

# *TECHNICAL GUIDANCE FOR THE ALLOWANCE OF ALTERNATIVE ONSITE WASTEWATER SYSTEMS WITHIN DRINKING WATER SOURCE PROTECTION ZONES*

*June 15, 2022*

## Executive Summary

Across Utah, development pressures have placed groundwater protection and local development interests at odds, especially in non-sewered areas where onsite wastewater systems (OWS)<sup>1</sup>, otherwise known as septic systems, are the preferred method for addressing wastewater. The Utah Department of Environmental Quality (DEQ) has prepared this document to assist local governments who have sought focused guidance on the use of alternative OWS design and operating standards to “adequately control” pollution within Drinking Water Source Protection (DWSP) zones. The most protective approach that local governments and public water systems can take to protect drinking water sources is to not allow new OWS in source protection zones one<sup>2</sup> and two<sup>3</sup>. While zones three and four<sup>4</sup> also warrant protection, DEQ regulations do not prohibit placement of OWS in these zones.

The primary purpose of a source protection program and this technical guidance is to ensure drinking water sources are protected because wells and springs are vulnerable to contamination. This guidance focuses on the criteria permitting agencies can use to determine whether an alternative OWS may be tolerated on an existing, platted residential lot. Specific strategies employed when planning for future development are covered in the document titled *Planning for Onsite Wastewater Disposal Systems in Non-Sewered Areas of the State: Tools for Preventing Contamination of Public Drinking Water Sources*.

This guidance recommends the following:

1. Continue to prohibit the construction of OWS within a DWSP zone one.
2. Prohibit the construction of conventional OWS within a DWSP zone two for sources developed in *unprotected* aquifers.
3. If connecting to sewer is not a feasible option, then an alternative OWS system capable of meeting less than 2.5 mg/L Nitrate-nitrogen at “end-of-the-pipe” may be permitted within a DWSP zone two. This type of system will be considered “adequately controlled” through design standards.
4. Alternative OWS treatment technologies, including those implemented to control pollution in DWSP zone two must be approved by DEQ’s Division of Water Quality, and:
  - a. Demonstrate through density-like studies or modeling that design standards<sup>5</sup> are sufficient to meet protection goals.
5. Alternative treatment systems should be operated under a permit or management plan which specifies performance standards and tracks pollutant loadings. Permits should include re-opener provisions enabling the inclusion of additional parameters as the need arises.

---

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

<sup>2</sup> 100-foot radius around a groundwater source.

<sup>3</sup> 250-day groundwater time-of-travel. Time of travel means the time required for a particle of water to move in the producing aquifer from a specific point to a groundwater source.

<sup>4</sup> 3-year and 15-year groundwater time-of-travel, respectively.

<sup>5</sup> Design standards must be based on aquifer classification and related to the size of the pollutant load, i.e., the number of OWS in the protection zone(s), unless protection goals are met at the surface, as in Item 3.

## 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)

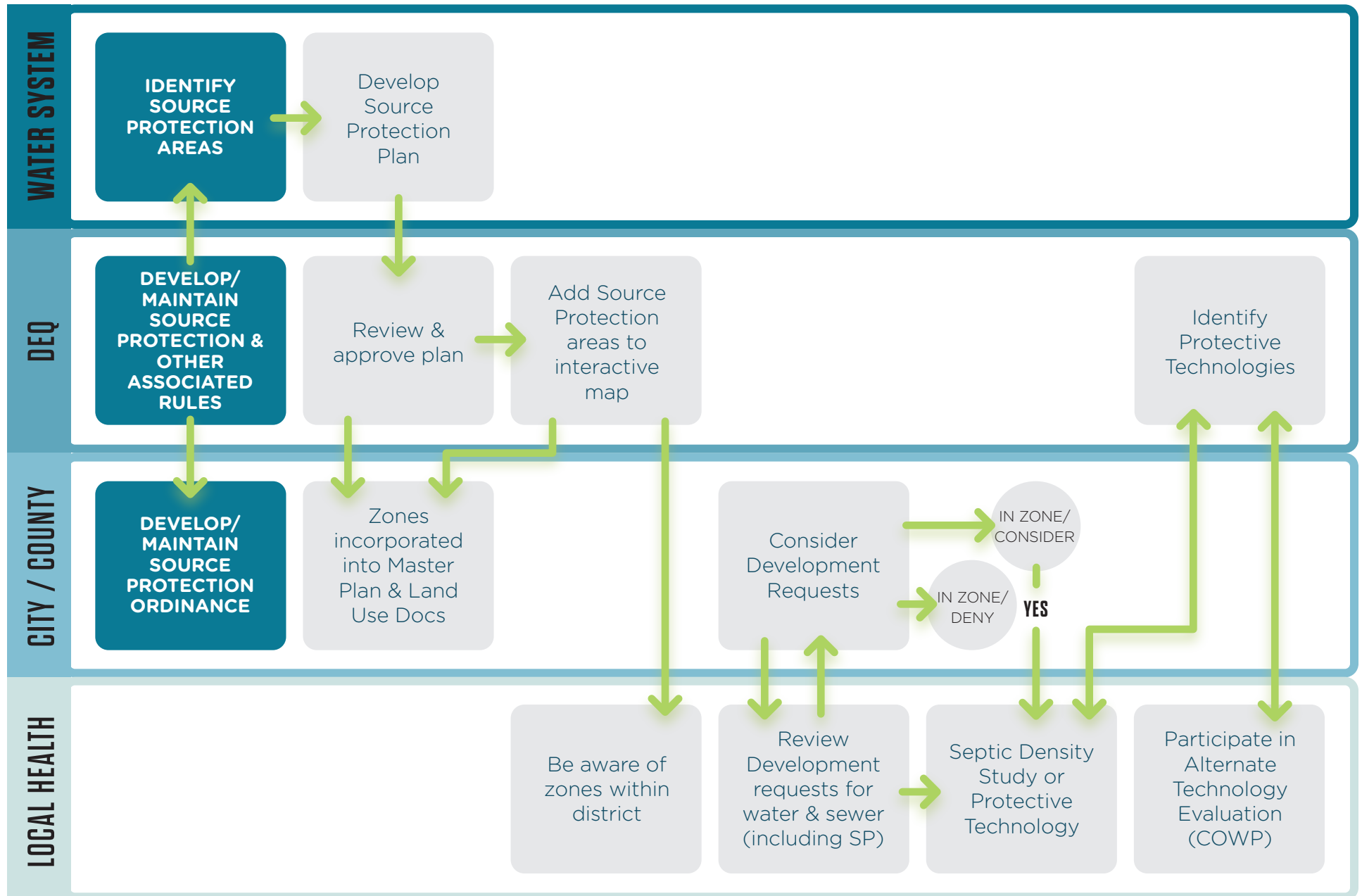
Most Public Water Systems lack the authority to prohibit or control pollution of groundwater, particularly beneath land they do not own, and often rely on local governments who can pass ordinances to control land uses.

**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



While this extensive body of regulation supports water systems in managing septic systems in their DWSP zones, intricacies of DEQ rules and their interplay with source protection ordinances has occasionally made it difficult for LHD to administer their OWS programs. Some landowners are unaware ordinances exist that limit the use of their land and only discover so when their request for a septic permit is denied. DEQ recommends local governments add DWSP zones to planning/zoning maps with clear information on potential impact to landowners. If local governments lack the resources to provide DWSP zone data to the public, they should direct prospective and current landowners to the DEQ Interactive Map<sup>6</sup>. While broadened release of this information may reduce future conflict, LHD still require guidance on the allowance of alternative OWS.

### ***Contaminants of Concern***

There are seventy-eight (78) chemicals regulated by DEQ rules and regulations, many of which have a reasonable potential to be present in septic tank effluent. There are several other contaminants for which health goals have been established, and others without goals or guidance, but for which concerns have been raised such as emerging pollutants of concern.

While a wide range of contaminants may be discharged to groundwater by septic systems, the most analyzed is nitrate because of its prevalence in OWS discharges and its recognized adverse health effects. Nitrate is a good indicator of OWS pollution because it is highly mobile through the soil and relatively conservative (i.e., remains in dissolved form and does not precipitate or adsorb). As such, nitrate is the most important pollutant to consider when establishing protection goals for OWS. The need to consider additional pollutants arises if they are present or become present in the groundwater background and if there are significant industrial discharges.

## **The Source Protection Rule and Permitting of Septic Systems**

The foundation of this guidance is the Source Protection Rule<sup>7</sup>, which addresses the protection of public supply groundwater sources. While this rule addresses protection of drinking water from all potential sources of contamination, further discussion will be limited to OWS pollution. Several, critical nuances of the Source Protection Rule will be discussed in subsequent sections.

### ***Existing versus New Groundwater Sources***

Important distinctions exist in the Source Protection Rule between an “existing groundwater source”<sup>8</sup> of drinking water and a “new groundwater source”<sup>9</sup>. “New groundwater sources” have additional requirements. Simply stated, these additional requirements include the need for land use agreements or protection under a zoning ordinance, sewer line offset and special construction requirements, and prohibitions on certain types of potential contamination sources, including septic systems. For “new” sources, OWS are restricted within zone one, and sometimes also in zone two. The Division of Drinking Water can enforce these restrictions because they have regulatory authority to approve the construction and siting (locating) of a new groundwater source.

The Division of Drinking Water does not have regulatory authority to limit activities in protection zones for “existing” sources that were in place and planned before the Source Protection Rule was enacted.

---

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

<sup>7</sup> R309-600

<sup>8</sup> A groundwater source for which plans and specifications are submitted on or before July 26, 1993.

<sup>9</sup> A groundwater source of drinking water for which plans and specifications are submitted after July 26, 1993.

Therefore, construction of new conventional, or alternative OWS within DWSP zones for an “existing” groundwater source does not violate the Source Protection Rule; however, public water systems are required to inventory new OWS and plan land management strategies to mitigate risk from OWS pollution. This is typically handled through public education programs.

Local land use ordinances typically prohibit OWS construction within DWSP zones one and two, regardless of a source’s designation as “new” or “existing” under the Source Protection Rule. While this difference may cause confusion, many water systems rely on ordinances to protect sources from future OWS pollution, especially for “existing” sources which may lack land use agreements. The clarification is provided because it is an area of the Source Protection Rule commonly misinterpreted by LHD, water systems, and landowners alike.

### ***Protected versus Unprotected Aquifer Designations***

While the Division of Drinking Water has no regulatory authority to control pollution sources, the Source Protection Rule prohibits the construction of a “new” groundwater source where OWS exist within DWSP zone one, for a source developed in a protected aquifer. To verify protected aquifer conditions, the PWS must demonstrate there is at least thirty (30) feet of clay covering the drinking water aquifer throughout DWSP zone two and that a surface seal has been installed to at least 100 feet below land surface and through the clay layer. A spring cannot be classified as producing from a protected aquifer.

As indicated in Rule<sup>10</sup>, a public water system choosing to verify protected aquifer conditions must employ the services of a licensed geologist or licensed engineer. The licensed professional must state that the aquifer meets the definition of a protected aquifer and provide documentation to support the claim. The source then receives a classification from the Division of Drinking Water based on a critical review of the information provided. If there is insufficient data to support protected aquifer status, the well is classified as producing from an “unprotected aquifer”<sup>11</sup>.

If a “new” well has been determined to be producing from a protected aquifer, pollution sources, including conventional OWS, are tolerated within a DWSP zone two. Conversely, if a public water system cannot verify protected aquifer status, construction of a new groundwater source would not be approved where OWS exist within DWSP zones one or two. All county land use ordinances prohibit OWS construction within DWSP zone one. Most ordinances prohibit construction of OWS within DWSP zone two regardless of aquifer type (unless controlled through design standards).

While local land use authorities are welcome to enact regulations more stringent than DEQ rules, if better alignment with the Source Protection Rule is deemed worthwhile, ordinances could be modified to make allowances for protected and unprotected aquifer classifications. DEQ tracks which groundwater sources produce from protected aquifers and can provide this information to local governments and LHD for assistance in enforcement of their ordinances.

---

<sup>10</sup> R309-600-9(4)

<sup>11</sup> As of September 2021, approximately twenty-two (22) percent of wells have been classified as producing from a “protected aquifer”. All other wells have been classified as producing from an “unprotected aquifer” (48%) or insufficient information is available (30%).

While differences exist between the Source Protection Rule and local zoning laws, the underlying goal remains the same – to protect groundwater quality. In keeping with this goal, DEQ recommends local governments:

- Continue to prohibit the construction of OWS within a DWSP zone one.
- Prohibit the construction of new conventional OWS within a DWSP zone two for sources developed in *unprotected* aquifers.

## Adequately Controlled Alternative Systems

According to the Source Protection Rule<sup>12</sup>, “adequately controlled” and “uncontrolled” pollution and potential contamination sources are terms used in the context of determining where new groundwater sources of drinking water may or may not be constructed, and to determine if OWS should be prohibited. Septic systems are defined as uncontrolled pollution sources; however, they can be controlled by using “design standards” according to the Source Protection Rule. The term “design standards” is not defined but it has been interpreted to mean any planned mechanism, method, or program designed to achieve a specified quality objective, e.g., groundwater protection goals.

The planned mechanisms, methods, and programs implemented for groundwater protection are “controls”, and the specific quality objectives these controls are intended to affect are the “design standards.” While design standards may be protection goals based on aquifer classifications, septic tank density studies, or establishment of minimum lot sizes, they are generally not easily applied on an individual lot basis. Therefore, the design standards outlined in this guidance relate to “end-of-the-pipe” effluent limits as a treatment control.

Alternative OWS systems are designed to overcome site limitations that prevent use of conventional OWS. Packed bed media systems are the most treatment intensive and are the only alternative OWS for which treatment performance standards are defined in Rule<sup>13</sup> for biological oxygen demand (BOD) or chemical oxygen demand (COD), total suspended solids (TSS), and at times *escherichia coli* (*E. coli*) bacteria. Approved packed bed media systems can provide good treatment of these waste constituents.

Some packed bed media systems are reported to partially remove nitrogen (through denitrification) thus reducing nitrate loadings into the groundwater. Nitrogen removal, along with BOD, TSS and pathogen removal, are essential components in the protection of groundwater resources from OWS discharges. DEQ’s rules provide neither prescriptive, nor performance-based design standards for using alternative systems to control pollution of aquifers from nitrate contamination or otherwise. No alternative OWS have been approved by DEQ for this purpose.

The idea of using alternative OWS to adequately control pollution has merit and potential. DEQ urges caution in expecting any alternative OWS not specifically designed for total nitrogen removal to achieve this level of treatment consistently. Proposed technology must be critically reviewed by DEQ’s qualified experts.

There are a few alternative OWS vendors who can deliver wastewater treatment that consistently meets groundwater protection goals, e.g., less than 2.5 mg/L Nitrate-nitrogen. With this level of treatment, groundwater protection goals are met without the need for further assessment, mass loading, or density

---

<sup>12</sup> R309-600

<sup>13</sup> R317-4-13

consideration. Thus, implementing 2.5 mg/L Nitrate-nitrogen (at “end-of-the-pipe”) as the design standard would be protective. Therefore:

- An alternative OWS system capable of meeting less than 2.5 mg/L Nitrate-nitrogen at “end-of-the-pipe” may be permitted within a DWSP zone two. This type of system will be considered “adequately controlled” through design standards.

The problems with these types of systems is the cost, the need for a homeowner to operate a sophisticated wastewater treatment plant, and the challenges of verifying system performance. DEQ recognizes these challenges may be too difficult to overcome for the average landowner. Regardless, this type of engineered OWS is considered protective and will negate the necessity for more detailed analyses. As these technologies advance, costs decline, and/or a competitive market develops, they will become accepted as the “design standard” for ordinances.

In situations where treatment to 2.5 mg/L Nitrate-nitrogen “end-of-the-pipe” cannot be implemented, DEQ recommends:

- Any other alternative OWS treatment technology implemented to control pollution in DWSP zone two be approved by DWQ, and:
- Demonstrate through density-like studies or modeling that design standards are sufficient to meet protection goals. Design standards must be based on the aquifer classification and related to the size of the pollutant load, i.e., the number of OWS in the protection zone(s).

When treatment will not be provided at the surface, establishment of controls for protecting drinking water sources should have a foundation in the protection levels for the aquifer. Aquifer classification analyses, coupled with density-like studies are necessary to develop an understanding of the potential impacts from OWS on an aquifer. An understanding of the potential impacts is needed to establish design standards and effective controls. Assessment and implementation of suitable controls will provide a high level of certainty and sufficient demonstration of adequate control to the LHD issuing OWS construction and operating permits.

Establishing groundwater protection goals and applying a mass balance approach is fundamental to evaluating alternatives that will result in adequate control of OWS in protection areas. Pollutant fate and transport modeling is often necessary to make accurate mass balance calculations that account for groundwater conditions, and the effects of soil on pollutant movement. Site-specific studies can demonstrate that an aquifer will be protected, and that the addition of septic systems meets the septic tank density study or mass balance loading analysis for the entire aquifer. For a detailed discussion on these methodologies, refer to the document titled *Planning for Onsite Wastewater Disposal Systems in Non-Sewered Areas of the State: Tools for Preventing Contamination of Public Drinking Water Sources*.

## Permit Requirements for Adequately Controlled Alternative Systems

The alternative OWS Rule<sup>14</sup> establishes minimum standards for administration by LHD of an alternative OWS system program. The rule includes requirements for oversight, inspections, recordkeeping, and annual programmatic reporting to DEQ. The rule does not require that administrators issue operating

---

<sup>14</sup> R317-4-1.5

permits. Local administrators may adopt stricter standards, issue operating permits, and take necessary steps to protect ground water<sup>15</sup>.

When alternative OWS are part of a DWSP strategy to prevent pollution of groundwater, they should be managed under an operating permit and management plan that specifies the design standards needed to consistently accomplish groundwater quality goals. Permits should include routine inspection requirements, and periodic review of performance records to verify required levels of treatment are being met and to monitor pollutant loads into the groundwater. Permits should also include re-opener provisions enabling the inclusion of additional parameters as the need arises.

In summary, DEQ recommends:

- Alternative treatment systems should be operated under a permit or management plan that specifies performance standards and tracks pollutant loadings. Permits should include re-opener provisions enabling the inclusion of additional parameters as the need arises.

## Conclusions

Onsite wastewater systems are the single largest potential source of contamination threatening groundwater sources of public drinking water in Utah. 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 occurs at the local level and with public water systems under the Source Protection Rule. Without the support of cities, counties, and LHD, most PWS 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 OWS discharges within designated DWSP 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 in the administration of OWS programs 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.

---

<sup>15</sup> R317-4-1.4.B