

CHAPTER 6: DATA COLLECTION AND ANALYSIS

6.1 INTRODUCTION

A key element in the success of Source Water Assessment and Protection (SWAP) rests with the ability of the State to coordinate the collection and management of information on the public water systems (PWSs). Information that must be assembled includes location coordinates of the surface water intakes and the ground water wells, followed by location of the systems within the hydrologic units. The location information will be acquired with global positioning units that will provide latitude and longitude readings for each well and intake. The Water Quality Control Division (Division) is currently undertaking this task. The assistance of outside contractors may be sought to ensure that the location data for intakes, wells, and potential sources of contamination (PSOCs) are collected and entered into a Geographical Information System (GIS) within the time frames defined in the Safe Drinking Water Act amendments. The latitude/longitude readings are to be entered into a database from which GIS maps can be created. The maps will indicate the Source Water Assessment Areas (SWAAs), within which the intakes and wells and PSOCs are located. The State will monitor the collection of the data and work to ensure that it is complete, consistent, and accurate.

The use of a GIS will also facilitate the presentation and sharing of the assessment results with stakeholders, the public, and local governments. To provide maximum accessibility and use of data, analysis and results, all information products will be designed for distribution in electronic form. It is the goal of the Division to make the assessment data available via the CDPHE Internet Home Page. Hard copies will also be available upon request.

SWAP will be an iterative process that starts with the basic, essential information needed for the assessment, and then builds upon it as the capabilities to assimilate and use it improves at the state and local levels. The Division is aware of the need to structure the program to enhance public participation. This will mean starting slow and building as participants' knowledge and confidence grows.

6.2 DELINEATION OF SOURCE WATER ASSESSMENT AREAS

Source Water Assessment Areas for surface water systems will include that portion of the entire watershed area upstream of each PWS's intake that actually drains to the intake structure (i.e. the catchment area). Where transbasin diversions of water are involved, the SWAA will also include that portion of the entire watershed upstream of the diversion structure that actually drains to the diversion structure, as well as that portion of the watershed(s) that drains to all open-channel conveyances (i.e., streams, canals, and ditches) from the point of diversion to the eventual point of intake. In both cases, the region will extend up to the headwater boundary of the watershed; however, it will not extend beyond the state line if the watershed crosses state boundaries. Ground water systems will use the calculated fixed radius or the semi-analytical computer model WHPA 2.2 to delineate the SWAA around the well or recharge area. The recommended delineation criterion for confined and unconfined aquifers is a five-year time of travel.

The size and configurations of the SWAAs may be altered depending on the outcome of the location display, and/or the desires of stakeholders to use alternative boundaries or to enter into partnering arrangements with neighboring PWSs to protect the source water. The State will review the alternative boundary proposals to ensure that the area defined adequately includes the area that provides water to the water supply. Any alternative proposal for the delineated SWAA must adequately cover the area that provides water to the intake or well. The State will not approve SWAAs that do not meet this criterion. Data will be needed to verify the topographical boundaries and to determine that the alternative proposals meet the criteria for source water protection.

As it becomes available, hydrogeologic information on the areas surrounding public ground water supply wells will need to be evaluated for the accurate delineation of SWAAs. This exercise will also need to be applied to identifying recharge areas, particularly when they are located some distance from the well field. The hydrologic connections between surface and ground water that serve as a PWS will also need to be determined and evaluated for delineation of SWAAs. Much of these data are maintained by the State Engineer's Office and by the U.S. and Colorado Geological Surveys. The Technical Advisory Team may be asked to explore methods to adapt these data for SWAP.

6.3 ELECTRONIC DATA ACQUISITION AND REPORTING

An inventory of the known PSOCs within the delineated SWAAs will require the State to develop lists of PSOCs in the SWAA. This information, along with the location data, will be input into GIS data layers, and maps will be developed from these layers to indicate the location of the contaminant sources relative to the drinking water intakes, wells, and recharge areas. The data obtained from state and federal regulatory agencies will be augmented with information provided by local and county governments and citizens to complete the contaminant inventories.

Process

Once defined and endorsed or approved by the PWSs, the SWAA serves as the delineated area within which the contaminant inventory is conducted. The contaminant inventory identifies and locates on a map, the most significant PSOCs that could have an adverse effect on the drinking water. Using an iterative approach, the first PSOCs that will be evaluated for the inventory are those regulated under Colorado's primary drinking water regulations. These include sources containing microbiological contaminants such as coliforms, and organic and inorganic chemicals. The inventory will also identify activities and land uses with the potential of manufacturing, producing, storing, using, disposing or transporting these substances, and will indicate their location on a map in relation to the public water intake and/or well. The state and federal regulatory agencies that collect and maintain this information will be approached to work with the Division on data transfers for SWAP.

Data Transfers

Data on regulated activities are maintained by a variety of different state and federal agencies. The challenge to SWAP will be to identify the most significant PSOCs, and to collect pertinent information on them from the different state and federal agencies. Examples of data sets that are of greatest or most immediate importance for the SWAP contaminant inventories are the location of Superfund sites, hazardous materials disposal sites, underground storage tanks, and concentrations of individual sewage disposal systems (septic tanks). Each is a potential source of contamination. Knowing their locations relative to the drinking water intakes and wells provides an important first step in the contaminant inventory process.

The data on these activities will need to be acquired from the regulatory agencies that maintain them, and adapted for use in SWAP. The Technical Advisory Team may be asked to assist with procedures that will allow for the transfer and integration of this information in a timely manner.

6.4 TECHNICAL ADVISORY TEAM

A Technical Advisory Team, made up of public and private sector representatives with knowledge about the data formats and transfer capabilities, has been appointed to assist the Division with this element of the SWAP. It is recognized that there will be incompatibilities among the data sets that could hamper the integration of the information. One of the key tasks that the Technical Advisory Team may be asked to perform will be to identify these problems, and recommend ways to overcome them.

The Division may assign staff to work on the collection and integration of the databases, and may enlist the help of the Department's GIS office to help the State's contractor(s) with the mapping of the SWAAs and the PSOCs. The Technical Advisory Team will provide valuable input on the data transfers and integration, and how best to format them for SWAP.

6.5 QUALITY ASSURANCE/QUALITY CONTROL

The data provided for use in SWAP will adhere to quality assurance and quality control protocols currently in place within the Division. Data received from outside sources will undergo checks for accuracy and consistency. Conflicts in information will be reconciled prior to incorporation in the final assessments. PWSs will have an opportunity to review and correct information prior to the issuance of the final assessment.

6.6 FIELD DATA COLLECTION

Although much of the data needed for the SWAP contaminant inventories can be handled through electronic transfers, certain information will need to be collected in the field or on site. Examples of such field data include the locations of the surface water intakes, the public water

wells, and PSOCs separate from those contained in state and federal data bases. Information obtained through interviews and surveys of citizens will also need to be field collected.

The field data will be evaluated for accuracy and consistency and will be incorporated into the general PSOC database. The integration of this information will provide as complete a picture as possible of the most serious contaminant sources in the SWAA. The field data will be included in the GIS and displayed on a map of the SWAA. The maps will be available to the public either electronically, via the web page, or in hard copy.

6.7 DATABASE INTEGRATION

Much of the environmental information that is needed for the SWAP assessments is stored in databases that reside in many disparate systems and at many different physical locations. Numerous people in different agencies of state and federal government are responsible for the data. Colorado is developing a method to enable the data maintained by these different agencies to benefit the SWAP programs and other programs as well. In all cases, the data that may be utilized in the SWAP program must be in a readily available and useable electronic format.

The primary goal of the effort will be to develop and maintain a "database clearinghouse" for databases on point information related to environmental facilities and conditions in Colorado. The State will prepare a list of databases to evaluate for use in the SWAP program. This list will include state and federal databases that are likely to contain information about the most significant PSOCs (see Table 4.1) that the State will attempt to inventory during the initial iteration. To be considered for use in the SWAP program, these databases will need to contain reliable location information at a minimum. Databases that meet this minimum criterion will be considered for use in the SWAP program and will be included in the database clearinghouse.

In addition, the databases will be evaluated for information pertaining to the possible types of contaminants that may be present at the facility, the compliance history of the facility, preventative/protective or best management practices that may be in place at the facility and hydrogeologic conditions. Such information will be useful for conducting the susceptibility analysis on the PSOCs. However, depending on the database and/or agency, some of this information may or may not be contained within a database. In this event, the State would have to rely on some of this information being collected at the local level and included in the database clearinghouse, or accept that some of this information is not readily available and defer to default rankings in the susceptibility analysis.

A secured or anonymous file transfer protocol (.ftp) site will be installed to facilitate the transfer of useable databases into the database clearinghouse which are not currently accessible over the Internet. There will be a hot link to databases that are currently accessible over the Internet. The useable databases will be made accessible to the State's contractor(s) via the SWAP web site. Each database would be maintained and updated as needed by the entity having ownership of the data. This will provide the most complete and accurate information possible for SWAP assessments and other efforts, without the cost to the SWAP program of maintaining a "super data base".

ACRONYMS

BMP	Best Management Practice
CAT	Citizen's Advisory Team
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CCR	Consumer Confidence Report
CDPHE	Colorado Department of Public Health and Environment
CSU	Colorado State University
EPA	U.S. Environmental Protection Agency
GIS	Geographical Information System
GPS	Global Positioning System
HUC	Hydrologic Unit Code
LEPC	Local Emergency Planning Committee
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
NPDES	National Pollutant Discharge Elimination System
NPS	Non-Point Source
NTNCWS	Non-Transient Non-Community Water System
PSOC	Possible Source of Contamination
PWS	Public Water Supply or System
RCRA	Resource Conservation and Recovery Act
RSVP	Retired Senior Volunteer Program
SDWA	Safe Drinking Water Act
SPCC	Spill Prevention Control and Countermeasure
STORET	STorage and RETrieval U.S Waterways data system
SWAA	Source Water Assessment Area
SWAP	Source Water Assessment and Protection
SWPA	Source Water Protection Area
TAT	Technical Advisory Team
TMDL	Total Maximum Daily Load
TNCWS	Transient Non-Community Water System
TOT	Time of Travel
UCCS	University of Colorado, Colorado Springs
UIC	Underground Injection Control
USGS	U.S. Geological Survey
UST	Underground Storage Tank
UWA	Unified Watershed Assessment
WHP	WellHead Protection
WHPA	WellHead Protection Area
Division	Water Quality Control Division
State	State of Colorado

GLOSSARY OF TERMS

Acute Contaminant: Contaminant which causes acute health effects that occur shortly after exposure to a drinking water contaminant, usually a matter of hours or days (USEPA Susceptibility Guidance).

Alluvium: Clay, silt, sand, or gravel, or similar unconsolidated material deposited by a stream or other body of running water as sediment in the bed of the stream or on its flood plain or delta.

Alluvial Aquifer: Ground water contained within an alluvial deposit or alluvium.

Aquifer: A formation, group of formations, or part of a formation containing sufficient saturated permeable material that could yield a sufficient quantity of water that may be extracted and applied to beneficial use (CRS 37-90-103(2), Colorado Ground Water Management Act).

Assessment: An evaluation of a drinking water source that includes delineation of the boundaries of the protection area of a public water supply, identification of land uses and possible contamination-related activities within that area, and a determination of the susceptibility of the source to contamination.

Assessment Map: A required element of a complete source water assessment. An assessment map must be based on a USGS quadrangle map (scale 1:24,000). For surface water sources, an assessment map must indicate the drainage area of the watershed contributing water to the intake structure. For ground water sources, the assessment map must show the boundaries of the wellhead protection area(s) and the approximate location of recharge area(s), if known. All assessment maps must show the approximate locations of potential sources of contamination, particularly those with high and moderate susceptibility rankings.

Best Management Practice (BMP): A practice or a combination of practices that is/are determined by a governmental agency after problem assessment, examination of alternative practices and appropriate public participation, to be the most effective, practicable (including technological, economic, and institutional considerations), means of preventing or reducing the amount of pollution generated by point and non-point sources to a level compatible with quality goals (5 CCR 1002-8, 3.1.5 (6), Water Quality Control Act).

Capture Zone: The depression produced in a water table or piezometric surface by a pumping or artesian well that defines the area of the aquifer contributing water to a well (American Geological Institute). Ground water within the boundary of this area will eventually flow to the well during the specified time of continuous pumping or artesian flow. This area is synonymous with the source water assessment area for a well.

Chronic Contaminant: Contaminant, which causes chronic health effects that, occur over several or many years (USEPA Susceptibility Guidance).

Community Water System: A public water system that: (A) serves at least 15 service connections used by year-round residents of the area served by the system; or; (B) regularly serves at least 25 year-round residents (Colorado Primary Drinking Water Regulations).

Cone of Depression: The conical-shaped depression produced in a water table or piezometric surface by a pumping or artesian well (American Geological Institute). Under the condition where the water table or piezometric surface are essentially flat, the cone of depression and the capture zone are generally synonymous. Where this condition does not prevail, the boundary of the cone of depression generally extends beyond the capture zone of the well and, therefore, not all ground water within the boundary of the cone of depression will eventually flow to the well during pumping or artesian flow.

Confined Ground Water: Ground water occurring in an aquifer situated beneath or between confining layers of relatively impermeable material. In such an aquifer, the static water level of a well will rise above the bottom of the overlying confining layer. Where the static water level in the well rises above land surface and flows naturally, the well is termed an artesian well.

Consumer Confidence Report: Notice provided by community public water systems to customers each year identifying the source of the drinking water, detection of regulated and unregulated contaminants in treated water, and compliance information.

Contaminant: Any chemical material, organic material, live organisms, radioactive material or heated or cooled water that will adversely affect the quality of water (2CCR 402-2, 5.2.10, Water Well Construction & Pump Installation Regulations).

Contaminant Source Inventory: The process of identifying and inventorying contaminant sources within delineated source water assessment areas by recording existing data, describing sources within the source water protection area, targeting likely sources for further investigation, collecting and interpreting new information on existing or potential sources through surveys, and verifying accuracy and reliability of the information gathered (State Source Water Assessment and Protection Program Guidance, U.S. EPA).

Drinking Water System: See Public Water System

Fracture: Any break in a rock, whether or not it causes displacement, due to mechanical failure by stress. Fractures included cracks, joints, and faults. A crack is a partial or incomplete fracture; a joint is a parting in a rock along which no movement occurred; a fault is a fracture or a fracture zone along which there has been movement (Bates & Jackson, 1980).

Fracture Flow Aquifer: An otherwise impermeable or low permeable rock aquifer where storage and movement of ground water occurs primarily within fractures. In Colorado, such an aquifer is common to igneous and metamorphic crystalline rock.

Ground Water: Ground water means subsurface waters in a zone of saturation which are or can be brought to the surface of the ground or to surface water through wells, springs, seeps or other discharge areas (5 CCR 1002-8, "The Basic Standards for Ground Water" Water Quality Control Act).

Ground Water Under the Direct Influence of Surface Water: Means any water beneath the surface of the ground with (1) significant occurrence of insects or other macroorganisms, algae, or large diameter pathogens such as *Giardia lamblia* or (2) significant and relatively rapid shifts in water characteristics such as turbidity, temperature, conductivity, or pH which closely correlate to climatological or surface water conditions (Colorado Primary Drinking Water Regulations 1.2.2(32)).

Hazard: Possible source of danger (American Heritage Dictionary).

Hydrology: The science of dealing with the waters of the earth, their distribution on the surface and underground, and the cycle involving evaporation, precipitation, recharge and flow to and from the oceans.

Maximum Contaminant Level (MCL): The general sanitary standard establishing the maximum permissible level of a contaminant in water which is delivered to the free flowing outlet of the ultimate user of a public water system, except in the case of turbidity where the maximum permissible level is measured at the point of entry to the distribution system. Contaminants added to the water under circumstances controlled by the user, except those resulting from corrosion of piping and plumbing caused by water quality, are excluded from this definition.

Maximum Contaminant Level Goal (MCLG): The contaminant level in drinking water which treatment facilities attempt to maintain if MCLs are lower than laboratory detection limits or treatment capabilities.

Municipal Well: A well used by a municipal corporation and the inhabitants thereof, primarily to promote the life, safety, health, comfort, and business of water well drilling or the business pursuits of the inhabitants (CRS 37-91-103(11) Ground Water Management Act).

Non-Community Water System: (Non-residential systems) A system serving a population of at least 25 people per day for 60 days or more per year. A non-community water system is classified as either a transient or non-transient non-community water system.

Non-Transient, Non-Community Water System: A non-community water system that regularly serves at least 25 of the same persons over six months per year (e.g., schools, workplaces, hospitals, etc.) (Colorado Primary Drinking Water Regulations).

Physical Barrier Effectiveness: A determination made about the ability of the drinking water source to be protected by its physical characteristics, including geology and hydrogeology, resulting from the drinking water source and site characteristics evaluation.

Pollutant: The dredged spoil, dirt, slurry, solid waste, incinerator residue, sewage, sludge, garbage, trash, chemical waste, biological nutrient, biological material, radioactive material, heat, wrecked or discarded equipment, rock, sand or any industrial, municipal, or agricultural waste (CRS 25-8-103(16) Water Quality Control Act).

Potential Source of Contamination (PSOC): Human activities or natural conditions that are or have the potential to contaminate a drinking water source. An evaluation of the PSOCs within the source water assessment area takes into account the characteristics of the identified source(s) and their related constituents, including factors such as location, likelihood of release, toxicity, environmental fate and transport, capability and compliance history of the facility, and effectiveness of mitigation measures. PSOCs include both microbiological and chemical contaminants that could have adverse effects on human health.

Public Water System: A system that provides piped water to the public for human consumption, if such system has at least 15 service connections or regularly serves an average of at least 25 persons daily at least 60 days out of the year. Such term and system includes (1) any collection, treatment, storage, and distribution facilities under control of the supplier of water from such system and used primarily in connection with such system, (2) any collection or pretreatment storage facilities not under such control which are used primarily in connection with such system, and (3) water vending and dispensing machines. A public water system is either a "community water system" or a "non-community water system" (Colorado Primary Drinking Water Regulations 1.2.2 (24)).

Risk: Possibility of suffering harm or loss (American Heritage Dictionary).

Source Water: Water drawn from an aquifer by a well or from a surface water body (e.g. reservoir, lake, river, or ditch) by an intake as a public supply of drinking water. Such water may or may not be treated before being distributed by a public water system for consumption.

Source Water Assessment Area (SWAA): The area or zone providing water to the surface water intake and/or the ground water well. The SWAA is also the area through or over which contaminants, if present, are likely to migrate and reach the drinking water well or surface water intake. For surface water systems, the SWAA will include that portion of the entire watershed area upstream of the public water system's (PWS's) intake structure that actually drains to the intake. In the instance of transbasin diversions, the SWAA will also include that portion of the entire watershed upstream of the diversion structure that actually drains to the diversion structure. For ground water systems, the SWAA will be the zone around the well that is defined in accordance with the methods recommended in the State's approved Wellhead Protection (WHP) program. The SWAA also may include the aquifer recharge area, if this area is known.

Source Water Protection Area (SWPA): The region of the watershed or aquifer, defined in a public water system's source water protection plan, for which protection measures will be implemented to prevent future contamination of the source water. Ideally, the SWAA would become the SWPA, but the SWPA could conceivably be defined as a portion the SWAA.

Susceptibility Analysis: Method of determining if a public water supply is vulnerable to a potential source of contamination (PSOC) located within the delineated source water assessment area. This analysis ranks the susceptibility of the PSOCs as high, moderate or low, depending on a variety of factors defined by appropriate stakeholders or the Division for a delineated source water assessment area (e.g. proximity to the PWS, watershed characteristics, presence of geological buffers, effectiveness of containment, comprehensive plans, characteristics of the PSOC, etc.).

Threat: Indication of impending danger or harm (American Heritage Dictionary)

Transient, Non-Community Water System: A non-community water system which does not serve 25 or more of the same people for 60 or more days per year, (restaurants, motels, campgrounds, etc.) (Colorado Primary Drinking Water Regulations).

Unconfined Ground Water: Ground water occurring in an aquifer in which the water table forms the upper boundary of the aquifer (i.e. water not confined under pressure beneath relatively impermeable rocks).

Water Quality Standard: Any standard promulgated pursuant to section 24-8-204 of the Colorado Water Quality Control Act CRS 25-8-103 (20). Standard also refers to drinking water standards reasonably designed to promote and protect the public health.

Watershed: The topographic boundary that constitutes the natural drainage area into a waterbody.

Watershed Approach: A coordinating framework for environmental management that focuses public and private sector efforts to address the highest priority problems within hydrologically-defined geographic areas, taking into consideration both ground and surface water flow.

Well: Any structure or device used for the purpose or with the effect of obtaining ground water for beneficial use from an aquifer (CRS 37-90-103(21)).

Well Field: Two or more wells, all of which were permitted on or after July 6, 1973, producing ground water from the same aquifer on a contiguous parcel of land or on non-contiguous parcels of land that are permitted together under rule 11.B of the statewide non-tributary Groundwater Rules (2 CCR 402-7 rule 4.A.13).

Wellhead Protection Area: The surface and subsurface area surrounding a water well or wellfield supplying a public water system, through which contaminants are likely to move toward and reach such water well or wellfield (Section 1428 of the 1986 federal Safe Drinking Water Act amendments).