



# *PLANNING FOR ONSITE WASTEWATER DISPOSAL SYSTEMS IN NON-SEWERED AREAS OF THE STATE: TOOLS FOR PREVENTING CONTAMINATION OF PUBLIC DRINKING WATER SOURCES*

*June 15, 2022*

## **Executive Summary**

Across Utah, development pressures have placed groundwater protection and local development interests at odds with one another, especially in non-sewered areas where onsite wastewater systems<sup>1</sup>, otherwise known as septic tanks, are the preferred method for addressing wastewater. Protecting groundwater quality is critical because wells and springs are vulnerable to contamination. Without focused attention, the State's growth trajectory may outstrip the capabilities of public water systems to protect sensitive drinking water sources.

The Utah Department of Environmental Quality (DEQ) has prepared this guidance to assist local health departments (LHD), local governments, and Public Water Systems (PWS) with identifying processes that will safeguard public drinking water sources while alleviating some of the difficulties associated with permitting decisions. This document is intended to be complementary to the report titled *Technical Guidance for the Allowance of Alternative Onsite Wastewater Systems within Drinking Water Source Protection Zones*.

This guidance recommends the following:

1. Establish a Source Protection Team to coordinate onsite wastewater management and to set groundwater protection goals, including the classification of drinking water aquifers in source protection zones and critical recharge areas.
  - a. Identify drinking water source protection zones and critical recharge areas on planning and web-based Geographic Information System (GIS) maps to ensure landowners and developers are aware of the locations of these sensitive areas.
  - b. Consult with DEQ's Division of Water Quality on Permit-By-Rule decisions for areas of concern and aquifer classification.
  - c. In recharge and other sensitive areas with Class 1 and 2 drinking water LHD should use Method 1 to establish minimum lot size and to confirm density requirements for subdivisions over (presumed) Class 1 and Class 2 aquifers.
2. When new developments occur in groundwater protection zones and in critical recharge areas, consider the onsite wastewater management needs at the same time drinking water supplies are being established.
3. Identify the body politic responsible for ongoing oversight and implementation of the management strategies of this guidance.

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<sup>1</sup> The terms "onsite wastewater system" and "septic system" are used interchangeably in this document.

## Background

### *Authorities*

DEQ regulates public drinking water and onsite wastewater systems. Specific rules include:

- Drinking Water Source Protection for Ground-Water Sources, Rule R309-600  
Administered by the Division of Drinking Water, outlines the responsibility of public water systems to protect wells and springs and provides a uniform, statewide framework for fulfillment of this responsibility.
- Ground Water Quality Protection, Rule R317-6  
Administered by the Division of Water Quality, outlines requirements for a groundwater discharge permit for any facility which discharges or is likely to discharge to groundwater. Onsite wastewater systems are a listed activity under permit-by-rule (R317-6-6.2) and are not required to obtain a permit from the Division of Water Quality.
- Onsite Wastewater Systems, Rule R317-4  
Administered by the Division of Water Quality, delegates the authority for regulating systems with flows less than 5,000 gallons per day to the LHD. The Division of Water Quality is responsible for the permitting of Large Underground Wastewater Disposal Systems.

**Public Water Systems** under DEQ's Source Protection Rule (R309-600), are responsible for the protection of wells, springs, and tunnels from existing and future sources of contamination. Water systems are required to file a Source Protection Plan with the Division of Drinking Water which designates the following source protection zones:

- Zone One (radius of 100-feet around a groundwater source)
- Zone Two (typically a 250-day groundwater time of travel)
- Zone Three (3-year groundwater time of travel)
- Zone Four (15-year groundwater time of travel)

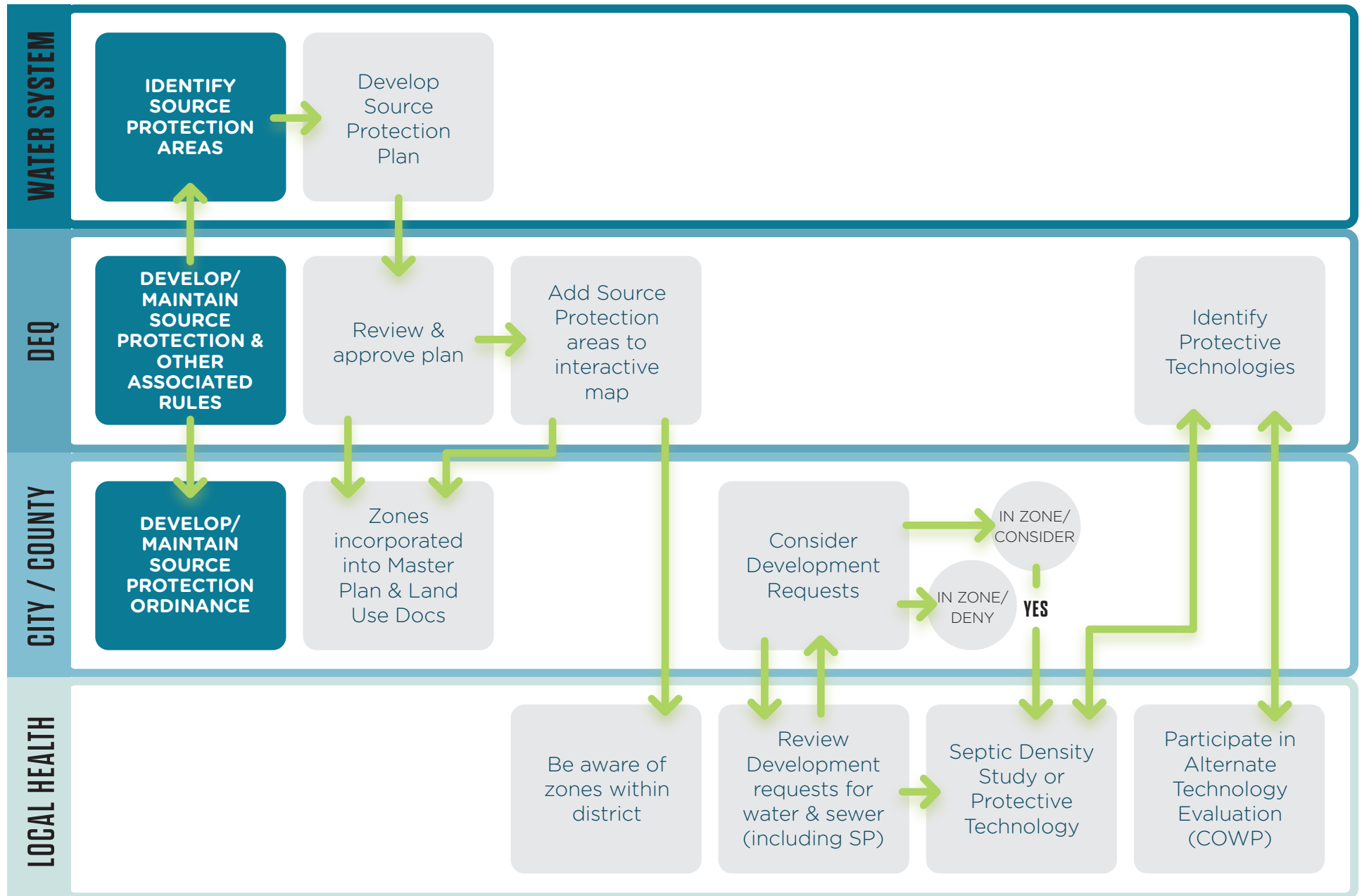
Most Public Water Systems lack the authority to prohibit or control pollution of groundwater, particularly beneath land they do not own, and often rely on local governments who can pass ordinances to control land uses.

**Local governments** have land use authority under Section 10-9a-5 of the Utah Code for cities and 17-27a-5 for counties. Under Section 19-4-113 of the Utah Code, counties of the first and second class were required to adopt drinking water source protection ordinances by May 3, 2010 to protect groundwater sources. Municipalities and towns have also been given statutory authority under Section 10-8-15 of the Utah Code to enact ordinances to protect their sources of drinking water. Seventeen (17) out of Utah's twenty-nine (29) counties and approximately 100 municipalities have adopted such ordinances. These ordinances prevent onsite wastewater system construction within a source protection zone one; most also restrict construction within zone two.

**Local Health Departments** may, under State Rule R317-4, issue operating permits for onsite wastewater systems and large underground wastewater disposal systems, take necessary steps to protect groundwater quality (based on a groundwater study or planning/zoning ordinances), require onsite systems to be placed under a responsible management entity, and enact more stringent requirements than R317-4. Rule R317-4-4.2 requires additional considerations for the evaluation of subdivisions using onsite wastewater systems. It provides an opportunity for planners to examine collective loads to groundwater where pollutant mass loadings may warrant more careful consideration of allowable lot sizes to protect sensitive groundwaters.

Figure 1, on the following page, is a graphical representation of the interplay between these authorities.

# SOURCE PROTECTION SWIM LANES



### ***Primary Contaminant of Concern***

Many of the chemicals regulated by DEQ's water programs have a reasonable potential to be present in effluent and may be discharged to groundwater by septic systems. The most analyzed is nitrate because of its prevalence in wastewater discharges and its recognized adverse health effects. It is, therefore, the most important pollutant to consider when establishing protection goals. Nitrate is a good indicator of pollution from onsite wastewater systems because it is highly mobile through the soil and relatively conservative (i.e., remains in dissolved form and does not precipitate or adsorb).

The need to consider additional pollutants may arise if they are or become present in the groundwater background and if there are significant industrial discharges.

### ***Source Protection Framework***

A framework for managing pollution in source protection zones exists for nearly every public drinking water well and spring in Utah. Public Water Systems draw from a suite of regulatory and non-regulatory controls and best practices available in guidance<sup>2</sup> to craft a management strategy that is consistent with their authority, jurisdiction, and assigned priority. By necessity, its scope is broad to encompass the myriad of pollution sources and potential contamination sources that the Public Water System must assess, inventory, track, and somehow manage. We believe that onsite wastewater systems, as the single largest contributor of waste discharges into the ground, require more specific guidance.

## **The Drinking Water Source Protection Team**

DEQ recommends a formal Drinking Water Source Protection Team be created for each health department, county, or regional planning area. The purpose of the Team is to establish leadership, define and coordinate responsibilities, and strengthen commitment to the process of protecting public groundwater sources of drinking water. The goal of the team should be to assist planners, public water systems, and LHDs in developing and carrying out workable management strategies to sustainably protect public drinking water and public health.

Core membership on the Team should be from the Public Water System(s), the LHD, and local government planners. The extended Team should include technical experts, DEQ staff, planning, zoning and building officials, public communications personnel, and legal and financial staff. Other important stakeholders to involve may include city and county leadership, real estate and development interests, agricultural partners, and the affected public.

Most of the responsibility for implementing source protection plans falls to Public Water System(s) but their ability to control land use are frequently limited. The growing need to implement broader protections and more sophisticated controls warrants closer coordination and communication among groups represented on the Team. The right leadership for each Team is important. The Team makeup will vary by area and its level of activity, effort, and development intensity as well as the weighed risk posed to public water supplies. The sufficiency of existing protections through source protection plans, state rules, and local ordinances will inform the work required of the Team and the level of support required of the member organizations.

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<sup>2</sup> Utah Department of Environmental Quality Division of Drinking Water, Source Protection User's Guide for Groundwater Sources, [Microsoft Word - DDW-2020-001458 \(utah.gov\)](#), October 2020

## ***Setting Groundwater Protection Goals Using Aquifer Classifications***

Every control, strategy, or plan considered for the protection of drinking water should be designed to meet water quality objectives or protection goals. To define protection goals, we recommend that the Team use groundwater class protection levels defined in Rule R317-6-4. Protection levels are based on an allowable increase in pollutant concentration relative to the background concentration. Protection goals could be incorporated into plans, though not required by the Source Protection Rule.

Groundwater class protection levels are good goals for all regulated pollutants. Protection levels can be between 10-50% of drinking water and groundwater quality standards<sup>3</sup>. Where background levels are high, protection levels can be as high but not higher than the MCLs. It is important to understand that protection levels should apply to all pollutants covered in these standards.

Many aquifers in Utah have not been classified, which takes detailed characterization of the aquifer and action by the Water Quality Board.<sup>4</sup> For goal setting purposes, a groundwater class can be determined from its total dissolved solids (TDS) concentration and classified by the Division of Water Quality<sup>5</sup> on a site-specific basis. Teams should work to classify all source waters associated with protection zones.

DEQ will provide technical assistance to teams that are interested in establishing protection levels and groundwater classifications. At the project level, DEQ uses information obtained through site specific analyses to understand the likely groundwater class and protection levels. The Utah Geological Survey (UGS) supports many communities and regions with investigations of groundwater availability, protection from septic system discharges, and classification. It may take several years to complete the formal classification of an aquifer.

Once aquifers have been classified, DEQ recommends that they be identified on planning maps and web-based GIS maps. DEQ also recommends local governments add source protection zones to planning/zoning maps with clear information on their potential impact to landowners. If local governments lack the resources to provide source protection zone data to the public, they should direct prospective and current landowners to the DEQ Interactive Map<sup>6</sup>.

In summary, DEQ recommends the following:

- Establish a Source Protection Team to coordinate onsite wastewater management and set groundwater protection goals, including the classification of drinking water aquifers in source protection zones and critical recharge areas.
- Identify source protection zones and critical recharge areas on planning and web-based GIS maps to ensure landowners and developers are aware of the locations of these sensitive areas.

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<sup>3</sup> i.e., Maximum Contaminant Levels (MCLs), defined in R309-200 and R317-6-2, respectively, depending on groundwater class and background levels.

<sup>4</sup> The time required to accomplish an aquifer classification can be considerable, e.g., 2 to 3 years.

<sup>5</sup> per R317-6-5.2.H

<sup>6</sup> <https://enviro.deq.utah.gov/>

## Methods for Assessing Adequate Control

In State Rule<sup>7</sup>, “adequately controlled” and “uncontrolled” pollution sources and potential contamination sources are terms used in the context of determining where new groundwater sources of drinking water may or may not be installed, and to determine if wastewater systems should be prohibited, restricted, or otherwise controlled within protection zones. Septic systems are defined as uncontrolled pollution sources; however, they can be controlled by using “design standards”<sup>8</sup> according to Drinking Water Source Protection Rule and Guidance. For our purposes, the planned mechanisms, methods, and programs assessed for groundwater protection are “controls” and the specific quality objectives that these controls are intended to affect are the “design standards.” Design standards may be protection goals based on aquifer classifications, septic tank density studies, or establishment of minimum lot sizes. Design standards may also be “end-of-the-pipe” effluent limits as a treatment control.<sup>9</sup>

The identification and assessment of hazards is the responsibility of Public Water Systems as part of their source protection plans. Controls for protecting drinking water aquifers should have a foundation in the protection levels for the aquifer, building back to the surface through design standards, and ultimately providing (1) an understanding of the potential impacts of onsite wastewater system on the aquifer, and (2) a proper assessment, identification, and implementation of appropriate controls. Hazard assessments and verifications can be challenging to undertake, particularly for water systems without technical expertise or resources. The source protection plan should include a high level of certainty and sufficient demonstration of adequate control to the LHD issuing onsite wastewater system permits. It is important, however, for the LHD to recognize the potential limitations of the plan.

Further discussion will focus on the methodologies that can be employed to demonstrate adequate control of planned onsite wastewater systems.

### ***Site Specific Analysis***

In many permitting and land planning situations, supplemental site-specific analysis is needed to better understand the potential impacts of septic system discharges on groundwater quality and to verify that the necessary management and controls are in place. The following tools are available to decision makers for conducting site specific analyses. While these may be applied at the individual lot level, they are more easily applied to subdivision and regional planning.

#### **Permit-By-Rule**

Onsite wastewater systems, as a listed activity under the groundwater permit-by-rule<sup>10</sup> are not required to obtain a groundwater discharge permit from the Division of Water Quality. The septic systems may not cause groundwater standards or Class protection level TDS limits to be exceeded.

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<sup>7</sup> Drinking Water Source Protection for Ground-Water Sources, Rule R309-600

<sup>8</sup> The term “design standards” is not defined but it has been interpreted in a broad sense to mean any planned mechanism, method, or program designed to achieve a specified quality objective, e.g., groundwater protection goals.

<sup>9</sup> For further discussion on “end-of-the-pipe” treatment controls and alternative onsite wastewater systems, please refer to the document titled *Technical Guidance for the Allowance of Alternative Onsite Wastewater Systems Within Drinking Water Source Protection Zones*.

<sup>10</sup> Rule R317-6-6.2





Groundwater is divided into different classes<sup>11</sup> based on overall quality, i.e., TDS and specific contaminants (nitrate or arsenic) and actual or potential beneficial uses such as drinking water or as groundwater important to the continued existence of wildlife habitat. Different levels of protection are described for each class<sup>12</sup> and the regulated contaminants are listed. The contaminants are, except for arsenic, identical to the federal drinking water standards mandated under the Safe Drinking Water Act. For example, pristine, Class 1 groundwater with drinking water as its current and primary beneficial use<sup>13</sup> would require a protection level to be 25% of the applicable drinking water standard for nitrate or 2.5 mg/L. Class 2 waters are also protected for use as drinking water.

The second condition of permit by rule is that onsite wastewater systems are approved by local health departments. If the LHD determines a septic system installation causes or has potential to cause exceedances of protection levels or goals, the Division of Water Quality can require applicants to submit a groundwater permit application. The Division regularly uses this approach in conjunction with large underground waste disposal system applications in support of onsite wastewater system performance determinations needed to accomplish “adequate control.”

#### **Establishment of Minimum Lot Size**

Method 1<sup>14</sup> is available to LHD for assessing site specific requirements for septic systems in lot size determination. This tool enables LHD to make site specific determinations of lot size based on supporting site specific data furnished by the applicant, scientific methods, training, and support from the Division of Water Quality. This method has been applied in several Utah cases, mostly in establishing controls for large underground waste disposal systems, but also in establishing lot density standards at county, watershed, and ground water protection zone scales.

Method 1 provides regulatory officials the opportunity to apply scientific knowledge and technology in establishing lot sizes. It requires better definition of ground water conditions, more detailed analysis, sometimes modeling, etc.; all of which require more specialized skills, financial resources, and time.

The technical rigor of Method 1 makes it difficult to employ on an individual lot basis. Nonetheless, Method 1 gives LHDs and planners the ability to better assess site specific needs and build protective requirements for development on difficult sites. This tool should be used in lot size and population density determinations when planning non-sewered development in designated source protection and critical aquifer recharge areas.

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<sup>11</sup> Rule R317-6-3

<sup>12</sup> See R317-6

<sup>13</sup> See R317-6-3

<sup>14</sup> (R317-4-4.1.C.1)

In summary, DEQ recommends the following:

- Consult with DWQ on Permit-By-Rule decisions for areas of concern and aquifer classification.
- In recharge and other sensitive areas with Class 1 and 2 drinking water, LHD should use Method 1 to establish minimum lot size and to confirm density requirements for subdivisions over (presumed) Class 1 and Class 2 aquifers.

### ***Mass Balance Approach to Assessing Controls***

In assessing controls or evaluating the effectiveness of existing controls, consider this simplified example.

For every 1,000 gallons per minute (gpm) of source water production, roughly 100 homes within the four (4) source protection zones would increase the groundwater nitrate concentration by 1 mg/L. Excluding zone 1, those 100 homes could be built in zones 2 through 4 and achieve the 1 mg/L increase as a protection goal. If protection goals accommodate a 2 mg/L increase, those 100 homes can become 200. Other pollution sources adding nitrate to the groundwater must be considered in the mass balance equation, which would have the effect of reducing the number of homes in the source protection area. Pollutants other than nitrate should also be considered.

Establishing groundwater protection goals and applying a mass balance approach, as in the above example, is fundamental to evaluating alternatives that will result in adequate control of onsite wastewater systems in protection areas. Pollutant fate and transport modeling are often necessary to make accurate mass balance calculations that account for groundwater conditions and the effects of soil on pollutant movement.

### ***Density Control***

Density control measures can be implemented by ordinance or land use agreements. As outlined above, density restrictions are determined from a mass balance of onsite wastewater system pollutants that could be imposed on an aquifer by a population. The impact of these pollutant loads is compared with water quality goals to determine the maximum density of development that will not exceed the water quality goals. Fairly simple analyses have been used in making determinations at the source protection zone scale. Intensive pollutant fate and transport modeling is more common, as in Wasatch and Washington counties.

Density control has been used as a bonus strategy in some areas wherein some systems connect with sewer, or new septic systems are built to a higher design standard, so that room is made for future planned units.

### ***Ordinances and Zoning Restrictions***

Only legislative bodies, including cities and counties, have land use authority<sup>15</sup> enabling them to regulate land use by ordinance. These types of ordinances and zoning restrictions can be the strongest tools for controlling pollution from onsite wastewater systems. Land use regulations are particularly important to public water systems needing to implement land management strategies for protection of groundwater

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<sup>15</sup> UCA 10-9a-5 and 17-27a-5, respectively,



supplies where they do not have land use authority. These Water Systems depend on the umbrella of city and county land use ordinances.

In Utah, most city and county source protection ordinances include land use restrictions that prohibit septic systems in source protection zone one; most also restrict onsite wastewater systems in zone two. Very few are based on achieving defined groundwater protection goals. Incorporating design standard requirements in these ordinances will be more effective when they are rooted in protection goals, i.e., the size of the pollutant load and the number of systems that will occur in the protection zones.

### ***Subdivision Ordinances***

Subdivision ordinances are another tool used by local government. One example is where the number of residential units in a proposed subdivision is multiplied by 150 to 300 feet. Within the resulting distance, subdivisions are required to connect with sewer. Allowances for feasibility waivers are usually included.

Additional considerations are required<sup>16</sup> for the evaluation of subdivisions using septic systems for wastewater disposal. The State Rule provides an opportunity for planners to examine collective loads to groundwater where pollutant mass loadings may warrant careful consideration of allowable lot sizes to protect sensitive ground waters.

### ***Management Areas and Districts***

Management Areas and Districts are usually organized to serve larger areas, such as towns or watershed basins. For example, Washington County uses two pre-existing districts to manage unincorporated county septic systems in accordance with their septic density ordinance.

There are several management models identified by the Environmental Protection Agency<sup>17</sup> that can be used for area-wide management of septic systems. These range from providing public education about onsite wastewater systems and the importance of good maintenance to owning and operating septic systems for property owners. In between there are models where the manager takes more responsibility for the long-term performance of the community's onsite wastewater system.

Higher levels of management come at a cost, which will require collection of service fees through means such as a sewer bill. These fees can be difficult to implement, especially for existing non-sewered properties. At least as challenging is to implement a management system that requires inspections and gaining access to private property without an easement or land use agreement. For these reasons, higher levels of management are usually employed for new development.

In terms of this guidance, emphasis should be placed on applying higher levels of management to onsite wastewater systems within critical source protection areas, using the Operating Permit Model<sup>17</sup> at a minimum.

In planning developments, particularly in groundwater protection zones, consideration should be given to the septic system management needs while drinking water supplies are being established. Important

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<sup>16</sup> Rule R317-4-4.2

<sup>17</sup> United States Environmental Protection Agency, Handbook for Managing Onsite and Clustered (Decentralized) wastewater Treatment Systems, <https://nepis.epa.gov/Exe/ZyPDF.cgi/00001PFM.PDF?Dockey=00001PFM.PDF>, December 2005

considerations should include identifying the body politic utility that will be responsible for oversight, easement requirements needed for inspections and service, as well as the management strategies of this guidance.

As such, DEQ recommends the following:

- In planning developments, particularly in groundwater protection zones and critical recharge areas, consider the septic system management needs at the same time the drinking water supplies are being established.
- Identify the body politic utility who will be responsible for ongoing onsite wastewater oversight and implementation of the management strategies of this guidance.

When considering higher levels of management, legal authority is necessary to carry out effective management programs<sup>17</sup>. Each regional Team will need to decide the best route to the legal authority needed to attain their source protection goals.

## Conclusions

Among the State's highest priorities is the protection of drinking water aquifers, recognizing that clean water is essential for a healthy and prosperous Utah. Responsibility for the protection of source water areas occur at the local level and with public water systems under the Source Protection Rule<sup>18</sup>. Without the support of cities, counties, and LHD, most public water systems have limited authority to fully accomplish adequate control, even though they maintain full liability for contamination of their groundwater sources.

The Department of Environmental Quality is committed to its environmental health partners, and together accomplishing better groundwater safeguards and protection. This guidance was primarily prepared for local planners, counties, and LHDs. It provides DEQ's recommendations for protecting drinking water sources from onsite wastewater or septic discharges within designated drinking water source zones while acknowledging the need for appropriate alternatives.

DEQ understands implementing change within any organization requires education, hard work, and financial resources. DEQ is motivated to support local governments and can bring specialized expertise to your process. Some of the roles we see DEQ performing include assistance with defining aquifer protection goals and classification, development of design standards, technology reviews, review of groundwater modeling and density-based analyses, and septic management programming.

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<sup>18</sup> R309-600