free of sanitary defects.

B. QUALIFICATIONS FOR SANITARY SURVEY INSPECTORS

All sanitary survey inspectors should possess certain baseline qualifications to ensure both their own safety and the quality of the inspection itself. An inspector's technical background and experience should qualify him/her to assess the types of systems being surveyed. At a minimum, these qualifications should include appropriate health and safety training and an understanding of basic water supply operation and treatment processes where applicable. Other means of assessing inspector qualifications include whether the inspector has attended formal training sessions, whether he/she has documented on-the-job-training, whether the training received is appropriate for the type and size of the system being surveyed, and whether the inspector is knowledgeable about State and Federal SDWA regulations.

C. ASSESSMENT CRITERIA

States, as part of their sanitary survey program, should develop assessment criteria for each of the minimum elements recommended for review during a sanitary survey. These criteria are needed to ensure that deficiencies are evaluated consistently among the various inspectors in a State. As part of this effort, States should identify the types of deficiencies that are considered to be significant and the appropriate follow-up actions. The criteria should also discuss appropriate follow-up actions for lesser deficiencies.

D. MINIMUM ELEMENTS OF A SANITARY SURVEY

Prior to the survey, the inspector should review pertinent files relating to the system being inspected. Particular attention should be focused on information regarding past sanitary surveys the system might have had, any changes or improvements made to the system, as well as files relating to the system's compliance and enforcement history.

A review of the eight elements listed below is considered essential for the proper conduct of a thorough sanitary survey. States should, however, have some flexibility to tailor minimum elements based on system type, size, and complexity. Included below with each main element are examples of areas that should be addressed:

<u>Element 1. - Source</u>

Protection, including:

- watershed protection program, including physical and hydrogeological description of watershed, land use and topography, and identifying potential contamination sites
- wellhead protection program
- verification and reevaluation of vulnerability assessment
- waiver from filtration
- well sites and impoundments
- water quality/quantity
- security measures
- spring sites

Physical Components and Condition, including:

- wells, including both construction information and sanitary conditions
- surface intakes
- infiltration galleries
- springs
- catchment and cistern
- raw water storage and transmission
- adequacy of source capacity, present and future
- backup source capacity
- interconnection with existing supplies (emergency)
- emergency power generation

Element 2. - Treatment

- schematic diagram of treatment process
- appropriateness of current treatment, given water quality
- adequacy of current treatment, including the adequacy of:
  aeration equipment, chemical addition (control and automation potential), chemical mixing process, type and effectiveness of clarification, sedimentation, filtration, disinfection, monitoring equipment, controls, as well as use of test results in process control, on-site sample results by surveyor to establish treatment efficacy, and adequacy of treatment capacity, both present and future
- treatment enhancements
- O&M of treatment facility
- condition of equipment
- process control, including standardization, calibration and sample analysis procedures
- record keeping
- use of approved chemicals (e.g., NSF-approved)
- chemical storage/spill containment
- cross-connection program
- operator qualifications
- CT assessment where applicable
- security measures
- rated capacities of treatment processes
- operational flows versus treatment process rated capacity
- epichlorohydrin/acrylamide certification
- treatment and equipment reliability
- ability to respond to changes in raw water fluctuations
- redundancy
- emergency power

Element 3. - Distribution System

- overall distribution system map and plan
- overall condition of the system
- materials and construction of distribution system
- cross-connection control *inspection* program
- installation and repair procedures for water mains
- flushing schedule and procedure
- pressure controls (e.g., for adequate fire protection)
- corrosion control program
- leak detection/unaccounted water (including meter replacement)

- maintenance schedule and procedure
- disinfectant residuals
- condition of system components
- proper separation from sewage system components
- valve exercise/replacement program

Element 4. - Finished Water Storage

- contamination prevention
- O&M of facilities
- water use demands and storage capacity
- condition of system components
- condition of facilities
- use of NSF approved coatings
- assessment of CT where applicable (at plant)
- security measures
- overflow piping

Element 5. - Pumps/Pump Facilities and Controls

- types and capacity
- condition of pumps including reserve pumps
- condition of pump facilities
- emergency power
- flooding potential
- NSF approved lubrication oils
- security measures
- vulnerability assessment
- pumping capacity with largest pump out of service
- pumping controls

Element 6. - Monitoring/Reporting/Data Verification

- sample plans for appropriate rules (e.g., TCR, L&C Rule, etc.)
- verification of validity of data reported to State through comparison of logbook data to data submitted to State
- review of bench sheets, on-site logs, and monthly operational reports
- waivers
- monitoring schedule and history, including an assessment of compliance with State and Federal monitoring requirements
- appraise current water quality vs. historical data
- verification that required monitoring is being conducted accurately

- calibration of process control and compliance equipment, including review of QA/QC procedures
- determine if primacy agency information is accurate and complete
- review of overall past/present practices
- review of cross-connection control inspection logs
- review of annual cross-connection control test reports
- a summary of water quality data, including raw, treated and distribution system data

<u>Element 7. - Water System Management/Operations</u>

- basic information on system and system operator
- emergency contingency plans
- staffing
- review of past survey results
- review of compliance with regulations
- operator support/training
- O&M plan and manuals
- cross-connection control plan
- water loss/conservation program
- safety program, including verification of safety strategy
- facility security
- basic information on equipment
- public notification plan
- review of standby and redundant capability
- condition of facilities
- sample siting plan
- adequacy of revenues/budget

<u>Element 8. - Operator Compliance with State Requirements</u>

- certification requirements
- qualifications
- training
- competency (on-site observations of performance)
- cross-connection inspector certification

E. DOCUMENTATION

Each sanitary survey should be documented by having the inspector prepare a final written report of the survey on a format used consistently within the State. The final written report should be used to notify water system owners and operators of the system's deficiencies and to encourage them to take corrective actions where deficiencies are noted.

The report will provide a written record for future inspectors as well as information that is useful during emergency situations. It will also provide a reference as to the need for technical assistance and training. Information contained in the report should be used to update records in the State's database management system. The following should be included in the report:

1. The date the survey was conducted and by whom;
2. The name(s) of those present during the survey besides the inspector;
3. A schematic drawing of the system and, where appropriate, photographs of key system components;
4. The findings of the survey, along with the signatures of the survey team members; and
5. Recommendations for improvement and a timeframe for compliance.

The written final report must have a more substantial and descriptive explanation when a system is determined to have a significant problem that could affect human health. Any differences between the findings discussed at the conclusion of the on-site survey and what is included in the final report should be discussed and clarified with the water system operator and management prior to becoming a part of the survey's official documents.

F. FOLLOW-UP AFTER SURVEY

The findings of the inspector should be transmitted to the system owner or operator soon after completion of the inspection. The report should identify, at a minimum, the deficiencies noted during the inspection and should also request that the system provide its recommendations for corrective action and a timetable for the completion of such action. The report should also notify the system of the actions that the State will take if the deficiencies that require action by the system owner/operator are not corrected.

G. TRACKING AND ENFORCEMENT

For sanitary surveys to be effective in ensuring that public water systems provide safe drinking water, the deficiencies disclosed in a survey must be followed up to ensure that timely corrective action is taken, especially to correct deficiencies that have the potential to significantly affect public health. States should develop a program for following up on recommendations made in their sanitary surveys. A computer tracking system of deficiencies may be a useful tool to assist states in tracking follow up actions.

UTAH

- **Sanitary Survey Guidance Document**
- **Sanitary Survey Form**

SANITARY SUR
UTAH

UTAH DIVISION OF DRINKING WATER

March 1994

SANITARY SURVEY GUIDANCE DOCUMENT

This document provides general information on conducting sanitary surveys along with new guidance on issues that need to be addressed during a sanitary survey as a result of the Federal Safe Drinking Water Act Amendments (SDWA). These new issues include, for example: monitoring waivers, source protection issues, surface/groundwater determinations, and source locations. If we continue to conduct sanitary surveys as we have in the past, without collecting the additional information required of us, we will be ill prepared to implement the provision of the Federal Safe Drinking Water Act Amendments in Utah.

The purpose of this document is to provide information to those conducting sanitary surveys so that they, in turn, will ask the right questions and perform the necessary investigations. Such front line activities will promote: 1) safe drinking water, 2) informed water system management, and 3) smooth implementation of changing federal regulations.

TABLE OF CONTENTS

A. The Need for Sanitary Surveys

Sanitary Surveys provide a means for the exchange of information. For example, the operator is informed of monitoring and reporting requirements, efficiencies that can be gained and deficiencies that need correcting. The surveyor is informed of the existence and status of physical facilities and evaluates the external influences that may effect water quality. The findings of the survey can and will have a direct bearing on subsequent monitoring requirements for the surveyed system.

B. Who Can Conduct Sanitary Surveys

As provided in Section R309-101-4 of the Utah Public Drinking Water Rules, the following groups of individuals may, under varying conditions, conduct Sanitary Surveys.

a. Division of Drinking Water
b. Utah Department of Health District Engineers
c. Local Health Officials
d. Forest Service Engineers
e. Utah Rural Water Association
f. Consulting Engineers
g. Other qualified individuals authorized in writing by the Drinking Water Board, Executive Secretary

C. Preparing for a Sanitary Survey

Coordination and communication between State Department of Environmental Quality, District Engineers, local health department, and water system management is essential in preparing for a Sanitary Survey. Preliminary discussions should include: a review of the system's historical records including chemical and bacteriological data, correspondence, engineering studies, and past violations. Through these preparations one will be able to assemble and evaluate all the proper information during the survey and make sound recommendations.

D. The Prescribed Content of the Sanitary Survey

A. Sanitary Survey and its associated report must include:

1. The name, address and phone number of the person legally responsible for the water system.

2. A visual inspection and written description of the water system's physical features from the source through the distribution system. The physical facilities include:

   a) Description of each source (wells, springs, intake structures).
   b) Description of any treatment or disinfection facility, including type, capabilities, flow treated, associated source, etc.
   c) Number of storage reservoirs, size, construction type and sanitary aspects.
   d) Description of the transmission and distribution system, as well as each pump station, etc.

   *Note: If the physical facilities are adequately described by an earlier report, the earlier report can be referenced in the text of the new report, but a copy of the earlier report must be attached to the new report and the new report must contain a statement identifying the facilities that were inspected during the more recent survey.

3. Establish an exchange of information between the operator and the surveyor. This should include:

   a) Discussion of proposed, pending as well as anticipated, EPA regulations and encourage the operator to offer comments to EPA as appropriate.
   b) Discussion of the water system's sampling site plan for Lead/Copper and for bacteriologic samples. Each utility is required to have a written sampling site plan (see Appendix B for bacteriologic guidance and Section E Lead/Copper evaluation questions on page 7).
   c) Discussion of and report on the system's planning and budgeting efforts to keep abreast of water demands and regulatory demands.
   d) Discussion of a report on the system's emergency response capability as well as its cross connection control program.
   e) Discussion of the status of certified operators. Also describe the services available to operators seeking certification and the need to obtain CEUs.

4. Computer information should be discussed and/or verified with the operator. This includes the information contained on three computer reports (see Appendix E) as follows:

   a) The water system inventory (Report 3.1.02).
   b) Water system/source chemical monitoring (Report 3.1.09).

5. Waiver eligibility determinations for Phase II & V contaminates (See items F and G below for a more detailed explanation of waivers).

6. Surface/Groundwater assessment (see item H below for a more detailed explanation of Surface/Groundwater assessment).

7. Drinking Water Source Protection Plan.

8. Debrief the operator/owner following the survey.

9. The report must provide formal notification of deficiencies.

10. The report should give appropriate time tables if necessary.

11. Report historical facts as appropriate.

12. The report should be completed and sent within four weeks of the survey, with a transmittal letter to the appropriate representative of the water system. Copies of the report should be sent to coordinating agencies.

E. Lead/Copper Rule

Action Levels

0.015 ppm for lead

1.3 ppm for copper

The Environmental Protection Agency's lead and copper regulations require all community and non-transient non-community water systems to collect tap water samples to determine lead and copper levels to which customers may be exposed. By the applicable date for monitoring, each applicable water system shall complete a material evaluation of its distribution system in order to identify a pool of targeted sampling sites that meet the requirements for sample site locations. All sites from which first draw samples are collected, must be from this pool. The pool must consist of tier 1 sites. If there is an insufficient number of tier 1 sites, than tier 2 sites may be added to the pool. If there is still an insufficient number of sites then tier 3 may be added to the sampling pool.

Tier 1. single family structures that contain lead pipes, or copper pipes with lead solder installed after 1982, and/or are served by lead service lines.

Tier 2. buildings and multiple-family residences served by lead service lines, or that contain lead pipes, or copper pipes with lead solder installed after 1982.

Tier 3. single family structures that contain copper pipes with lead solder installed before 1983.

If you're surveying a non-transient non-community water system, lead and copper tap water samples must be collected from sampling locations that meet one of the following criteria:

Tier 1. buildings that contain copper pipes with lead solder installed after 1982 and before 1986, and/or are served by lead service lines.

Tier 2. buildings that contain copper pipes with lead solder installed before 1983 and before 1986.

To identify enough sites that meet the targeting criteria the water utility personnel should survey all records documenting the materials used to construct and repair your distribution system, buildings connected to your distribution system.

It is recommended that a system identify more sampling sites than the number of samples you are required to collect during each monitoring period in case volunteers drop out.

During the sanitary survey, the surveyor must review with the water utility personnel their criteria for selecting sites and procedures for collecting samples.

Evaluation Questions:

1. Has your water system completed a sampling site plan?

2. What methods were used to identify the sampling sites?

   a. Plumbing Code - Construction date of the house between 1982 and 1986.
   b. Plumbing Permits - Records of remodeling which would include the plumbing between 1982 and 1986.
   c. Existing sample results - previous monitoring which may indicate problem areas.
   d. Community survey - questionnaire mailed to water consumers asking about the plumbing materials as well as gaining consumer cooperation with the sampling.

3. Was the system able to identify a sufficient number of "Tier 1" sites?

4. How did the system handle the required sampling procedures (first draw water, and bathroom or kitchen sinks only)?

   a. If consumers collected the sample, how was the training on the sampling methods provided?

A written narrative of the system's methods in identifying the lead and copper sampling sites must be included in the sanitary survey.

F. Waiver Eligibility Determinations

The Phase II & V Rules allow the Executive Secretary to issue monitoring waivers. These waivers are issued to specific sources and can significantly reduce the amount of samples that a system must take on that individual source. Three types of waivers are offered, each type must meet certain criteria before it can be issued. Each waiver will affect the monitoring frequency for a specific contaminant group. **Verification of certain elements of the waiver(s) program must occur during a sanitary survey, without this verification, the existing waiver(s) will not be considered verified and will be revoked.** The system must then begin monitoring that source at the base monitoring frequency. All waivers must be periodically renewed. After 1999, waivers will only be renewed if there is in place a source protection plan and it verifies the waiver.

Type of Waivers:

1. "Reliably and Consistently" Waiver (R): The source water quality is reliably and consistently below the MCL.

2. "Use" Waiver (U): Contaminants are not used, manufactured, and/or stored in source area.

3. "Susceptibility" Waiver (S): Source is not susceptible to contamination based on an evaluation of: prior analytical data; vulnerability assessment results; environmental persistence and transport of the contaminant; construction of the source; the extent of the protection area around the source; the movement of the groundwater and the geology of the area; and the proximity of contaminants to the source combined with appropriate management practices associated with such contamination. **This type of waiver will only be issued in conjunction with the Drinking Water Source Protection Plan for a particular source and only if deemed appropriate with regard to the susceptibility waiver criteria listed in section G.**

Contaminant Group	Waiver Yes/No	Waiver Types	Basis of Waiver
Asbestos	Yes	U, S	No asbestos cement pipe and no asbestos geology
Nitrate/Nitrite	No		
Inorganics & Heavy Metals	Yes	R	Evaluation of last 3 cycles of monitoring
VOCs	Yes	U, S	Presence of contaminants and/or susceptibility of source to contamination
Pesticides/PCBs/SOCs	Yes	U, S	
Unregulated Organics	Yes	U, S	

State Implementation:

1. **"Reliably and Consistently" Waiver (R):** Computer code will be written to search the state database for previous analytical results on these specific contaminants, the code would then compare the results to see if they are reliably and consistently below the MCL. Sources eligible for the monitoring waiver would be automatically flagged on the inventory and the system would be notified by direct mail. The computer routine could be executed periodically as new data is received.

2. "Use" Waiver (U): A questionnaire has been sent to the operators of every community and non-transient non-community water system asking specific and general questions about each of their sources. The Division will also gather data from different segments of the federal

government which will focus on the different land use practices of each of the agencies involved, both current and historical.

3. "Susceptibility" Waiver (S): Systems with sources not eligible for a use waiver have been notified. If the system wishes to pursue the possibility of a susceptibility waiver, a Drinking Water Source Protection Plan will need to be in place before the source will be evaluated for waiver eligibility.

Perform by Persons Conducting Sanitary Surveys:

1. "Reliably and Consistently" Waiver (R): No involvement is anticipated.

2. "Use" Waiver (U): Assist water utility managers in filling out questionnaires and latitude/longitude of existing sources during the next sanitary survey of the water system. Adjustments to any waivers would be made at that time. As source protection areas are delineated for the Drinking Water Source Program, the inventory of potential sources of contamination will need to be verified in place of the questionnaire information.

3. "Susceptibility" Waiver (S): Initially no involvement is anticipated, however, as source protection areas are delineated for the Drinking Water Source Program, the inventory of potential sources of contamination will need to be verified.

G. <u>Waiver Verification Procedures</u>

As can be seen, the above criteria are rather easy to assess, provided the operator is familiar with the nature and extent of man's activities around the system's sources and the surveyor has access to past analytical results. It is imperative that the surveyor comment on the above aspects of the water system in the Report of Survey. However, it must be recognized that the above outlined approach is rather simplistic because it does not take into account special construction methods or mitigating geologic conditions.

In order for mitigating circumstances to be taken into account the water system must document to the satisfaction of the Executive Secretary that a source is not susceptible to a potential contamination site within the area. Only sources that have completed a Drinking Water Source Protection Plan will be evaluated for "susceptibility" waivers.

The Executive Secretary may issue a susceptibility waiver based on an evaluation of the following criteria:

1. Previous analytical results.
2. The proximity of the source to a potential point or non-point source of contamination. Point sources include spills and leaks of chemicals at or near a water treatment facility or at manufacturing, distribution, or storage facilities, or

from hazardous and municipal waste landfills and other waste handling or treatment facilities. Non-point sources for Pesticides/PCBs/SOCs include the use of pesticides to control insect and weed pests on agricultural areas, forest lands, home and gardens, and other land application uses.

3. The environmental persistence and transport of the contaminants.

4. How well the water source is protected against contamination due to such factors as depth of the well and the type of soil and the integrity of the well casing and sanitary seal.

In the case of Pesticides/PCBs/SOCs the following would also apply:

5. Elevated levels of nitrates at that particular source.
6. Use of PCBs in equipment used in production, storage, or distribution of water (i.e., PCBs used in pumps, transformers, etc.).

Required Verification Elements that must be included in the Report

These elements must be addressed within the body of the sanitary survey report. Any potential site of contamination in the area around each source must be listed in the report. The exact area of concern will vary depending upon the type of source and whether or not there is a source protection plan in place for each individual source.

1. Once a Drinking Water Source Protection Plan is in place, the area that need to be looked at is the actual geographic area scientifically delineated for each individual source.

2. Protection zone delineation and inventories of potential contamination sources are integral parts of the new Drinking Water Source Protection (DWSP) rule which became effective on July 26, 1993. However, since this rule will not be fully implemented until 1999, the Division of Drinking Water allows waivers to be based on a 1500-ft radius until December 1995. And from January 1996 until December 1999, a one-mile radius will be used in conjuntion with a sanitary survey. If a system's DWSP Plan is due prior to December 1999, its waivers must be based on this plan. After December 1999, all waivers will be based on DWSP plans. Additionally, since waivers must be reevaluated every three years, systems may delineate a three-year ground-water time of travel protection area around their sources on which to base their waivers.

The purpose of the inspection is to look for potential sources of organic contamination, the following is a partial list of contaminants or potential sources of contaminants. This list is just for illustration purposes and by no means reflects a complete list of the items of concern.

1. Volatile Organic Chemicals (VOCs): Dry cleaners, landfills, any industry that uses chemicals, gas stations, oil wells, etc.

2. Pesticides/PCBs/SOCs: agricultural fields, transformers, golf courses, residential areas with large areas of lawn, etc.

H. Surface Water/Ground Water Determination

Recent amendments to 40 CFR Parts 141 and 142 of the National Primary Drinking Water Regulations commonly called the "**Surface Water Treatment Rule**" define "ground water under direct influence of surface water," as:

> Any water beneath the surface of the ground with (i) significant occurrence of insects or other microorganisms, algae, or large-diameter pathogens such as *Giardia lamblia*, or (ii) significant and relatively rapid shifts in water characteristics such as turbidity, temperature, conductivity, or pH which closely correlate to climatological or surface water conditions.

Part of these amendments require that the "State" classify all ground water sources as to whether or not they are influenced by surface water. These classifications will be made by the Executive Secretary and state staff.

Previously, R309-106-1 of the Utah Administrative Code made the following statement:

> **R309-106-1 SURFACE WATER**
> A surface water source is defined to mean tributary systems, drainage basins, natural lakes, artificial reservoirs, impoundments or low quality springs. Surface water sources will not be considered for culinary use unless they can be rendered acceptable by complete treatment (chemical coagulation, sedimentation, filtration and disinfection) or other equivalent treatment acceptable to the Executive Secretary.

Part of the amendments published in the federal register of Thursday June 29, 1989 require that "direct influence must be determined for individual sources in accordance with criteria established by the State" and that "the State determination of direct influence may be based on an evaluation of site-specific measurements of water quality and/or well construction characteristics and geology with field evaluation." Further clarification in part III, Response to Major Issues; states, "It is important to note that the intent of this rule is not to regulate viral and bacterial contamination in systems using ground water, unless *Giardia* cysts are also associated with such occurrence. Thus, if there is little likelihood for *Giardia* cysts to occur in a system using ground water, but there is potential for bacterial and viral contamination, EPA does not expect the State to classify this source as a ground water source under the direct influence of surface water."

The State of Utah intends on following EPA's recommendation not to regulate viral and bacterial contamination in systems using ground water sources via this rule and intends to classify only those ground water sources which clearly indicate a likelihood for *Giardia* cysts to occur in a system using ground water, but there is potential for bacterial and viral contamination, EPA does not expect the State to classify this source as a ground water source under the direct influence of surface water."

The State of Utah intends on following EPA's recommendation not to regulate viral and bacterial contamination in systems using ground water sources via this rule and intends to classify only those ground water sources which clearly indicate a likelihood of contamination by *Giardia* cysts as "under direct influence of surface water."

We request the aid of surveyors in identifying those sources which are influenced by surface water. In order to do this we recommend that the following questions should be reviewed and answered for each source inspected:

1. Is it clear that the source is obviously a surface water, i.e. pond, lake, stream, etc., or does the utility have open storage facilities that furnish water for human consumption without additional treatment.

2. If the source is a well, does the system have a copy of the "Report of Well Driller" as required to be filed with the State Engineer's Office, and does the report and the well itself indicate the following:

    a. a casing that penetrates a confining strata of clay, shale, or otherwise impervious material,

    b. the annulus between the drilled hole and the casing is sealed using bentonite clay, cement slurry, sand-cement grout or other acceptable material; and this seal extends from the surface down and into the confining strata mentioned above,

    c. any perforations of the casing or placement of screens are below the confining strata mentioned above,

d. the well is drilled to a depth greater than 50 feet,

e. the well is located at a distance greater than 200 feet from any surface water,

f. the well has been pump tested in accordance with a reviewed and approved yield/drawdown test and results clearly determine the porosity and transmissivity of the aquifer materials, and

g. water quality records indicate that there is no record of total coliform or fecal coliform contamination in untreated samples collected over the past three years; no history of turbidity problems associated with the well; and no history of known or suspected outbreaks caused by Giardia or other pathogenic organisms associated with surface water and attributed to the well.

If the above conditions are met, then the well is probably not influenced by surface water.

3. If the source is a spring, does the spring indicate any of the following:

a. a variable discharge; especially one which exhibits increased discharge coinciding closely with snowmelt runoff or periods of precipitation,

b. periods of increased turbidity that; if not measured, are clearly visible as either cloudiness or discoloration; or if measured, approach or exceed the maximum level of 5 NTU,

c. standing or running surface water within 50 feet of the collection devices,

d. located within a broad flood plane, meadow or stream/drainage bottom,

e. water quality records indicate that there has been total coliform or fecal coliform contamination in untreated samples collected over the past three years, or there is a history of known or suspected outbreaks caused by Giardia or other pathogenic organisms associated with surface water and attributed to the spring.

If any of the above conditions exist, then the spring may be influenced by surface water and further tests will be necessary.

Those tests may involve one or more of the following:

1.) Temperature, pH, Conductivity, and turbidity monitoring and recording.

2.) Mircroscopic Analysis (MPA) - Consensus Method for Determining Groundwaters under the direct influence of Surface Water (refers to Sampling Water for Detection of Waterborne Macroorganisms such as Giardia).

3.) Dye Testing

4.) Hydrogeologic investigation by one trained to perform such

I. Source Location

to facilitate: a) computer based geographic information system (GIS) mapping, b) emergency response, c) computer aided determination of contaminating entities and many other GIS uses involving integration of numerous environmental factors, it is necessary to accurately locate each drinking water source. This is done by accurately identifying each source by latitude and longitude.

Essentially all community drinking water sources have already been located by latitude and longitude. This information should be field verified and additional information involving non-community and non transient-non community water system sources should be obtained.

The following procedure should be used to determine the latitude/longitude of sources.

1. Obtain and use a U.S.G.S. quad map to plot sources in the field.

2. Extract the latitude and longitude off the quad map using a georuler.

3. Enter the exacted latitude and longitude data onto the computer data base. Note the extracted latitude/longitude information will appear on the "water source citing, treatment and vulnerability" computer printout if it has been entered. (Report 3.2.04 - Section D - Item 4 above, or Appendix D-3 below).

APPENDIX A

Suggested References

1. National Primary Drinking Water Regulations, Code of Federal Regulations, Part 141, (1986).

2. A Manual for the Evaluation of a State Drinking Water Supply Program, U.S. Environmental Protection Agency, Washington, D.C. (1974).

3. Sanitary Survey Training Student's Text, U.S. Environmental Protection Agency, Washington, D.C. (1983).

4. Manual for Evaluating Public Drinking Water Supplies, U.S. Environmental Protection Agency, Washington, D.C. (1971).

5. Karalekas, P.C., Jr., "Watershed Management and Water Quality", Journal of New England Water Works Association, March, (1977).

6. Reilly, J. Kevin, Steppacher, Lee, et all., "Water Supply: Surface and Groundwater Applicability", Merrimack River Geographic Initiative, U.S.E.P.A., Boston, MA (1986).

7. Woodruff, Lee, "Watershed Control Program", Guidance Document, EPA, Washington, D.C. (1986).

8. Moore, E.W., "Sanitary Analysis of Water", in Preventive Medicine and Public Health, 10th ed., Sartwell P.E., Ed., Appleton-Century Crofts, New York, (1973).

9. Hibler, Dr. Charles P., "Hibler Test For Giardia", C.H. Diagnostic Incorporated, 2012 Derby Courts, Fort Collins, Colorado, 80526.

10. Manual of Water Utility Operations
    Available from: Texas Water Utilities Association
    6521 Burnet Lane
    Austin, TX 78757

11. Water Systems Handbook
    Available from: Water System Council
    221 North LaSalle Street
    Chicago, IL 60601

12. Environmental Engineering and Sanitation
    - by Joseph A. Salvato
    Available from: John Wiley & Sons, Inc.
    Somerset, NJ 08873

13. "How to Conduct a Sanitary Survey" Procedures Manual
    Available from: New Mexico Health and Environmental Department
    Environmental Improvement District
    P.O. Box 968
    Santa Fe, NM 87504-0968

APPENDIX B

Suggested List of Things to Look For

<u>Well and Spring Information</u>

1. Is there a sanitary seal on the well, and is it properly installed?

2. Does the casing extend at least 12" above the floor or 18" above ground?

3. Is the top of the well protected so that foreign matter or surface water cannot enter the well?

4. Is the site protected against flooding?

5. Does the well site and well pump house have proper drainage?

6. Is the well vent properly constructed including a screened end which terminates in a downturned position at least 18" above ground level or above the maximum flood level?

7. If a pitless adapter or well pit is used, are all entry points to the casing tightly sealed?

8. Are the check valves, water meters, and other well system appurtenances maintained and operating properly?

9. If standby power is available, is it in operable condition and well maintained?

10. Is direct surface drainage and contamination diverted around or away from the spring?

11. Is the area around the spring properly fenced?

12. What are the depth and extent of spring collection facilities?

13. Is there adequate soil cover over the spring collection system?

Surface Water Source

1. Is the source subject to industrial, domestic, or other types of pollution?

2. Have the intakes been properly protected from silt buildup?

3. Are there multiple intake locations?

4. Is human activity restricted in the watershed?

5. Is the raw water pumping capacity adequate?

6. If standby or auxiliary power is available, is it operable and well maintained?

7. Are chemicals properly stored and handled?

8. Is chemical feeding adequate to produce a visible and settleable floc?

9. Is jar testing routinely performed to optimize chemical feed?

10. Are the necessary treatment plant report forms properly completed and reported to the State on time?

Vulnerability of Source

1. What is the nature of potential sources of contamination and how far are they located from drinking water source sites?

2. Is the source within a known or potential VOC/SOC contamination area?

3. What physical/geological conditions exist to protect drinking water sources?

4. Is the source drawing from a confined or unconfined aquifer?

5. What is the proximity to stored chemicals, pesticides, industry, mining, septic tank and drain fields, land fills, fuel storage and feed lots.

6. Is there nearby use of possible VOCs and SOCs? If so, how far away?

7. Are intakes properly located, protected and in good working condition?

8. Is the source collection point located in a metropolitan area?

9. Does the water system have adequate control over watershed areas?

10. What is the proximity to drainage areas - can the pattern of drainage be determined?

Source Location

1. Has each source been correctly plotted on U.S.G.S. quad maps?

2. Has all the latitude/longitude information on each source been verified?

3. Has the extraction of the latitude and longitude off the quad map by a georuler been completed?

Surface/Groundwater

1. Is the source subject to contamination as evidenced by past chemical and/or bacteriological history?

2. Is there relatively rapid shifts in water quality parameters such as turbidity, temperature, conductivity and pH?

3. Is the well or spring properly constructed?

4. Is the source susceptible to contamination by surface water via infiltration, underground channeling, lakes, streams, rivers, canals, lagoons, etc.?

Disinfection

1. Is the disinfection equipment being operated and maintained properly?

2. Are critical repair tools and spare parts on hand?

3. If gas chlorination is used, are adequate safety precautions being followed (exhaust fan with intake near floor, gas mask with positive pressure system used, an ammonia leak bottle available, tanks chained to wall or otherwise secured)?

4. If hypochlorite is used, are dilutions being made in a proper manner?

5. Are chlorine residual measurements being made and recorded?

6. Is a free chlorine residual being maintained throughout the water system?

7. Is there sufficient contact time (at least 30 minutes) between the chlorination point and first point of use?

8. Are the necessary report forms being completed and properly reported to the State?

Other Treatment

1. Is chemical storage adequate?

2. Are chemical feeders and pumps in operation, good condition and being properly maintained?

3. Are instrumentation and controls for the process being utilized and in proper working order?

4. Are accurate records being maintained (amount of water treated, amount of chemical usage, etc.)?

5. Are adequate safety devices available and precautions observed (dust mask, safety goggles, gloves, protective clothing)?

Storage

1. Is there adequate storage capacity?

2. Is the storage reservoir properly coated to reduce flaking and corrosion? Is an approved coating material used?

3. Does surface run-off and underground drainage drain away from the storage structure?

4. Are the storage reservoir protected against flooding?

5. Are overflow lines, air vents, and clean out pipes turned downward or covered, screened and terminate a minimum of 18 inches above the ground or storage tank surface?

6. Are the storage reservoirs clean and free from contamination?

7. Is the reservoir structurally sound?

Distribution System

1. Are pressure and flows adequate throughout the system at all times of the year?

2. Are all services metered?

3. Are plans of the water system available and current?

4. Are there multiple pressure zones?

5. Are valves and hydrants routinely exercised?

Management

1. Are personnel adequately trained? For those community systems serving a population above 800, is the responsible charge operator properly certified?

2. Is the emergency plan available and workable?

3. Are supplies and maintenance parts inventories adequate?

4. Are sufficient operation and maintenance records being kept?

5. Are routine maintenance schedules established and adhered to for all components of the water system?

6. Are all facilities and activities free from safety defects?

7. Are the necessary operational reports completed and submitted on time to the State?

Cross Connections

1. Does your system have a Cross Connection Control Program?

2. What are the basic components of your program?

    a. Does your system have an ordinance, bylaw or policy regarding cross connection control in place? If yes, what are the basic requirements?

b. Has your system distributed public awareness information? If yes, what type and how was it distributed? What follow up information do you plan to provide and when?

c. Has the water system personnel been trained in the area of backflow prevention and cross connection control?

d. Where are your records for the program stored?

What do your records consist of (assembly test reports, assembly location forms, copies of public awareness information, copies of written notice given for dual check installation if required)?

How is the system tracking and ensuring that the required annual test of backflow assemblies is completed?

e. How is the program being enforced?

What type of protection strategy is the water system using containment or isolation?

Is the enforcement procedure outlined within the ordinance, policy or bylaw?

Are the procedures clearly understood by all water system personnel?

3. Has the water system been separated into areas of high and low hazards?

Have hazard assessments been performed on all high hazard connections?

Has the appropriate protection been installed?

A written narrative of the system's cross connection control program must be included in the sanitary survey. The narrative must include a complete discussion of the issues outlined above.

APPENDIX C

Guidance For the Preparation of

SAMPLING SITE PLAN

On June 29, 1989, the Environmental Protection Agency finalized the Total Coliform Rule (TCR) under the Safe Drinking Water Act. The TCR applies to all public water systems (PWS) and becomes effective on January 1, 1990. Under the TCR, all routine bacteriological samples must be collected according to a written sample site plan. The intent of the plan is to assure that all required routine samples are collected at sites which are representative of the entire water distribution system.

The following criteria have been established to assist PWSs in developing a sampling site plan. By January 1, 1991, each community and applicable non-community PWS must have a written plan on file and are required to sample according to the sample sites identified.

Sampling Site Plans - content and use

Sampling site plans should consist of:

- A map of the water distribution system showing the location of each sampling site.
- A complete description of each sampling site (i.e., address and specific sampling point).

Beginning January 1, 1991

- All required routine bacteriological samples must be collected from the sites identified in the approved plan.
- Required routine samples cannot be collected from the same site more than once during the month unless all remaining sites have already been sampled.

Number of Sampling Sites

The number of sampling sites is recommended, based on the population served as shown below:

Population	Minimum Number of Sampling Sites
1000	5
1001-2500	8
2501-3300	10
3301-4100	12
4101-6700	15
6701-21500	20
21501-59000	30
59001-70000	40
70001	50

This chart indicates the minimum number of sample sites recommended. You may designate more if desired. Sample sites should be rotated on a regular basis.

Systems using groundwater as the sole source of their water supply and serving less than 4901 people may take all samples in one day. Other systems should indicate a time table during a month when samples will be taken.

Location of Sampling Sites

Criteria to use when choosing sampling sites are as follows:

1. Accessible at reasonable times of the day for sampling
2. Available during the entire year
3. Located throughout the entire distribution system
4. Not the last service site on a dead end line
5. Has a tap suitable for sampling; preferably a single cold water non-swivel and non-aerated tap.

- Sampling must be possible from a tap within five service connections upstream and downstream of each sampling site (to meet the repeat sampling requirements).

- Sampling sites cannot be located any closer than two service connections upstream of dead ends in the water distribution system.

- Small systems with few service connections may need to appropriately adjust the location of repeat samples.

<u>Selection of Sampling Taps</u>

- The plumbing should be inspected to assure that no cross-connections exist with nonpotable water sources.

- The sampling tap must be free of any aerator, strainer, hose, or water treatment devices

- Outside sampling taps should be avoided.

Each plan will be reviewed when a site visit, sanitary survey, or construction inspection is made. Sampling site plans should be reviewed each year by the public water system to insure that the plan is current.

APPENDIX D

REPORT OF SURVEY

Utah Department of Environmental Quality
Division of Drinking Water

LOGAN CITY WATER SYSTEM

On Thursday, June 17, 1993, a sanitary survey of the Logan City Water System was conducted by Dennis Corbridge, operator of the Logan City Water System along with Grant Koford and Leonna Lundstrom of the Bear River District Health Department and David F. Hansen of the Division of Drinking Water. The following report describes the physical features of the system and offers conclusions and recommendations regarding deficiencies noted during the survey.

General Description

The Logan City Water System serves about 30,000 people through approximately 11,500 connections. Residents receive their water from four well sources, a spring source, three booster stations, and six storage reservoirs with a total capacity of 7,500,000 gallons. The spring source is the only source that is chlorinated.

Sources

Dewitt Spring:

The Dewitt Spring area is located approximately five to six miles east of Logan in Logan Canyon. It consists of a very large concrete junction with feeder tile extending into the spring collection area. In the collection area three boxes gather surface water and distribute into the overflow area of the spring. The spring area sits at the base of Logan Canyon, water collects into the feeder tiles and then into the junction box which was properly gasketed and locked. It is then properly chlorinated. The spring area is properly fenced with a chain link fence and secured with a locked gate. The fenced spring area is approximately 3 1/2 acres and well drained. It has been raised by fill dirt which protects it to some extent from flooding by the Logan River. The immediate area around the spring has be landscaped, and planted with grasses.

Well No. 1:

Well # 1 is located on Canyon Road and Crockett Avenue. It is 12 inches in diameter approximately 990 feet deep with the top of the bowls located at 210 feet. It is equipped with a 700 Hp Johnston vertical turbine pump with a I.D. Electric motor capable of delivering 4,600 gpm. Each well house is constructed of concrete block and is properly equipped with a sampling tap, check valve, pressure gauge, flow meter and air relief valve although not properly screened. There is a bypass line from the wells to an adjacent canals. The buildings was properly heated, lighted, vented, and properly locked during the time of the inspection.

Well No. 2:

This well is located on 2nd East and Center Street. It is 10 inches in diameter approximately 1,000 feet deep with the top of the bowls set at 200 feet. It is equipped with a Fairbanks Moorse 200 Hp pump with a Fairbanks Moorse 400 booster pump capable of delivering 3,800 gpm when in operation.

Well No. 3:

Well # 3 is located on 6th East and 7th North. It is 12 inches in diameter approximately 1,000 feet deep with the top of the bowls set at 170 feet. It is equipped with a Johnston pump with a U.S. Electric 200 Hp motor capable of delivering 3,400 gpm.

Willow Park Well:

This well is located on the west side of Willow Park next to the canal. It is 12 inches in diameter approximately 990 feet deep with the top of the bowls set at 220 feet. It is equipped with a Johnston pump with and U.S. 500 Hp motor capable of delivering 3,600 gpm. This well was used only once during the last eight years.

Booster Stations

Golf Course Booster Station:

This pumping station is well constructed from concrete, and has two 75 Hp motors with four Auora pumps which alternate depending on the load. The pump station serves the bench area north and east of Utah State University.

Cliff Side Drive Pump Station:

There are two Cliff side booster stations with station # 1 being the older of the two and is currently used as a standby station. The standby station or Cliff side # 1 has two 60 Hp marathon motors. Cliff side # 2 is equipped with two U.S. Electric 125 Hp motors which are sensor probed two the Cliff side 1,000,000 gallon reservoir which kicks the booster on at 7.5 and turns off at 14.5 .

Storage

Golf Course Reservoirs:

Logan City has 5 different reservoirs located on the hillside next to the golf course. Two of these tanks are rectangular in shape concrete and buried. The one nearest the golf course booster station is 1,000,000 gallons and the other has 2,000,000 gallons in storage. The other two reservoirs are circular concrete buried tanks. Each of these tanks have a storage capacity of a 1,000,000 gallons. In addition Logan City has contracted with Utah State University and is using a 1,000,000 gallon reservoir. They were all properly locked and screened.

Cliff Side Reservoir:

The cliff side reservoir is the newest of Logan City reservoirs and has a 1,000,000 gallons storage capacity.

Castle Hills Reservoir:

The castle hills reservoir is a 500,000 gallon concrete circular reservoir, about a mile north of the college reservoir.

Chlorination Facilities

The new chlorination facility for the Logan City water system is housed in a building located just north of Dewitt Springs. The vacuum operated chlorinator is operated by dual alternating 1 1/2 H p Lesson motors powering Jaczzi booster pumps located in an adjacent underground vault. The chlorinator is a Wallace and Tiernan V-notch chlorinator. The chlorinator was set a 53 pounds per day. Water flow is measured through a transducer and indicated the spring water is being chlorinated at the rate of 0.3 ppm. The building was state of the art with chlorine leak detectors, digital scales etc. The chlorination building had separating rooms for the cylinders and the digital read outs for chlorine and flow. There were no gas maks but we were told at the time of inspection they were on order. The only thing noticeable wrong was that the chlorine vent tube should be screened.

Distribution System

The City of Logan serves approximately 30,000 people through 11,500 connections. There are approximately 610 fire hydrants. The distribution system is made up of 8, 6, and 4 pvc, steel and asbestos line. Logan's water works is connected to a telemetry system which maintains pressure, activates wells, points out terrible spots, maintains reservoir levels and records the day to day operation of the system. Even with the heavy loads during the last few years water pressure seems to adequate in all areas of the City.

Waiver Assessment

Although the well sources are deep in nature, properly grouted and equipped with a sanitary seal Use Waivers cannot be granted because of the close proximity of the homes, parks, canals etc.. The Dewitt Spring, however, due to its remote location does qualify for a Use Waiver. Source protection plans must be developed for these sources.

Sampling Site Plan

Logan City currently has a bacteriological and Lead/Copper site plan in place.

Cross Connection

Logan City cross connection program consists of dual checks at the meter and required annual testing of double checks and RP devices.

Source Location

The latitude and longitude of each source has previously been determined by the Division of Drinking Water.

Recommendations and Conclusions

1. Remove the deep rooted vegetation in and around the spring area.

2. Screen all reservoirs and tank overflow pipes with non-corrodible, # 4 mesh screen.

3. The new chlorination building apparently was developed without review and approval of plans and specifications for its construction. As-built plans must be submitted to this office for review and approval. Therefore, you must provide as-built plans and the documentation outlined in R309-106-5 of the Utah Public Drinking Water Rules.

4 All the wells air relief valves were not properly screened with a No. 14 non-corrodible mesh screen.

5. The chlorine vent tube must be screened with a No. 1 non-corrodible mesh screen.

6. Once the gas masks arrive they should be mounted in a properly area for convenient access.

UTAH DIVISION O DRINKING WATER

PUBLIC WATER SUPPLY INFORMATION SYSTEM

02/28/94

Water System Number: 03010

Name:	LOGAN CITY WATER SYSTEM	Rating:	APPROVED	Population:	26,871
Owner:	LOGAN CITY CORP	Rating Assigned:	09/21/63	Residential Conn.:	4,800
Address:	P. O. BOX 527	Inventory Reviewed:	02/01/94	Other Connections:	40
	LOGAN, UT 84321	Inventoried By:	SCANLAN	Total No. Connections:	7,174
Area:	LOGAN	Last Surveyed:	07/17/93	Type Other Conn:	COMMERCIAL
County:	CACHE	Surveyed By:	HANSEN	Outside Use Permitted:	YES
Type:	COMMUNITY-POLITICAL SUBDIV	Last Plan Appr.:	04/20/87	Calc Peak Demand (GPD):	7,680,000
Mangr.:	ROBERT LAURSEN	System Engineer:	R HUGIE	GPD/1440 * Demand (GPM):	5,333
Phone:	750-9936	Begin Operation:	01/01	Peak Hourly Demand:	9,600
Oper.:	STEVE LINEBACK	End Operation:	12/31		
Phone:	750-9956				

-BACTERIOLOGIC QUALITY-		- - - - -STORAGE- - - - -		- - - TREATMENT- - - -		- - - - - DISTRIBUTION - - - - -	
Samples Req/Month:	30	Number of Units:	5	Type:	CHLORINATION	Pump/Gravity:	BOTH
Month Insuf. Sampls:	0	Material:	CONCRETE	Plant:		Fire Hydrants:	YES
Month Unsat Result:	0	Capacity:	4,000,000	Capacity (MGD):	.00	Pressure Adeq.:	YES
Record Satis.:	YES	Adequate:	YES	Installed:	19	PCT Metered:	100
12 Mos End.:	09/30/93					Master Meter:	NO

* No.	Source Type	Source Name	- - Well - - Type	Dia	Yield (GPM)	Adeq. Prot.	Type of Treatment	SOURCE LOCATION -Latitude - Deg Min Sec	-Longitude- Deg Min Sec
01	SPRING	DEWITT			7,800	YES	CHLORINATION	41 45 31.0	111 49 26.0
02	WELL	CROCKETT AVE#1	DEEP		5,400		NONE	41 44 18.5	111 48 44.0
03	WELL	200 EAST CENTER			3,800		NONE	41 43 54.0	111 49 40.0
04	WELL	700 N 600 E			3,400		NONE	41 44 42.5	111 49 08.0
*N05	WELL	WILLOW PARK	DEEP	20	4,000	YES	NONE	41 43 11.0	111 50 55.0
*N06	WELL	1000 N 300 EAST		18	4,500		NONE	41 44 59.5	111 49 35.5

"*N" MEANS THIS SOURCE IS CURRENTLY NOT USED

UTAH DIVISIO.. O DRINKING WATER

02/28/94

WATER SYSTEM NUMBER: 03010
WATER SYSTEM NAME: LOGAN CITY WATER SYSTEM
SOURCE NUMBER: 02
SOURCE NAME: CROCKETT AVE#1

- - SOURCE INFORMATION - -
SOURCE TYPE: WELL
SOURCE CAPACITY: 5,400 GPM
LATITUDE: 41* 44' 18.5"
LONGITUDE: 111* 48' 44.0"
TYPE OF TREATMENT: NONE
PERIOD OF OPERATION: JAN 01 TO DEC 31
USE: IN USE

SOURCE MONITORING

CHEMICAL GROUP	DATE LAST SAMPLED	DATE NEXT SAMPLE DUE	SAMPLING FREQ. THEREAFTER	WAIVER ISSUED:	VIOLATION INFORMATION
INORGANIC & METALS:	06/18/92	06/18/95	EVERY 3 YEARS		
NITRATE:	06/18/92	06/18/93	EVERY YEAR		
NITRITE:	06/18/92	06/18/93	EVERY YEAR		
V O C 's:	07/03/90	07/03/93	EVERY 6 YEARS	USE WAIVER	
PESTICIDES:			NOT REQUIRED	USE WAIVER	
RADIONUCLIDES:	12/17/90	12/17/94	EVERY 4 YEARS		
UNREGULATED ORGANIC:	07/03/90		NOT REQUIRED	USE WAIVER	

NOTE: It is the water utilities responsibility to forward results of analysis to the State. Some laboratories do not automatically forward results to the State, therefore, please specifically instruct the laboratory to forward the results to the state, or forward the results yourself. All results of analysis should be sent to:

The Compliance Section
Utah Division of Drinking Water
P O Box 144830
Salt Lake City Utah 84114-4830
PHONE: (801) 538-6159

U T A H D I V I S I O N O D R I N K I N G W A T E R

02/28/94

WATER SYSTEM NUMBER: 03010
WATER SYSTEM NAME: LOGAN CITY WATER SYSTEM
SOURCE NUMBER: 03
SOURCE NAME: 200 EAST CENTER

- - SOURCE INFORMATION - -
SOURCE TYPE: WELL
SOURCE CAPACITY: 3,800 GPM
LATITUDE: 41* 43' 54.0"
LONGITUDE: 111* 49' 40.0"
TYPE OF TREATMENT: NONE
PERIOD OF OPERATION: MAY 01 TO SEP 30
USE: IN USE

S O U R C E M O N I T O R I N G

CHEMICAL GROUP	DATE LAST SAMPLED	DATE NEXT SAMPLE DUE	SAMPLING FREQ. THEREAFTER	WAIVER ISSUED:	VIOLATION INFORMATION
INORGANIC & METALS:	06/18/92	06/18/95	EVERY 3 YEARS		
NITRATE:	06/18/92	06/18/93	EVERY YEAR		
NITRITE:	06/18/92	06/18/93	EVERY YEAR		
V O C 's:	07/03/90	07/03/93	EVERY YEAR		
PESTICIDES:		07/03/93	QUARTERLY		
RADIONUCLIDES:	12/17/90	12/17/94	EVERY 4 YEARS		
UNREGULATED ORGANIC:	07/03/90	03/31/93	QUARTERLY		

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U T A H   D I V I S I O   O   D R I N K I N G   W A T E R

02/28/94

DRINKING WATER SAMPLING REQUIREMENTS FOR: LOGAN CITY WATER SYSTEM

WATER SYSTEM NUMBER: 03010

WATER SYSTEM NAME: LOGAN CITY WATER SYSTEM
WATER SYSTEM MANAGER: ROBERT LAURSEN
ADDRESS: P. O. BOX 527
CITY, STATE: LOGAN, UT 84321
PHONE: 750-9936
POPULATION: 26,871
TYPE OF SYSTEM: COMMUNITY-POLITICAL SUBDIV

D I S T R I B U T I O N   S Y S T E M   M O N I T O R I N G

BACTERIOLOGIC MONITORING: 30 SAMPLES PER MONTH FOR THE ENTIRE YEAR

If a bacteriologic sample is unsatisfactory, you must collect at least 3 "REPEAT" samples. One of the "REPEAT" samples must be collected at the same location as the original unsatisfactory sample. The second and third "REPEAT" samples must be collected within five service connections on both sides of the original unsatisfactory sample site.

LEAD & COPPER MONITORING: 30 SAMPLES ANNUALLY

All samples must be "FIRST DRAW" from either kitchen or bathroom taps. "FIRST DRAW" means the water has not been used in the building for at least 6 hours prior to sample collection. Be sure to record the results of analysis on forms provided by the Division of Drinking Water, following the instructions on the back of the forms (the forms are colored grey for lead and yellow for copper).

TOTAL TRIHALOMETHANE: FOUR SAMPLES MUST BE TAKEN FOR EACH CHLORINATED SOURCE AT AREAS IN THE DISTRIBUTION SYSTEM FURTHEST FROM THE CHLORINATION FACILITY AND AT LOCATIONS WHERE A CHLORINATION RESIDUAL OF AT LEAST 0.2 mg/l IS MEASURED

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Utah Division of Drinking Water
P O Box 144830
Salt Lake City Utah 84114-4830
PHONE: (801) 538-6159

UTAH DIVISION OF DRINKING WATER

02/28/94

WATER SYSTEM NUMBER: 03010
WATER SYSTEM NAME: LOGAN CITY WATER SYSTEM
SOURCE NUMBER: 01
SOURCE NAME: DEWITT

- - SOURCE INFORMATION - -
SOURCE TYPE: SPRING
SOURCE CAPACITY: 7,800 GPM
LATITUDE: 41* 45' 31.0"
LONGITUDE: 111* 49' 26.0"
TYPE OF TREATMENT: CHLORINATION
PERIOD OF OPERATION: JAN 01 TO DEC 31
USE: IN USE

SOURCE MONITORING

CHEMICAL GROUP	DATE LAST SAMPLED	DATE NEXT SAMPLE DUE	SAMPLING FREQ. THEREAFTER	WAIVER ISSUED:	VIOLATION INFORMATION
INORGANIC & METALS:	06/18/92	06/18/95	EVERY 3 YEARS		
NITRATE:	06/18/92	06/18/93	EVERY YEAR		
NITRITE:	06/18/92	06/18/93	EVERY YEAR		
V O C 's:	07/03/90	07/03/93	EVERY 6 YEARS	USE WAIVER	
PESTICIDES:			NOT REQUIRED	USE WAIVER.	
RADIONUCLIDES:	12/17/90	12/17/94	EVERY 4 YEARS		
UNREGULATED ORGANIC:	07/03/90		NOT REQUIRED	USE WAIVER	

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PENNSYLVANIA

- **Reference Guide for Inspecting Public Water Systems**

REFERENCE GUIDE FOR INSPECTING PUBLIC WATER SYSTEMS

OCTOBER 1993

Prepared By
Division of Drinking Water Management
Bureau of Water Supply and Community Health
Pennsylvania Department of Environmental Resources

Reference Guide For Inspecting
Public Water Systems

TABLE OF CONTENTS

FOREWARD

This reference guide was developed for the purpose of assisting Safe Drinking Water Program staff in the Pennsylvania Department of Environmental Resources. With the increasing complexity of federal regulations and the varieties of treatment needed for compliance, a guide was necessary to ensure consistent, detailed assessment of source, treatment and distribution facilities. While no reference guide contains all components of a public water system, this guide includes some of the most common inquiries into physical conditions, operation, maintenance and administration. While using the guide, the facility inspector needs to keep two questions in mind:

1) Is the problem (or potential problem) resulting in a <u>real</u> impact on the performance of the water system, and thus compromising public health protection?

2) Is the problem a violation of the Pennsylvania Safe Drinking Water Regulations (which would again entail public health protection)?

Every public water system will have <u>some</u> problems that, in an ideal world, should be corrected. However, in recognition of time constraints and limited resources of the water system and the facility inspector, those problems resulting in a "YES" to either of these questions will increase the priority schedule for correction. Nevertheless, it is anticipated that priorities will shift due to new or modified regulations and changing time constraints, thus initiating frequent revisions of this reference guide.

Reference Guide for Inspecting Public Water Systems

A. Source Water and Facilities

1. *Watershed Characteristics*

   Are all of the following items (a - f) documented in records, and do any of them adversely impact water quality or quantity of the source water?

   a. Area of watershed or recharge area

   b. Stream flow

   c. Land uses (e.g. forested, agriculture, rural housing, recreation, commercial, industrial, etc.)

   d. Degree of public access to the watershed or recharge area

   e. Terrain, soil type, and geology

   f. Types of vegetation and extent of cover

2. *Contamination and Adverse Activities*

   Do any of the following items (a - q) in the watershed or recharge area adversely impact (actual and potential) water quality or quantity of the source water?

   a. Point discharges of sewage, stormwater or other wastewater

   b. Single and multiple family sewage disposal systems

   c. Recreation (swimming, boating, fishing, hunting, etc.)

   d. Human habitation

   e. Pesticide/herbicide/fertilizer application

   f. Logging

   g. Commercial, industrial or manufacturing activity

   h. Solid waste or other disposal facilities, including landfills, hazardous waste, waste tailings, etc.

   i. Materials storage, transport or transfer, including hazardous materials storage, road salt stockpiles, road/rail/barge transport with spill potential, transfer stations, manure pits, etc.

j. Above and below ground storage tanks and pipelines

k. Mining operations and discharges

l. Injection and productions wells (oil, gas, water, etc.)

m. Livestock and other concentrated domestic animal activity

n. Agricultural activities such as grazing, tillage (erosion), concentrated manure areas, chemical applications, etc.

o. Turbidity fluctuations from precipitation

p. Inorganic contaminants from parent materials (e.g. asbestos fibers)

q. Algae blooms

3. ***Watershed Management and Source Protection***

a. Surface <u>and</u> Ground Water

1) If the public water system does not own the entire watershed or recharge area, have written agreements beer made with other land owners to satisfactorily control the land uses?

2) Is the public water system making efforts to obtain as complete ownership of the watershed or recharge area as possible? Is effort directed to control critical adverse impacts on the source?

3) Where access is limited, is the watershed or recharge area regularly inspected for new potential and actual sources of contamination?

4) Does the water system employ adequately qualified personnel to identify watershed and water quality problems? Who is given responsibility to correct these problems?

5) Are raw water quality records kept to assess trends and to assess the impact of different activities and contaminant control techniques in the watershed or recharge area?

6) Has the water system responded adequately to concerns expressed about the source or watershed/recharge area in past inspections and sanitary surveys?

7) Has the water system identified problems in its yearly watershed control reports, and if so, what progress has been made in solving these problems?

8) Does the water system actively interact with other

agencies that have control or jurisdiction in the watershed or recharge area? Are their policies or activities consistent with the water system's goal of maintaining high raw water quality?

9) Does the water system actively initiate corrective measures to improve raw water quality (e.g. copper sulfate treatment to control aquatic growth, vegetation control around reservoir shorelines, etc.)?

b. Ground Water

1) In addition to the above management practices and protective measures (items 1 - 9), has the water system formally delineated a wellhead protection area for each well? Is it being implemented?

2) Is a protective radius of 100 feet established around each well? How is it controlled?

3) Are any contaminant sources within a zone of 100 feet?

4) Is the source protected from rapid shifts in water quality characteristics during heavy precipitation events? Is infiltration occurring from a nearby surface source?

5) Do any man-made features (e.g. abandoned wells, roadcuts, etc.) within 200 feet of the source expose the aquifer to direct surface water infiltration? Does the topography, or depth of weathering, within 200 feet expose the source?

6) Is the well located in a carbonate aquifer and does it have a static water level of 50 feet or less? If in an unconfined aquifer, does the well have a static water level of 100 feet or less? If in a confined aquifer, does it have a static water level of 50 feet or less?

7) During a pump test, is the well's recharge boundary within 200 feet of a surface water body?

4. *Source Construction*

a. Surface Intakes

1) Is the source adequate in quantity?

2) Is the best quality source, or location of the source, in use?

3) Is the intake protected from icing problems?

4) Can intake levels be varied to obtain the best water quality?

5) Is the intake screened to prevent entry of debris, and are the screens maintained?

6) Is animal activity controlled within the immediate vicinity of the intake?

7) Is a raw water tap available for routine monitoring?

b. Wells

1) Is the source adequate in quantity?

2) Is the well properly cased and grouted? Is the casing capped and locked?

3) Is a well construction diagram available?

4) Is a raw water tap available for routine monitoring?

c. Springs, Infiltration Galleries, and Collectors

1) Is the source adequate in quantity?

2) Is the immediate source area adequately protected (fencing and locks), and is the area within 200 feet controlled?

3) Is the best construction used to capture the flow?

4) Are drains available to divert surface water from the vicinity of the source?

5) Is the collection structure of sound construction with no leaks or cracks?

6) Are the vents, overflow, and drain pipes screened?

7) Is the supply intake located above the floor and screened?

8) Is a raw water tap available for routine monitoring?

5. *Source Equipment*

a. Are all intake pumps, booster pumps, and other pumps of sufficient capacity?

b. Does the design of the intake structure result in excessive clogging of screens, a buildup of silt, or passage of solids that damages downstream processes?

c. Are all pumps and controls operational and maintained properly?

d. Does the existence of high volume constant speed pumps cause undesirable hydraulic loadings on downstream unit processes?

e. Are check valves, blow-off valves, master meters, and other appurtenances operated and maintained properly?

f. Is emergency power backup with automatic start-up provided and is it checked regularly to ensure good working order?

g. Are underground compartments and suction wells waterproof?

h. Is the interior and exterior of the pumphouse in good structural condition and properly maintained?

i. Are there any safety hazards (electrical or mechanical) in the pumphouse?

j. Is the pumphouse locked and otherwise protected against vandalism?

k. Are water production records maintained at the pumphouse?

l. SOURCE EQUIPMENT MAINTENANCE PROGRAM (refer to Maintenance, Section E)

6. ***Sampling, Monitoring and Records***

(refer to Sampling, Monitoring and Records under Treatment, Section B)

B. Treatment

1. *Overall Facilities*

a. Does the excessive age or poor physical condition of facilities adversely affect water quality delivered to consumers?

b. Is hourly production within the design flow capacity of the treatment facilities?

c. Do one or more of the following raw water quality characteristics (items 1 - 3) exceed what the facilities were designed for, or exceed what is thought to be tolerable, and degrade process performance?

1) THM Precursors

2) Turbidity

3) Seasonal Variation

Do seasonal variations such as change in temperature or high turbidity during spring runoff exist?

d. FACILITY MAINTENANCE PROGRAM (refer to Maintenance, Section

2. *Presedimentation Basin*

Does a deficient design cause poor sedimentation that results in poor plant performance (e.g. inlet configuration, size, type, or depth of the basin; or placement or length of the weirs)?

3. *Chemical Pretreatment*

a. Are the appropriate type and amount of chemicals added?

b. How does the operator determine proper chemical doses (e.g. jar tests, process monitoring results, streaming current monitor or zeta meter, visual observation of floc, historical performance data, etc.)?

c. Are pH levels properly maintained after the coagulant is added (e.g. pH at 6.7 to 7.2 after alum addition or pH at 7.0 to 8.8 after ferric chloride/sulfate addition)?

d. Are sufficient alkalinity levels maintained after the coagulant is added (generally greater than 20 mg/l)?

e. Do chemical feed facilities have various feed points to optimize treatment (e.g. feed coagulants and cationic polymers at rapid mix, feed non-ionic *or anionic polymers at* points where mixing is gentle)?

f. Do facilities exist to feed the types of chemicals required to produce a high quality stable finished water (e.g. coagulant aids, flocculant aids, filter aids, stabilization chemicals)?

g. Do chemical feed facilities provide adjustable feed ranges that are easily set for operation at all required dosages?

h. Do chemical feed controls remain set once adjusted or do they vary?

i. Are chemical feed rates easily measured, and are chemical feed facilities calibrated at least once every six months?

4. ***Rapid Mix***

Does a lack of mixing or inadequate mixing result in excessive chemical use or insufficient coagulation to the extent that it impacts plant performance?

5. ***Flocculation***

a. Does the performance of the flocculation unit process contribute to problems in downstream unit processes and eventually degrade plant performance?

b. Does a lack of flocculation time or flocculation stages with variable energy input result in poor floc formation and degrade plant performance?

c. Is a floc formed and does it settle at an appropriate location?

6. ***Sedimentation***

a. Does a deficient design cause poor sedimentation that results in poor filter performance (e.g. inlet configuration, size, type, or depth of the basin; or placement or length of the weirs)?

b. Do design problems or other problems (e.g. high flow rates) lead to short-circuiting?

c. Is sludge removed often enough to prevent short-circuiting?

d. Does the type or capacity of sludge disposal and treatment processes cause process operation problems that degrade plant performance? Are sludge facilities of sufficient size and type to ensure that poor plant performance does not occur, or that applicable permits regulating the discharge are not violated?

7. *Filtration*

a. Does excessive filter run time between backwashes lead to a degradation in filter effluent quality?

b. What criteria (e.g. headloss, time or turbidity, or all three) is used to determine when to backwash a filter?

c. Is the backwash time long enough and backwash rate (usually 15 gpm/sq ft) high enough to adequately clean the media? Are mudballs and mud accumulation apparent?

d. Is the backwash even throughout the filter bed (e.g. no media boils or dead spots)?

e. Are the surface wash and backwash facilities adequate to maintain a clean filter bed?

f. How severe are post-backwash turbidity spikes? Does the lack of filter-to-waste (rewash) facilities, or lack of use, result in high on-line turbidity spikes?

g. How quickly does the filter effluent return to the pre-backwash turbidity levels?

h. Does the size of filter, or the type, depth and effective size of filter media hinder its ability to adequately treat water?

i. Have the underdrains or support gravels been damaged or disturbed to the extent that filter performance is compromised?

j. Does the lack of functional filter appurtenances (e.g. headloss gauges, rate-of-flow controllers, etc.) result in degraded filter effluent quality?

k. Are the backwash waste facilities and disposal area of sufficient size and type to ensure that poor plant performance does not occur, or that applicable permits regulating the discharge are not violated?

8. *Disinfection*

a. Is the disinfection equipment appropriate for the application (e.g. correct equipment for chloramines, liquid or gas chlorine, ozone, chlorine dioxide)?

b. Are back-up units available in case of failure, and are they operational?

c. Is auxiliary power available with automatic start-up in case of power outage? Is it tested and operated on a regular basis, both with and without load?

d. Is an adequate quantity of disinfectant on hand and is it properly stored?

e. In the case of hypochlorinators, does an excessive amount of scale buildup on feeder valves result in a failure to properly feed the solution?

f. In the case of gaseous chlorine, is automatic switch-over equipment available when cylinders expire?

g. Are scales available and operational?

h. Are chlorine cylinders properly labeled and chained?

i. Are critical spare parts on hand to repair disinfection equipment?

j. Is disinfectant feed proportional to the water flow?

k. Are daily records kept of disinfectant residual near the first customer from which to calculate CT values?

l. Are production records maintained to determine CT values?

m. Are year-round CTs acceptable based on the level of treatment provided?

n. Does prechlorination cause excessive finished water disinfection by-products?

o. Is the proper disinfectant residual maintained at the entry point and in the distribution system, and are records kept of daily or continuous measurements?

p. Is the system in compliance with all disinfectant and disinfectant by-products monitoring requirements?

q. If gas chlorine is used, are the following safety precautions (items 1 - 5) being followed to ensure the safety of both the public and employees in the event of a chlorine leak?

   1) Is the exhaust fan operational, and is an intake locatec within six inches of the floor?

   2) Is a self-contained breathing apparatus available, and is it regularly tested?

   3) Is regular safety training provided to employees?

   4) Are automatic chlorine leak detectors available, or ammonia bottles?

   5) Are windows provided to view the chlorine room's interior?

9. *Fluoridation*

a. Are the minimum and maximum fluoride doses based on the proper annual average of the maximum daily air temperatures

b. Do excessive natural fluoride levels in the raw water lead to high finished water fluoride levels?

c. Does the lack of chemical feeder calibration, lack of flow-paced feed, or lack of a means to check feeder output lead to improper fluoride doses?

d. Does the lack of continuous monitoring equipment and alarms result in excessive finished water fluoride levels?

e. Do improper sodium fluoride bed depths (i.e. typically 6 to 10 inches is proper) in the saturator cause improper treatment?

f. Does excessive hardness (i.e. over 75 mg/l) of the dilution water result in scaling in the equipment and feed lines?

g. Does the lack of routine cleaning and maintenance result in equipment failure?

h. Is the system in compliance with all fluoride monitoring requirements?

i. Is safety equipment available, including goggles or face shield, gloves, apron, respirator, eye wash station, safety shower, exhaust fan/dust collector?

10. *Phosphate Treatment*

a. In the case of sequestration, do iron and manganese levels (i.e. more than 0.1 mg/l and 0.3 mg/l, respectively) limit the phosphate's ability to adequately sequester these metals

b. For sequestration, is chlorine added <u>after</u> (downstream of) the addition of the phosphate?

c. Are phosphate solutions used within 48 hours?

d. Is enough free chlorine (i.e. 0.2 mg/l) maintained throughout the distribution system to prevent growth of iron bacteria?

e. Does the phosphate treatment result in phosphorous levels that lead to excessive bacterial growths in the distribution system?

f. Do phosphorous levels cause the wastewater treatment plant to violate the discharge limit?

11. *Ion Exchange*

a. Synthetic Zeolites

1) Does the source water contain any dissolved oxygen that can foul the resins with insoluble iron, rust or manganese dioxide?

2) Does infrequent regeneration with brine solution lead to occasional breakthrough of contaminants?

3) Do high concentrations of raw water contaminants prevent full removal by regeneration?

4) Do high raw water concentrations of hardness (e.g. over 350 mg/l) or total dissolved solids (e.g. over 500 mg/l) lead to excessive leakage into the finished water?

5) Is the backwash of sufficient duration and flow to adequately expand media (e.g. 75 to 100%) for solids and contaminant removal?

6) Do inadequate brine concentrations (e.g. less than 10% sodium chloride solution) lead to excessively long contact times for successful regeneration? Do high brine concentrations (e.g. 15 to 26%) result in osmotic shock on the ion exchange resin?

7) Do inadequate rinse cycles lead to noticeable salty tastes when the unit is returned to service?

8) Does the overall ion exchange process lead to excessive levels of sodium in the finished water?

9) Is the brine solution disposed of in an approved manner?

b. Greensand Zeolite

1) Do the source water contaminant concentrations limit the efficiency of the greensand filters?

2) Do upstream processes (i.e. reaction basins) provide sufficient detention time for chemicals to react?

3) Does infrequent filter media regeneration with potassium permanganate lead to iron and manganese breakthrough?

4) Does the lack of process control testing (i.e. jar tests) result in incorrect doses of chlorine, potassium permanganate, alkalis, etc.?

12. *Aeration*

a. Dispersers, Cascade

1) Are the source water contaminant concentrations too high for aeration to work properly?

2) Does the lack of alkali addition (i.e. lime, sodium hydroxide, etc.) result in a reaction time that is too slow for oxidation to occur?

3) Are flow rates too high to allow enough time for oxidation reactions to occur?

4) Do insufficient disinfectant levels lead to excessive slime growths?

5) Do problems with freezing prevent the year-round practice of aeration?

6) Does the lack of covered units or unscreened vents lead to contamination from rain, stormwater runoff, rodents and insects? Are air gaps present to prevent backflow?

b. Counter-Current (Packed) Towers

13. *Reverse Osmosis (Membrane Filtration)*

a. Does improper feedwater quality adversely affect the reverse osmosis system and its accessory equipment?

1) Are excessive turbidity levels and suspended solids concentrations removed with cartridge filters?

2) Are pH values adjusted to proper ranges?

3) Are precipitating compounds (e.g. calcium carbonate, calcium sulfate, etc.) sequestered with sodium hexametaphosphate to prevent scaling or fouling of the membrane?

4) If necessary, is the proper chlorine dose used to prevent excessive biological fouling?

b. Are differential pressures across the unit routinely checked to prevent possible damage to the reverse osmosis modules? Are pressures within the manufacturer's acceptable limits?

c. Does inadequate cleaning frequency, or improper use of cleaning solutions, hinder the performance of the membrane?

d. Do malfunctioning automatic controls and shutdown alarms lead to unacceptable operating conditions?

e. Is the reject stream disposed of in an approved manner?

14. *Sampling, Monitoring and Records*

a. Does the operator frequently measure and record the appropriate water quality parameters throughout the source, treatment, and distribution processes to determine and/or verify proper chemical treatment?

b. Is the operator performing the necessary testing for all water quality parameters?

c. Are samples collected as close to the sample sources as possible to prevent contamination from sample lines?

d. Are sample taps opened slowly and thoroughly flushed to prevent dislodged scale and other material from contaminating the sample?

e. Are samples preserved/fixed with the proper chemicals? Are analysis for metals completed within 48 hours, or otherwise acidified to a pH level of 2?

f. Does the absence or wrong type of process control testing cause improper operational control decisions to be made?

g. Does the operator correctly interpret and apply the monitoring results?

h. Are monitoring tests truly representative of performance?

i. Is the analytical equipment adequate and are the instruments properly and regularly calibrated? Is the shelf life of reagents expired?

j. Is the system in compliance with all treatment techniques and monitoring requirements for the source, treatment, and distribution processes?

k. Are records of water test results and water quality compliance results maintained?

15. ***Miscellaneous***

The "miscellaneous" category covers areas of inadequacy (mostly design oriented) that are not specified in the previous treatment categories.

a. Process Controllability

1) Do the existing process control features provide adequate adjustment and measurement of plant flow rate, backwash flow rate, and filtration rate?

2) Does the lack of needed automated monitoring or control devices (streaming current monitor, continuous

recording turbidimeters, etc.) cause excessive operator time for process control and monitoring? Does the automatic operation of critical unit processes degrade plant performance during start-up and shutdown?

b. Lack of Standby Units for Key Equipment

Does the lack of standby units for key equipment cause degraded process performance during breakdown or during necessary preventive maintenance activities (e.g. backwash pumps and chemical feeders, etc.)?

c. Flow Proportioning Units

Does inadequate flow proportioning or flow splitting to duplicate units cause problems or partial unit overloads that degrade effluent quality or hinder achievement of optimum process performance?

d. Alarm Systems

Does the absence or inadequacy of an alarm system for critical pieces of equipment or processes cause degraded process performance (e.g. raw or finished water turbidity)?

e. Alternate Power Source

Does the absence of an alternate power source cause problems in reliability of plant operation leading to degraded plant performance?

f. Laboratory Space and Equipment

Does the absence of an adequately equipped laboratory limit plant performance?

g. Sample Taps

Does a lack of sample taps on key process flow streams (e.g. individual filters, sedimentation basin solids, backwash recycle streams) for sampling prevent needed information from being obtained?

h. Plant Inoperability Due to Weather

Are certain units in the plant externally vulnerable to weather changes and, as such, do not operate at all or do not operate as efficiently as necessary to achieve the required performance? Do poor roads leading into the plant cause it to be inaccessible during certain periods of the year for chemical or equipment delivery or for routine operation?

i. Waste Recycle

Does excessive volume and/or a highly turbid return process flow stream (e.g. backwash waste water recycle flow) cause adverse effects on process performance, equipment problems, etc.? Does the inability to measure or sample these streams degrade plant performance?

C. Distribution System

1. *Storage*

a. Gravity

1) Are storage reservoirs covered and otherwise constructec to prevent contamination?

2) Are all overflow lines, vents, drain lines, or cleanout pipes turned downward and screened?

3) Are reservoirs inspected regularly?

4) Is the storage capacity adequate for the system, including fire fighting demands?

5) Do the reservoirs provide sufficient pressure throughout the system (e.g. no less than 20 psi)?

6) Are surface coatings within the reservoirs in good repair and acceptable for potable water contact?

7) Is the hatch cover for the tanks watertight and locked?

8) Can each reservoir be isolated from the system?

9) Is adequate safety equipment (e.g. caged ladder, OSHA approved safety belts, etc.) in place for climbing tanks

10) Is the site fenced, locked or otherwise protected against vandalism?

11) Are storage reservoirs disinfected after undergoing repairs?

12) What is the scheduled cleaning program for removing sediments or slime growths on the floor and side walls?

13) Are provisions made for potential service interruptions resulting from power supply, equipment, or structural failures?

b. Hydropneumatic

1) Is the storage capacity adequate for the system, including fire fighting demands?

2) Are instruments, controls, and equipment adequate, operational and well maintained?

3) Are the interior and exterior surfaces of the pressure tank in good condition?

4) Are tank supports structurally sound?

5) Does the low pressure start-up provide adequate pressure throughout the entire system (e.g. no less than 20 psi)?

6) Is the pump cycle rate acceptable (not more than 15 cycles per hour)?

7) Are provisions made for potential service interruptions resulting from power supply, equipment or structural failures?

2. ***Pipes and Meters***

a. Do all construction materials meet AWWA or equivalent standards?

b. Is the appropriate pipe size and type used for the system conditions?

c. Are proper pressures and flows maintained at all times of the year?

d. Are all services metered and are meters read?

e. Are maps for the distribution system available and current?

f. Does the distribution system have an adequate maintenance program?

1) Is leakage evident in the system?

2) Is there a pressure testing program?

3) Is there a regular line flushing program?

4) Are valves and hydrants regularly exercised and maintained?

5) Are AWWA standards for disinfection followed after all repairs?

6) Are specific bacteriological criteria and limits prescribed for new line acceptance or following line repairs?

7) Is the system interconnected with other systems?

3. *Corrosion Control Program/Lead and Copper Rule*

a. Corrosion Control Program

1) Have customer complaint records been examined to evaluate distribution areas of discolored water, stained plumbing fixtures, pressure loss from scale build-up, or deterioration of household pipes/hot water heaters?

2) Have accurate corrosion indices (e.g. Langelier Saturation Index, Aggressive Index, etc.) been developed to predict corrosion?

3) Has an accurate, representative sampling plan been developed for a thorough corrosion monitoring program? Has the program isolated problem sections in the distribution system due to differences in pipe materials, pipe/tank linings, or water quality characteristics?

4) Is the best corrosion control treatment or combination of treatments in use (e.g. alkalinity and pH adjustment, calcium and hardness adjustment, or phosphate/silicate based corrosion inhibitor)?

5) Has the water system developed a means to evaluate an optimum corrosion control treatment plan (e.g. desk top evaluation, pipe rig/loop tests, metal coupon tests, partial system tests, etc.)?

b. Lead and Copper Rule

1) Has an accurate, representative sampling plan been developed for lead and copper monitoring?

2) Has the water system exceeded any action levels for lead and copper? If so, have the correct target public audiences received minimum education materials that are consistent with mandatory language?

3) Has the water system identified areas of lead pipe and lead service lines, and areas of lead solder used?

4) Is the system in compliance with all Lead and Copper Rule monitoring requirements?

4. *Cross-Connection Control*

a. Legal Authority

1) Has the water system adopted an ordinance that contains the necessary provisions and authority for eliminating and preventing cross-connections, including penalty provisions for non-compliance?

2) Have all municipalities served by the water system adopted an ordinance relating to cross-connections?

3) Where appropriate, has the PUC approved the ordinance?

4) Does the ordinance include the following items?

- purpose and general policy statement outlining the need for the program
- definitions of terminology used in the program
- technical requirements (materials specs, sizes, etc.)
- responsibilities of each party (customer, water system, testers, etc.)
- acceptable backflow prevention devices and their uses depending on degree of hazard
- requirements for testing/retesting installed devices
- qualifications for persons who install, test, and repair backflow prevention devices
- authority to enter premises to conduct inspections
- provisions on penalties or termination of service

b. Plumbing Standards

Has the water system adopted a nationally recognized plumbing code or developed its own plumbing standards that establish minimum requirements?

c. System Surveys and Plan Reviews

1) Has the water system implemented a program to survey existing customers and to approve new construction for determining the type of backflow prevention devices required?

2) Has the system surveyed and classified customers by degree of hazard?

3) Has the system established installation deadlines based on the degree of hazard?

4) Are plans for new service connections to the system under review for approval?

d. Installation Requirements

Has the water system established standards on acceptable cross-connection control procedures and how each device or assembly is to be installed in the distribution system, including the following?:

- information on devices or assemblies acceptable to or required by the water system
- criteria on the type of devices required for each type or degree of hazard
- guidelines on the required installation procedures for each type of device
- minimum and maximum acceptable performance standards for each type of device
- guidelines on the required installation testing requirements
- qualifications standards for installers of devices

e. Testing and Maintenance

1) Has the water system adopted requirements covering the routine testing of each device?

2) Do these requirements clearly indicate who is responsible for the device's testing, repair or replacement?

3) Are testing and inspection procedures documented?

f. Record Keeping

Has the water system developed a system for maintaining records on the installation, repair and replacement of backflow prevention devices, including the following:?

- each customer's name, address, telephone number, and emergency contact person(s)
- each customer's commercial activities and types of potential water contaminants
- devices installed, size, make, model, and serial number(s)
- installation and testing dates and testing results
- name, address, and certification number of the person testing the device
- correspondences or notices sent to customers

g. Training

1) Has the water system established a training program for

system personnel, including concepts of backflow and backsiphonage, identification of cross-connections, and the measures to eliminate them?

2) How many persons have been assigned to administer the program?

3) Does the water system refer plumbers/customers to a tester certification program?

h. Public Information

1) Has the water system established program requirements for disseminating information to those affected?

2) Can the system provide copies of relevant state, federal and local regulations that apply to cross-connection?

3) Does the water system provide information on the precautions that should be considered when installing devices (e.g. thermal expansion, pressure differentials, and changes in flow, etc.)?

4) Is the system prepared to provide comments on the installation of fire suppression systems, irrigation systems, auxiliary sources, swimming pools, and other hazards?

i. Accident Response

Does the water system have an emergency response plan that includes the necessary guidance on how to respond to the contamination of the distribution system due to backflow or backsiphonage?

5. *Total Coliform Rule Sampling*

a. Is an accurate, representative sampling plan available to meet requirements of the Total Coliform Rule?

1) Where in the distribution system are samples collected? Do the locations adequately represent the distribution system? Do they include the first service connection (or equivalent) and dead ends?

2) Who is collecting the samples?

3) When are samples collected?

4) Are the correct number of samples collected?

6. *Sampling, Monitoring and Records*

(refer to Sampling, Monitoring and Records under Treatment, Section B)

D. Administration and Management

1. *Water System Administrators*

a. Policies

Do operating staff members have authority to make required decisions involving operation (e.g. adjust chemical feed), maintenance (e.g. hire electrician), and/or administration (e.g. purchase critical piece of equipment), or do policies cause critical decisions to be delayed, which in turn affects water system performance and reliability? Does any established administrative policy limit system performance (e.g. non-support of training, or system funding too low because of emphasis to avoid rate increases)?

b. Familiarity with Water System Needs

Do administrators have a first-hand knowledge of needs through water system visits or discussions with operators? Are they adequately trained, educated and/or certified? If not, has this been a cause of poor system performance and reliability through poor budget decisions, poor staff morale, or limited support for system modifications?

c. Supervision

Do management styles, organizational capabilities, budgeting skills, or communication practices at any management level adversely impact the water system to the extent that performance is affected?

d. Planning

1) Do administrators regularly summarize both current and long-term problems in the water system and define how they intend to solve the problems? Is their planning mechanism effective and do they follow through with plans?

2) Does lack of long-range plans for facility replacement, alternative source waters, emergency response, etc. adversely impact system performance?

e. Violations

Does the long-term inability of the system to comply with all applicable MCLs or monitoring requirements result in extra burdens on water system personnel?

f. *Water Demand*

Does excessive water use caused by a declining rate structure, concessions to industry, or high unaccounted-for use exceed the capability of treatment unit processes and, therefore, degrade system performance?

g. Safety

Have administrators instituted a safety training and education program regarding specific work environments, tools and equipment, and is it reinforced with regular meetings, literature and supervisor oversight?

2. ***Water System Staff***

a. Manpower

1) Number

Does a limit to the number of people employed have a detrimental effect on water system operations or maintenance (e.g. not getting the necessary work done)?

2) Insufficient Time on Job

Does the short time on the job and associated unfamiliarity with water system needs result in the absence of adjustments or in improper adjustments being made (e.g. opening or closing a wrong valve, turning on or off a wrong chemical feed pump, backwashing a filter incorrectly, etc.)?

3) System Coverage

Is water system coverage adequate to accomplish necessary operational activities? Can appropriate adjustments be made during the evenings, weekends or holidays? For example, is staff available to respond to changing raw water quality characteristics or emergencies during periods of operation?

4) Workload Distribution

Does the improper distribution of adequate manpower (e.g. a higher priority on maintenance tasks) prevent process adjustments from being made or cause them to be made at inappropriate times, resulting in poor water system performance?

5) Personnel Turnover

Does a high personnel turnover rate cause operation and/or maintenance problems that affect process performance or reliability?

b. Morale

1) Motivation

Does the water system staff want to do a good job because they are motivated by self-satisfaction?

2) Pay

Does a low pay scale or benefit package discourage more highly qualified persons from applying for operator positions or cause operators to leave after they are trained?

3) Work Environment

Does a poor work environment and/or numerous safety concerns create a condition for more "sloppy work habits" and lower operator morale?

c. Staff Qualifications/Certification

1) Aptitude

Does the lack of capacity for learning or understanding new ideas of critical staff members cause improper operation and maintenance decisions leading to poor system performance or reliability?

2) Level of Education

Does a low level of education result in poor operation and maintenance decisions? Does a high level of education cause staff to believe that needed training is unnecessary?

3) Water Treatment Understanding

Is the operator's lack of basic understanding of water treatment (e.g. limited exposure to terminology, lack of understanding of the function of unit processes, etc.) a factor in poor operational decisions and poor system performance or reliability?

4) Application of Concepts

Is the staff deficient in the application of their knowledge of water treatment and interpretation of process control testing such that improper process control adjustments are made?

5) Certification

Does the lack of adequately certified personnel result in poor operation and maintenance decisions?

6) Training and Technical Guidance

Does inattendance at available training programs result in poor process control decisions by the water system staff or administrators?

Does inappropriate operational information received from a technical resource (e.g. design engineer, equipment representative, state trainer or inspector) cause improper operational decisions to be implemented or continued?

3. *Financial*

a. Insufficient Funding

Does the lack of available funds (e.g. inadequate rate structure) cause poor salary schedules, insufficient spare parts inventories that result in delays in equipment repair, insufficient capital outlays for improvements or replacement, lack of required chemicals or chemical feed equipment, etc.?

b. Unnecessary Expenditures

Does the manner in which available funds are utilized cause problems in obtaining needed equipment, staff, etc.? Are funds spent on lower priority items while more necessary, higher priority items are unfunded?

c. Bond Indebtedness

Does the annual bond debt payment limit the amount of funds available for other needed items such as equipment, staff, etc.?

4. ***O&M Manual/Procedures***

a. Adequacy

Does the Operation and Maintenance Manual contain at least the following (items 1 - 11):?

1) A description of the facilities.

2) An explanation of startup and normal operation procedures.

3) A routine maintenance program.

4) Records and reporting system.

5) Sampling and analyses program.

6) Staffing and training.

7) Sanitary survey program.

8) Safety program.

9) Emergency plan and operating procedures.

10) Manufacturer's manuals.

11) An interconnect, valve and blowoff exercise and testing program.

b. Use

Does the operator's failure to utilize a good O&M Manual/Procedures cause poor process control and poor treatment that could have been avoided?

Does inappropriate guidance provided by the O&M Manual/Procedures result in poor or improper operation decisions?

c. Productivity

Does the water system staff conduct the daily operation and maintenance tasks in an efficient manner? Is time used efficiently?

5. *Consumer Complaints*

a. Have administrators developed a policy for responding to an recording consumer complaints? Does the lack of adequate response adversely affect morale of water system personnel?

b. Does the lack of records lead to inadequate follow-up procedures and inability to determine trends?

c. Have administrators developed informational brochures, utility bill inserts, and other educational tools to inform consumers and avoid future complaints?

6. *Emergency Response*

a. Is a comprehensive emergency plan of action available that includes response to equipment breakdown, loss of power, pipe/storage tank breaks or failures, vandalism, toxic spills, employee strikes, and natural disasters?

b. Do provisions include the following (items 1 - 7):?

1) Alternative sources of supply and reserve finished water storage capacity.

2) A list of organizational personnel and detailed descriptions of their responsibilities.

3) A plan for recovery operation.

4) Training programs for operators to carry out the plan.

5) A plan for local and regional coordination such as state agencies, police, and fire departments.

6) Communications procedures.

7) Protection for personnel, plant equipment, records, and maps.

c. Is the plan reviewed and updated at least annually?

E. Maintenance

1. *Preventive*

   a. Lack of Program

   Does the absence or lack of an effective scheduling and recording procedure cause unnecessary equipment failures or excessive downtime that results in water system performance or reliability problems?

   b. Spare Parts Inventory

   Does a critically low or nonexistent spare parts inventory cause unnecessary long delays in equipment repairs that result in degraded system performance?

2. *Corrective*

   a. Procedures

   Are procedures available to initiate maintenance activities on observed equipment operating irregularities (e.g. work order system)? Does the lack of emergency response procedures result in activities that fail to protect process needs during breakdowns of critical equipment (e.g. maintaining disinfectant or chemical feeds during equipment breakdowns)?

   b. Critical Parts Procurement

   Do delays in getting replacement parts caused by procurement procedure result in extended periods of equipment downtime?

3. *General*

   a. Housekeeping

   Does a lack of good housekeeping procedures (e.g. unkempt, untidy, or cluttered working environment) cause an excessive equipment failure rate?

   b. References Available

   Does the absence or lack of good equipment reference sources (maintenance portion of O&M Manual, equipment catalogs, etc.) result in unnecessary equipment failure and/or downtime for repairs?

c. Staff Expertise

Does the water system staff have the necessary expertise to keep the equipment operating and to make equipment repairs when necessary?

d. Technical Guidance (Maintenance)

Does inappropriate guidance for repairing, maintaining, or installing equipment from a technical resource (e.g. equipment supplier or contract service) result in equipment downtime that adversely affects performance? If technical guidance is necessary to decrease equipment downtime, is it available and retained?

e. Equipment Age

Does the age or outdatedness of critical pieces of equipment cause excessive equipment downtime and/or inefficient system performance and reliability (due to unavailability of replacement parts)?

4. ***O&M Manual/Procedures***

(refer to O&M Manual/Procedures under Administration and Management, Section D)

REFERENCES

Substantial portions of the preceding reference guide were obtained from the following documents:

Renner, R.C., B.A. Hegg, J.H. Bender, E.M. Bissonette, Handbook - Optimizing Water Treatment Plant Performance Using the Composite Correction Program, EPA 625/6-91/027, U.S. EPA, Cincinnati, Ohio, February 1991.

Water Treatment Plant Operation, Vol. II, California State University, Sacramento, California, 1991.

Guidance Manual For Compliance with the Filtration and Disinfection Requirements for Public Water Systems Using Surface Water Sources, Appendix K, U.S. EPA, Office of Drinking Water, Washington, D.C., March 1991.

APPENDIX B:

Guidance Table for Using Surveillance Forms

Department Activities	Forms: Inspection	Narrative	Inventory
*Full Inspection	x		?
New Violations Identified	x		
Follow-up/Progress Evaluation		x	
Inventory Update			x
Complaint Investigation		x	
On-site Consultation		x	
Office (phone contact, etc.)		x	
Emergency Response (no violations)		x	
Permit Related		x	

*use Water Supply Inspection Checklist as mnemonic tool

SECTION II

INSPECTIONS

Introduction

Under the requirements of Chapter 109, Safe Drinking Water Regulations (SDWR), the Department must conduct a first-time sanitary survey at all community water systems by June 29, 1994, followed by a sanitary survey frequency of once every three years. Department staff will conduct more frequent surveys or consultations if problems have been identified in the system. In years between surveys, staff should review the community water system's annual survey that is attached to the annual water supply report as a tool in assessing conditions of source, treatment and distribution facilities. At noncommunity water systems, the Department must conduct a first-time sanitary survey by June 29, 1999, followed by a sanitary survey frequency of once every ten years for protected groundwater systems and once every five years for all other noncommunity systems. For the purposes of the SDWR, the Department's inspection format as outlined in this strategy satisfies all sanitary survey requirements. Accordingly, inspection dates must be transferred into the Model State Information System to satisfy the Primacy agreement with the Environmental Protection Agency for sanitary survey frequency.

During the inspections, staff should review source, treatment and distribution facility conditions and operational control, focus on current and proposed regulatory information, and refer the water system to helpful organizations, groups, assistance programs and other public water systems. Staff should also determine if the water system's inventory forms require updating; the appropriate inventory forms should be on hand during inspections. Two inspection formats, one a routine inspection and the other a narrative report, are outlined below.

Inspection

Staff should conduct an inspection jointly with the facility operator and use a checklist (**Attachment 2A**) of specific items to review during the on-site assessment. The checklist serves as a mechanism to maintain consistency in the review process of facilities, but not as an inventory mechanism. Checklist items include an evaluation of surface and groundwater sources and their watersheds to substantiate possible reduced monitoring requirements and to maximize "use" and "susceptibility" waivers. The checklist also includes treatment facilities, along with finished water storage facilities and the distribution system. Other items to examine include operation and complaint records as well as support documents (emergency response plans, cross connection control plans, etc.). An inspection should also entail on-site measurements of water quality parameters to verify proper facility operation, compliance with regulations, or to cross-check facility monitoring equipment.

Staff should refer to the document, "Reference Guide for Inspecting Public Water Systems" when inspecting water systems. The following references may also serve as useful tools for conducting an inspection:

a. Permit
b. Prior Department inspection reports or inventory forms
c. Filter plant performance evaluation report
d. Small systems outreach report
e. Annual water supply report
f. Annual public water system sanitary survey (in the annual water supply report)
g. Complaint reports
h. Emergency response plan
i. Cross connection control plan
j. Water quality analysis results
k. Water system distribution map
l. MSIS inventory and reports
m. Brief description form
n. Correspondences
o. Other reports or studies

In addition to documenting the review of a water system, the inspection form (**Attachment** 2B) also documents violations or problems that have been identified, and any necessary corrective actions. This documentation is especially critical to assist Field Operations staff in selecting a water system for more intensive surveillance efforts (see "Comprehensive Evaluations", Section III) or for additional follow-up activities. Staff should discuss an overview of inspection findings and violations with the water system operator prior to leaving the facility. Staff should complete the inspection form only in conjunction with a <u>full</u> inspection (i.e. review of source, treatment and distribution facilities) or when documenting new violations.

FREQUENCY: At community water systems, the Department must conduct an inspection at least once every three years. At noncommunity water systems, the Department must conduct an inspection at least once every ten years for protected groundwater systems and once every five years for all other noncommunity systems. More frequent inspections may be necessary at public water systems presenting a health risk to consumers.

DISTRIBUTION: The original inspection form is retained in the district office, and copies are provided to (1) the public water system and (2) the regional office (or county environmental health director). The completed checklist form is retained in the district office.

Narrative Report

A narrative report form (**Attachment 2C**) serves as a means to record other Department activities associated with a public water system. The goal of the narrative report is to demonstrate the water system's progress in resolving specific problems, especially violation or problems previously requiring enforcement action. Field Operations staff should include in the report any on-site consultations that were initiated as a result of problems previously identified in an inventor survey, inspection or comprehensive evaluation. Other items may include partial inspections, responses to consumer complaints, emergency response, the supplier's completion and updating of the annual water supply report and annual sanitary survey, transfer of regulatory information, training associated with the supplier, permitting activities such as source siting, pump tests and progress o construction, and office activities such as telephone consultations. The reason the narrative was completed should be clearly stated at the beginning of the form.

FREQUENCY: Staff should use discretion when deciding when or if an on-site follow-up consultation is necessary. However, staff should document all activities associated with a public water system by using a narrative report. The report should seek qualitative results (as opposed to a quantitative orientation), and should serve as a tool to achieve progress in correcting problems at a public water system.

DISTRIBUTION: The original is retained in the district office, and if necessary, copies are provided to the public water system.

Attachment 2.

PWS ______________________________ DATE ______________

WATER SUPPLY INSPECTION CHECKLIST

SURFACE WATER FILTRATI

SURFACE & GROUNDWATER SOURCES

01 Watershed/recharge area characteristics & changes
02 Contamination/adverse activities & changes
03 Watershed management/ wellhead protection efforts
04 Source construction & quantity satisfactory? Y N
05 Source equipment operational & maintained? Y N
*06 Date of last watershed survey by PWS? ____________

OVERALL FACILITIES & MAINTENANCE

*10 Max. production rate ________GPM
Total production ____________GPD
Operating time ____________hours
Design capacity ________GPD/GPM
11 Are all facilities operational & in good physical condition? Y N
12 Maintenance program? Y N

DISINFECTION

20 Back-up units/parts available? Y N
21 Auxiliary power available? Y N
22 Stored quantity/proper storage of disinfectant? Y N
23 Auto switchover equipment? Y N
24 Flow proportioned feed? Y N
*25 Entry point residual/CTs maintained? Y N
26 Gas chlorine facilities & safety equipment adequate? Y N

OTHER TREATMENT

30 Chemical doses/solutions proper, equipment operational, monitoring adequate? Y N
31 Zeolite adequate for source water quality? Y N
32 Zeolite regeneration, backwash & rinse sufficient? Y N
33 Aeration adequate for source water quality? Y N
34 Flows/chemicals optimal for aeration? Y N
35 Reverse osmosis feedwater optimized? Y N
36 Reverse osmosis pressures proper? Y N

DISTRIBUTION SYSTEM

*50 Storage reservoirs protected? Y N
51 Storage reservoirs maintained? Y N
*52 Storage capacity adequate? Y N
*53 Pressure problems? Y N
*54 Distribution maps current? Y N
55 Adequate distribution system leak detection/flushing/ maintenance programs? Y N
*56 Lead & copper site sampling plan? Y N
57 Corrosion control inhibitor?
____
*58 Cross connection control plan? Y N
*59 TCR site sampling plan? Y N
*60 Adequate disinfection residuals maintained? Y N

MONITORING & RECORDS

*70 All monitoring requirements fulfilled? Y N
71 Proper sample collection procedures? Y N
72 Approved/appropriate analytical tests performed? Y N
73 Adequate/calibrated analytical equipment? Y N
75 Outdated reagents/ chemicals? Y N
74 Are results recorded properly? Y N

ADMINISTRATION & MANAGEMENT

*80 O&M plan & records updated? Y N
*81 Complaint records? Y N
*82 Emergency response plan? Y N
*83 Certified operator? Y N

MISCELLANEOUS

90 Corrective action(s)from previous surveys? Y N
91 Inventory update needed (list items)

CHEMICAL PRETREATMEN

100 Coagulant dose (mg/L) ____
Polymer dose (mg/L) ______
Pre-Cl_2 dose (mg/L) ______
Others? ______
101 How does the operator dete proper chemical doses? (jar process monitoring, etc.)
102 Proper pH/alkalinity ranges?
103 Chemical feeders operation good condition, & easily adjustable? Y N
104 Date of last chemical equipm calibration ________

FLOCCULATION & SEDIMENTATI

110 Flocculation time & facilities adequate? Y N
111 Floc formation & settling adequate? Y N
112 Short circuiting evident? Y N
113 Sludge disposed properly & o enough? Y N
114 Turbidity of settled water __

FILTRATION

120 Filtration rate (GPM/Ft^2)
____
121 Excessive filter run time? Y N
122 Criteria used to initiate backw (time, turbidity, headloss)
123 Backwash rate & time adequate? Y N
124 Backwash uniform? Y N
125 Filter-to-waste after wash? Y
*126 Turbidity when filter is put on
____
127 Filter media size, depth & condition adequate? Y N
128 Filter appurtenances functional? Y N
129 Backwash waste facilities adequate/permitted? Y N

* Potential Violations of 25 Pennsylvania Chapter 109

NOTE: Some problems may indicate the need for a specific water quality analysis (attach results)

WATER SUPPLY INSPECTION CHECKLIST

Check List #	Notes

Attachment 2B

COMMONWEALTH OF PENNSYLVANIA

DEPARTMENT OF ENVIRONMENTAL RESOURCES

WATER SUPPLY INSPECTION

FACILITY NAME	PWS ID #	COUNTY	MUNICIPALITY	INSPECTION DATE

CERTIFIED OPERATOR'S NAME	TELEPHONE NO	RESPONSIBLE OFFICIAL'S NAME	TYPE SYSTEM	POPULATION

FACILITY LOCATION ADDRESS

FIELD ORDER # ______________ ISSUE DATE ______________

VIOLATIONS

A1.	Response to emergency	
A2.	Continuous disinfection	
A3.	Response to an acute violation	
B1.	Inadequate supply	
B2.	Minimum disinfection residual	
B3.	PMCL/trt. technique violation	
B4.	Public notice for PMCL	
B5.	Noncompliance with Order	
B6.	Failure to obtain permit	

C1.	Design/construction standards	
C2.	Performance monitoring	
C3.	Failure to treat as permitted	
C4.	Operate and maintain PWS	
C5.	Certified operator	
C6.	Improper interruption/repair	
D1.	Reports/Records/Maps	
D2.	Operation and maintenance plan	
E1.	Other	

INSPECTION TIME

START ______________

STOP ______________

NARRATIVE

WATER QUALITY SAMPLING POINT LOCATION	SAMPLE NUMBER	pH	CHLORINE		TURBIDITY				
			F	T	R	F			

RECEIVED BY (SIGNATURE AND DATE) | INVESTIGATOR (SIGNATURE AND DATE) | MSIS UPDATED | SUPV INITIALS

	VIOLATION	REGULATION REFERENCE		
A1.	Failure to act in an emergency situation (includes: disease outbreaks, spills, unregulated contaminants).	109.4,	.402	
A2.	Failure to provide continuous disinfection (Disinfection must be done continuously; any breakdown is an imminent threat).	109.4	.202(c)(1) and (2)	
A3.	Failure to respond to an acute violation (includes reporting to DER, public notification, investigation of cause and corrective measures for the following acute violations: nitrate MCL, turbidity exceeding 5 NTU, and MCL for total coliform with fecal coliforms present).	109.4,	.401-.403	
B1.	Failure to provide an adequate supply of water (includes: source, storage and distribution system inadequacies).	109.602,	.603	
B2.	Failure to provide acceptable minimum disinfection residual throughout the system.	109.710		
B3.	PMCL or treatment technique violation (includes: filtration/turbidity violations).	109.202		
B4.	Failure to issue public notice for a PMCL violation.	109.401,	.403,	.701(a)(
B5.	Failure to comply with an Order issued by the Department.	Section 13.(a) of Act 43 (SDWA)		
B6.	Failure to obtain a permit, experimental permit, major permit amendment, or emergency permit.	109.501-.507		
C1.	Failure to meet design and construction standards (additive for multiple violations).	109.602-.609,		.611-.61
C2.	Failure to conduct performance monitoring for surface water systems.	109.301(1) and (2)		
C3.	Failure to provide level of treatment as designed and permitted, failure to filter to waste.	109.703		
C4.	Failure to operate and maintain the water system or implement O&M Plan.	109.4,	.702	
C5.	No certified operator or certified back-up.	109.701		
C6.	Improper interruption and repairs, failure to disinfect facilities.	109.708,	.711	
D1.	Failure to maintain/submit: daily plant records, sample siting plan,			
	water supplier complaint log.	109.701		
	wa supplier sanitary surveys.	109.705		
	distribution map.	109.706		
	emergency response plan.	109.707		
D2.	No operation and maintenance plan.	109.702		
E1.	Violations of other Safe Drinking Water Regulations (examples: SMCLs, unregulated contaminants, special monitoring, etc.)			

ER—WSCH—04: Rev. 1/93

REPORT SHEET
(Consultation, Narrative, etc.)

Attachment 2C

COMMONWEALTH OF PENNSYLVANIA — DEPARTMENT OF ENVIRONMENTAL RESOURCES

Facility Name	Prog. Code	Date	PWS No.	Permit/Lic. No.

Address	City, Boro, Twp.	County

Item No.

Received By (Signature and Date)

Investigator (Signature and Date)

Supervisor's Initials

MARYLAND

- **Water Treatment Plant Inspection Report Form**

MARYLAND DEPARTMENT OF THE ENVIRONMENT

Public Drinking Water Program

Water Treatment Plant Inspection Report

PWSID #: ___-____ Name: ______________________

County: ____________ Plant Class: ____

Inspection Class: ____ Inspected By: ______________ Date: __/__/__

Problem: Y/N Follow-up Letter Sent: Y/N Follow-up Inspection Scheduled: Y/N

System Information Type (FRDS): ____ Total # POEs: ____

Raw Sources: ____ Source Type: GR SU SP PG PS

Connections: ____ RESIDENTIAL ____ NON-RESID. ____ OTHER Metered: Y/N Population: ____

Mailing Address: (STREET) ______________________

(CITY) ______________________

(STATE) ________ (ZIPCODE) _____-____

System Contact: ______________ Title: ______________

Telephone #: (__) ___-____ Fax #: (__) ___-____

System Owner: ______________ Telephone #: (__) ___-____

Interconnected To: ______________ Reason: PURCHASE SELL EMERGENCY

Plant Information POE #: ____ Plant Status: ACTIVE/INACTIVE New Treatment: Y

Plant Address: ______________________

Plant Contact: ______________ Telephone #: (__) ___-____

Avgerage Daily Flow: ________MGD Design Capacity: ________MGD

Raw Source(s):

In-service:	# Ground:____	# Surface:____	# Spring:____
On-standby:	# Ground:____	# Surface:____	# Spring:____
Out-of-service:	# Ground:____	# Surface:____	# Spring:____

Treatment: Aeration \ Pre/Post-Disinfection \ Disinfection \ Coagulation \ Flocculation \ Sedimentation \ Filtration \ Corrosion Control \ Fluoridation \ Iron Removal \ Other

Chemicals Added: ______________________

Operating Agency: ______________________

		CERTIFIED(Y/N)	CLASS	NO.
Superintendent:	______________	___	___	____
Operator(s):	______________	___	___	____
	______________	___	___	____
Other:	______________			

Comments/Recommendations: ______________________

INSPECTION INFORMATION

FLOW MEASUREMENT:

Identification					
Meter Type					
Units					
Present Reading					
Previous Reading					
Date					

PLANT MONITORING:

Parameters	Method	Frequency	Location	On-Site Test	On-Site Location
pH					
Free Cl_2					
Total Cl_2					
Iron					
Fluoride					
Turbidity					
Other					

OPERATION AND MAINTENANCE

Part 1 - Management

	S	US	NA	Comments
Plant Safety				
Record Keeping				
Laboratory Control Tests				
Maintenance Log				
Customer Complaint Log				
Emergency Response Plan				
Preventative Maintenance				
Staffing				
Other				

Plant Information POE #: _____ Plant Status: ACTIVE/INACTIVE New Treatment: Y/N

Plant Address: ______________________________

____

Avgerage Daily Flow: __________MGD Design Capacity: __________MGD

Raw Source(s):

In-service:	# Ground:____	# Surface:____	# Spring:____
On-standby:	# Ground:____	# Surface:____	# Spring:____
Out-of-service:	# Ground:____	# Surface:____	# Spring:____

Treatment: Aeration \ Pre/Post-Disinfection \ Disinfection \ Coagulation \ Flocculation \ Sedimentation \ Filtration \ Corrosion Control \ Fluoridation \ Iron Removal \ Other

Chemicals Added: ______________________________

Plant Information POE #: _____ Plant Status: ACTIVE/INACTIVE New Treatment: Y/N

Plant Address: ______________________________

____

Avgerage Daily Flow: __________MGD Design Capacity: __________MGD

Raw Source(s):

In-service:	# Ground:____	# Surface:____	# Spring:____
On-standby:	# Ground:____	# Surface:____	# Spring:____
Out-of-service:	# Ground:____	# Surface:____	# Spring:____

Treatment: Aeration \ Pre/Post-Disinfection \ Disinfection \ Coagulation \ Flocculation \ Sedimentation \ Filtration \ Corrosion Control \ Fluoridation \ Iron Removal \ Other

Chemicals Added: ______________________________

Plant Information POE #: _____ Plant Status: ACTIVE/INACTIVE New Treatment: Y/N

Plant Address: ______________________________

____

Avgerage Daily Flow: __________MGD Design Capacity: __________MGD

Raw Source(s):

In-service:	# Ground:____	# Surface:____	# Spring:____
On-standby:	# Ground:____	# Surface:____	# Spring:____
Out-of-service:	# Ground:____	# Surface:____	# Spring:____

Treatment: Aeration \ Pre/Post-Disinfection \ Disinfection \ Coagulation \ Flocculation \ Sedimentation \ Filtration \ Corrosion Control \ Fluoridation \ Iron Removal \ Other

Chemicals Added: ______________________________

Plant Information POE #: _____ Plant Status: ACTIVE/INACTIVE New Treatment: Y/N

Plant Address: ______________________________

____

Avgerage Daily Flow: __________MGD Design Capacity: __________MGD

Raw Source(s):

In-service:	# Ground:____	# Surface:____	# Spring:____
On-standby:	# Ground:____	# Surface:____	# Spring:____
Out-of-service:	# Ground:____	# Surface:____	# Spring:____

Treatment: Aeration \ Pre/Post-Disinfection \ Disinfection \ Coagulation \ Flocculation \ Sedimentation \ Filtration \ Corrosion Control \ Fluoridation \ Iron Removal \ Other

Chemicals Added: ______________________________

Plant Information POE #: ____ Plant Status: ACTIVE/INACTIVE New Treatment: Y/N
Plant Address: ______________________________

Avgerage Daily Flow: ________MGD Design Capacity: ________MGD
Raw Source(s): *In-service:* # Ground:____ # Surface:____ # Spring:____
On-standby: # Ground:____ # Surface:____ # Spring:____
Out-of-service: # Ground:____ # Surface:____ # Spring:____
Treatment: Aeration \ Pre/Post-Disinfection \ Disinfection \ Coagulation \ Flocculation \ Sedimentation \ Filtration \ Corrosion Control \ Fluoridation \ Iron Removal \ Other
Chemicals Added: ______________________________

Plant Information POE #: ____ Plant Status: ACTIVE/INACTIVE New Treatment: Y/N
Plant Address: ______________________________

Avgerage Daily Flow: ________MGD Design Capacity: ________MGD
Raw Source(s): *In-service:* # Ground:____ # Surface:____ # Spring:____
On-standby: # Ground:____ # Surface:____ # Spring:____
Out-of-service: # Ground:____ # Surface:____ # Spring:____
Treatment: Aeration \ Pre/Post-Disinfection \ Disinfection \ Coagulation \ Flocculation \ Sedimentation \ Filtration \ Corrosion Control \ Fluoridation \ Iron Removal \ Other
Chemicals Added: ______________________________

Plant Information POE #: ____ Plant Status: ACTIVE/INACTIVE New Treatment: Y/N
Plant Address: ______________________________

Avgerage Daily Flow: ________MGD Design Capacity: ________MGD
Raw Source(s): *In-service:* # Ground:____ # Surface:____ # Spring:____
On-standby: # Ground:____ # Surface:____ # Spring:____
Out-of-service: # Ground:____ # Surface:____ # Spring:____
Treatment: Aeration \ Pre/Post-Disinfection \ Disinfection \ Coagulation \ Flocculation \ Sedimentation \ Filtration \ Corrosion Control \ Fluoridation \ Iron Removal \ Other
Chemicals Added: ______________________________

Plant Information POE #: ____ Plant Status: ACTIVE/INACTIVE New Treatment: Y/N
Plant Address: ______________________________

Avgerage Daily Flow: ________MGD Design Capacity: ________MGD
Raw Source(s): *In-service:* # Ground:____ # Surface:____ # Spring:____
On-standby: # Ground:____ # Surface:____ # Spring:____
Out-of-service: # Ground:____ # Surface:____ # Spring:____
Treatment: Aeration \ Pre/Post-Disinfection \ Disinfection \ Coagulation \ Flocculation \ Sedimentation \ Filtration \ Corrosion Control \ Fluoridation \ Iron Removal \ Other
Chemicals Added: ______________________________

PWSID #:___ - ____
System:________________

OPERATION AND MAINTENANCE

Part 2 - Water Source(s)

	S	US	NA	Comments
Quantity				
Quality				
Protection				

Part 3 - Treatment Processes

	Method	S	US	NA	Comments
Screening					
Aeration					
Pre-Disinfect					
Post-Disinfect					
Disinfection					
Mixing					
Coagulation					
Flocculation					
Sedimentation					
Filtration					
Corrosion Ctrl					
Fluoridation					
Iron Removal					
Taste & Odor					
Other					

Part 4 - Distribution System

	S	US	NA	Comments
Pressure				
Cross Connection Prevention Plan				
Storage				
Flushing Program				
Other				

OPERATION AND MAINTENANCE
Part 5 - Maintenance

	S	US	NA	Comments
Spare Parts Inventory				
Instrument Calibration (eg. chemical feeders, meters, gauges, etc.)				
Sludge Removal				
Other				

PLANT SCHEMATIC:

PWSID #:___-____
System:__________

WELLS

INSPECTION	Well #__	Well #__	Well #__	Well #__
Well Location (eg. outside): Protected?				
ADC Map Coordinates (pg/grid):				
Well Tag? (Y/N) Tag No.:				
Casing Height Above Ground (ft):				
Run Time (hrs/day): Time Metered? (Y/N)				
Raw Water Sample Tap? Before check valve?				
Finished Water Sample Tap?				
Well Vented? Screen?				
Well Cover/Seal Tight?				
Check Valve?				
Blowoff Valve?				
Pitless Adaptor? (Y/N)				
VELL COMPLETION REPORT*	Well #__	Well #__	Well #__	Well #__
Year Drilled: Original Well Driller:				
Well Depth (ft):				
Aquifer: Confined? (Y/N)				
Casing Diameter (in):				
Casing Depth (ft):				
Pump Type (S*/T/J): *Pump Depth (ft):				
Pump Intake Level (ft):				
Rated Pump Capacity (gpm):				
Pumping Test rate/time(gpm/hrs):				
Static Water Depth (ft):				
Drawdown (ft):				

* E: If current information available, do not use Well Completion Report data

List all sources for the information (e.g. past inspection, well data table, etc.) noting any discrepancies:

WELLS

GENERAL INFORMATION

1. What directly controls well pump operation? (eg. storage tank pressure)

2. Do wells operate together? Explain.

3. List potential sources of contamination (eg. farmland, septic fields, fuel tanks) in the well's vicinity:

4. Are the wells subject to flooding? If yes, what is the flood level? (NOTE: Well casing should terminate at least 18" above flood level)

5. Have the wells been evaluated to determine whether they are under the influence of surface water? If yes, what do the results indicate?

6. Have any wells ever tested positive for total coliform and/or fecal coliform? Please describe.

WELLHEAD PROTECTION

If the system has a Wellhead Protection Program (WHPP), please check the following:

a. Designation of the Wellhead Protection Area (WHPA)
   - Map of the WHPA (generally 1/2 to 1 mile radius around well)

b. Potential contaminants are identified and located
   - Land use divided into: residential, agricultural, industrial, commercial

c. Management of the WHPA
   - Regulatory controls (eg. zoning)
   - Non-regulatory controls (eg. public education; ground water monitoring)

d. Future planning
   - Potential future problems identified
   - Contingency plan for alternate water supplies in the event that water supply is disrupted by contamination or other events
   - New wells sited carefully

WELL AREA SCHEMATIC

PWSID #: ___-___
System: __________

SURFACE WATER

GENERAL INFORMATION

1. Source:

2. Location:

3. # Reservoirs: __________ Volume: __________gals

4. Total # intakes: __________ Intake level(s): __________ft

5. # intakes used during normal operation: __________
   Reason for selecting a particular intake:

6. Maintenance schedule for intakes (eg. how often screen inspected; how often debris removed):

7. Is the area around the intakes restricted (eg. swimming, powerboats) for a radius of 200 feet?

8. Are there any sources of pollution in the proximity of the intakes? Specify. (eg. waste wate discharges, marinas, boat launching ramps, sewers, construction projects, animal pasturing, chemicall treated agricultural land, chemical storage areas (eg. highway de-icing salt or petroleum products))

9. Is the source adequate in quantity and quality to meet current and future (10 or 20 year) demands?

10. Are pre-treatment chemicals applied in the reservoir? If yes, please describe.

11. Conditions which cause water quality fluctuations (eg. stratification, algal blooms, ice formation):

12. Type(s) of raw water testing: Frequency:

13. Is there a dam? If yes, is it inspected for safety?

14. Raw water quality (ranges): pH__________ Turbidity__________ Temperature__________

WATERSHED PROTECTION

1. What is the nature of the total watershed (eg. industrial, agricultural, forest, residential)? Give %.

2. What is the size of the owned/protected area of the watershed?
   Zoning restrictions and ordinances?

3. How is the watershed managed/controlled? (eg. ownership with restricted access, ordinances)

4. Has management had a watershed survey performed?

5. Is a list available with all upstream users and dischargers?

6. Is there an emergency spill response plan with potential spill sites identified?

7. What arrangements are in place with other owners in the watershed?

PWSID #: ___-____
System: ______________

SPRINGS

1. Name:

2. Location (Please include ADC map page & grid):

3. Type (gravity or artesian):

4. Is the recharge area protected?

5. What is the nature of the recharge area? (eg. industrial, agricultural, forest, residential)?

6. Is the site subject to flooding?

7. Is the collection chamber properly constructed:
   a. watertight?
   b. impervious and locked tank cover?
   c. exterior valve on drain?
   d. drain screened at end?
   e. drain apron for overflow discharge to prevent soil erosion?

8. Is the site adequately protected from stray livestock and tampering (eg. fence, locked covers, warning signs)?

9. Is there a surface drainage ditch uphill from the source to intercept surface water runoff and carry it away from the source?

10. Has the spring been rehabilitated to protect from surface water influence?
    If yes, please explain what was done.

11. Has the system performed sampling according to PDWP sampling protocol? (eg. rainfall event sampling and dry weather sampling for pH, coliform, turbidity, and temperature)
    If yes, what do the sampling results indicate? Explain.

12. Has the spring been evaluated to determine whether it is under the influence of surface water? Explain what was done.

13. Has the system conducted tracer studies?
    If yes, what do the results indicate?

STORAGE

HYDROPNEUMATIC TANK

Identification			
Location			
Total Size (gal)			
Operating Pressure Range (psi)			
Effective Storage (%)			
Protection from Vandalism?			
Exterior Condition			
Sightglass?			
Alarm?			
Bypass?			
Pressure Relief Valve?			
Drain? Size.			
Air Compressor? Manual or Automatic?			

ELEVATED AND/OR GROUND STORAGE

Identification			
Location			
Capacity			
Operating Range (ft or psi)			
Covered?			
Drain? Size.			
Altitude Valve?			
Pumped or Gravity Floating on the System?			
Vent Screened?			
Overflow: Termination Point Screened?			
General Condition Interior Coating NSF/ANSI Approved?			
Type/Frequency of Inspections			
Able To Isolate From Rest of System?			
Manhole Watertight and Locked?			
Protection from Vandalism?			

Are there provisions for maintaining water supply when storage out-of-service? If yes, please describe.

DISTRIBUTION

1. List all distribution materials (mains *and* service lines), percent of each, and the diameters.
2. Frequency of main breaks:
3. Pressure testing program?
4. Flushing program?
5. Valve maintenance program?
6. Disinfection after repair?
7. Repair materials available?
8. Dead ends?

PUMPS

1. Total # pumps: _____ 	# in service: _____
out-of-service: _____
on-standby/backup: _____
2. Type (eg. high service):
3. Rated capacity (hp and/or gpm):
3. Application (eg. chemical feed):
4. Location:
5. Type and amount of lubricant:
6. Condition of equipment:
7. Protection of equipment (eg. protective guards on rotating parts):
8. Emergency/backup systems?
9. Preventative Maintenance (PM) program?

ADDITIONAL NOTES

MIXING

1. What chemicals are added at the mixing basin?
2. Is there any noticeable short circuiting?
3. Where is the mixing basin located?
4. What type of mixer is used (eg. motorized, baffles, etc.)? If a motorized mixer used, is it variable spe
5. What is the condition of the mixer?
6. Does the plant require shut-down in order to make repairs to the mixer?

COAGULATION

1. What chemical is used for coagulation?
2. Where is the chemical added?

FLOCCULATION

1. Number of flocculation basins:
2. Are baffles used? If yes, how many?
3. Is a mechanical flocculator used? If yes, what type? Is it shearing the floc particles?
4. What is the appearance of the flocculated particles?
5. Is there an even distribution of floc?
6. What is the condition of the flocculation equipment?

SEDIMENTATION

1. Number of sedimentation tanks: Size (gal): Surface Area (ft^2):
2. Are tube settlers or inclined plates used? If yes, describe condition.
3. Does the floc settle out properly?
4. Is the flow through the tank smooth?
5. Is the flow over the weir even throughout the tank?
6. Sludge: How is the sludge collected and removed? How often? By whom? What is the condition of the removal equipment?
7. Can the unit(s) be taken out of service for inspection and repair?

FILTRATION

1. Total number of filters:

2. Number of filters used at a time during normal operation:

3. Average filter rate (gpm)?

4. Is the flow equal through all filters? Y or N

5. Type of filter(s) (eg. pressure, rapid sand, etc.):

6. Filter media used:

7. Filter aids used:

8. Backwash Cycle:
   a. Does the plant shut-down when the filters backwash? If not, is the raw water flow reduced?

   b. Do the filters backwash at the same time?

   c. Where does the water to backwash filters come from? Is it metered? Gravity or pumped? If pumped, are there back-up pumps for backwashing?

   d. Where does the backwash water go to?

   e. Is recycle used? If yes, describe point where re-introduced in plant and any additional treatment.

   f. Is the cycle automatic or manual?

   g. What determines when backwashing will take place (eg. headloss, turbidity, time)?

   h. Duration of cycle (from draining to putting back on-line):

   i. Is there surface wash or air scour? If yes, describe: type, source of water/air, pressure, duration, and condition of equipment.

   j. What is the bed expansion (%)?

   k. What is the backwash rate (gal/min/ft^{2*})? *NOTE: ft^2 refers to the filter surface area.

9. Are filter-to-waste procedures followed after backwash? Does the plumbing allow for filter-to-waste?

10. What are the procedures when filter put back on-line after backwash (eg. slowly increase filter rate)?

11. What are the procedures for plant start-up (eg. backwash filters; filter-to-waste)?

12. Are there obvious problems with the filter(s) (eg. mudballs, media cracking, uneven bed expansion)?

13. For surface water plants:
   a. Are influent and effluent turbidity measurements taken from each individual filter?
   b. Are the turbidimeters cleaned and calibrated regularly?

LIQUID DISINFECTION

Check all that apply: ___Pre-disinfection ___Post-disinfection ___Disinfection

1. Chemical used: *Brand Name*: ______________________
   NSF Approved? Y/N *Chemical Name*: ______________________
   Concentration: ______________________

2. Is it purchased as a liquid solution or as a dry powder? ______________________

3. What is the dilution ratio and/or concentration of the chemical feed? ______________

4. Is an adequate residual being maintained? Y/N

5. Location of disinfectant injection point(s): ______________________

6. Is there a day tank and/or mixing tank? Y/N. Size: _____gal. How often filled? _____

7. For systems with alternating wells and one chemical feed pump, is the feed rate adjusted for each wel (eg. if wells have different pumping capacities)? Y/N

8. Is the disinfectant dosage automatically adjusted according to variations in water quality or quantity vi flow-paced equipment or streaming current detectors? Y/N

   If no, are manual adjustments typically made? Y/N
   What is the basis for the adjustments (eg. residuals)?

9. Describe chemical feed/injection equipment:
   Equipment condition:
   Are the feed equipment and line accessible for repairs? Y/N

10. What determines when chemical is fed (eg. well pump signals feed pump)? ______________

11. Is operational stand-by/back-up equipment provided? If not, are critical spare parts available?

12. Chemical storage:
    Amount: ______________ *Location*: ______________
    Adequate/safe? ______________ *Purchase/refill sched*: ______________

13. Are proper safety precautions being taken in the handling of the chemicals? (eg. gloves) Y/N

14. Is there a Preventative Maintenance program? Y/N

15. Chlorine storage and feed equipment area(s):
    a. Isolated from other areas? Y/N
    b. Heated? Y/N
    c. Ventilated? Y/N
    d. Warning sign on door? Y/N
    e. Exhaust fan and light switches outside bldg.? Y/N

16. Is there a continuous chlorine analyzer? Y/N

'7. For surface water systems, has the chlorine contact time ever been calculated? Y/N. Is it sufficient

PWS ORGANIZATION

1. Ownership/Management Type (check applicable category)

   PUBLIC (Town/City/District/State)
   [ ] Water Commissioner
   [ ] Selectmen
   [ ] Town Manager
   [ ] Other:____________________

2. Governing Body (Water Commissioners, Selectmen, Trustees, Operator, and other legally responsible parties). Please list the names, addresses, telephone numbers on the Update Form (or on blank page).

   Name of Governing Body:

   Length of service of its members (term of office):

   Number of members:

   Names/Addresses/ Telephone Numbers (attach to this page):

   Number of Governing Body meetings for the year:

3. **If an organizational chart, is available, please provide OR (put on blank page) identifying the hierarchy of decision making for the PWS.**

4. **Staff Meetings How often are Staff meetings held with Staff?**

5. **Does the system have an updated master plan? Yes___ No___**

   If yes, Date updated _______

   If available, provide DEP region with a copy.

ADMINISTRATION CONTINUED

Provide staffing plan of all certified operators or complete information below.

NAME/TITLE	F/P*	DUTIES	Certification Grade/**	Total Years Experience	DEP COMMENTS

* F/P = Full Time/ Part Time

Use blank page for additional information

** Does staff have appropriate Certification?

ADMINISTRATION CONTINUED

PERSONNEL: Plant/Distribution Coverage: (Number of operators and grade certification)

Weekdays:

Shifts (Times/Overlap?/Number/Shift):

Weekends and Holidays:

Are there sufficient personnel?____

TRAINING ACTIVITIES

Do you have a plan for Staff training? If written, please supply.

What incentives and opportunities are provided to new and existing staff to train and/or to increase their knowledge on water supply?

Operator Training Budget (ATTACH if available):

Training Activities of Staff over the Last Year (attach):

FINANCIAL

FINANCIAL INFORMATION (Planned or Actual for ______ (YEAR)
Attach appropriate pages of master plan if this information is presented)

SOURCE OF REVENUE (please check): [ ] Taxes; [ ] Flat Fee; [ ] Metered User Fee; [ ] Other):____

If Budget is available, please provide. If not please fill out below:

ESTIMATED INCOME/REVENUE:*

1. Taxes: ______________
2 Flat Fee: ______________
3. User Fee: ______________
4. Connection Fee: ______________
5. ______________
6. ______________

TOTAL INCOME (A)

Review Water Rates Questionnaire on most current Annual Statistical Report.

ESTIMATED OPERATION EXPENSES

Personnel/Overtime ______________
Water Quality Testing ______________
Supplies/Operating Expenses ______________
Contract Services ______________
Repairs ______________
Debt Service (principal + interest) ______________
TOTAL EXPENSES (B) $ ______________

*Are financing and budget satisfactory?

Subtract Total Expense (B) from Total Income (A)

SURPLUS/LOSS	$

In space provided here list capital improvements planned in next six years.

CAPITAL IMPROVEMENTS	$

FINANCIAL CONTINUED

INCOME LOSSES and **INCOME SURPLUSES**. What do you do when you have an income loss or income surplus?

INCOME LOSS		INCOME SURPLUSES	
Withdraw from emergency fund		Deposit to enterprise fund	
Withdraw from enterprise fund		Deposit to general fund of town	
Withdraw from reserve account. How much is in the reserve account?		Deposit to savings	
Borrow		Deposit to emergency fund	
Delay Paying Bills		Deposit to water department operations budget	
Others:		Profit/Income	
		Pay bond interest, Pay down debt	
		Pay corporate dividend	
		Buy needed equipment or supplies	
		Other:	

How much money do you set aside for major repairs and emergencies?_______________ This reflects what percentage of your total estimated expenses?__________________.

Have you ever received subsidized grants and/or loans from state and/or federal resources? [ ] YES [ ] NO.
Are you eligible for state and federal grants and loans? [ ] Yes [ ] No. Please describe.

SMALL SYSTEM ISSUES

Are you under rent control, which precludes any rate increase?

Are you under DPU or FHA restrictions/constraints?

GENERAL DATA

Total number connections________________ % Metered____________________
Consumption (Daily-MGD) Maximum__________ Minimum_______ Average_______
Maximum Hourly____________

MUNICIPALITIES/DISTRICT SERVED BY WATER SUPPLY

Municipality/District	Total Population	Population Served	Avg. Consumption (MGD)

PERMANENT INTERCONNECTIONS WITH OTHER WATER SUPPLIES*

Water Survey Purveyor	Give location and arrangement for use. What is the maximum daily flow in MGD for this interconnection and when was it last used or tested.
	POSSIBLE TEMPORARY INTERCONNECTIONS

REMARKS: Are interconnection valves operable?
Is there a maintenance plan to keep valves optional?
Last date inspected?
Results of Inspection

* DWS staff locate interconnections in the field

Distribution System Maps and Records

(1) Are up-to-date distribution system maps available?________________________

Do we have a copy?__________________________

(2) Are up-to-date records on valve locations kept?________________________

(3) Are there dead end areas in the distribution system?____________________

If yes how many_________

Are they clearly shown on available distribution system maps?_________________

Is there a program in place to eliminate dead ends?________________________

Are terminal hydrants available on dead ends?______________________________

(4) Are sampling locations indicated on Distribution Map?_______________________

(5) Describe the flushing program in place___________________________________

Does program address the dead end areas?__________________________________

(6) Are the locations, type and size of master meters shown on available distribution system maps?____

____

If not, list them____

(7) List the distribution system weakness and problems (river crossings, corrosion, breaks, freezing, etc).

____

____

____

(8) For Consecutive systems: are source bacteria sampling locations indicated in distribution map?

____

____

____

(9) Do you have a copy of the water quality sampling schedule for WQA monitoring?

____

____

____

OPERATION AND MAINTENANCE

What is the method of scheduling maintenance?

Spare Parts Inventory

Is there a spare parts inventory?

Is it adequate to prevent long delays in equipment repairs?

Pump Maintenance

Is a maintenance schedule available for pumps, valves?______________________________
Chemical feed ____
Turbine pumps ____
High & low lift pumps ____

Are pump maintenance records kept? Yes ( ) No ( )

Operation and Maintenance Manual

Are operation details posted for operator daily use for maintenance?

Is an O & M Manual available and accessible to staff?

Does manual conform to DWS policy? Yes____ No____.
Is it used?

Does manual provide guidance for operational decisions?

Instrumentation/Process Automation

Are there alarms or instrumentation for process automation? (Such as chlorine, turbidity, etc.) List

Are adequate Resources Available for Operation and Maintenance What kind? e.g. outside support/contractors.

Safety and Protective Equipment

Are there adequate safety and personnel protective equipment provided?

DISTRIBUTION PROTECTION CROSS CONNECTION PROGRAM

1. Does the PWS have an approved cross connection program?

   Yes___No___

   If yes, does the PWS have delegation?

   If no, by what date does the PWS plan to submit their cross connection implementation plan?

   Is a third party used to survey or test as part of your programs?

   If yes, ________ Name & contact person

2. Have all industrial, commercial, and institutional facilities been surveyed by the PWS?

   Yes___No___

   If no, what is the estimated completion date for surveying all facilities?________

3. How many employees are currently assigned to the cross connection program?________

4. Were all reduced pressure backflow prevention devices tested twice a year by the PWS?

   Yes___No___

   If no, explain

5. Were all double check valve assemblies tested once a year by the PWS?

   Yes___No___

   If no, explain

6. Are there any outstanding cross connection violations? Yes_____No_____

   If yes, explain

7. Is DEP assistance needed?

   PWS Owned Cross Connections.

   Are backflow prevention devices installed at all DWS OWNED locations? Select

   ___No___Yes or___NA(not applicable)

   Are devices approved, permitted? Select_____No____Yes, or____NA(not applicable)

   Are cross connections being inspected each year?
   Select ___NO___YES, or___NA(not applicable)

PWS I.D.

Purveyor:______________________________

DISTRIBUTION SYSTEM DATA PIPE USED IN WATER SUPPLY

Portion of Transmission line and Distribution System	Type of Pipe	Miles of Pipe	Pipe Diameter	Date Installed Cleaned/Line
Source to Treatment Facility				
Treatment Facility to Distribution System				
Distribution System				

PRESSURE

Location			
In Treatment Plant at	In Distribution System at	Minimum (20 PSI)	Maximum (PSI)

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EMERGENCY PLANS

1. Is the Emergency Response Plan Phone and Contact List from Annual Statistical Form H Posted? Is an emergency plan available and workable?

   How many level I, II, and III incidents has the system had in the past year?________ (see Statistical report form for definition).

   If there were incidents, were they all reported to DWS? ______

   Is the system experiencing any of the following water quantity/quality problems? inadequate supply, no back up source, hazardous spill, boil order, emergency declaration, also distribution or system problems such as pipe breaks or cross connections.

WATER QUANTITY/CONSERVATION

1. Does this system have adequate plans for meeting its water quantity for the next twenty years? (this should be in PWS master plan). If not, what do they plan to do?

2. Does this system have a (Water Management Act) WMA withdrawal registration and/or permit?

3. Check annual statistical information on water consumption to determine if their demand agrees with WMA amount.

4. Is this system in compliance with its water conservation plan included in the WMA withdrawal permit?

5. Is there a WMA permit requirement to delineate Zone II or adopt land use controls?

6. Submittal dates met or being pursued?

WATER QUALITY

1. List violations and actions taken for the last twelve months.____

2. Give the number and type of water quality complaints during the past year?____

3. Have the causes of these complaints been determined? Explain.____

4. Has the Water Department investigated and/or taken any corrective action with respect to these complaints?____

5. Does the Water Department have a complaint tracking log?____

6. Does the water receive treatment, if so is the treatment designed to correct any of the problems noted above?____

PURVEYOR: PWS ID # _

WELLS OF INFILTRATION GALLERY *

IDENTIFYING NAME OR NUMBER	Total Depth (FT)	Yield GPM**		INSTALLATION DATA							
		Safe	Avg.	Date	Screen Length	Casing Depth	Casing Height	Vent 18" Invert	Sample Cock Raw/Finish	Sanitary Seal (Y/N)	Grout Depth
a											
b											
c											
d											
e											
f											

Well	PUMP					WATER LEVEL					RECHARGE AREA
	Type	HP	Capacity GPM	Aux. Power	Fuel Storage	Dynamic	Limit Switch	Posted	Bylaw	Proper Radius	½ Mile Radius Subject to: +
a											
b											
c											
d											
e											
f											

(Attach well logs for each well.)

1) Do all wells have required radii? _____
If No, list wells ______

2) Are all areas properly maintained? _____
If No, state problems ______

3) Is dry well properly located? ______

4) Are any sources legally abandoned? If Yes, any plans to return?

Remarks: ______

* VERIFY SOURCE STATUS INFORMATION
** APPROVED PUMPING RATE
\+ KEY: Flood-f, Drought-d, Underground Storage Tank-T, Saltstorage-s, Subsurface disposal-ss, Solid Waste-sw, Hazardous Waste-hw, Agriculture-agr, Industrial-ind, Other-o

WELLHEAD PROTECTION

SOURCE(s) ____

(may be completed for one or more sources at once)

1. Is there a sanitary well seal? yes ___ no ___
   Distance sealed cap on well above ground ___ ft.
   Is there a well log/specification that indicates that a proper sanitary seal was installed?

2. Zone I
   a. What is the Approved Pumping rate_____gpd (If available)
   b. Zone I radius in feet______
   c. (Interim Wellhead Protection Area) IWPA radius in feet _______

3. DWS Evaluate progress toward source protection.

4. DWS Evaluate land uses from Annual Statistics.

5. DWS note land uses in Zone 1/IWPA that might change SOC/VOC waiver designation (i.e. VOC or pesticide use in Zone I).

6. Does water supplier inspect the Zone II annually? Required by 310 CMR 22.21(4)

7. Does water supply need underground injection (UIC referral?)

   UIC Referrals: Within a Zone I or Zone II/IWPA, industrial facilities managing hazardous materials (e.g. auto repair garage, dry cleaner, machine shop, furniture stripping, etc) should be referred to the UIC Program for a possible inspection. UIC inspectors address unauthorized discharges to the ground (e.g. via a floor drain leading to a dry well or septic system) in such facilities. The threat may be less in sewered areas as determined on a case-by-case basis.

PUBLIC WATER SUPPLY EVALUATION
SURFACE SOURCE

A) Name of Source ____________________

B) Terminal Reservoir? ____________________

C) Total Surface Area ____________________

D) Total Storage Capacity ____________________

E) Watershed Area in Sq. Miles ____________________

G) Pumped Gravity ____________________

(1) What portion of the watershed is owned by the purveyor? ____________________

*a) What are the potential sources of pollution? (Sewage facilities, industrial waste facilities, farm animals, fertilizer, pesticides, roadway spills, timbering operations, sand and gravel operations, recreational activities, etc. ____________________

b) List potential sources within 100 feet per 310 CMR 22.20 ____________________

(2) What sources of pollution have been causing periodic problems? ____________________

How frequently? ____________________

(3) What is being done to correct the problem? ____________________

(4) How frequently is the watershed inspected?

(5) **Has a watershed protection plan been completed for surface supply? ____________________

* Review Annual Statistics - Land Uses
** Required under 310CMR 22.20(9)

RAW WATER IMPOUNDMENTS

(1) Is supply taken from a multi-purpose reservoir? (used for recreation, flood control, power production, etc.)

____

____

____

(2) Is the reservoir area fenced and/or posted?

____

(3) How is the raw water quality affected by heavy rainfall?

____

(4) Is the reservoir subject to algae related problems?

____

If yes, is Aquatic herbicide used in reservoir or on dam?

____

INTAKE STRUCTURES

(1) How many intakes are provided?

____

(2) Is the intake stationary or movable?

____

(3) At what depth(s) is the intake(s)?

____

(4) What is the maximum intake capacity?

____

(5) a) Is the intake(s) screened and in good condition?______________________________
Date last checked:______________________________

(6) Condition of pumphouse or dam?______________________________

Remarks:______________________________

____

____

____

____

____

Purveyor: PWS I.D.#

PUBLIC WATER SUPPLY EVALUATION
TREATED WATER STORAGE

Name or Number of Storage Unit	TYPE OF STORAGE				LOCATION OF STORAGE			Frequency of Clean-ing	Last Date Cleaned	Material Used to Construct	Capacity (MG)
	Under Ground	Ground Level	Elevated	Hydropneu-matic tank	Plant	Distri-bution System	Condi-tion of Tank				

Name or Number of Storage Unit	PROTECTION AND SAFETY						SITE PROTECTION			
	Proper Overflow Structure	Covered and Locked	Properly Vented & Screened	Sample Tap *	High Level Control/ Alarm	Low Level Control/ Alarm	Flood	Runoff	Fenced	Overflow Elevation

1) Can each storage unit be bypassed for repair and cleaning without interrupting service? ____________________

2) Is there sufficient storage for fire protection? ____________________

Remarks: ____________________

* Before or after tank? ____________________

Purveyor:

PWS I.D. #

PUBLIC WATER SUPPLY EVALUATION
PUMPS & PUMPING STATIONS, DISTRIBUTION SYSTEM

PUMPING STATION:		REGULAR	EMERGENCY
A	LOCATION		
	FUNCTION		
B	LOCATION		
	FUNCTION		
C	LOCATION		
	FUNCTION		
D	LOCATION		
	FUNCTION		

Pump Station					SUCTION			DISCHARGE			MOTOR		
	Type	Date Installed	Standby/ * Emerg. Power	Capacity (GPM)	Size - inches	Combined or Separate	Head (feet)	Size - inches	Combined or Separate	Head (feet)	HP	Type Power (Gas, Elec.etc)	Control Automatic or Manual

* Frequency of Testing ______________________

Remarks: ______________________

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PWS ID#

PUBLIC WATER SUPPLY EVALUATION
CHEMICAL FEED EQUIPMENT

Purveyor: ____________________

Source: ____________________

Plant Name: ____________________

Chemical(s)	Point of Application of Unit	Chemical Feed Unit			Feed					Operation				Scales	
		Reg.	Emer.	anti-Siphon Valve	Solution	Dry	Range mg/l	Average used lb/day	Supply (Days)	Automatic	Manual	X-Conn	Pacing	Yes	No

a. Is the chemical feed equipment in a separate room? ____________________

b. Is it properly ventilated? ____________________

Are the feed lines color coded? If so, what chemicals are represented by what colors? ___

____

____

Can chemical storage, be measured? ____________________

Is there adequate chemical contaminant? ____________________

Is there an eye wash and/or shower? ____________________

If phosphates are used is a chlorine residual maintained in feed? ____________________

If fluoride, is an upflow saturator used? ____________________

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TREATMENT

Chemical Feed

1) Do chemical feed facilities provide adjustable feed ranges that are easily set for operation at all required dosages?

____

____

2) How is the feed rate determined? ______________________

Are feed rates easily measured?______________________

Are feed rates checked and adjusted?______________________

How is the chemical feed equipment being calibrated and at what frequency is it calibrated?

____

____

3) Who maintains and/or operates chemical feed? Name and Grade______________

____

4) Are monthly chemical treatment forms currently being completed and reported to DEP?

____

5) DWS will evaluate operator for performing chlorine residual test

____

Chlorinator Equipment Inspection (Gas)

Purveyor: ______________________

PWS I.D. #

Type of Chlorination: ______________________

Location: ______________________

	YES	NO	UNSAT	N/A
Access to chlorinator room from outdoors				
Doors of chlorinator room open outward				
Chlorinators in separate room				
Observation window present				
Air inlets near ceiling				
Exhaust ports near floor				
Mechanical ventilation				
Switches for fans and lights outside room				
*Adequate heating in chlorination room (min 60F)				
Spare cylinders stored in same room				
If so, adequate room for movement, storage etc.				
Cylinders are restrained in position				
Alarm system for alert if Cl2 leaks				
Bottle of ammonia present				
Gas mask present (SCBA) Positive Pressure				
Gas mask located outside chlorinator room (SCBA)				
*Operator protective clothing on hand				
*Standby chlorinator				
*Separate injection line for standby				
*If not, is extra corporation cock installed				
*Is standby equal in capacity to regular				
Is capacity estimated to be sufficient to produce free residual of 2 ppm after contact time of 30 minutes at max. flow rates and max. demand				
*Pacing				
*Are chlorinators set to start and stop with main pumps				
Ventilation of chlorinators to outdoors and above grade				
Automatic Switch cover				
Number of Cylinders hooked up adequate to prevent cl2 icing				
Cylinders on scale(s)				
Scale(s) flush with floor				

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Purveyor:_______________________ PWS I.D. #

CHLORINATOR EQUIPMENT INSPECTION (GAS) PAGE TWO

	YES	NO	UNSAT	N/A
Standby non-electric water feed pump for chlorinators				
Does feed pump engage automatically at power failure				
*Approved means for residual testing				
*Sampling point located at least 100 feet downstream from cl2 injection point				
Chlorine residual recorders				
*Spare parts present				
*Tools on hand				

1. Size of Cylinders?_______________________
2. Are Chlorination facilities properly maintained?_______________________
If no explain_______________________

HYPOCHLORINATORS

1. Type of hypochlorite used?_______________________
2. % of available chlorine ?_______________________
3. Is hypochlorite diluted?_______________________
4. What is hychlorite storage capacity?_______________________
   Is it properly stored?_______________________
5. Is a stand by pump available?_______________________

*Hypochlorinator also

NOTE: Use chemical feed equipment sheet for additional hychlorinator reviews.

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PWS I.D.#

Purveyor: ____________________
Source: ____________________
Plant Name: ____________________

PUBLIC WATER SUPPLY EVALUATION AERATION

Location of Unit in Treatment Scheme	Purpose	Aeration Unit						
		Spray	Forced Draft	Air/Water Ratio	Media Type	Other	Protected Contamination	Can unit be Bypassed?

1) Can water be sampled; Before ________? After ________?
   a) Method of cleaning ____________________
   b) Is backwash/cleaning water properly disposed of? ____________________

2) Has unit been approved by Air Quality? ____________________

3) Post Aeration disinfection? ____________________

Remarks: ____________________

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Purveyor: ____________________

Source: ____________________

Plant Name: ____________________

PWS I.D. #

PUBLIC WATER SUPPLY EVALUATION
MIXING FACILTIES

RAPID MIXING

Location of Unit in treatment Scheme	Unit no.	Type of Unit				Detention Time (seconds)	
		Over and Under or around end Baffles	Vertical or Horizontal Shaft Mixer and HP	Static Mixer	Variable or Constant Speed	Design	Actual

FLOCCULATION BASINS

# of Compartments	Unit No.	Type of Basin			Detention Time (mins.)		Flow-through Velocity or Flow	
		Over & end Baffle or around	Vertical or Horizontal shaft mixer and HP	Tapered	Design	Actual	Design	Actual

1. Can Floc formation be observed? ____________________
2. Can Samples be taken after; Rapid Mix? __________ Flocculation? __________

Remarks: ____________________

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Pu. ,yor: ____________________

Plant Name: ____________________

PWS I.D.

PUBLIC WATER SUPPLY EVALUATION SEDIMENTATION

SEDIMENTATION UNIT			DETENTION TIME		WEIR OVERFLOW RATE gpd/ft.		TYPE OF SLUDGE REMOVAL	SAMPLE TAP
TYPE	NUMBER	WATER DEPTH FT.	DESIGN	ACTUAL	DESIGN	ACTUAL		

1. What provisions have been made for the disposal of sludge?

____

____

2. Can sedimentation units be bypassed for cleaning?

____

____

3. How frequently are the units cleaned? ____________________

____

____

Date Last cleaned ____________________

4. What has been done to minimize shortcircuiting at the basin outlet? ____________________

____

5. Are basins covered? ____________________

Remarks: ____________________

____

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PUBLIC WATEK SUP. .Y EVALUATION
FILTERS AND ION EXCHANGES

Purveyor
Source:
Plant Name: ______________________

PWS ID #

Number and Type of Filters or Ion Exchanges		Ion Exchange Resin or Filter Media				Supporting Gravel		Filter Runs (Hrs.)			Backwash	
Gravity	Pressure	Type *	Depth (inches)	Effective Size (mm)	Uniformity Coefficient	Depth (inches)	Diameter (inches) Min. Max.	Minimum	Average	Maximum	Rate GMP/Ft^2	Length (minutes)

1) Describe the general condition of the filter media (worn, improper stratification, and ball formation, etc.)

2) Is a combination air and water backwash system used?_____ If so, how effective is it? ____________

3) Are loss of head and rate of flow controllers provided and in good operating condition?____________

4) What is the source of backwash water? ____________

5) What happens to the used backwash water? ____________

6) a) Is adsorptive capacity of gal tested on a regular basis? ____________
b) If yes, what method is used? ____________
c) At what point is GAC replaced/regenerated? ____________

7) Where are sampling locations (e.g., influent, on each filter, combined)? ____________
Is there a continuous turbidimeter at sampling location?____________

* If GAC, answer question No. 6

SDWA COMPLIANCE

LEAD AND COPPER RULE COMPLIANCE

1. Have you submitted a lead and copper sampling plan? Do you keep it current noting any changes in sampling locations?

2. Have you completed your required monitoring?

3. Did you exceed the lead or copper action levels? If you exceeded the lead level have you completed the required initial public education?

4. If you exceeded the lead and/or copper action level have you completed your "Desk Top Evaluation" (Form 141-C) and submitted it to your DEP regional office? Does your system need help with this? L and C Staff Referral if required.

5. If you exceeded the lead and/or copper action level have you completed the required water quality parameter monitoring and source water monitoring for lead and copper? (NOTE: Th water quality sites as determined by the population served must be sampled twice during the monitoring period during which the exceedance occurred.)

PWS Name:________________________________PWSID:________________

FINDINGS

DWS STAFF must describe performance of the PWS for each of the following areas, at a minimum. Describe areas which exceed, meet, or are deficient in meeting DWS regulations, guidelines and policies. When applicable, indicate type of technical assistance as followup by DEP and/or a Mobilization partner (giving organization name/address/telephone number/contact person).

Section 1: ADMINISTRATION

Section 2: OPERATIONS AND MAINTENANCE

Section 3: TREATMENT

Section 4: DISTRIBUTION

Section 5: DISTRIBUTION SYSTEM PROTECTION: CROSS CONNECTIONS

Section 6: EMERGENCY PLANS

Section 7: WATER QUANTITY

Section 8: WATER QUALITY

Section 9: RESOURCE PROTECTION

Section 10: FUTURE REGULATORY REQUIREMENTS

 Date: / /

FORM 1 - INVITATION LETTER TO DEBRIEFING MEETING FOR SYSTEMS "WHERE VIOLATIONS ARE FOUND" -

meeting scheduled, or meeting to be scheduled.

> **NOTE: "Violations" are violations of regulation or statute, i.e., conditions which endanger the delivery of fit and pure water to all consumers.**

REGION LETTERHEAD
Town:
PWS Name:
PWS I.D. #:
Date:

Address

Attention:

RE: <u>COMPREHENSIVE COMPLIANCE EVALUATION: Sanitary Survey Stage 1</u>

On ____________________, a Comprehensive Compliance Evaluation (Sanitary Survey Stage 1) of the above referenced public water system (PWS) was conducted by the Department of Environmental Protection (DEP) Division of Water Supply (DWS). A sanitary survey is an on site review of the water sources, facilities, equipment, operation and maintenance of a public water system for the purpose of evaluating the adequacy of such source, facilities, equipment, operation and maintenance for collecting and distributing safe drinking water.

Attached you will find the following:

1. Comprehensive Compliance Evaluation - "Sanitary Survey Report"
2. "Findings"
3. "Compliance Plan"

During the course of the sanitary survey the Department discovered violation(s) of regulation or statute, that is, condition(s) in the source, facilities, equipment, operation and maintenance of the PWS which jeopardize the delivery of pure and safe water to all consumers (hereafter collectively referred to as "violations"). All violations found at the PWS are listed in Section A of the attached Compliance Plan. Additional recommendations for improving your system may also have been identified, and if so, are listed in Section B of the

Compliance Plan.

Debriefing Meeting and Written Proposal for Compliance
Please review the attached Report, Finding and Compliance Plan.

OPTION 1:

[, and contact (name) ____________ of this office at (phone number) ________ by (date) _______ to arrange for a debriefing meeting. You are requested to bring with you to the debriefing meeting a written proposal describing how and when you propose to come into compliance and correct the violations listed in the Compliance Plan. The written proposal can be created by filling out columns II and III of the Compliance Plan.]

OPTION 2:

[or: before the debriefing meeting scheduled for (date) ______ at (time) ______ (place) _________________________. You are requested to bring with you to the debriefing meeting a written proposal describing how and when you propose to come into compliance and correct the violations listed in the Compliance Plan. The written proposal can be created by filling out columns II and III of the Compliance Plan.]

At the debriefing meeting we will discuss the Department's evaluation of your system including the violations listed in the Compliance Plan, the actions necessary to achieve compliance, and your written proposal.

Plan for Future Compliance
At the meeting, your input on the system's future compliance efforts is essential. Together we will work out a final Compliance Plan specifying how and when your system will come into compliance by completing columns II and III of the Compliance Plan, describing the actions to be taken and a schedule for correcting the identified problems. If we can agree on the final terms to be inserted into columns II and III, DEP will ask you to sign the compliance schedule and a consent order which incorporates the terms and requirements of the schedule.

Alternatively, the Division may issue a Notice of Noncompliance with a Compliance Plan for all violations found at your system, or a unilateral administrative order requiring that necessary corrective actions be taken within reasonable deadlines. Noncompliance with the terms of such an order or the terms of a NON may result in further enforcement action, including the imposition of penalties of up to $25,000 for each day after the effective date of the order or Notice during which each violation continues or is repeated.

Attendance at the Meeting
In order to ensure the attendance of the persons who are primarily responsible for taking the appropriate actions in response to this survey, please invite to the debriefing meeting the chief operator, water commissioners, and chief financial officer (or person(s) responsible

for budgeting). The Division strongly urges you to make every effort to ensure the attendance of the responsible officials for your system. The attendance of these officials will expedite the drafting and implementation of your system's written proposal to come into compliance in response to the survey findings.

The DWS staff in this region looks forward to meeting with the responsible officials for your public water system to help you achieve and maintain compliance with the drinking water regulations and improve the overall quality of your system. If you have any questions please contact the above mentioned DWS staff person.

Sincerely,

DWS Water Supply Chief
__________ Region

enc: Comprehensive Compliance Evaluation - Sanitary Survey Report
Findings
Compliance Plan

cc: DEP/DWS Boston
City/Town Board of Health
Town Manager/Board of Selectmen

FORM 2 - letter
1) CONFIRMING DEBRIEFING MEETING HELD AT THE SITE where compliance schedule "FIELD NON" ISSUED, i.e.,
2) FOR SYSTEMS WITH VIOLATIONS
3) THE COMPLIANCE SCHEDULE WAS FILLED OUT COMPLETELY AT THE SITE, including dates for taking action; SIGNED OR UNSIGNED BY PWS
4) AND COMPLIANCE PLAN IS A NON (THAT OPTION IS CHECKED).

NOTE: "Violations" are violations of regulation or statute, i.e., conditions which endanger the delivery of fit and pure water to all consumers.

REGION LETTERHEAD
Town:
PWS Name:
PWS I.D.#:
Date:

Address:

Attention:

RE: <u>COMPREHENSIVE COMPLIANCE EVALUATION: Sanitary Survey Stage 1</u>

On ____________________, a Comprehensive Compliance Evaluation (Sanitary Survey Stage 1) of the above referenced public water system (PWS) was conducted by the Department of Environmental Protection (DEP) Division of Water Supply (DWS). A sanitary survey is an on site review of the water sources, facilities, equipment, operation and maintenance of a public water system for the purpose of evaluating the adequacy of such source, facilities, equipment, operation and maintenance for collecting and distributing safe drinking water.

Attached you will find the following:
1. Comprehensive Compliance Evaluation - "Sanitary Survey Report"
2. "Findings"
3. "Compliance Plan"

During the course of the sanitary survey the Department discovered violation(s) of regulation or statute, that is, condition(s) in the source, facilities, equipment, operation and maintenance of the PWS which jeopardize the delivery of pure and safe water to all consumers (hereafter collectively referred to as "violations"). All violations found at the PWS are listed in Section A of the attached Compliance Plan. **Please note that the attached Compliance Plan is also a Notice of Noncompliance (NON) pursuant to M.G.L. c.21A, §16 and 310 C.M.R. 5.00.** Additional recommendations for improving your system may also have been identified, and if so, are listed in Section B of the Compliance Plan.

Debriefing Meeting

After the sanitary survey was completed the representative of the Division of Water Supply met with ________________________ (name) __________________ (title) from your public water system. At the debriefing meeting the Division's evaluation of your system, including the violations and any recommendations identified by the Division to improve your system were discussed. ______________ (name), representing your public water system, acknowledged receipt of the Compliance Plan/NON at that time. Enclosed with this letter is a copy of the signed Compliance Plan/NON discussed at that meeting. Please note that the NON requires, among other things, the submission of quarterly written progress reports on the identified violations.

Nowithstanding this Notice of Noncompliance, the Department reserves the right to exercise the full extent of its legal authority in order to obtain full compliance with all applicable requirements. Noncompliance with the terms of the NON may result in further enforcement action, including the assessment of administrative penalties of up to $25,000 for each day after the effective date of the NON during which each violation continues or is repeated, or the issuance of a unilateral administrative order requiring the necessary corrective action within a reasonable time period. Noncompliance with the terms of such an order may result also in further enforcement action, including the imposition of penalties of up to $25,000 for each day after the effective date of the Order during which each violation continues or is repeated.

The DWS staff in this region look forward to working together with the responsible officials for your public water system to help you achieve and maintain compliance with the drinking water regulations and improve the overall quality of your system. If you have any questions please contact the above mentioned DWS staff person.

Sincerely,

DWS Water Supply Chief
___________ Region

enc: Comprehensive Compliance Evaluation - Sanitary Survey Report
Findings
Compliance Plan

cc: DEP/DWS Boston
City/Town Board of Health
Town Manager/Board of Selectmen

COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENVIRONMENTAL PROTECTION

In the Matter of: ____________________ PWS ID# __________	AO - ____ - ____

Model Consent Order

PARTIES

1. The Massachusetts Department of Environmental Protection (hereinafter referred to as the "Department") is a duly constituted agency of the Commonwealth of Massachusetts having its principal office located at One Winter Street, Boston, MA, 02108, and a regional office located at ______________ ____________________, ______________, MA __________.

2. The (choose one) City/Town/Water Company/Water District of ____________________ (hereinafter referred to as "PWS") is a (choose one) duly constituted political subdivision of the Commonwealth/duly constituted corporation doing business in Massachusetts/ duly constituted Water District having its principal offices located at ______________________ __________ __________.

STATEMENT OF FACT AND LAW

3. The Department has primary enforcement responsibility of the requirements of the federal Safe Drinking Water Act, 42 U.S.C. §§300f <u>et seq.</u> (hereinafter the "Act"), and the regulations promulgated thereunder by the United States Environmental Protection Agency (hereinafter "EPA").

4. The Department may issue such orders as it deems necessary to ensure the delivery of safe and pure drinking water by public water systems to all consumers. M.G.L. c.111, §160. The Department may also require by order the provision and operation of such treatment facilities as it deems necessary to insure the delivery of a safe water supply to all consumers. M.G.L. c. 111, §5G.

5. Pursuant to the authority granted to the Department in M.G.L. c.111, §160, the Department's Division of Water Supply has

promulgated the Massachusetts State Drinking Water Regulations at 310 CMR 22.00, applicable to all public water systems.

6. PWS is a Public Water System as defined by 310 C.M.R. 22.02, 42 U.S.C. §300f(4), and 40 C.F.R. §141.2.

7. On ____________ (date) a representative of the Department conducted a Sanitary Survey (sometimes referred to as a "Sanitary Survey Stage 1" or a "Comprehensive Compliance Evaluation") of the entire PWS system. A Sanitary Survey is an on site review of the water sources, facilities equipment, operation and maintenance of a PWS for the purpose of evaluating the adequacy of such sources, facilities, equipment, operation and maintenance for producing and distributing safe drinking water. 310 C.M.R. 22.02.

8. As a result of the sanitary survey, the Department identified violations of the drinking water regulations, deficiencies in meeting the Department's Guidelines and Policies for Public Water Systems and general sanitation standards which imperil the delivery of a fit and pure supply of water by the PWS to all of its consumers (hereinafter referred to as "violations").

9. The Findings of the Sanitary Survey and draft Compliance Plan were sent to the PWS. The Sanitary Survey Findings is attached to and incorporated into this Order as Attachments A.

10. On ____________ PWS attended a meeting with representatives of the Department to discuss the Findings of the Sanitary Survey, and the required actions necessary to achieve compliance.

[Use paragraph 11 for systems which have agreed to a schedule.

Use paragraph 12 for systems which have not agreed to a schedule at the debriefing meeting, but are willing to sign a consent order.

11. At the meeting PWS and the Department agreed on a Compliance Plan specifying the necessary corrective actions, and reasonable deadlines by which the necessary corrective action for each violation will be accomplished.

remember: USE ¶ 11 OR 12 - not both.

12. At the meeting PWS and the Department were not able to agree upon a Compliance Plan specifying the necessary corrective actions and the deadlines by which the necessary corrective action for each violation should be accomplished.

DISPOSITION AND ORDER

13. In order to facilitate long range system planning, conserve resources and expedite compliance, and pursuant to the authority

granted to the Department by M.G.L. c.111, §160, M.G.L. c.21A, §16, 310 C.M.R. 5.00 and 310 C.M.R. 22.00, the Department hereby issues and the PWS hereby consents to the following Order.

14. All violations and recommendations, necessary and recommended corrective actions, and mutually agreeable deadlines for completing the required actions, are listed in the Compliance Plan appended hereto as Attachment B. The Compliance Plan is hereby incorporated into and made a part of this Consent Order. The parties hereby agree that the deadlines listed in the Compliance Plan constitute reasonable time periods by which the actions required shall be accomplished.

15. This Consent Order shall constitute an admission by PWS of the violations listed in the Compliance Schedule.

Note: If PWS's object to this paragraph it may be omitted. The following may also be substituted:

"This Consent Order shall not constitute an admission of liability on the part of the PWS."

16. Each undersigned representative hereby certifies that he or she is fully authorized to enter into this Consent Order and to legally bind the respective parties to the terms and conditions of this Order.

17. This Consent Order shall be binding on the PWS and all its heirs, successors and assigns. No change in ownership of PWS shall alter the responsibility of PWS under this Order. PWS shall not violate this Consent Order and shall not allow or suffer its employees, agents, or contractors to violate this Consent Order.

18. Nothing in this Consent Order shall be construed as, or operate as, barring, diminishing, or in any way affecting any legal or equitable right of the Department to issue any future Order with respect to the subject matter of this Consent Order, or in any way affecting any other claim, action, suit, cause of action or demand that the Department may have with respect thereto.

19. optional: If any event occurs beyond the reasonable control and without the fault of PWS and any entity PWS controls, which causes or contributes to a delay in PWS achieving compliance with this Consent Order which could not have been avoided with the exercise of due care, foresight or due diligence on the part of PWS, PWS shall notify the Department in writing within 15 days of the occurrence. Such notice shall include the cause of the delay, the anticipated length of the delay, and measures taken or planned to be taken to minimize the delay, and may include a

request to revise the Compliance Schedule deadlines for implementing the required measures. If such a request is made it shall include a proposed revised Compliance Schedule for implementing the required measures. The Department may extend the performance dates in question for a period of time up to the length of the anticipated delay. Upon approval of the request to revise the Compliance Schedule, PWS shall implement such measures approved by the Department, including any requirements to avoid or minimize any delay.

20. Optional, but please use if you use Paragraph 19 Unanticipated or increased costs associated with the implementation of the required actions, or changes financial circumstances of PWS shall not be considered circumstances beyond the control of PWS for the purposes of this Consent Order.

21. PWS shall be responsible for procuring all federal, state and local permits, licenses and approvals necessary to perform the work required by this Consent Order and agrees to exert its best efforts to obtain all such necessary permits, licenses and approvals in a timely fashion. All work required by the terms of this Order shall be performed in accordance with applicable federal, state and local laws, regulations and approvals.

22. Any written submittal required of PWS pursuant to this Consent Order shall be delivered or mailed to:

(name)____________
Department of Environmental Protection
____________ Region
Division of Water Supply
__________, MA ________

23. This Consent Order shall be considered a Notice of Noncompliance issued pursuant to M.G.L. c.21A, §16 and 310 C.M.R. 5.00. PWS is advised that if it fails to comply with this Consent Order, M.G.L. c.21A, §16 and M.G.L. c. 111, §160 provide for civil administrative penalties of up to $25,000 for each day after the effective date of this Consent Order during which each violation covered by this Order continues or is repeated.

24. Commencing on ____________(date)_ and continuing every three months thereafter, PWS shall submit a quarterly progress report to the Department summarizing the progress made in completing the required actions set out in Attachment A to this Order.

25. The Department expressly reserves its right pursuant to M.G.L. c.111, §165, and 310 C.M.R. 22.18 to inspect the system and enter any system facility to monitor PWS's compliance with this Consent Order, M.G.L. c.111, §160 and 310 C.M.R. 22.00.

26. If any term of this Consent Order shall be held to be invalid or unenforceable, the remainder of this Order shall not be affected by such validity or enforceability.

27. The effective date of this Order shall be the date of the last signature below.

For the Department
of Environmental Protection,

______________________________ ____________

Name: ______________________ Date

Title: ______________________

For ____,
Public Water System:

______________________________ ____________

Name: ______________________ Date

Title: ______________________

Attachment A: Sanitary Survey Findings
Attachment B: Compliance Plan

PWS NAME ______________________________ PWS ID# __________

SANITARY SURVEY COMPLIANCE PLAN

For use when violations are discovered during a survey

On __________(date) a Sanitary Survey was conducted of the above public water system. During that survey violations of regulations or statute were identified, and are listed in section A of the table below. Additional recommendations for improving the system may also have been identified and are listed in section B.

1) *TO SCHEDULE A DEBRIEFING MEETING - This paragraph can be used when a debriefing meeting has not yet been scheduled, or will not be scheduled.*
You must submit a written proposal to the Department setting forth how and when you propose to come into compliance and correct the violations listed below, no later than __________ (date). You may use column II and III from the table below to submit this information.

2) *WHEN DEBRIEFING MEETING HAS BEEN SCHEDULED.*
You must submit a written proposal to the Department setting forth how and when you propose to come into compliance and correct the violations listed below, at a debriefing meeting scheduled for __________(date) at __________(time) at ____(location). If you are unable to attend, please contact ___(name)__________ of the Division of Water Supply immediately at ___(phone)__________ to make/reschedule the debriefing meeting.

3) *WHEN A DEBRIEFING MEETING WAS HELD ON SITE - This paragraph may be used when the debriefing meeting is held at the PWS site, and the supplier agrees upon the necessary corrective actions and reasonable deadlines by which the actions are to be accomplished. (Using the "NON approach" when the debriefing meeting is done at the site.)*

The Findings of the Department's Sanitary Survey were discussed with the above named public water system at the end of the survey and/or a debriefing meeting held on __________(date). The following action plan to remedy the violations and achieve compliance was agreed upon by the Public Water System and the Department. Actions necessary to correct the violations found during the survey are listed in column II of the table below, and the deadlines by which the corrective actions are to be taken are listed in column III.

This Compliance Plan [is ____] or [is not _____] (check one) a Notice of Noncompliance pursuant to M.G.L. c.21A, §16, and 310 C.M.R. 5.00. Section B of this Compliance Plan is not a Notice of Noncompliance.

REMEMBER: IF this Compliance Plan is also a Notice of Noncompliance (NON): It must contain all the required elements of a NON, including reasonable deadlines for coming into compliance or deadlines for submitting a written proposal for coming into compliance.

PAGE ____ of ____

____
PWS INITIALS

Date: ___ /___ /___

PWS NAME ______________________________ PWS ID# __________

SANITARY SURVEY COMPLIANCE PLAN

For use when DEP has only Recommendations

This paragraph may be used to schedule a debriefing meeting for PWS's to discuss the Department Recommendations.

On _______ (date) a Sanitary Survey was conducted of the above public water system. During that Survey conditions at the system were identified which could be improved by implementing the Department's recommendations listed on Section B of the Compliance Plan attached to this letter. Please contact ________________(name) at ________________(phone) to schedule a debriefing meeting to discuss the Department's Sanitary Survey and Findings, including it recommendations.

____
PWS INITIALS

Date: ___ /___ /___

PWS NAME ______________________ PWS ID# ________

SANITARY SURVEY COMPLIANCE PLAN

SIGNATURE PAGE

For use when Section A of the Compliance Plan has been filled out

For Public Water System:

______________________ Signature	______________________ Title
______________________ Printed Name	______________________ Date
______________________ Signature	______________________ Title
______________________ Printed Name	______________________ Date
______________________ Signature	______________________ Title
______________________ Printed Name	______________________ Date
______________________ Signature	______________________ Title
______________________ Printed Name	______________________ Date

For the Department of Environmental Protection:

______________________ Signature	______________________ Title
______________________ Printed Name	______________________ Date

____
PWS INITIALS

Date: ___ /___ /___

PWS NAME ______________________ PWS ID# __________

SANITARY SURVEY COMPLIANCE PLAN

SIGNATURE PAGE

For use when Section B of the Compliance Plan has been filled out

I hereby acknowledge receipt of the findings and inspection report of the sanitary survey conducted by the Department of Environmental Protection's Division of Water Supply, including this compliance schedule, with its recommended actions to improve the system.

For the Public Water System:

______________________ Signature	______________________ Title
______________________ Printed Name	______________________ Date
______________________ Signature	______________________ Title
______________________ Printed Name	______________________ Date
______________________ Signature	______________________ Title
______________________ Printed Name	______________________ Date

For the Department of Environmental Protection:

______________________ Signature	______________________ Title
______________________ Printed Name	______________________ Date

PAGE ____ of ____ ______________ PWS INITIALS Date: ___ /___ /___

PWS NAME ______________________ PWS ID # ______________

SANITARY SURVEY

COMPLIANCE PLAN - SECTION A - VIOLATIONS

#	I. VIOLATIONS OF REGULATION OR STATUTE	II. CORRECTIVE ACTION	III. DEADLINE FOR TAKING CORRECTIVE ACTION *	IV. DWS USE

* Please be reminded to provide DEP with quarterly progress report or as otherwise specified in writing by DWS; for example on 1/1/94, 3/1/94, 6/1/94, 12/1/94, etc.

PAGE __ OF __ ______________ DATE __/__/__

PWS NAME ____________________ PWS ID # ____________________

SANITARY SURVEY
COMPLIANCE PLAN - SECTION A - VIOLATIONS

#	I. VIOLATIONS OF REGULATION OR STATUTE	II. CORRECTIVE ACTION	III. DEADLINE FOR TAKING CORRECTIVE ACTION*	IV. DWS USE

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PAGE ___ OF ___

____
PWS INITIALS

DATE ___/___/___

PWS NAME ____________________ PWS ID # ____________________

SANITARY SURVEY

COMPLIANCE PLAN - SECTION B - RECOMMENDATIONS

Recommendations to improve the protection of drinking water and public health. DEP/DWS will provide technical assistance to systems responding to these recommendations. Please call your regional DWS office for referral to the appropriate staff person.

#	I. IDENTIFIED PROBLEM	II. RECOMMENDED ACTIONS TO IMPROVE THE SYSTEM	III. TIME FOR TAKING RECOMMENDED ACTIONS *	IV. DWS USE

* Please monitor progress and provide DEP with progress reports.

PAGE __ OF __

____
PWS INITIALS

DATE __/__/__

PWS NAME ____________________ PWS ID # ____________________

SANITARY SURVEY

COMPLIANCE PLAN - SECTION B - RECOMMENDATIONS

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* Please monitor progress and provide DEP with progress reports.

PAGE ___ OF ___ ____________________ PWS INITIALS DATE __/__/__

COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENVIRONMENTAL PROTECTION

In the Matter of: ________________ PWS ID# ________	)	AO - _____ - _____

Model Consent Order

PARTIES

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STATEMENT OF FACT AND LAW

3. The Department has primary enforcement responsibility of the requirements of the federal Safe Drinking Water Act, 42 U.S.C. §§300f <u>et seq.</u> (hereinafter the "Act"), and the regulations promulgated thereunder by the United States Environmental Protection Agency (hereinafter "EPA").

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9. The Findings of the Sanitary Survey and draft Compliance Plan were sent to the PWS. The Sanitary Survey Findings is attached to and incorporated into this Order as Attachments A.

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18. Nothing in this Consent Order shall be construed as, or operate as, barring, diminishing, or in any way affecting any legal or equitable right of the Department to issue any future Order with respect to the subject matter of this Consent Order, or in any way affecting any other claim, action, suit, cause of action or demand that the Department may have with respect thereto.

19. optional: If any event occurs beyond the reasonable control and without the fault of PWS and any entity PWS controls, which causes or contributes to a delay in PWS achieving compliance with this Consent Order which could not have been avoided with the exercise of due care, foresight or due diligence on the part of PWS, PWS shall notify the Department in writing within 15 days of the occurrence. Such notice shall include the cause of the delay, the anticipated length of the delay, and measures taken or planned to be taken to minimize the delay, and may include a

request to revise the Compliance Schedule deadlines for implementing the required measures. If such a request is made it shall include a proposed revised Compliance Schedule for implementing the required measures. The Department may extend the performance dates in question for a period of time up to the length of the anticipated delay. Upon approval of the request to revise the Compliance Schedule, PWS shall implement such measures approved by the Department, including any requirements to avoid or minimize any delay.

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21. PWS shall be responsible for procuring all federal, state and local permits, licenses and approvals necessary to perform the work required by this Consent Order and agrees to exert its best efforts to obtain all such necessary permits, licenses and approvals in a timely fashion. All work required by the terms of this Order shall be performed in accordance with applicable federal, state and local laws, regulations and approvals.

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(name)____________________
Department of Environmental Protection
________________ Region
Division of Water Supply
__________, MA __________

23. This Consent Order shall be considered a Notice of Noncompliance issued pursuant to M.G.L. c.21A, §16 and 310 C.M.R. 5.00. PWS is advised that if it fails to comply with this Consent Order, M.G.L. c.21A, §16 and M.G.L. c. 111, §160 provide for civil administrative penalties of up to $25,000 for each day after the effective date of this Consent Order during which each violation covered by this Order continues or is repeated.

24. Commencing on ________________(date)_ and continuing every three months thereafter, PWS shall submit a quarterly progress report to the Department summarizing the progress made in completing the required actions set out in Attachment A to this Order.

25. The Department expressly reserves its right pursuant to M.G.L. c.111, §165, and 310 C.M.R. 22.18 to inspect the system and enter any system facility to monitor PWS's compliance with this Consent Order, M.G.L. c.111, §160 and 310 C.M.R. 22.00.

26. If any term of this Consent Order shall be held to be invalid or unenforceable, the remainder of this Order shall not be affected by such validity or enforceability.

27. The effective date of this Order shall be the date of the last signature below.

For the Department
of Environmental Protection,

____________________________ ____________

Name: ____________________ Date

Title: ____________________

For ____,
Public Water System:

____________________________ ____________

Name: ____________________ Date

Title: ____________________

Attachment A: Sanitary Survey Findings
Attachment B: Compliance Plan

NEW YORK

- **Procedure for Detailed System Evaluations of Public Water Supplies**

NEW YORK STATE DEPARTMENT OF HEALTH
OFFICE OF PUBLIC HEALTH
OFFICE OF LOCAL HEALTH MANAGEMENT

ENVIRONMENTAL HEALTH MANUAL

PROCEDURE

3/23/81 TRANSMITTAL LETTER 1L

PROCEDURE: PWS 181 PAGE 1

ISSUING UNIT: Bureau of Public Water Su

SUBJECT: Detailed System Evaluations Public Water Supplies

POLICY

Public water systems which have their own source of supply and/or provide treatment will be evaluated on the following schedule:

Community Systems: At least once every five years.

Noncommunity Systems: Systems meeting the following special criteria must be evaluated at least once every ten years:

1. Systems with known violations of Part 5, State Sanitary Code.
2. Systems with surface sources.
3. Elementary and secondary schools.
4. Systems which serve 1,000 people or more, per day of operation.

Systems should be evaluated based on the following priority:

1. Community systems with known code violations.
2. Noncommunity systems with known code violations.
3. Community systems with surface sources.
4. Community systems with groundwater sources serving more than 1,000 people.
5. Noncommunity systems with surface sources.
6. Elementary and secondary schools.
7. All other community systems.
8. Noncommunity systems serving 1,000 people or more per day of operation.
9. All other noncommunity systems.

OBJECTIVES

To ensure that an adequate and safe supply of water is delivered to all consumers.

To provide guidance and assistance to suppliers of water.

To ensure compliance with applicable codes, rules and regulations.

PROCEDURE

FIELD

1. Schedules detailed system evaluation.

2. Reviews all appropriate files on the public water system including correspondence, annual inspection reports, monthly operating reports, violations, water quality, plan review, etc.

3. Determines special sampling needs and contacts Bureau of Public Water Supply (BPWS) for approval.

BPWS

4. Reviews special sampling requests and contacts DL&R to arrange for analysis.

5. Notifies FIELD of approval or disapproval for special sampling.

FIELD

6. Conducts detailed system evaluation and completes appropriate portions of evaluation forms (including inspection report form).

    a. Community Systems - GEN 218 - GEN 200

    b. Noncommunity Systems - GEN 223 - GEN 201

7. Collects microbiological samples, routine surveillance samples, and special samples as previously approved.

8. Discusses evaluation findings with responsible person:

    a. Orders immediate correction or abatement of imminent health hazards, confirmed in writing to the supplier of water within 48 hours of learning of the hazard, with copies to the Regional/Area office and the BPWS.

    b. Orders correction of serious violations and schedules re-inspection.

9. Transmits written report to supplier of water citing as a minimum:

    a. All code violations.

    b. Operational problems.

    c. Available water quality analyses.

FIELD (Cont.)

d. Compliance schedule for code violations.

e. Accomplishments of the water system.

10. Forwards one copy of the written report, detailed system evaluation form and inspection report form to the Regional/Area office. An additional copy of these reports should be submitted to the Public Service Commission if the system is a privately owned community water supply.

REGIONAL/AREA OFFICE

11. Forwards a copy of the written report, Detailed System Evaluation form and Inspection Report Form to the BPWS.

FIELD

12. Conducts follow-up inspection within prescribed schedule to assure compliance with Part 5.

a. If Code violations are corrected, notifies supplier of water in writing. Transmits one copy of letter to both Regional/Area Office, BPWS, and PSC if applicable.

b. If Code violations are not corrected, initiates appropriate enforcement action.

REFERENCES

Form GEN 218 - Detailed System Evaluation

Form GEN 223 - Small Water System Detailed System Evaluations - Groundwater Sources.

Form GEN 200 - Public Water Supply Annual Inspection

Form GEN 201 - Noncommunity Public Water Supply Annual Inspection

Part 76 - Administrative Procedure

EHM Procedure PWS 180 - Annual Inspections of Public Water Supplies

NEW YORK STATE DEPARTMENT OF HEALTH
Bureau of Public Water Supply Protection

Sanitary Survey
Public Water Systems

PART I **Section A. Identifying Information** SURVEY DATE

1. Name of Public Water System Station No.

2. Location City, Village, Town County 3. Prog. Code

Section B. Personnel Information

4. a. Chief Operator Name

b. Title and Grade

c. Home Address No. & Street City State Zip

d. Telephone No. Home Work

5. Emergency Contacts a. Day Name Tel. No.

b. Night Name Tel. No.

6. Water supplier personnel present during evaluation on (Date) Mo Day Yr

Name Title

Name Title

Name Title

7. Other Certified Operators

Name	Grade	Certificate No.
a.		
b.		
c.		
d.		
e.		
f.		
g.		
h.		

8. Remarks

PART II. General Data

1. System Name Station No.

Section A. Source Transmission Mains

2. Number from each source

3. Size Length Ft. Ft. Ft.

Diameter In. In. In.

	Yes	No	Yes	No	Yes	No
4. Protected from freezing	☐	☐	☐	☐	☐	☐
5. Blowoffs on low points	☐	☐	☐	☐	☐	☐
6. Relief valves on high points	☐	☐	☐	☐	☐	☐
7. Cleaning frequency						
8. Cleaning method						

Section B. Distribution System

9. Total storage (gallons) ☐☐☐☐☐☐☐☐☐

10. No. of storage facilities ☐☐

11. Is at least 1 day's storage provided? Yes ☐ No ☐

12. Normal maximum pressure ☐☐☐ psi

13. If maximum pressure is over 100 psi are pressure-reducing valves used? Yes ☐ No ☐

14. Normal minimum pressure ☐☐ psi

15. No. of rechlorination stations ☐☐

Section C. Miscellaneous Information

16. No. of emergency sources ☐☐ Names:

17. No. of abandoned sources ☐☐ Names:

18. Are abandoned sources adequately protected or isolated? Yes ☐ No ☐

19. Remarks

PART III. Wells or Infiltration Galleries

Section A. General Information

	#1		#2		#3	
1. Name of well or infiltration gallery						
2. Is this for regular or auxiliary use?	☐ R	☐ A	☐ R	☐ A	☐ R	☐ A
3. How often is it used?	__/__		__/__		__/__	
4. Does this source receive any treatment?	Yes ☐	No ☐	Yes ☐	No ☐	Yes ☐	No ☐

Section B. Protection (Do not use this section for springs or surface sources.)

	Yes	No	Yes	No	Yes	No
5. a. Are Watershed Rules & Regulations in effect?	☐	☐	☐	☐	☐	☐
b. If yes, when where they last updated?	Mo Day Yr		Mo Day Yr		Mo Day Yr	

6. *What is the distance to the nearest*			
a. Subsurface disposal system	Ft.	Ft.	Ft.
b. Sanitary sewer	Ft.	Ft.	Ft.
c. Storm sewer	Ft.	Ft.	Ft.
d. Waste lagoon	Ft.	Ft.	Ft.
e. Surface water	Ft.	Ft.	Ft.
	Yes No	Yes No	Yes No
7. Is it subject to 100 year flooding?	☐ ☐	☐ ☐	☐ ☐
8. Is it subject to chemical spills?	☐ ☐	☐ ☐	☐ ☐
9. Is the yield constant?	☐ ☐	☐ ☐	☐ ☐
10. Is the site properly drained?	☐ ☐	☐ ☐	☐ ☐
11. How much land from the source is owned by the supplier?	ft.	ft.	ft.
12. How much land from the source is controlled by local ordinances or WR&R?	ft.	ft.	ft.
13. How much land from the source is fenced?	ft.	ft.	ft.
	Yes No	Yes No	Yes No
14. Is the source located in a well house?	☐ ☐	☐ ☐	☐ ☐
15. (DRILLED WELL ONLY) Is the well casing properly sealed and grouted?	☐ ☐	☐ ☐	☐ ☐
16. a. Does the well vent face downward?	☐ ☐	☐ ☐	☐ ☐
b. Is it screened?	☐ ☐	☐ ☐	☐ ☐
17. a. Is the well located in a pit?	☐ ☐	☐ ☐	☐ ☐
b. If yes, is the pit floor dry and well drained?	☐ ☐	☐ ☐	☐ ☐
18. What is the distance from the floor to the top of the casing?	in.	in.	in.

Section C. Construction (for ground sources only)

19. What is the type of well?	☐ Drilled ☐ Dug ☐ Driven	☐ Drilled ☐ Dug ☐ Driven	☐ Drilled ☐ Dug ☐ Driven
20. What is the diameter of the well?	ft.	ft.	ft.
	Yes No	Yes No	Yes No
21. a. Is the source an infiltration gallery?	☐ ☐	☐ ☐	☐ ☐
b. If Yes, what is the diameter of the collection basin?	ft.	ft.	ft.
	Yes No	Yes No	Yes No
22. Is a low water shutoff provided?	☐ ☐	☐ ☐	☐ ☐
23. Is a discharge pressure gauge provided?	☐ ☐	☐ ☐	☐ ☐
24. Is a gate valve provided?	☐ ☐	☐ ☐	☐ ☐
25. Is a check valve provided on the discharge piping?	☐ ☐	☐ ☐	☐ ☐
26. a. Is a blow-off provided on the discharge piping?	☐ ☐	☐ ☐	☐ ☐
›. If Yes, is it connected directly to a sanitary sewer?	☐ ☐	☐ ☐	☐ ☐

	Yes	No	Yes	No	Yes	No
27. Is a raw water sampling cock provided?	☐	☐	☐	☐	☐	☐
28. Is a well alarm system provided?	☐	☐	☐	☐	☐	☐
29. a. Is the source metered?	☐	☐	☐	☐	☐	☐
b. Are daily records kept?	☐	☐	☐	☐	☐	☐

Section D. Well Maintenance (for ground sources only)

30. When was the well last reconditioned? ______ ______ ______

31. What chemical was used in the last reconditioning? ______ ______ ______

Section E. Well Pump (for ground sources only)

32. What is the capacity? ☐☐☐☐ gpm ☐☐☐☐ gpm ☐☐☐☐ gpm

	Yes	No	Yes	No	Yes	No
33. Does the pump cycle more than 4 times /hour?	☐	☐	☐	☐	☐	☐
34. Are air relief valves provided?	☐	☐	☐	☐	☐	☐
35. Is the pump on a routine maintenance schedule?	☐	☐	☐	☐	☐	☐

36. What is the general condition of the:

a. Pump ______ ______ ______

b. Motor ______ ______ ______

c. Switch gear ______ ______ ______

Section F. Auxiliary Power (for ground sources only)

	Yes	No	Yes	No	Yes	No
37. Is auxiliary power supply provided on site?	☐	☐	☐	☐	☐	☐
	M	A	M	A	M	A
38. Is it engaged manually or automatically?	☐	☐	☐	☐	☐	☐

39. What fuel does the generator use?

☐ Gasoline	☐ Gasoline	☐ Gasoline
☐ Diesel	☐ Diesel	☐ Diesel
☐ Propane	☐ Propane	☐ Propane

40. How often is auxiliary power tested? ______ ______ ______

	Yes	No	Yes	No	Yes	No
41. Are the exhaust gases properly vented?	☐	☐	☐	☐	☐	☐

Section G. Remarks

PART IV. Pumping

Section A. General Information

1. What is the pump station name?	________	________	________
2. Is it used for distribution or transfer pumping?	☐ D ☐ T	☐ D ☐ T	☐ D ☐ T
3. What is the type of use?	☐ Regular ☐ Auxiliary ☐ Emergency	☐ Regular ☐ Auxiliary ☐ Emergency	☐ Regular ☐ Auxiliary ☐ Emergency
4. Are gate valves located on suction and discharge sides of each pump?	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
5. Is check valve located on discharge side of pump?	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
6. Is total flow from each station metered?	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
7. What is total pumping capacity from each station?	____ gpm	____ gpm	____ gpm
8. Does pump cycle more than 4 times/hour?	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
9. Is the pump on manual or automatic control?	☐ M ☐ A	☐ M ☐ A	☐ M ☐ A
10. If automatic, what type of control?	________	________	________
11. Is pump station clean and dry?	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
12. Is proper drainage provided?	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
13. Is pump station subject to 100 year flooding?	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
14. Is pump station fenced?	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Are a sufficient number of pumps provided?	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
16. Is there a low pressure shutoff or alarm provided at each station?	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
17. Is a standard pressure gauge installed on each discharge line?	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
18. Is a compound gauge installed on the suction line of each pump?	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
19. Are pumps on a routine maintenance schedule?	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
20. What is the general condition of the: a. Pump	________	________	________
b. Motor	________	________	________
c. Switch gear	________	________	________

Section B. Auxiliary Power

21. Is auxiliary power supply provided on site?	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
22. Is it engaged manually or automatically?	☐ M ☐ A	☐ M ☐ A	☐ M ☐ A
23. What fuel does the generator use?	☐ Gasoline ☐ Diesel ☐ Propane	☐ Gasoline ☐ Diesel ☐ Propane	☐ Gasoline ☐ Diesel ☐ Propane
24. How often is auxiliary power tested?	________	________	________
2. .re the exhaust gases properly vented?	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

Section C. Remarks

PART V. Finished Water Storage

Section A. Treatment Plant Storage

	#1		#2		#3	
1. Plant name						
2. Storage volume (in millions)	☐☐☐ gal.		☐☐☐ gal.		☐☐☐ gal.	
3. Type of storage	☐ Elevated ☐ Ground level ☐ Below ground		☐ Elevated ☐ Ground level ☐ Below ground		☐ Elevated ☐ Ground level ☐ Below ground	
4. Type of use	☐ Clear well ☐ Backwash		☐ Clear well ☐ Backwash		☐ Clear well ☐ Backwash	
	Yes	No	Yes	No	Yes	No
5. Is common wall shared with unfinished water?	☐	☐	☐	☐	☐	☐
6. Is storage facility covered and protected?	☐	☐	☐	☐	☐	☐
7. Are there any noticeable leaks in the storage facility?	☐	☐	☐	☐	☐	☐
8. Are deposits from purification chemicals present?	☐	☐	☐	☐	☐	☐
9. Is a water level indicator provided?	☐	☐	☐	☐	☐	☐

Section B. Distribution Storage

	#1		#2		#3	
10. Name of distribution storage facility						
11. Usable volume (in millions)	☐☐☐ gal.		☐☐☐ gal.		☐☐☐ gal.	
12. Type	☐ Elevated ☐ Ground level ☐ Below ground		☐ Elevated ☐ Ground level ☐ Below ground		☐ Elevated ☐ Ground level ☐ Below ground	
	Yes	No	Yes	No	Yes	No
13. Is storage facility covered?	☐	☐	☐	☐	☐	☐
14. If uncovered, is effluent adequately disinfected?	☐	☐	☐	☐	☐	☐
	Yes	No	Yes	No	Yes	No
15. a. Are roof hatches accessible?	☐	☐	☐	☐	☐	☐
b. Locked?	☐	☐	☐	☐	☐	☐
16. Does the overflow have a screen or a hinged flap?	☐	☐	☐	☐	☐	☐
17. Is the site fenced?	☐	☐	☐	☐	☐	☐
18. Are access ladders inaccessible to the public?	☐	☐	☐	☐	☐	☐
19. Does the storage facility have a separate drain?	☐	☐	☐	☐	☐	☐
20. How often is water in storage tank turned over?	__/__		__/__		__/__	
21. Is a chlorine residual maintained in tank?	☐	☐	☐	☐	☐	☐
22. Is there adequate surface drainage around tank?	☐	☐	☐	☐	☐	☐

	Yes	No	Yes	No	Yes	No
23. Is elevation adequate to maintain 20 psi?						
24. Are level controls provided?						
25. Is the level monitored 24 hrs/day?						
26. Is an altitude valve used?						
27. Are valve pits vandal proof?						
28. Is cathodic protection of tank provided?						
29. Are anodes periodically checked and replaced?						

30. a. Inspection date of exterior paint
    b. Inspection date of interior paint

31. a. Date last painted (exterior)
    b. Date last painted (interior)

	Yes	No	Yes	No	Yes	No
32. Was acceptable paint used in the interior?						
33. Has a maintenance contract been provided?						

Section C. Hydropneumatic Storage

34. Name of facility

35. Usable volume ______ gal ______ gal ______ gal

	Yes	No	Yes	No	Yes	No
36. Is a pressure gauge provided?						

37. Pressure range, PSI ___ - ___ ___ - ___ ___ ___

	Yes	No	Yes	No	Yes	No
38. a. Is an air volume control provided?						

b. If Yes, what type?

	Yes	No	Yes	No	Yes	No
39. Is a sight glass provided?						

Section D. Remarks

PART VI. Transmission & Distribution System

Section A. Distribution Transmission Mains

1. Plant name

2. Number of transmission mains

3. a. Size of mains: length ______ ft. ______ ft. ______ ft.

   b. diameter ___ in. ___ in. ___ in.

	Yes	No	Yes	No	Yes	No
4. Are mains adequately protected from freezing?						
re relief valves provided on high points?						

	Yes	No	Yes	No	Yes	No
6. Are blowoffs provided on low points?	☐	☐	☐	☐	☐	☐
7. a. Are mains periodically flushed?	☐	☐	☐	☐	☐	☐
b. If Yes, how often?						

Section B. Distribution System

	Yes	No	Yes	No	Yes	No
8. Is an adequate map maintained?	☐	☐	☐	☐	☐	☐
9. Has a card system been developed that locates valves, etc.?	☐	☐	☐	☐	☐	☐
10. Are there areas with chronic low pressure problems?	☐	☐	☐	☐	☐	☐
11. Is the fire flow adequate?	☐	☐	☐	☐	☐	☐
12. a. Are valves exercised regularly?	☐	☐	☐	☐	☐	☐
b. If Yes, How often?	/		/		/	

	Yes	No	Yes	No	Yes	No
13. Do dead ends in distribution system pose problems?	☐	☐	☐	☐	☐	☐
14. Are blowoffs provided where necessary?	☐	☐	☐	☐	☐	☐
15. a. Is the system periodically flushed?	☐	☐	☐	☐	☐	☐
b. If Yes how often?	/		/		/	

	Yes	No	Yes	No	Yes	No
16. Are mains protected from freezing?	☐	☐	☐	☐	☐	☐
17. Is a replacement and/or relining program in place?	☐	☐	☐	☐	☐	☐
18. Is 15% or more of water unaccounted for?	☐	☐	☐	☐	☐	☐
19. Is a water conservation program in effect?	☐	☐	☐	☐	☐	☐
20. Are replacement parts available?	☐	☐	☐	☐	☐	☐
21. Are new piping & repairs adequately disinfected?	☐	☐	☐	☐	☐	☐

22. Describe the general condition of the system.

Section C. Cross Connection Control

	Yes	No	Yes	No	Yes	No
23. Is an ordinance in effect?	☐	☐	☐	☐	☐	☐
24. If Yes, is ordinance adequate?	☐	☐	☐	☐	☐	☐
25. Is an effective inspection program in effect?	☐	☐	☐	☐	☐	☐
26. Is a maintenance and testing program in effect?	☐	☐	☐	☐	☐	☐

Section D. Communities that Purchase Water

	Community Name	ID#	Population	Consumption (gal)
27. a.				
b.				
c.				
d.				
e.				

28. Remarks

PART VII. Disinfection

Section A. General Information

	#1		#2		#3	
1. Location of facilities						
2. Number of units at each location	☐		☐		☐	
3. Disinfection method						
	Yes	No	Yes	No	Yes	No
4. Is capacity adequate?	☐	☐	☐	☐	☐	☐
5. Are chemicals stored properly?	☐	☐	☐	☐	☐	☐
6. Is a 30 day supply on hand?	☐	☐	☐	☐	☐	☐
7. Has there been a problem obtaining chemicals?	☐	☐	☐	☐	☐	☐
8. Is sufficient stand-by equipment available?	☐	☐	☐	☐	☐	☐
9. Are spare chlorinator parts available?	☐	☐	☐	☐	☐	☐
10. Is a treated water tap provided?	☐	☐	☐	☐	☐	☐
11. If Yes, what is the contact time at the tap?	min	hr	min	hr	min	hr
12. Contact time before first consumer: a. Ground water	min	hr	min	hr	min	hr
b. Surface water	min	hr	min	hr	min	hr
13. Type of chlorine residual kit used	☐ OTA	☐ DPD	☐ OTA	☐ DPD	☐ OTA	☐ DPD
14. Describe the general condition of the chlorinators						

Section B. Gas Chlorination

	#1		#2		#3	
15. Facility name						
16. Point of application						
17. Purpose	☐ Pre-treatment ☐ Post-treatment		☐ Pre-treatment ☐ Post-treatment		☐ Pre-treatment ☐ Post-treatment	
	Yes	No	Yes	No	Yes	No
18. Is self-contained breathing apparatus available?	☐	☐	☐	☐	☐	☐
	Yes	No	Yes	No	Yes	No
19. Are chlorinators located in a separate room?	☐	☐	☐	☐	☐	☐
20. Is there an outside entrance with panic hardware?	☐	☐	☐	☐	☐	☐
21. Is a sight window present?	☐	☐	☐	☐	☐	☐
22. Is the room properly vented?	☐	☐	☐	☐	☐	☐
Is there adequate forced ventilation?	☐	☐	☐	☐	☐	☐

24. Is the exhaust fan properly located?	☐	☐	☐	☐	☐	☐
25. Are controls for fan and light outside of room?	☐	☐	☐	☐	☐	☐
26. Are gas leak detectors provided?	☐	☐	☐	☐	☐	☐
27. Are cylinders placed on scales while in use?	☐	☐	☐	☐	☐	☐
28. Is gas piping simple and supported?	☐	☐	☐	☐	☐	☐
29. Are safety chains used for all cylinders?	☐	☐	☐	☐	☐	☐
30. Is chlorinator room adequately heated?	☐	☐	☐	☐	☐	☐
31. Is the proper cylinder repair kit provided?	☐	☐	☐	☐	☐	☐

Section C. Hypochlorination

32. Facility name			
33. Point of application			
34. Purpose	☐ Pre-treatment ☐ Post-treatment	☐ Pre-treatment ☐ Post-treatment	☐ Pre-treatment ☐ Post-treatment
35. Hypochlorite used a. Type	☐ Sodium ☐ Calcium ☐ Common bleach	☐ Sodium ☐ Calcium ☐ Common bleach	☐ Sodium ☐ Calcium ☐ Common bleach
b. Concentration	__ %	__ %	__ %
36. What size crock is used for mixing?	__ gal.	__ gal.	__ gal.
37. What is the final solution strength?	__ %	__ %	__ %
38. Describe the general condition of the chlorinators.			

Section D. Other Methods

39. Facility name			
40. Point of application			
41. Purpose	☐ Pre-treatment ☐ Post-treatment	☐ Pre-treatment ☐ Post-treatment	☐ Pre-treatment ☐ Post-treatment
42. Describe the overall condition of the equipment.			
43. Describe any special safeguards that should be used with this equipment.			

Section E. Remarks

PART VIII. Treatment Plant Maintenance & Safety

Name of Treatment Facility ....

Section A. Maintenance

	Yes	No
1. Is plant generally neat & clean?	☐	☐
2. Is the interior piping maintained & color coded?	☐	☐
3. Are there condensation problems in the interior of the plant?	☐	☐
4. Is masonry work inside and outside of the plant well maintained?	☐	☐
5. Is a preventive maintenance schedule in place for:		
a. Motors	☐	☐
b. Mechanical equipment	☐	☐
c. Structure	☐	☐
6. Are equipment & tools needed for routine maintenance provided?	☐	☐
7. Are commonly needed replacement parts available?	☐	☐
8. Is a separate maintenance staff provided?	☐	☐

Section B. Safety

	Yes	No
9. Are emergency telephone numbers posted next to frequently used phones?	☐	☐
10. Are chemical feed rooms properly ventilated?	☐	☐
11. Are the activated carbon feed and storage rooms separate from the rest of the facility?	☐	☐
12. Do activated carbon feed and storage rooms contain:		
a. spark proof fixtures	☐	☐
b. no smoking signs	☐	☐
13. Are eye wash stations located in:		
a. Laboratory	☐	☐
b. Chemical storage area	☐	☐
c. Chemical feed area	☐	☐
d. Any area where chemicals are handled/stored	☐	☐
14. Are emergency showers located in:		
a. Laboratory	☐	☐
b. Chemical storage area	☐	☐
c. Chemical feed area	☐	☐
d. Any area where chemicals are handled/stored	☐	☐
15. Do the chemical storage and feed rooms contain:		
a. Goggles	☐	☐
b. Aprons	☐	☐
c. Rubber gloves	☐	☐
16. Is a first aid kit provided?	☐	☐
17. Are fire extinguishers		
a. Provided	☐	☐
b. Properly located	☐	☐
18. Are railings provided around all tanks and basins?	☐	☐
19. Is emergency lighting adequate to maintain routine facility operation?	☐	☐
20. Are overhead hazards present?	☐	☐
21. Are hard hats available and used?	☐	☐
22. Are there any specific safety hazards in the plant? If Yes, please describe under Remarks.	☐	☐

23. Remarks

PART IX. Emergency Plan

Section A. General Information

1. Is an emergency telephone list containing the following available?

	Yes	No
a. Ambulance	☐	☐
b. Hospital	☐	☐
c. Doctor	☐	☐
d. Fire	☐	☐
e. Police	☐	☐
f. Power company	☐	☐
g. Local public health/district engineer	☐	☐
h. Responsible official	☐	☐

2. List emergency sources available to the public water system.

	Yes	No
3. Are portable auxiliary power sources available?	☐	☐

Section B. Emergency Plan

	Yes	No
4. a. Does a written emergency plan exist?	☐	☐
b. If Yes, are job duties assigned to all personnel?	☐	☐

5. Does the plan effectively handle the following emergencies?

	Yes	No
a. Flooding	☐	☐
b. Power outages	☐	☐
c. Hurricanes	☐	☐
d. Main breaks	☐	☐
e. Vandalism	☐	☐
f. Loss of source	☐	☐
g. Chemical spills	☐	☐
h. Other emergencies	☐	☐

	Yes	No
6. Is all equipment necessary to handle an emergency at hand or at an emergency equipment stockpile?	☐	☐
7. Is the emergency plan up to date?	☐	☐

8. Remarks

PART X. Laboratory

1. Laboratory that analyzes monitoring samples for:

	Name	Approved Laboratory Yes	Approved Laboratory No
a. Microbiology		☐	☐
b. Inorganic chemicals		☐	☐
c. Organic chemicals		☐	☐
d. Radiological		☐	☐

	Yes	No
2. Is a copy of Subsection 5-1.23 "Reporting Emergency Changes" posted?	☐	☐

PART XI. Conclusions and Recommendations

1. State conclusions reached from evaluation; list commendations as well as deficiencies.

2. State specific recommendations based on the deficiencies found.

NEW YORK STATE DEPARTMENT OF HEALTH
Bureau of Public Water Supply Protection

Small Water System Sanitary Survey
Ground Water Sources

SECTION A. Identifying Information

Survey Date M D Y

1. Name of System   Sta. No.

2. Location (City, Village, Town)   County   3. Prog. Code

4a. Name of Public Water System

b. Address	No. & Street	City	State	Zip	Tel. No. ( )

5a. Owner of Water Supply

b. Address	No. & Street	City	State	Zip	Tel. No. ( )

	#1	#2
6. Name of well or infiltration gallery		
7. Is this for regular or auxilliary use?	☐ R ☐ A	☐ R ☐ A
8. How often is it used?	/	/
9. Does this source receive any treatment?	☐ Yes ☐ No	☐ Yes ☐ No

SECTION B: Protection

	#1	#2
1a. Are Watershed Rules & Regulations in effect?	☐ Yes ☐ No	☐ Yes ☐ No
b. If yes, when were they last updated?	M D Y	M D Y
2. What is the distance to the nearest:		
a. Subsurface disposal system?	Ft.	Ft.
b. Sanitary sewer	Ft.	Ft.
c. Storm sewer	Ft.	Ft.
d. Waste lagoon	Ft.	Ft.
e. Surface water	Ft.	Ft.
3. Is it subject to 100 year flooding?	☐ Yes ☐ No	☐ Yes ☐ No
4. Is it subject to chemical spills?	☐ Yes ☐ No	☐ Yes ☐ No
5. Is the yield constant?	☐ Yes ☐ No	☐ Yes ☐ No
6. Is the site properly drained?	☐ Yes ☐ No	☐ Yes ☐ No
7. How much land from the source is owned by the supplier?	Ft.	Ft.
8. How much land from the source is controlled by local ordinances or WR&R?	Ft.	Ft.
9. How much land from the source is fenced?	Ft.	Ft.
10. Is the source located in a well house?	☐ Yes ☐ No	☐ Yes ☐ No
11. (DRILLED WELL ONLY) Is the well casing properly sealed and grouted?	☐ Yes ☐ No	☐ Yes ☐ No

12a. Does the well vent face downward?	☐ Yes ☐ No	☐ Yes ☐ No
b. Is it screened?	☐ Yes ☐ No	☐ Yes ☐ No
13a. Is the well located in a pit?	☐ Yes ☐ No	☐ Yes ☐ No
b. If yes, is the pit floor dry and well drained?	☐ Yes ☐ No	☐ Yes ☐ No
14. What is the distance from the floor to the top of the casing?	☐☐ In.	☐☐ In.

SECTION C. Construction

1. What is the type of well?	☐ Drilled ☐ Dug ☐ Driven	☐ Drilled ☐ Dug ☐ Driven
2. What is the diameter of the well?	☐☐☐ Ft.	☐☐☐ Ft.
3a. Is the source an infiltration gallery?	☐ Yes ☐ No	☐ Yes ☐ No
b. If Yes, what is the diameter of the collection basin?	☐☐☐ Ft.	☐☐☐ Ft.
4. Can the water level in the source be measured?	☐ Yes ☐ No	☐ Yes ☐ No
5. What is the static water level?	☐☐☐ Ft.	☐☐☐ Ft.
6. What is the pumping water level?	☐☐☐ Ft.	☐☐☐ Ft.
7. Is a low water shutoff provided?	☐ Yes ☐ No	☐ Yes ☐ No
8. Is a discharge pressure gauge provided?	☐ Yes ☐ No	☐ Yes ☐ No
9. Is a gate valve provided?	☐ Yes ☐ No	☐ Yes ☐ No
10. Is a check valve provided on the discharge piping?	☐ Yes ☐ No	☐ Yes ☐ No
11a. Is a blow-off provided on the discharge piping?	☐ Yes ☐ No	☐ Yes ☐ No
b. If Yes, is it connected directly to a sanitary sewer?	☐ Yes ☐ No	☐ Yes ☐ No
12. Is a raw water sampling cock provided?	☐ Yes ☐ No	☐ Yes ☐ No
13. Is a well alarm system provided?	☐ Yes ☐ No	☐ Yes ☐ No
14a. Is the source metered?	☐ Yes ☐ No	☐ Yes ☐ No
b. Are daily records kept?	☐ Yes ☐ No	☐ Yes ☐ No

SECTION D. Well Maintenance

1. When was the well last reconditioned?	__ __ M Y	__ __ M Y
2. What chemical was used in the last reconditioning?	__________	__________

SECTION E. Well Pump

1. What is the capacity?	☐☐☐ GPM	☐☐☐ GPM
2. Does the pump cycle more than 4 times/hour?	☐ Yes ☐ No	☐ Yes ☐ No
3. Are air valves provided?	☐ Yes ☐ No	☐ Yes ☐ No
4. Is the pump on a routine maintenance schedule?	☐ Yes ☐ No	☐ Yes ☐ No
5. What is the general condition of the: a. Pump	________	________
b. Motor	________	________
c. Switch gear	________	________

SECTION F. Auxiliary Power

1. Is auxiliary power supply provided on site?	☐ Yes ☐ No	☐ Yes ☐ No
2. Is it engaged manually or automatically?	☐ M ☐ A	☐ M ☐ A
3. What fuel does the generator use?	☐ Gasoline ☐ Diesel ☐ Propane	☐ Gasoline ☐ Diesel ☐ Propane
4. How often is auxiliary power tested?	________	________
5. Are the exhaust gases properly vented?	☐ Yes ☐ No	☐ Yes ☐ No

SECTION G. Disinfection

1. Location of facilities	________	________
2. Number of units at each location	☐	☐
3. Disinfection method (hypo/gas)	________	________
4. Is capacity adequate?	☐ Yes ☐ No	☐ Yes ☐ No
5. Are chemicals stored properly?	☐ Yes ☐ No	☐ Yes ☐ No
6. Is a 30 day supply on hand?	☐ Yes ☐ No	☐ Yes ☐ No
7. Has there been a problem obtaining chemicals?	☐ Yes ☐ No	☐ Yes ☐ No
8. Is sufficient stand-by equipment available?	☐ Yes ☐ No	☐ Yes ☐ No
9. Are spare chlorinator parts available?	☐ Yes ☐ No	☐ Yes ☐ No
10. Is a treated water tap provided?	☐ Yes ☐ No	☐ Yes ☐ No
11. If Yes, what is the contact time at the tap?	☐☐ Min. ☐☐ Hr.	☐☐ Min. ☐☐ Hr.
12. Contact time before first consumer:	☐☐ Min. ☐☐ Hr.	☐☐ Min. ☐☐ Hr.
13. Type of chlorine residual kit used	☐ OTA ☐ DPD	☐ OTA ☐ DPD
14. Point of application	________	________
15. Type of compound used	________	________
16. Crock size	________	________
17. Solution strength	________	________

18. Describe the general condition of the chlorinators

SECTION H: Hydroneumatic Storage

1. Location
2. Usable volume ☐☐☐☐ gal. ☐☐☐☐ gal.
3. Is a pressure gauge provided? ☐ Yes ☐ No ☐ Yes ☐ No
4. Pressure range, PSI ☐☐-☐☐ ☐☐-☐☐
5a. Is an air volume control provided? ☐ Yes ☐ No ☐ Yes ☐ No
   b. If Yes, what type?
6. Is a sight glass provided? ☐ Yes ☐ No ☐ Yes ☐ No
7. Is there a separate inlet and outlet? ☐ Yes ☐ No ☐ Yes ☐ No

Remarks

SECTION I. Distribution System

1. Are blowoffs provided where necessary? ☐ Yes ☐ No ☐ Yes ☐ No
2. Are mains adequately protected from freezing? ☐ Yes ☐ No ☐ Yes ☐ No
3. Any unprotected cross connections? ☐ Yes ☐ No ☐ Yes ☐ No
4. Are new piping/repairs adequately disinfected? ☐ Yes ☐ No ☐ Yes ☐ No
5. Production/consumption measured? ______ Prod. ______ Consum. ______ Prod. ______ Consum.
6. Number of emergency sources
7. Describe the general condition of the system.

Small Water System Sanitary Survey
Attachments, Emergency Plan, Safety, Conclusion and Recommendations

1. Name of system ______________________ Location (C,V,T) ______________

2. Date evaluation completed: |___|___|___|
 M D Y

3. Summary of existing emergency plan ______________________

4. List specific safety problems ______________________

5. Copy of subsection 5-1.23 "Reporting Emergency Changes" posted ______________________

6. List specific sanitary code violations found ______________________

7. List other deficiencies found ______________________

8. State specific conclusions/recommendations based on deficiencies from previous pages ______________________

9. Other comments ______________________

NEW YORK STATE DEPARTMENT OF HEALTH
Bureau of Public Water Supply Protection

Sanitary Survey
Springs, Surface Sources
Additional Treatments

PART I. Identifying Information

SURVEY DATE

1. Name of System — Station No. ☐☐☐☐☐☐☐☐

2. Location (City, Village, Town) — County — 3. Program Code ☐☐☐

PART II. General Information

Section A. Inventory Data – Springs

	#1	#2	#3
1. Name or number of spring	______	______	______
2. Is this for regular or auxiliary use?	☐ R ☐ A	☐ R ☐ A	☐ R ☐ A
3. How often is it used?	__/__	__/__	__/__
4. Does this source receive any treatment?	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
5. Is spring considered a surface (S) or ground (G) source?	☐ S ☐ G	☐ S ☐ G	☐ S ☐ G

Section B. Protection

	#1	#2	#3
1 a. Are Watershed Rules & Regulations in effect?	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
b. If yes, when where they last updated?	Mo Day Yr	Mo Day Yr	Mo Day Yr
2. What is the distance to the nearest:			
a. Subsurface disposal system	☐☐☐ ft.	☐☐☐ ft.	☐☐☐ ft.
b. Sanitary sewer	☐☐☐ ft.	☐☐☐ ft.	☐☐☐ ft.
c. Storm sewer	☐☐☐ ft.	☐☐☐ ft.	☐☐☐ ft.
d. Waste lagoon	☐☐☐ ft.	☐☐☐ ft.	☐☐☐ ft.
e. Surface water	☐☐☐ ft.	☐☐☐ ft.	☐☐☐ ft.
	Yes / No	Yes / No	Yes / No
3. Is it subject to 100 year flooding?	☐ ☐	☐ ☐	☐ ☐
4. Is it subject to chemical spills?	☐ ☐	☐ ☐	☐ ☐
5. Is the yield constant?	☐ ☐	☐ ☐	☐ ☐
6. Is the site properly drained?	☐ ☐	☐ ☐	☐ ☐
7. How much land from the source is owned by the supplier?	☐☐☐☐ ft.	☐☐☐☐ ft.	☐☐☐☐ ft.
8. How much land from the source is controlled by local ordinances or WR&R?	☐☐☐☐☐☐ ft.	☐☐☐☐☐☐ ft.	☐☐☐☐☐☐ ft.
9. How much land from the source is fenced?	☐☐☐☐ ft.	☐☐☐☐ ft.	☐☐☐☐ ft.
٦. Is the land posted?	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐

Section C. Construction

	#1 Yes	#1 No	#2 Yes	#2 No	#3 Yes	#3 No
1. Is there a proper cover?	☐	☐	☐	☐	☐	☐
2. Is there proper ventilation?	☐	☐	☐	☐	☐	☐
3. Is there evidence of animals?	☐	☐	☐	☐	☐	☐
4. Is an overflow provided?	☐	☐	☐	☐	☐	☐
5. Is there surface water intrusion?	☐	☐	☐	☐	☐	☐
6. Is the source metered?	☐	☐	☐	☐	☐	☐

	#1	#2	#3
7. When was the spring last cleaned?	Mo Day Yr	Mo Day Yr	Mo Day Yr
8. How often is it cleaned?	/	/	/
9. Condition of spring basin(s)			

Section D. Basin Pump

	#1		#2		#3	
1. What is the capacity?	gpm		gpm		gpm	
	Yes	No	Yes	No	Yes	No
2. Does the pump cycle more than 4 times /hour?	☐	☐	☐	☐	☐	☐
3. Are air relief valves provided?	☐	☐	☐	☐	☐	☐
4. Are pressure gauges installed?	☐	☐	☐	☐	☐	☐
5. Is the pump on a routine maintenance schedule?	☐	☐	☐	☐	☐	☐

6. What is the general condition of the:
   - a. Pump ____________ ____________ ____________
   - b. Motor ____________ ____________ ____________
   - c. Switch gear ____________ ____________ ____________

Section E. Auxiliary Power

	#1		#2		#3	
	Yes	No	Yes	No	Yes	No
1. Is auxiliary power supply provided on site?	☐	☐	☐	☐	☐	☐
	M	A	M	A	M	A
2. Is it engaged manually or automatically?	☐	☐	☐	☐	☐	☐
3. What fuel does the generator use?	☐ Gasoline ☐ Diesel ☐ Propane		☐ Gasoline ☐ Diesel ☐ Propane		☐ Gasoline ☐ Diesel ☐ Propane	
4. What is the capacity?	gpm		gpm		gpm	
5. How often is auxiliary power tested?						
	Yes	No	Yes	No	Yes	No
6. Are the exhaust gases properly vented?	☐	☐	☐	☐	☐	☐

Remarks

PART III. General Information

Section A. Inventory Data – Surface Sources

	#1	#2	#3
1. Name of the surface source			
2. Is this for regular or auxiliary use?	☐ R ☐ A	☐ R ☐ A	☐ R ☐ A
3. How often is it used?	__/__	__/__	__/__
4. Does this source receive any treatment?	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐

Section B. Protection

	#1	#2	#3
1 a. Are Watershed Rules & Regulations in effect?	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
b. If yes, when where they last updated?	Mo Day Yr	Mo Day Yr	Mo Day Yr
2. Is there a local ordinance/law limiting use?	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
3. Is there a solid waste disposal site on the watershed?	☐ ☐	☐ ☐	☐ ☐
4. Is there a scavenger disposal site on the watershed?	☐ ☐	☐ ☐	☐ ☐
5. Is there a water pollution control plant on the watershed?	☐ ☐	☐ ☐	☐ ☐
6. Is the watershed posted?	☐ ☐	☐ ☐	☐ ☐
7. Percent of agricultural use of watershed	%	%	%
8. Percent residential development in watershed	%	%	%
9. Percent of watershed owned by public water system	%	%	%
10. Are the following permitted?	Yes No	Yes No	Yes No
a. Fishing	☐ ☐	☐ ☐	☐ ☐
b. Boating	☐ ☐	☐ ☐	☐ ☐
c. Swimming	☐ ☐	☐ ☐	☐ ☐
d. Hiking	☐ ☐	☐ ☐	☐ ☐
e. Other________	☐ ☐	☐ ☐	☐ ☐
11. Radius of restricted use from intake	ft.	ft.	ft.
12. Other sources of pollution			

Section C. Source Water Quality Control

	#1 Yes	#1 No	#2 Yes	#2 No	#3 Yes	#3 No
1. Is the source subject to turnover?						
2. Is the hypolimnion blown off?						
3. Is there algae control?						
If yes, frequency of control						
4. Has DEC permit been issued?						
5. Is there weed control?						
If yes, frequency of control						
6. Has DEC permit been issued?						
7. Are there significant silted areas?						
8. Is there overgrown vegetation on the shoreline?						

Section D. Construction

	#1	#2	#3
1. Type: Reservoir (R), Impoundment (I), Stream (S)			
2. Average daily withdrawal – Mgd.			
3. Maximum daily withdrawal – Mgd.			
4. Safe Yield – Mgd.			
5. Watershed area – sq. mi.			
6. Volume of usable raw water storage – mg.			
7. Number of intake levels			
8. Frequency of cleaning intakes			

	#1 Yes	#1 No	#2 Yes	#2 No	#3 Yes	#3 No
9. Is reservoir drain exercised?						
10. Type of dam						
11. Are there leaks in the dam?						
12. Is the concrete spalling?						
13. Are trees growing on the dam?						
14. Is the dam face eroding?						
15. Are ramps/walkways safe?						
16. Overall condition						

Section E. Pumps

	#1		#2		#3	
1. What is the capacity?	☐☐☐☐ gpm		☐☐☐☐ gpm		☐☐☐☐ gpm	
	Yes	No	Yes	No	Yes	No
2. Does the pump cycle more than 4 times /hour?	☐	☐	☐	☐	☐	☐
3. Are air relief valves provided?	☐	☐	☐	☐	☐	☐
4. Are pressure gauges installed?	☐	☐	☐	☐	☐	☐
5. Is the pump on a routine maintenance schedule?	☐	☐	☐	☐	☐	☐
6. What is the general condition of the:						
a. Pump	______		______		______	
b. Motor	______		______		______	
c. Switch gear	______		______		______	

Section F. Auxiliary Power

	#1		#2		#3	
	Yes	No	Yes	No	Yes	No
1. Is auxiliary power supply provided on site?	☐	☐	☐	☐	☐	☐
	M	A	M	A	M	A
2. Is it engaged manually or automatically?	☐	☐	☐	☐	☐	☐
3. What fuel does the generator use?	☐ Gasoline ☐ Diesel ☐ Propane		☐ Gasoline ☐ Diesel ☐ Propane		☐ Gasoline ☐ Diesel ☐ Propane	
4. What is the capacity?	☐☐☐☐ gpm		☐☐☐☐ gpm		☐☐☐☐ gpm	
5. How often is auxiliary power tested?	__/__		__/__		__/__	
	Yes	No	Yes	No	Yes	No
6. Are the exhaust gases properly vented?	☐	☐	☐	☐	☐	☐

Remarks

PART IV. General Information

Section A. Treatment – Chemical Feed

	Feeder 1		Feeder 2		Feeder 3		Feeder 4	
1. Treatment objective								
2. Chemical used								
3. Feeder type								
4. Dosage in ppm								
5. Where is chemical fed to system?								
	Yes	No	Yes	No	Yes	No	Yes	No
6. Is adequate chemical storage available?	☐	☐	☐	☐	☐	☐	☐	☐
7. Is there a 30 day minimum inventory?	☐	☐	☐	☐	☐	☐	☐	☐
8. Are feed lines color coded?	☐	☐	☐	☐	☐	☐	☐	☐
9. Do feed lines clog?	☐	☐	☐	☐	☐	☐	☐	☐
10. Is there adequate dust control?	☐	☐	☐	☐	☐	☐	☐	☐
11. Frequency of feeder calibration	___/___		___/___		___/___		___/___	
12. Overall condition of feeder								

Section B. Aerators

1. Type of aerator
2. Treatment objective
3. Overall condition
4. Any operational problems? Yes ☐ No ☐

Section C. Rapid Mix

1. Type of rapid mix units
2. Number of units available ☐☐☐
3. What chemicals are used?
4. Is there proper mixing? Yes ☐ No ☐
5. Can the energy gradient be varied? ☐ ☐
6. Overall condition of rapid mix units

Section D. Flocculation

1. Type of flocculation units
2. Number of flocculation basins provided
3. How is energy gradient varied? ☐ Speed ☐ Paddles
4. Is the floc size maintained to the clarification basin? Yes ☐ No ☐
5. Is there adequate detention time? ☐ ☐

   Time in minutes

6. Is there proper flow through velocity? Yes ☐ No ☐

   Velocity in feet per second (FPS)

7. Frequency of equipment maintenance __/__
8. Overall condition of basins/equipment

Section E. Clarification

1. Type of clarifiers
2. Number of basins provided
3. What is the detention time?
4. Is there short-circuiting? Yes ☐ No ☐
5. Is effluent weir flow level and uniform? ☐ ☐
6. Is there excessive flocculation carryover to filters? ☐ ☐
7. Type of cleaning method

   Frequency of cleaning __/__

8. If tubes are used, do they self-clean? Yes ☐ No ☐
9. Installation angle of tubes ☐ 7.5° ☐ 60°
10. Method of cleaning top tubes
11. General condition of clarification units

Section F. Filtration

F1. Filters	Filter #1		Filter #2		Filter #3	
1. Type of filter						
2. Number of filters						
3. Operating rate, gpm/sq. ft.						
4. Approved design rate						
	Yes	No	Yes	No	Yes	No
5. Are filter runs too short?	☐	☐	☐	☐	☐	☐
6. Head loss/filter rate after backwash (gpm/sq. ft.)						
7. Head loss/filter rate at backwash time (gpm/sq. ft.)						
	Yes	No	Yes	No	Yes	No
8. Are the following installed?	☐	☐	☐	☐	☐	☐
backwash flow rate gauges	☐	☐	☐	☐	☐	☐
head loss gauges	☐	☐	☐	☐	☐	☐
flow rate gauges	☐	☐	☐	☐	☐	☐
9. Condition of wash troughs						
10. Is the backwash rate adequate?	☐	☐	☐	☐	☐	☐
11. Is there adequate bed expansion during backwash?	☐	☐	☐	☐	☐	☐
12. Is there a surface (air) wash provided?	☐	☐	☐	☐	☐	☐
13. Is backflow protection provided for the surface wash water?	☐	☐	☐	☐	☐	☐

F2. Media	Filter #1		Filter #2		Filter #3	
1. What type of media is used?						
2. What is the depth of the media?	in.		in.		in.	
	Yes	No	Yes	No	Yes	No
3. Are dead spots present?	☐	☐	☐	☐	☐	☐
4. Are cracks in the media evident?	☐	☐	☐	☐	☐	☐
5. Is there evidence of uneven media layering?	☐	☐	☐	☐	☐	☐
6. Are mud balls present?	☐	☐	☐	☐	☐	☐
7. Date media last analyzed	Mo Day Yr		Mo Day Yr		Mo Day Yr	
8. Uniformity coefficient						
9. What is the effective size?						
10. What is the particle shape of the media?						
	Yes	No	Yes	No	Yes	No
11. Is additional media stored on the site?	☐	☐	☐	☐	☐	☐

F2. Diatomaceous Earth Filters	Filter #1		Filter #2		Filter #3	
	P	V	P	V	P	V
1. Is it pressure or vacuum?	☐	☐	☐	☐	☐	☐
2. What is the precoat rate?						
	Yes	No	Yes	No	Yes	No
3. Does the precoat have adequate thickness?	☐	☐	☐	☐	☐	☐
4. Is the precoat water potable?	☐	☐	☐	☐	☐	☐
5. What is the body feed rate?						
6. Is the body feed rate adequate?	☐	☐	☐	☐	☐	☐
7. What type of backwash is provided?						

Section G. Backwash Waste

1. Describe type of treatment process

	Yes	No	Yes	No	Yes	No
2. Does the treatment process have DEC approval?	☐	☐	☐	☐	☐	☐
3. Is the wash water recycled?	☐	☐	☐	☐	☐	☐

If yes, where?

Condition of disposal facility

Section H. Clarification Sludge

1. Describe type of treatment process

	Yes	No	Yes	No	Yes	No
2. Is alum reclaimed?	☐	☐	☐	☐	☐	☐

3. How is the sludge ultimately disposed of?

	Yes	No	Yes	No	Yes	No
4. Is the supernatant recycled?	☐	☐	☐	☐	☐	☐
5. Does the treatment process have DEC approval?	☐	☐	☐	☐	☐	☐

Condition of disposal facility

LOCAL HEALTH DEPARTMENT - PUBLIC WATER SUPPLIES
WATER SUPPLY DATA VALIDATION / SANITARY SURVEY

System Name: DEMO SYSTEM PWS ID: 9939999
ACTIVE COMMUNITY SYSTEM

Program Code: 100 Primary Service Area Type Code: Ownership: V (CITY or VILLAGE)

System Locality: ANYWHERE(T) Gazatteer Code: 1111 System Zip: 12121-2121

Service Connections: 500 Retail Population: 10000 SNC: NO

System Production Capacity: 0 (gallons/day)

Average Daily Consumption: 0 (gallons)

Distribution Storage Cap.: 0 (gallons) Type:

System Begin Date: 95/03 (yy/mm) System Deactivation Date: / (yy/mm)

For Seasonal Supplies: Begin Date: / (mm/dd) End Date: / (mm/dd)

Percent Metered: Residential: (%) Commercial: (%) Industrial: (%)

Date of Last Visit: 03/28/95 Staff: JONES

Last Sanitary Survey: 03/28/95 Staff: JONES

Data Validation or Inspection Date (this form): ___ / ___ / ___ by: ____________________

NOTES / COMMENTS

Source/Treatment Information for: DEMO SYSTEM
PWS ID: 9939999

SOURCE TYPE	ID	AVAIL.	CODE	NAME	PRODUCTION CAPACITY (gpd)	NEXT ID	ENTRY POINT
SOURCE	001	PERM	G	WELL 1	9999999	000	Y

Treatment Objective: D Process: 423 Status: Active Required? Yes

Date Printed 03/29/95

Address Information for: DEMO SYSTEM
PWS ID: 9939999

< A=EHS OWNER, O=OWNER, B=EHS OPER, R=CHEIF OPER, E=EMPLOYEE, Z=EMERGENCY >

TYPE	LAST NAME	FIRST NAME	MI	ADDRESS
O	PUBLIC Title: MAYOR phone: (555) 555-5555	JOHN type: WORK	Q	CITY HALL 1 CITY HALL PLAZA ANYWHERE NY 121212121
R	WRENCH Title: SUPERVISOR phone: (555) 555-5555 T Certification ID: 99999 D Certification ID: 99999	JOHN type: WORK	Q	DEMO TREATMENT PLANT 2 DEMO WAY ANYWHERE NY 121212121

System Comments for: DEMO SYSTEM
PWS ID: 9939999

This is a sample of system comments. Two to three pages are available.

LOCAL HEALTH DEPARTMENT 03/29/95
PUBLIC WATER SUPPLY INSPECTION/SANITARY SURVEY

DEMO SYSTEM PWS ID: 9939999
INSPECTION/SURVEY DATE: 03/28/95 STAFF: JONES

CODE REQUIREMENT	COMPLIANCE
1) WATER SOURCE PROTECTION (5-1.12,14) This is a sample of comments section for each que stion.	>> 1 <<
2) NEW CONSTRUCTION/MODIFICATIONS/REPAIRS (5-1.20...22)	>> 1 <<
3) EMERGENCY PLANS & RESPONSE (5-1.23,25,26,33)	>> 1 <<
4) TREATMENT MAINTAINED (DISINFECTION) (5-1.30)	>> 1 <<
5) TREATMENT MAINTAINED (OTHER TREATMENT) (5-1.30)	>> 1 <<
6) ADEQUATE SYSTEM PRESSURE (5-1.27)	>> 1 <<
7) CROSS CONNECTION CONTROL (5-1.31)	>> 1 <<
8) WATER PLANT OPERATOR CERTIFICATION (5-4)	>> 1 <<
9) OPERATION REPORTS (5-1.72)	>> 1 <<
10) PUBLIC NOTIFICATION (5-1.50...52)	>> 1 <<
11) WATER QUALITY COMPLIANCE (5-1.50...52)	>> 1 <<

COMPLIANCE KEY: 1-Compliance, 2-Code Violation, 3-Unknown, 4-Not Applicable, 5-Disinfection Waiver

Disinf. Waiver Effective: / / Expires: / / Reviewed: / /
Reduced Microbiological Monitoring Date: / /
Cross Connection Devices: Installed: 4 Tested: 4

EPA REGION IV

- **Onsite Inspection Report Form**

EPA Region IV On-Site Inspection Report Form

ON SITE INSPECTION REPORT

(**Part I:** To be completed by State, Indian Land, and/or PWS)

Date:
Name of PWS: Phone:
Mailing address:
County: PWS ID#:

Physical location and directions:
Name, address, and phone no. of Owner or Person Legally Responsible:

Name(s) of Operators:
Certification/type(s):
Last Sanitary Survey completed:
PWS source(s):

PWS TYPE

- ☐ Community
- ☐ Non-Community
- ☐ Transient Non-Community
- ☐ Non-Transient Non-Community

SERVICE DATA

Service Area:
☐ Residential ☐ School
☐ Industrial ☐ Other: ___________

Population (Year round): ___________
Summer: _________ Winter: ___________
Connections: ___________________
Factoring method or actual
calculation: ___________________

Water (gal/day)
in house use: ___________________
consumer use: ___________________
raw water pumped: ___________________
water lost: ___________________

Purchased from: ___________________
Sold to: ___________________

In past 5 years have there been any?
Interruptions in service ☐
Reports of waterborne disease ☐
Complaints about water quality ☐

RESERVOIRS, LAKES, AND STREAMS

Name(s): ___________________________
____

Lat: ___________ Long: ___________

Area: ___________ Volume: ___________
Rate of flow (gal): ___________________

Frequency of intake inspection:
____

Date of last inspection ___________

STORAGE TANK(S)

Number and type of material:
ground level: ___________________
underground: ___________________
tower: ___________________

Volume (gal):
gravity _________ pressure _________

Total days supply (all sources) _____

WATER TREATMENT DATA

Daily output (gal/day):
design _________ average ___________
maximum ___________

WELL INFORMATION

Well Number	1	2	3
Latitude			
Longitude			
Well housed			
Date drilled			
Total depth (ft)			
Rate of flow			
Pump set at			
Type of pump			

COMMENTS:

DISTRIBUTION DATA

System Number	1	2	3
Type			
Origin			
Material			
Interior Diameter			
Length			

COMMENTS:

Note: If more than three wells or three distribution systems exist please use as many copies of this page as are necessary.

MONITORING AND RECORDS

VIOLATIONS				
Type of violation	Month and year		Contaminant	Federal or State
M/R:				
MCL:				
Public Notice (M/R)				
Public Notice (MCL)				

HIGH SERVICE PUMPS

Pump number	1	2	3
Type			
Make			
Model			
Capacity			
Date installed			
Last Maintenance			

COMMENTS:

Note: If more than three pumps exist please use as many copies of this page as are necessary.

ON SITE INSPECTION REPORT

(Part II: To be completed during on site visit)

Name of PWS: ______________________ PWS ID #: ______________________

PWS Source: ______________________

SPRINGS AND INFILTRATION GALLERIES

How is access to water source controlled?

- ☐ Ownership
- ☐ Ordinances
- ☐ Fencing
- ☐ Uncontrolled

Sources of potential pollution:

____

____

____

Watershed survey? ☐ Yes ☐ No

Date ____________ Agency ____________

Describe supply intake: ____________

____

____

Describe seasonal or other conditions which change water quality:

____

____

____

Overall service rating:

- Satisfactory ☐
- Unsatisfactory ☐
- Not Applicable ☐

Comments: ______________________

____

____

RESERVOIRS, LAKES, AND STREAMS

Sources of potential pollution:

____

____

Watershed survey? ☐ Yes ☐ No

Date ____________ Agency ____________

Surface treatment of contained water? ☐ Yes ☐ No

Area around intake restricted?

☐ Yes ☐ No Radius (ft) ____________

Multiple intakes at different levels?

☐ Yes ☐ No

Intakes screened? ☐ Yes ☐ No

Frequency of intake inspection:

____

Describe seasonal or other conditions which change water quality:

____

____

____

Raw water measurement for:

Turbidity ____________ PH ____________

Temp ____________ TC ____________

Giardia cyst ______________________

Overall service rating:

- Satisfactory ☐
- Unsatisfactory ☐
- Not Applicable ☐

Comments: ______________________

____

____

MONITORING AND RECORDS

Number of bacteria samples taken per month: ____________________

Is sampling procedure adequate? ☐ Yes ☐ No ☐ NA

Are copies of monitoring results, system records, and plans:
- retained on premises? ☐ Yes ☐ No
- available to surveyor? ☐ Yes ☐ No

Samples taken during survey?
☐ Yes ☐ No
type ____________________
results ____________________
____

Laboratory certified by state for:
- Bacti/Turb? ☐ Yes ☐ No ☐ NA
- Chem/Rad? ☐ Yes ☐ No ☐ NA

Overall service rating:
- Satisfactory ☐
- Unsatisfactory ☐
- Not Applicable ☐

Comments: ____________________
____

WATER TREATMENT DATA

Plant schematic readily available and up to date? ☐ Yes ☐ No

Types of treatment:
- ☐ Aeration
- ☐ Coagulation
- ☐ Flocculation
- ☐ Sedimentation
- ☐ Filtration
- ☐ Disinfection
- ☐ Fluoridation
- ☐ Corrosion Control Inhibitors
- ☐ Other____________________

Mixing, coagulation, flocculation and sedimentation:
Are chemical dosages based on laboratory data? ☐ Yes ☐ No

If not then what? ____________________
____

Chemicals used ____________________
____

Filtration:
Type __________ Media __________

Backwash determining factor(s):
- ☐ Turbidity
- ☐ Time
- ☐ Automatic setting
- ☐ Headloss
- ☐ Other ____________________

Average time between backwash: ________

Violation of finished water turbidity in past year? ☐ Yes ☐ No

Standby equipment? ☐ Yes ☐ No
In good working order? ☐ Yes ☐ No

Spare parts available? ☐ Yes ☐ No

Missing or altered data? ☐ Yes ☐ No
If "yes" explain: ____________________
____

Possible falsification of system files? ☐ Yes ☐ No
(if "yes" explain): ____________________
____

Disinfection: ☐ liquid ☐ gas
Method in use:
- ☐ Chlorine gas/liquid
- ☐ Ozone
- ☐ Na hypochlorite
- ☐ Iodine
- ☐ Ca hypochlorite
- ☐ UV
- ☐ Chloramines
- ☐ Ammonia
- ☐ Other: ____________________

Dosage ____________________

Point of application ____________________

Contact time between injection and first point of use? ____________________

Residual monitored? ☐ Yes ☐ No
TTHMs evaluated? ☐ Yes ☐ No ☐ NA

Overall service rating:
- Satisfactory ☐
- Unsatisfactory ☐
- Not Applicable ☐

Comments: ____________________
____
____

STORAGE TANKS

Type of tank(s): ____________________
Date tank(s) last cleaned ____________
Site subject to flooding?
☐ Yes ☐ No
Unit structurally sound and properly maintained? ☐ Yes ☐ No

Are overflow lines, air vents, drainage lines, and clean-out pipes:
☐ turned downward ☐ covered/screened
☐ terminated three diameters above ground ☐ NA

Can tank(s) be isolated from system? ☐ Yes ☐ No
Is storage: ☐ covered ☐ enclosed

If repaired was tank disinfected?
☐ Yes ☐ No
Are there any cisterns on site?
☐ Yes ☐ No
Do any tanks store untreated water?
☐ Yes ☐ No

Overall service rating:
Satisfactory ☐
Unsatisfactory ☐
Not Applicable ☐

Comments: ____________________
____

DISTRIBUTION DATA

Cross connection control program?
☐ Yes ☐ No
Adequate maintenance program?
☐ Yes ☐ No
Plans of system available & current?
☐ Yes ☐ No
Adequate pressure throughout the distribution system (min 20 psi)?
☐ Yes ☐ No
Interconnection with other system?
☐ Yes ☐ No
Describe: ____________________
____

Overall service rating:
Satisfactory ☐
Unsatisfactory ☐
Not Applicable ☐
Comments: ____________________
____

SAFETY

Chemicals and supplies stored properly? ☐ Yes ☐ No

Adequate ventilation in necessary areas? ☐ Yes ☐ No

Adequate safety equipment provided and required? ☐ Yes ☐ No

Breathing apparatus ☐ Yes ☐ No

Chlorine doors posted with warnings? ☐ Yes ☐ No

Chlorine doors open outward to outside? ☐ Yes ☐ No

Fan in chlorine room with vent to outside? ☐ Yes ☐ No

Leak detector in chlorine room? ☐ Yes ☐ No

Chlorine feed and storage isolated from other facilities? ☐ Yes ☐ No

Chlorine cylinders adequately restrained? ☐ Yes ☐ No

Chlorine leak kits available? ☐ Yes ☐ No

Emergency plan for all areas? ☐ Yes ☐ No

Employees familiar with emergency plan? ☐ Yes ☐ No

Backup power? ☐ Yes ☐ No

Contingency/Emergency Operating Plan? ☐ Yes ☐ No

Staff completed safety training? ☐ Yes ☐ No

Overall service rating:
Satisfactory ☐
Unsatisfactory ☐
Not Applicable ☐

Comments: ____________________
____
____

SECURITY

(Please place "X" in appropriate boxes)

	Patrolled	Fenced	Locked
Wells			
Springs and infiltration galleries			
Stream intakes			
Reservoirs and lakes			
Pump houses			
Treatment facilities			
Storage tanks			
Manholes and vaults			
Chemical storage shed			

Access to all facilities restricted to authorized personnel? ☐ Yes ☐ No

Overall service rating:

- Satisfactory ☐
- Unsatisfactory ☐
- Not Applicable ☐

Comments: ______________________________

COMPREHENSIVE OVERALL RATING FOR ENTIRE FACILITY

- Satisfactory ☐
- Unsatisfactory ☐
- Not Applicable ☐

ADDENDA - RECOMMENDATIONS - SUMMARY

Please make drawings and schematics on back of this page.

Note: If system has a diagram or schematic readily available please attach to back of this page.

Survey conducted by: ______________________________

Others present: ______________________________

ON SITE INSPECTION REPORT SUMMARY

System Name:______________________________Inspection Date:________
PWS ID: ______________Class: ________________
Address:____Tel.:____________________
Official Party: _____________________________Tel.:____________________
Address:____
Operator:____________________________________Tel.:_____-____-_________
Address: ____
No. Connections:__________No. Meter:__________Population:__________
Field Chemical Analysis: pH:________________Cl2:________________
Source:______________________Water Rates: ____________________

OVERALL GENERAL RATINGS:

SPRINGS AND INFILTRATION GALLERIES	☐ SAT	☐ UNSAT	☐ N/A
RESERVOIRS, LAKES, AND STREAMS	☐ SAT	☐ UNSAT	☐ N/A
MONITORING AND RECORDS	☐ SAT	☐ UNSAT	☐ N/A
WATER TREATMENT DATA	☐ SAT	☐ UNSAT	☐ N/A
STORAGE TANKS	☐ SAT	☐ UNSAT	☐ N/A
DISTRIBUTION DATA	☐ SAT	☐ UNSAT	☐ N/A
SAFETY	☐ SAT	☐ UNSAT	☐ N/A
SECURITY	☐ SAT	☐ UNSAT	☐ N/A

COMMENTS\RECOMMENDATIONS:____

PROJECT MANAGER\INSPECTOR:____________________ TEL:______________

ON SITE INSPECTION REPORT SUMMARY
PAGE 2

System Name: ______________________________

COMMENTS\RECOMMENDATIONS (continued): ______________________________

PROJECT MANAGER\INSPECTOR: ____________________ TEL.: ____________

EPA REGION VIII

- **Sanitary Survey Form**

U.S. EPA REGION VIII
DRINKING WATER BRANCH (8WM-DW-PWSIE)
999 - 18TH STREET, SUITE 500
DENVER, COLORADO 80202-2405
Phones: 1-800-227-8917, (303) 293-1413

SANITARY SURVEY

ADMINISTRATIVE DATA

1. Date of Survey: ____________ PWS ID No.: ____________
2. Classification: ____________
3. Name of PWS: ____________
4. Mailing address: ____________
5. County: ____________ Telephone: ____________
6. Physical location and directions: ____________
____
7. Name of Surveyor: ____________
8. Prior Survey (By whom and date): ____________
9. Date of VOC vulnerability & score: ____________
10. Date of GWUDISW assessment & score: ____________
11. Name and phone No. of Owner or Person Legally Responsible, e.g. Mayor, or City Manager: (circle which) ____________
12. Name(s) and phone no(s). of Public Works Director, City Engineer, and/or Water Plant Superintendent: (circle which) ____________
13. Name(s) and phone no(s). of Operators: ____________
14. Certification(s) type and date ____________
15. Person contacted for survey and phone no.: ____________

The following abbreviations will be used throughout this document
NI = No Information NA = Not Applicable NR = Not Requested

(Attach any available maps or diagrams of system to this report.)
Rev. 4-93 bj/jll

SERVICE DATA

1. Service Area(s) ______
2. Owner type (circle which) Private Mixed public/private Federal gov't
   State gov't Local gov't Native American
3. Population... High ______ Low ______ Aver. daily ______
4. Period of open ______ Per. qual'd as PWS ______
5. No. of Connections ______ Metered? ______
6. Water usage (gal/day) ______ Water lost (gal/day) ______
   (For community systems only) Water usage per person/day ______
7. Water sold to (Name(s) of consecutive system(s) & PWS ID#) ______
   ______
8. Have there been any interruptions in service ...
   a. during the past year? ______
   b. during the past 5 years? ______
   c. when, where, why and how long? ______
9. Have there been any reports of waterborne disease? ______
   If yes, give details ______

SOURCE DATA

FOR CONSECUTIVE SYSTEMS

1. Water purchased from (syst. name & PWS ID#) ______
2. Water source type: Ground ______ Surface ______
3. Does this PWS have another PWS consecutive to it? ______
   If so, name and PWS ID# ______
4. If a water hauler is involved...
   a. does he haul only water? ______
   b if his source is a surface source, is there a disinfection residual remaining at the time of delivery? ______
   c. how often does he disinfect his tank? ______
   d. what other customers does he have? ______
   e. is there backflow prevention on his tank's hose? ______
   f. are there dust caps on the fill points? ______
5. Does this PWS have booster disinfection? ______

Include map, if available, or make drawing of distribution system.

WELL INFORMATION

1. Nature of recharge area ______
2. How is access to recharge area controlled? ______
3. Has there been a survey of the recharge area? ______
   Date ______ Agency ______
4. Are abandoned wells possible sources of pollution? ______
   Comments ______
5. Other nearby sources of potential pollution ______
6. Formation and/or rock type (if available) ______
7. Describe emergency response plan (potential pollution) ______

CURRENT AND ABANDONED WELLS

1. Name/Number of well ______
2. Location: Latitude ______ Longitude ______
   Section ______ Township ______ Range ______
3. Is the well housed? ______ Pitless adapter? ______
   If pit vault present, is vault... open ______ covered ______
4. Date drilled ______
5. Well depth (total in ft) ______

   Hole size (in) ______ Casing size ______ Depth ______

7. Perforations: Size ______ Total # ______
   Depth ______
8. Pump set at ______ Type of pump ______
9. Yield/Design rate of flow (gpm) ______
10. Well head properly sealed? ______
11. Subject to flooding? ______
12. Casing 12 in. above ground? ______
13. Vent 18 in. above ground? ______
14. Vent facing downward & screened? ______
15. Working sample cock? ______
16. Is there emergency power? ______
    Comments ^C ______

SPRINGS AND INFILTRATION GALLERIES

1. Name/Number ______________________________
2. Location: Latitude __________ Longitude __________
Section ______________ Township ______________ Range ______________
3. Yield (gpm) ______________________________
4. Describe supply intake ______________________________
5. Subject to surface infiltration? ______________________________
6. Subject to flooding? ______________________________
7. Nature of recharge area ______________________________
8. How is access to water source controlled? ______________________________
9. Sources of potential pollution: ______________________________
10. Has there been a watershed survey? ______________________________
Date ______________ Agency ______________
11. How is collection chamber constructed? ______________________________
____
12. Are there seasonal or other conditions which change water quality? ______________
Describe ______________________________
13. Describe emergency response action ______________________________
____

STREAMS

1. Name/Number ______________________________
2. Location: Latitude __________ Longitude __________
Section ______________ Township ______________ Range ______________
3. Nature of watershed ______________________________
4. How is the watershed protected? ______________________________
5. Rate of flow (in gal) ______________________________
6. Sources of potential pollution (nature and distance from intake)
____
7. Has there been a watershed survey? ______________________________
Date ______________ Agency ______________
8. Is there surface treatment of contained water? ______________________________
9. Is the area around the intake restricted? ______________________________
Radius (ft.) ______________________________
10. Are there multiple intakes located at different levels? ______________
Describe ______________________________
11. Are the intakes screened? ______________________________
12. Frequency of intake inspection and date of last inspection ______________
____

13. Are there seasonal or other conditions which change water quality? ________
14. Describe emergency response plan ______________________________
____

Comments ____
____

RESERVOIRS AND LAKES

1. Name/Number ____
2. Location: Latitude ________ Longitude ___________
   Section ____________ Township ___________ Range ___________
3. Nature of watershed ______________________________________
4. How is watershed protected? _______________________________
5. Area and volume ____
6. Sources of potential pollution ____________________________
7. Has there been a watershed survey? _________________________
   Date _____________ Agency ___________________________________
8. Is there surface treatment of contained water? _____________
9. Is the area around the intake restricted? __________________
   Radius (ft.) ____
10. Are there multiple intakes located at different levels? _________
    Describe ____
11. Are the intakes screened? ______________________________
12. Frequency of intake inspection and date of last inspection
    ____
13. Are there seasonal or other conditions which change water quality? ________
    Describe ____
14. Describe emergency response plan (potential pollution) ______________
    ____

TRANSMISSION DATA (RAW WATER)

1. Name or designation ____________________
2. Point of origin ____________________
3. Point of termination ____________________
4. Date in service ____________________
5. Length __________ Diameter __________ Material __________
____
6. Pressure range __________ Flow Rate (gpm) __________
7. Controls and/or PRVs (describe) ____________________
8. ARVs (number) ____________________
9. Condition ____________________
10. Have there been any breaks in the last two years? __________
If yes, describe ____________________
11. Is the pump station subject to flooding? __________
12. Is there emergency power? __________
13. Pumps

Number	Type	Standby	Flow Rate	Condition

Comments ____________________
____

STORAGE DATA (RAW WATER)

TANKS AND CISTERNS

1. Name or designation ______
2. Number and type of material: Ground level ______
   Underground ______
   Tower ______
3. Volume in Gal: Gravity ______ Pressure tank ______
4. Total days of supply (all sources) ______
5. Date(s) in service ______
6. Is the site subject to flooding? ______
7. Is the unit structurally sound and properly maintained? ______
8. Are overflow lines...
   a. turned downward? ______
   b. covered or screened? ______
   c. terminated at least 3 diameters above ground? ______

   Are air vents...
   a. turned downward? ______
   b. covered or screened? ______

   Are drainage lines and cleanout pipes...
   a. turned downward? ______
   b. covered or screened? ______
   c. terminated at least 3 diameters above ground? ______
9. Can the tank(s) be isolated from the system? ______
10. Is all storage covered or enclosed? ______
11. When was the tank last cleaned? ______
12. If repaired, was it disinfected? ______
13. Describe emergency response plan ______

RESERVOIRS

1. Name/Number of well ______
2. Location: Latitude ______ Longitude ______
   Section ______ Township ______ Range ______
3. How is reservoir protected? ______
4. Area and volume ______
5. Sources of potential pollution ______
6. Is the area around the intake restricted? ______
   Radius (ft.) ______
7. Are there multiple intakes located at different levels? ______
8. Frequency of intake inspection and date of last inspection ______
9. Describe emergency response plan (potential pollution) ______

WATER TREATMENT DATA

1. Plant/Office Location and Directions ______
2. Location: Latitude ______ Longitude ______
   Section ______ Township ______ Range ______
3. Date plant put on line ______
   Latest modifications ______
4. Plant schematic readily available and up to date? ______
5. Daily output (gal/day) ______
   Design ______ Average ______ Maximum ______
6. Types of pre-treatment ______
   a. What is the purpose: Disinfection by-products control or particulate removal (scratch out inappropriate term)
   b. Chemicals and/or additives used: ______
   c. Are chemical dosages based on lab data? ______
   d. Do processes appear adequate? ______
   Comments ^C ______
8. Filtration
   a. Type ______
   b. Media ______
   c. Length of filter runs ______
   d. Backwash determining factor(s): Turbidity ______ Automatic setting
      Head loss ______ Time ______ Other ______
   e. Gallons used per backwash ______

f. Percentage loss of finished water for backwash: ____________________

g. Has there been any violation of finished water turbidity in the last year? __

Comments ____________________

9. Disinfection
   a. Method ____________________
   b. Dosage ____________________
   c. Point of application ____________________
   d. What is the contact time between injection and first point of use? __________
   e. Is disinfectant residual being monitored? ____________________
   f. Have TTHMs been evaluated?
   g. Is there standby disinfection equipment? ____________________
      In good working order? ____________________
      If not, are critical spare parts on hand or available? __________
   h. Is there an emergency power source for the disinfection equipment? __________
   i. Have there been any interruptions in disinfection in the past year? __________
10. Is the facility subject to flooding? ____________________
11. Describe emergency response plan ____________________

TRANSMISSION DATA, TREATED WATER

1. Service area or designation ____________________
2. Point of origin ____________________
3. Point of termination ____________________
4. Date in service ____________________
5. Length ______________ Diameter ______________ Material ______________
6. Pressure range ______________. Flow Rate (gpm) ______________
7. Controls and/or PRVs (describe) ____________________
8. ARVs (number) ____________________
9. Condition ____________________
10. Have there been any breaks in the last two years? ______________
    If yes, describe ____________________
11. Is the pump station subject to flooding? ____________________
12. Is there emergency power? ____________________
13. Pumps

Number	Type	Standby	Flow Rate	Condition

Comments ____

____

STORAGE DATA, TREATED WATER

TANKS AND CISTERNS

1. Name or designation ______________________
2. Number and type of material: Ground level ______________________
   Underground ______________________
   Tower ______________________
3. Volume in Gal: Gravity ____________ Pressure tank ____________
4. Total days of supply (all sources) ______________________
5. Date(s) in service ______________________
6. Is the site subject to flooding? ______________________
7. Is the unit structurally sound and properly maintained? ______________
8. Are overflow lines...
   a. turned downward? ______________________
   b. covered or screened?
   c. terminated at least 3 diameters above ground? ______________

   Are air vents...
   a. turned downward? ______________________
   b. covered or screened? ______________________

   Are drainage lines and cleanout pipes...
   a. turned downward? ______________________
   b. covered or screened? ______________________
   c. terminated at least 3 diameters above ground? ______________
9. Can the tank(s) be isolated from the system? ______________
10. Is all storage covered or enclosed? ______________
11. When was the tank last cleaned? ______________
12. If repaired, was it disinfected? ______________

13. Describe emergency response plan ________________________________
Comments ^C ____

____

DISTRIBUTION DATA

1. Lines

	Origin	Material	Inside Diam	Length
Main Lines				
Dist Lines				
Svc Lines				

2. Pressure zones

Area	Pressure Range	Control		
		Auto	Manual	Remote

3. Cross connection control

Location	Type	Size	Last Tested

4. Date of cross connection control training for operator ______
5. Dead ends ______
6. Is there an adequate maintenance program? ______
   Describe ______
7. Is there interconnection with any other system? ______
   Describe ______
8. Are plans of the system available and current? ______
9. Describe emergency response plan (ruptures) ______

______

SAFETY AND SECURITY DATA

1. Security

	Fenced	Locked	How Often Patrolled
Wells			
Springs & Infilt. Galleries			
Stream intakes			
Reservoirs/Lakes			
Pump houses			
Treat. plant			
Storage tanks			
Manholes & vaults			
Storage shed for chems			

2. Is access to all facilities restricted to authorized personnel? ____________

Comments ^C ____________

____

'hlorine Safety

1. Is there ongoing chlorine safety training for all water system personnel ____________
   Describe ____________
2. Are chlorine room doors...
   a. posted with warnings? ____________
   a. do they open outward? ____________
   b. do they open to the exterior of the building? ____________
   c. are they all equipped with crash bars and viewports? ____________
3. Is there a leak detector in the chlorine room with an audible alarm?
4. Are chlorine feed and storage areas isolated from other facilities? ____________
5. Are chlorine areas adequately ventilated? ____________
6. Are all chlorine cylinders adequately restrained? ____________
7. Are self contained breathing units...
   a. readily available for use in chlorine emergencies? ____________
   b. Where are they stored? ____________
9. Are water system personnel adequately trained in the use and maintenance of the self-contained breathing apparatus? ____________
11. Are chlorine leak kits available? ____________
12. Are all personnel trained in proper use of chlorine leak kits? ____________
   Comments ____________

____

Chemical safety

1. Are all treatment chemicals and maintenance supplies properly stored? ____________
2. Are oxidizers, corrosives, and flammables ...
   stored in separate areas and in closed, marked containers? ____________
3. Are flammables stored in appropriate containers...
   and cabinets away from combustion sources? ____________
4. Is there adequate ventilation in the areas...
   where solvents, aerosols and chemical feeders are in use? ____________
5. Are adequate masks, protective clothing and safety equipment...
   provided and required? ____________
6. Are all personnel trained in proper handling of all utilized chemicals and materials? ____________
7. Are they familiar with the MSDS sheets? ____________
8. Are bulk storage areas physically isolated from treatment areas...
   to prevent spills from entering treated or untreated water? ____________
9. Is the fire department familiar with the facilities and their contents? ____________

MONITORING AND RECORDS

1. Number of bacteria samples per month required ____________
2. Sample siting plan submitted to EPA? ____________
3. Is sampling procedure adequate? ____________

   Comments ^C ____________

4. Are copies of monitoring results, system records and plans...
   - Retained on the premises? ____________
   - Available to the surveyor? ____________
5. Violations (w/in last 2 yrs) Date: ____________ Type(s) ____________
   Agency action ____________
   System response ____________
6. Samples taken during survey ____________
   Type ____________ Results ____________
7. Are all system records and plans properly filed and available to the Surveyor? ______
8. Next tests due...
   Inorganic chemicals ____________
   Organic chemicals ____________
   VOCs ____________
   SOCs ____________
   Total trihalomethanes ____________
   Radionuclides ____________

   Comments ^C ____________

Environmental Protection Agency, Region VIII
999 18th St. Suite 500 (8WM-DW)
Denver, Colorado 80202-2405

ASSESSMENT OF GROUND WATER UNDER THE DIRECT INFLUENCE OF SURFACE WATER AND SUBJECT TO SURFACE WATER TREATMENT RULE

Name: PWS# 5600000

Source Name: County:

Date: [ ]C [ ]NC [ ]NTNC Index Points Score

A. TYPE OF SUBSURFACE WATER SOURCE (Circle One)

Well, equal to or grater than 50 ft. deep....... 0
Well, less than 50 ft. deep..................... 5
Spring.. 5
Infiltration Gallery............................ 10

B. HISTORICAL MICROBIOLOGICAL CONTAMINATION (Circle)

History or suspected outbreak of Giardia or other pathogenic organisms associated with surface water with current system configuration. 50

Record of total coliform acute MCL violations over last 3 years.............................. 30

Record of total coliform monthly MCL violation over last 3 years
- One Month................................ 5
- Two Months............................... 10
- Three Months............................. 20

Regulatory agency verifies complaints about turbidity or suspected waterborne disease....... 10

C. HYDROGEOLOGICAL FEATURES (Circle)

Distance between a surface water source and casing or nearest collector lateral
- Over 200 ft.............................. 0
- 100 - 200 ft............................. 5
- Less than 100 ft......................... 10

Intake is located on floodplain at approximate altitude of stream............................ 20

Surface runoff drains toward intake............. 15

Exposed aquifer that is coarse alluvial, cavernous, or fractured is used for water supply 15

D. WATER INTAKE STRUCTURE (Circle)

Poorly constructed well, or spring collection chamber (uncased, or casing not cemented to depth of at least 20 feet below land surface).......... 15

Poor sanitary seal, or seal without acceptable material.............................. 15

Intake open to atmosphere........................ 15

Leaks of source collector that allow entry of surface water................................ 15

TOTAL SCORE ______

COMMENTS:

Analyst: Mike Sposit

revised 10/22/91

The GWUDISW assessment will be incorporated into sanitary survey visits. This assessment form is designed for the first round screening based on the field observations and record review of a PWS.

If a PWS scores above the criteria EPA Region VIII set above, the PWS has 3 options to proceed:

The first option is to improve or modify intake structure(s), if item D makes up most of the points.

The second option is to collect and analyze at least 2 particulate samples (one collected in dry season, and one collected in wet season).

The third option is to monitor the source water quality daily, from Monday to Friday, for at least 4 consecutive calender quarters.

A PWS, which scores above the set criteria, has to either do the particulate analysis and/or start a water quality monitoring program immediately, but no later than 6 months of this assessment.

The most convincing data for the determination are the particulate analyses. We should recommend a PWS do the particulate analyses. And it is the responsibility of a PWS to collect the samples for particulate analyses.

A PWS, which scores above the set criteria, will be a GWUDISW and start to monitor as specified in the SWTR; unless the PWS can prove otherwise (through particulate analysis, source water monitoring, or improvement).

Based on the test or monitoring results, EPA will make the final determination about the water supply source.

REVISED 10-22-1991

Environmental Protection Agency, Region VIII
999 18th St. Suite 500 (8WM-DW)
Denver, Colorado 80202-2405

VULNERABILITY INDEX FOR VOLATILE ORGANIC CHEMICALS
IN PUBLIC WATER SUPPLIES IN REGION VIII

Name: PWS# 5600000

County: [ ]C [ ]NC [ ]NTNC [ ]GW [ ]SW

	Index Points	Score
LOCALLY KNOWN HAZARDS		
Chemical analysis of any regulated VOC exceeding MCL in water supply	50	____
Chemical analysis of any VOC detected in water supply	50	____
Significant VOC spill in last three years	15	____
Significant VOC spill more than three years ago	10	____
LOCAL HAZARDOUS WASTE SITES		
CERCLA, RCRA, or LUST site that generates VOCs within metropolitan area	two points per site	____
metropolitan area ____________	No.sites ____	
Use, disposal, or storage of VOCs within metropolitan area	10	____
WATERSHED PROTECTION		
Unprotected	15	____
Public and agriculture are denied access to watershed	12	____
New industry is denied access to watershed	9	____
New industry, public, and agriculture are denied access to watershed	6	____
New industry, public, agriculture, and transportation are denied access to watershed	0	____

	Index Points	Score
POPULATION OF SYSTEM (rounded to nearest thousand)		
0 to 1,000	1	____
1,000 to 2,000 etc	2	____
MISCELLANEOUS		
Large water system nearby	5	____
CHARACTERISTICS OF GROUND-WATER SYSTEMS		
Infiltration gallery or spring	10	____
Well depths (feet)		
0 to 100	10	____
100 to 200	7	____
200 to 500	3	____
More than 500	0	____
Poorly constructed well (uncased, or casing not cemented to depth of at least 20 feet below surface)	10	____
Stream in vicinity of wells, gallery, or spring	5	____
Coarse alluvial, cavernous or highly fractured aquifer used for water supply	3	____
TOTAL SCORE		____

The vulnerability index is the total of all index points for each city. A vulnerability assessment is required every 3 years for water systems with more than 500 service connections; an assessment is required every 5 years for systems with fewer than 500 service connections.

Specal vulnerability test for Ethylene Dibromide (EDB) and 1,2 Dibromo-3-Chloropropane (DBCP). Note: Nationwide about 10 years ago, 300 millon lbs. of these two VOC's were used annually.

Is PWS vulnerable to EDB (gasoline additive/pesticide)? [ ]Yes [ ]No
Is PWS vulnerable to DBCP (pesticide)? [ ]Yes [ ]No
If vulnerable, state why:

ND = Not Detected

\alyst _Mike Sposit__ Date _May 21, 1991_

revised 05/21/91

Ref: 8WM-DW-PWSIE

February 9, 1995

1~
c/o 2~
3~
4~, 5~ 6~

RE: Ground Water Under The Direct Influence Of surface Water (GWUDISW)
PWS ID# 7~ 8~

Dear 9~:

This letter concerns the ground water source that supplies water for your public water system.

The Surface Water Treatment Rule (SWTR) requires that each ground water source, including wells, springs, and infiltration galleries, be assessed to determine if it is influenced by surface water. If a ground water source is determined to be under the direct influence of surface water, the system has to either provide filtration or meet the filtration avoidance criteria (40 CFR Section 141.70).

The most recent on-site sanitary survey of your water system included the first screening in the process of assessing the influence, if any, of surface water on the ground water source.

This first assessment indicated the possibility that your ground water supply source(s) might be directly influenced by surface water.

In order for us to make a final determination, we must acquire further information.

> The most conclusive information can be obtained by conducting a microscopic particulate analysis - or MPA. The method is used to determine if certain surface water indicators - microscopic particulates - are present or absent in the ground water source.

In some cases other options exist:

> It is possible that structural improvements of the surface facilities will assure that the source will be protected from the influence of surface water.

> A third option involves water quality parameter (WQP) monitoring. Under this option, you must monitor WQPs (four parameters) for at least a year and submit the

data to EPA for determination. If interested, please contact us for more information on this option.

Our preferred option is MPA testing. With MPA, a minimum of three raw water samples from each source are required in order to make a determination. At least two of the samples must be collected in the wet season - from late March to late June - when the spring run-off occurs and the ground water source is most susceptible to surface water influence. The third sample can be collected during a dryer period.

The MPA sampling, or one of the other options, should be completed by September 1996. Please advise us as to how you wish to proceed.

The collecting of MPA samples is a technical process and requires special equipment. For these reasons, EPA is offering technical assistance in the form of providing people and equipment for MPA sampling. The laboratory cost for the analysis of the samples is the responsibility of the public water supply owner/operator.

It should be emphasized that we are not requiring you to use EPA's technical assistance or to use a particular laboratory. You should understand, however, that it is your responsibility to provide, in a timely manner, the necessary data to make a final determination about your ground water source.

If you elect to arrange for the MPA testing yourself, be sure that you check with the laboratory you select prior to the actual sampling. We are enclosing a list of MPA laboratories for your information. This reference does not imply any endorsement or certification from EPA.

If you select one of the other options, you must advise us so that we can monitor your structural improvements and/or concur in your WQP testing.

If you wish to take advantage of EPA's technical assistance, you may contact Chuck Lamb at 1-800-227-8917, ext. 1428. He will be glad to answer your questions or explain the options to you. If you desire, he will arrange an appointment with you to sample your source(s) for MPA.

You may also contact Mary Wu on ext. 1698 or (303) 293-1698 for more information.

Sincerely,

Tony Medrano
Chief, PWS Implementation and
Enforcement Section

Enclosure
FCD: February 9, 1995, clamb, cfl, C:\DATA\WP\GWA\MPA1ST.LTR

SYSTEM CASE STUDY for GWUI

Date ______

Location: ______ PWS 56

Source: ______ Evaluator: ______

Aquifer Type:
Unconsolidated: Silt____ Sand____ Sand/Gravel____ Gravel____
Cobbles____ Boulders____
Consolidated: Sandstone____ Limestone(karst)____ Volcanic(lava)____
Fractured Bed Rock____
Identify rock type - Sandstone, Limestone, Shale, Siltstone, Granite, etc. ______

Note: Multiple Aquifer Types? ______

Source Type:
Spring____ Infiltration Gallery____ Well____

Collection Device:
Direct____ Collection Box____
Ave. daily discharge_____ gpm Max. daily discharge_____ gpm
Is source used seasonally or intermittently? No___ Yes___

Microbiological Quality:
Basis of potential source contamination from Giardia/Cryptosporidium and estimated distance from source water?
Surfacewater___ Type______ Distance_____ft.
Septic System___ Type______ Distance_____ft.
Wastewater___ Type______ Distance_____ft.
Other______ Distance_____ft.

Has there ever been a waterborne disease outbreak associated with this source? No___ Yes___ If yes explain.

Have there been bacteriological MCL violations within the last five years associated with this source? No___ Yes___ If yes, describe.

Have there been consumer complaints within the past five years associated with this source? No___ Yes___ If yes, describe nature.
Comments: Frequency: Remedial Action:

Bill Jolley
Wyoming State Veterinary Lab 1174 Snowy Range Rd. Laramie, Wyoming 82070 (307)742-6638

Construction:
Does this source meet construction specifications including good sanitary practices regarding location, construction, seal, etc. to prevent the entrance of surfacewater?
Points to check: surface seal, casing, depth of casing, and flooding. Acceptable___ Unacceptable___

File No. ____________

MAP

MPA Environmental Support Data

PWS No. ______________

Date: __________

Weather Conditions:
Last Rain: Date ___/___/___ Time ________ Inches ________

Spring Run Off: Date Started ___/___/___ Ended ___/___/___
Note: ____

Current Temperature: Air ___ °C Type of Day: [ ] Cold [ ] Warm [ ] Dry [ ] Wet

Surfacewater: Distance to Groundwater Source _______ feet

Condition of Stream: [ ] Clear [ ] Muddy [ ] Low [ ] High [ ] Slow [ ] Fast

Approximate Altitude of Stream; ___________ feet

Subsurface Water Table: _____ feet Condition of Soil: [ ] Wet [ ] Dry
Area Geology:____

Pumping Rate: _____ gpm _____ % of Design or maximum

Surface Area around well site: Evidence of [ ] Cattle [ ] Sheep [ ] Wildlife [ ] Other

Notes:

Relinquished By:	Affiliation:	Date/Time:	Received by:	Affiliation:	Date/Time:
Relinquished By:	Affiliation:	Date/Time:	Received by:	Affiliation:	Date/Time:
Relinquished By:	Affiliation:	Date/Time:	Received by:	Affiliation:	Date/Time:

re samples received in good condition?	Remarks:

ENCLOSURES TO NEW SYSTEM PACKETS

NC-GRD

BACTI SAMPLING
BACTI SAMPL TRNG GUIDE
CERTIFIED LABS (MAY 91)
CHLORINE RES TEST KITS
DISINFECTION
PUBLIC NOTICE
- LEAD
- PN FOR PWS
- MAND LANGUAGE

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SODIUM & INORG

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RAD SAMPLE ANALY
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SODIUM & INORG
THM MONITOR
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