Current Wastewater Management and Regulation Review of the Barton Springs Zone

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Introduction

As the population increases in central Texas, wastewater management in the region is becoming an essential issue for policy makers and the population at large. This report discusses the current state of regulations at all levels of government, the effectiveness of available wastewater disposal methods as they relate to Central Texas surface and groundwater quality, and an inventory of wastewater practices in the region.

The current state of regulations across all levels of government is described in Part I and provides details on the collection of regulations concerning wastewater practices. This assortment of regulations will frequently lead to uncertainty in the permitting of wastewater practices. As such, this report will heavily examine the role of the Texas Commission on Environmental Quality (TCEQ) in permitting the various wastewater disposal methods and the benefits of avoiding this uncertainty.

Part II examines the current practices of wastewater discharge in the Barton Springs Zone (BSZ) along with an inventory of operating discharges in the region. This will provide a base from which to make an assessment of the water quality impact of wastewater in the region and may help guide future steps in deciding to mitigate the impacts and optimize a series of controls to benefit all.

Part I – Regulations Governing Wastewater Management

Overview

A brief overview of applicable rules and authorities for various components of wastewater management is provided below starting at the federal level and proceeding to the local jurisdictions. Rules where the BSZ is specifically mentioned or environmental sensitivity may be considered are identified. The main distinction to be made is how a particular wastewater regulation or regulatory program would potentially provide superior water quality and quantity protection to the BSZ commensurate with its fragility and sensitivity. Naturally, overlap, cross referencing, and duplication in the regulations of multiple jurisdictions makes some cases difficult. However, there is potential to use many of these regulations to maintain and improve wastewater management in the BSZ; although interpretation, policy, application, and on the ground practice usually determines how effective these regulations are.

Regulatory authority for wastewater management in the BSZ is found in several sometimes overlapping Federal, State, County, and local municipality rules. Some of these rules specifically single out the BSZ, either Barton Springs Recharge Zone (BSRZ) or Barton Springs Contributing Zone (BSCZ) or both for special treatment. Other rules show partiality by special treatment of areas with characteristics that the BSZ watershed possesses such as nutrient poor pristine streams, habitat for endangered cave and aquatic salamander species, karst geology, and shallow soils.

Regulation is also concentrated in different levels of government by a hierarchy of technology from the broadest potential impact to the most localized. Centralized treatment with direct discharge is primarily regulated by TCEQ with some oversight by United Stated Environmental Protection Agency (EPA) through a Memorandum of Understanding delegation. Centralized wastewater collection systems are similarly designed based on statewide design criteria slightly modified for those over the Barton Springs Edwards Aquifer (BSEA) as organized sewer collection systems (OSCS) and further regulated if local review and inspection is delegated to local authority. These delegated systems are regulated finally by local ordinance when that authority has adopted more stringent criteria than statewide standards and universal plumbing codes.

Land application management is primarily a TCEQ regulatory permit program using centralized wastewater treatment and surface or subsurface (Subsurface Area Drip Dispersal System or SADDS) technology. However, the state includes a separate program of registrations for use of reclaimed wastewater for more flexible land application on sites not tied to the permit. The administration of more localized on-site sewage facility (OSSF) rules varies the most over the BSZ due to multiple local and county jurisdictions; however, it must be specifically delegated by TCEQ and is still subject to state Edwards Aquifer-specific OSSF conditions and uniform state-wide rules. Municipalities often incorporate by reference TCEQ rules governing OSSF in their local codes, and this provides some common framework. In some cases, local rules for land development may indirectly alter how wastewater is regulated.

Additional governmental and quasi-governmental entities such as groundwater districts, regional water planning groups, and voluntary regional planning coalitions influence how wastewater is managed in the BSZ. New state and federal laws, rules, and their interpretations always have the potential to either benefit or impinge on the protections of sensitive environments such as the BSZ from wastewater impacts at local levels.

The land area of the BSZ includes portions of northern Hays County, southwest Travis County and a small section of eastern Blanco County. It includes all or a portion of the Cities of Austin, Buda, Dripping Springs, Hays City, Kyle, Mountain City, Rollingwood, Sunset Valley, West Lake Hills and the Villages of Bee Cave, Bear Creek, Lakeway and portions of the Barton Springs/Edwards Aquifer, Hays Trinity, Southwestern Travis County and Blanco-Pedernales Groundwater Conservation Districts. The BSZ as considered herein includes the contributing and recharging portions of Barton and Onion Creek and their tributaries. Typically, the major tributary watersheds are considered Little Barton, Bear, Little Bear, Slaughter, and Williamson Creeks.

Federal Rules

Federal authority for regulation of wastewater management applicable in all areas of the BSZ originates from the 1972 Clean Water Act with revisions. In addition, major federal actions can also prompt an Environmental Assessment, Categorical Exclusion, or Environmental Impact Statement to be necessary under the National Environmental Policy Act. This is seldom needed in wastewater permitting unless EPA determines that the discharge to surface waters is a major (>5MGD) "New Source" or the United States Fish and Wildlife Service (USFWS) determines that the federal action of granting a wastewater permit may result in "take" (harm or harassment) of endangered species under the 1969 Endangered Species Act. This may also require a Section 7 consultation with the public agency responsible for "take". One example of this was the application of the EPA NPDES (now TPDES under TCEQ) General Construction Permit for stormwater discharges in 2001. Since that time, several programmatic Memorandum of Understanding (MOU) between EPA, USFWS, and TCEQ override or circumvent USFWS consultation rules.

The Endangered Species Act 10(a)(1)(b) Incidental Take Permit (ITP) held by the City of Austin for operation of Barton Springs Pool also has some provisions in its Habitat Conservation Plan (HCP) obliquely related to wastewater management through regional coordination (Dries et al. 2013). The Barton Springs Edwards Aquifer Conservation District (BSEACD) HCP mentions wastewater impacts on the aquifer, but an HCP or ITP cannot confer any direct regulatory authority over wastewater management.

The Safe Drinking Water Act (SDWA) provisions for source water protection and sole source aquifer restrictions are often referred to as vehicles for ensuring the integrity of the aquifer and its contributing and recharge zones. For example, sole-source surface drinking water supplies including the BSEA and surface water contributions are presumed to be provided a higher standard of protection, but how this is provided is uncertain. All it allows is EPA review of projects receiving federal assistance that have the potential to contaminate an aquifer providing more than 50% of the drinking water supplies to its service area. If EPA determines that such

contamination will occur and cannot be mitigated, it can deny funding. Therefore, unless a wastewater management project is federally funded and should have been prevented anyway, it appears to mean little. An EPA summary of Sole Source Aquifer Designation (Albright 2000) states:

> The Sole Source Aquifer program allows for EPA environmental review of any project which is financially assisted by federal grants or federal loan guarantees. These projects are evaluated to determine whether they have the potential to contaminate a sole source aquifer. If there is such a potential, the project should be modified to reduce or eliminate the risk, or federal financial support may be withdrawn. This doesn't mean that the Sole Source Aquifer program can delay or stop development of landfills, roads, publicly owned wastewater treatment works or other facilities. Nor can it impact any direct federal environmental regulatory or remedial programs, such as permit decisions.

Similarly, the Source Water Protection Program under the SDWA as administered through TCEQ is primarily an assessment system with no enforcement provisions. It may have some planning and funding implications through the Texas Water Development Board Region K process, but it has had no practical influence on wastewater management in the BSZ. It has also been ineffective in other areas with respect to the BSZ such as environmental review of transportation projects including application to potential impacts of the Austin Outer Loop highway (Peach et al. 1992).

Federal Direct Discharge Regulations

Direct discharges are regulated by federal and state government agencies under the Clean Water Act. The Clean Water Act (CWA) gave authority to the EPA to set effluent limitations on a water-quality basis to protect receiving waters in the United States. The EPA was then required by Section 402 of the CWA to implement the National Pollutant Discharge Elimination System (NPDES) requiring federal permits for discharge of pollutants directly to surface receiving waters. Primarily, the NPDES program protects the receiving waters by limiting the concentrations of pollutants in the wastewater effluent. Limitations must be based on available technology to control the pollutants (technology-based) and the water quality standards of the waters receiving the effluent (water quality-based). In cases where the technology-based limit is not sufficient to ensure the water quality standards of the receiving waters, section 303(b)(1)(c) of the CWA and NPDES regulation 40 CFR 122.44(d) require the stricter water quality-based effluent limitations to be used. This would be applicable in the BSZ as an environmental sensitive area, and permits are considered on a case by case basis in such areas.

Under the CWA, the EPA may authorize any state government to administer the NPDES program and the State of Texas assumed that authority in 1998. The Texas Commission on Environmental Quality (TCEQ) predecessor agency developed the Texas Pollutant Discharge Elimination System (TPDES) program having regulatory authority over direct discharge of pollutants to Texas surface water except for discharge from oil, gas, or geothermal exploration. The TPDES program is similar to the NPDES program in its requirements of effluent limitations. The EPA /TNRCC (TCEQ) NPDES delegation MOU mentions implementation of water quality based standards that presumably could have resulted in permit limitations based on the sensitivity of the watershed; however, this has had limited direct effect in the BSZ. The TPDES

permits issued in similar sensitive areas and the Belterra permit approved for the BSCZ discharge have not reached the stringency that could be said to be protective of BSZ water quality (Herrington 2005, 2006, 2008a, 2008b, 2008c, Slade 2006, Richter 2010, 2016, Porras 2016). They also have not reached the current capability of today's wastewater treatment technology or included all of the pollutants that are of concern in the BSZ. Barring a significant change in the application of Clean Water Act anti-degradation requirements by TCEQ, it is unlikely that appropriate limits or parameters will be applied in future discharge permits in the BSZ. More recently, a permit for the City of Dripping Springs Waste Water Treatment Plant (WWTP) has followed the same pattern although questions by the USFWS could have prompted some reconsideration of additional permit provisions for protection of endangered species. In all cases, only marginal improvements to the stringency of permits in the BSZ seem to be gained through contested case hearings at great cost to the public and private interests and still the resource is not protected to any appropriate degree.

Federal Impact on Land Disposal Permits

One feature of federal regulation of wastewater management in Texas is that it does not directly address land application or onsite sewage facilities (OSSFs). There are no equivalent federal regulations for OSSFs, Texas Land Application Permits (TLAPs) or SADDs applicable to the BSZ situation. Although the Clean Water Act does not allow discharge into waters of the US without a permit, land application is not considered a discharge, even if soil characteristics, shallow groundwater flow, and karst features would make it so at times without appropriate measures. Although EPA provides guidance on Land Application (EPA 2006a) and OSSFs (EPA 2002), the actual limitations to these systems through permitting are delegated to TCEQ. TCEQ can further delegate OSSF regulation to local entities as authorized agents. These agents may then have more stringent requirements beyond that of TCEQ. EPA also has in the past operated a technology vetting center for on-site residential nutrient reduction treatment systems through the Environmental Technology Verification Center (EPA 2006b) and provided funding for research into a wide variety of advanced nutrient removal OSSFs and decentralized treatment systems. The required use of these advanced systems is left to other regulatory entities.

Federal Consultation Agreements

Various lawsuits were filed from 1998-2000 by development interests and citizen environmental groups in disagreement over the handling of EPA/USFWS consultation on both the Construction General Permit (CGP) protections in the BSZ and the Municipal Separate Storm Sewer System (MS4) NPDES permit for the City of Austin. After considerable debate and settlement of the lawsuits, the consultation on the CGP was concluded. At the time, no direct NPDES permits had been approved for wastewater discharge in the BSZ. In their Biological Opinion for the CGP, USFWS states that concerning the Barton Springs Salamander:

> Wastewater Systems - The primary sources of wastewater discharge to the environment that are of concern for the survival and recovery of the salamander are septic tank fields, organized sewage collection systems, and irrigation disposal of partially treated wastewater. Threats are present from direct impacts of bacteria and viruses, nutrient enriched algal blooms, discharge of oxygen demanding organic material, and concomitant discharge of toxic pollutants commonly found in domestic wastewater. In addition, any

> spills and leaks from sewer pipelines and lift stations may also add polluted water to the streams and aquifer system (USFWS 2001).

The only other references to wastewater in the Biological Opinion were acknowledging the potential impact of reclaimed wastewater irrigation on golf courses and that residential construction of less than 5 acres that included OSSFs was not addressed in this version of the CGP.

The USFWS Biological Opinion on the Construction General Permit (CGP) included several conservation measures that were supposed to protect the Barton Springs Salamander from construction impacts in general. However, very little was specific to superior wastewater management in the BSZ other than random inspection of construction under the CGP that would include wastewater infrastructure. No reports of enforcement actions concerning such infrastructure under this provision were found. Additional research into nonpoint source pollution impacts to the salamander, monitoring, and water quality measures were discretionary provisions of the Opinion.

The TNRCC (TCEQ) was delegated the administration of the CGP in 2003. The current CGP states that

> Discharges that would adversely affect a listed endangered or threatened aquatic or aquatic-dependent species or its critical habitat are not authorized by this permit, unless the requirements of the Endangered Species Act are satisfied. Federal requirements related to endangered species apply to all TPDES permitted discharges and site-specific controls may be required to ensure that protection of endangered or threatened species is achieved. (TCEQ 2018)

The Optional Enhanced Measures for Edwards Rules were another product of consultation between USFWS and TNRCC (TCEQ) resulting in an MOU that included stream buffer zones in which no wastewater collection or treatment ponds could be constructed. This is more restrictive than the statewide regulations and the baseline Edwards Rule requirements. Enforcement of these rules is the responsibility of TCEQ although the MOU included a Federal Agency. However, these measures are "optional" with the other option being to obtain an individual ITP that may not require such conditions on wastewater management. Much like other federal and state permits, the ease of obtaining such permits and the conditions therein seem to be contingent upon the administration at the time of permit processing or other case-by-case considerations. The trend in permitting infrastructure projects at this time under Presidential Executive Order 13807 is to reduce environmental review to the bare minimum and synchronize reviews across agencies to result in one federal decision on the shortest critical path to approval. Little effective recourse also appears to be available for protestants to such permit actions. There is no contested case hearing process for ITP permits and lawsuit settlements in federal court leading to more protective conditions are astronomically few and far between in the BSZ. The last consent decree in federal court with favorable environmental restrictions imposed on a project in the BSZ was almost 30 years ago in a case concerning the Austin Outer Loop (BSEACD v. State Department of Highways and Public Transportation (SDHPT), Smith 1990).

Endangered Species Act Requirements

The City of Austin also maintains an ITP for operation of Barton Springs Pool. A Habitat Conservation Plan (Dries et al. 2014) was developed for a new permit issued in 2014 which addresses wastewater impacts in the BSZ only tangentially for the reasons below:

> A habitat conservation plan can include only actions that occur within the legal jurisdiction of the applicant. Therefore, only City actions on City property are covered by this habitat conservation plan. Some actions that cannot be covered by this plan include regulation of groundwater withdrawal from the Edwards Aquifer, urban development outside of the City's jurisdiction, and wastewater disposal regulated by the State of Texas. These and other actions in the watershed are regulated by state and regional entities (e.g., Barton Springs Edwards Aquifer Conservation District). Protection of water quality from effects of activities conducted outside the City's jurisdiction is provided by Texas Commission on Environmental Quality Edwards Aquifer Rules (30 TAC 213) and Enhanced Measures for the Edwards Aquifer (TCEQ 2007). State regulations also cover wastewater disposal via direct discharge or land application of effluent consistent with the federal Clean Water Act and the Texas Commission on Environmental Quality.

However, the City HCP does recognize the potential impact on the salamanders from wastewater management in the BSZ:

> Domestic wastewater disposal via direct discharge or land application of treated wastewater effluent may contribute to eutrophication of the Edwards Aquifer (Mabe 2007, Herrington et al. 2011). In 2009, Hays County Water Control and Improvement District 1 serving the Belterra Subdivision was granted the first wastewater discharge permit in the contributing zone of the aquifer. All other centralized wastewater disposal in the Barton Springs Zone is done under the Texas Land Application Permit (TLAP) system irrigating wastewater effluent with no intentional discharge to surface waters or by individual on-site sewage facility (OSSF) (Herrington et al. 2011). City of Austin wastewater collection service extends throughout the Williamson Creek watershed and in portions of the Barton and Slaughter Creek watersheds over the recharge zone within the City's jurisdiction (Herrington et al. 2011).

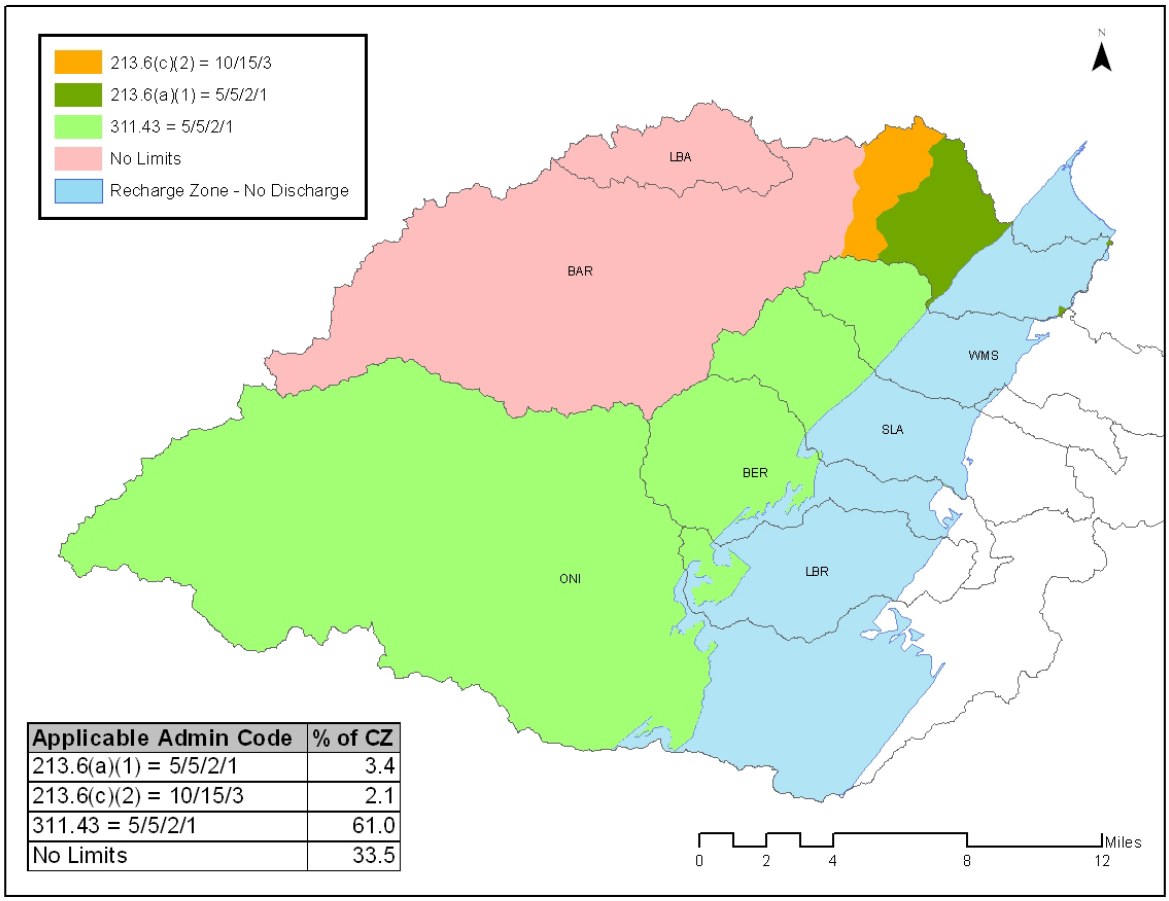
For the above reasons, one of the alternative sets of measures considered in the COA HCP included provisions that would address wastewater issues in the BSZ. These alternative measures would include purchase of all of the remaining undeveloped land in the BSZ by the COA. This would effectively reduce OSSFs in the BSZ as well as reduce the number of new wastewater plant applicants seeking to discharge in the BSCZ or land apply in the BSRZ. In addition, the City would offer to provide all water and wastewater service in the area and limit new connections. Pumping from the BSEA would be reduced by retiring pumping permits replaced by City water service. Given that the alternative set of measures would cost the City billions of dollars without any guarantee that Barton Springs or the Barton Springs Salamander would be protected, it was dismissed as infeasible. However, unless such seemingly radical alternatives are actually evaluated in planning and conservation documents, it is uncertain whether progress will ever be made towards recovery and delisting of the species. Bracketing the status quo and additional moderate efforts does not seem to be moving the needle; therefore,

the recent HCP sought to bracket what could feasibly be done for the permit period (20 years) with what would be considered extreme measures to salvage a species including the wastewater management component.

Hays County also maintains a Regional HCP (RHCP) for their ITP for the black-capped vireo and golden-cheeked warbler [Loomis 2010]. Texas Parks and Wildlife Code §83.014(c) prohibits Hays County or any participant in a RHCP from limiting or denying water or wastewater service to preserve land, potential preserve, critical habitat, or contains species or its habitat. However, the RHCP does allow a streamlined ESA compliance for the County, municipalities, and developers that includes measures to mitigate and minimize impacts to listed species. Wastewater collection pipelines are mentioned as one of the infrastructure types that are covered as "otherwise lawful activities" causing incidental take, and infrastructure that may be installed on preserve land. Therefore, it would seem that some benefits in streamlined participation could be provided if mitigation and minimization measures that include water quality and quantity protection are designed into proposed wastewater projects in the BSZ under the RHCP.

TCEQ Laws, Rules, Permits and Guidance

Most rules and design criteria for wastewater management are found at the state level. The Texas Commission on Environmental Quality (TCEQ) regulates discharge of wastewater and land application of wastewater for municipal systems over 5,000 gpd. TCEQ is the regulatory body having authority pursuant to the Texas Water Code, §26.401 and Title 30 of the Texas Administrative Code, Section 213 (the Edwards Rules) for regulation of activities having the potential for polluting the Edwards Aquifer. Regulations for OSSF are specified in 30 TAC §285 and TCEQ can delegate authority for permitting individual OSSF to local authorities. Baseline effluent limits for discharge required by TCEQ vary across the BSZ as shown in Figure 1. Still, these discharges are to be considered on a case-by-case basis and TCEQ could require limits that are more stringent or deny a permit under their discretion or as directed in a contested case hearing under a State Office of Administrative Hearing (SOAH) judge.



Applicable Admin Code	% of CZ
213.6(a)(1) = 5/5/2/1	3.4
213.6(c)(2) = 10/15/3	2.1
311.43 = 5/5/2/1	61.0
No Limits	33.5

Figure 1 TPDES Effluent Limits by Rule in BSZ

Texas Water Code

Authority for regulation of wastewater management in the BSZ and elsewhere in the state is derived from the Texas Water Code (TWC) Chapter §26. In §26.012, the state is required to prepare a State Water Quality Plan which is to guide specific TCEQ policy. In §26.0135 TCEQ must consider its watershed monitoring in reviewing wastewater permits and other water quality management activities. In §26.0282 regional treatment options are to be considered; but no mention is made of potential adequacy and appropriateness of decentralized treatment. Although a much under-used method for water conservation and wastewater reduction in the BSZ, statewide greywater controls and standards are provided in §26.0311. This portion of the TWC prohibits nuisance and damage to surface and groundwater quality.

The authority to use a general permit for discharges or land application under 5,000 gpd comes from §26.0405, also allowing regulation through counties (authorized agents) and design criteria under Chapter 366 of the Health and Safety Code. State-wide, single family residential systems presumably OSSFs are allowed under this section as well as discharges to surface water if OSSFs cannot be designed under the design criteria. Regulations for OSSF are specified in 30 TAC §285, and TCEQ can delegate authority for permitting individual OSSF to local authorities.

Fees and Hearings for the Edwards Aquifer Protection Program (EAPP) at TCEQ are mentioned, but nothing that would provide for specific protection for the BSZ is mentioned in this section of the TWC. Improvements to protection of the surface streams in the BSZ and the BSEA would be best addressed through the TAC rather than modifying the Water Code. Existing regulations authorized under the Water Code attempt to address these wastewater issues but are inadequate and outdated at present.

TPDES Permits – Direct Discharge

Direct discharge in the BSZ is governed under state rules (30 TAC§213.6). A summary of this coverage is provided below and the applicable watershed areas for each discharge limitation is shown in Figure 1.

- Barton Springs Recharge Zone – New or increased direct discharge prohibited. Land Application considered on case-by-case basis
- Barton Springs Contributing Zone 0-5 miles above the recharge zone. Allowable effluent limits at least as stringent as maximum 5 mg/L Biological Oxygen Demand (BOD), 5 mg/L Total Suspended Solids (TSS), 2 mg/L ammonia (NH_3-N), 1 mg/L Total Phosphorus (TP), and 5 mg/L Dissolved Oxygen (DO) min.
- Barton Springs Contributing Zone 5-10 miles above the recharge zone – Cross references effluent set 2N from 30TAC§309. This results in effluent limits at least as stringent as 10 mg/L BOD, 15 mg/L TSS, and 2 mg/L NH_3-N with no limit for TP.
- Barton Springs Contributing Zone >5 miles upstream from the recharge zone which enter the main stem or a tributary of Segment 1428 of the Colorado River, or Segment 1427, main stem Onion Creek, or a tributary of Onion Creek must comply with §311.43 watershed rule and §311.44 relating to disinfection. The result is effluent limits at least as stringent as
- In all cases there is a clause that allows TCEQ to impose more stringent effluent limits, consider the permits on a case by case basis, and/or consider the relative distance of the facility from the recharge zone boundary.

In practice, these rules have managed to dissuade applicants from proposing discharge permits in the contributing zone and land application permits in the recharge zone for many years. The Edward Rules provisions went into effect almost 19 years ago on June 1, 1999, and the effluent limits for Onion Creek and its tributaries were effective about 28 years ago on June 1, 1990. However, improvements in wastewater treatment technology, development pressure, land costs/treatment cost differentials and simple Texas politics have made such options more viable. Therefore, these rather lax regulations by today's standards serve to allow wastewater management that is detrimental to the integrity of BSZ water resources as shown by proposed discharges were modeled at these limits (Herrington 2008a,2008b, 2008c, Richter 2010, 2016, Turner 2006, 2009, 2012, Porras 2017). One constraint to effluent limits that could be used to limit the degradation of surface and groundwater in the BSZ from direct discharge is found in 30 TAC §311.43(d) that provides that treatment levels "may be modified if the results of water quality studies show that this is necessary." Since this still leaves some ambiguity on which studies it prefers, TCEQ could use applicant or citizen provided studies if the quality

assurance/quality control and design is sufficient. Further, TCEQ could use monitoring or modeling studies with their own considerations for what shows that more stringent effluent limits are "necessary". However, in only rare occasions have citizen studies been used to set effluent limits. Even in these cases, other factors have eroded the protections of more stringent limits. Applicants have proposed and obtained statistical metrics to be applied that effectively loosen limits, and adaptive management triggers that are often set on limited information have been found to be less protective in practice after startup (Herrington 2008a, Turner 2009).

30 TAC §309 – Texas Land Application Permits (TLAP)

This section of state regulations addresses effluent sets for wastewater discharge and land application. In addition, this section essentially provides the design criteria for land application of treated effluent under TLAPs (subchapter C). Section 30 TAC §309.3(f) addresses the minimum effluent quality requirements for land application. Unfortunately, some existing plants in the BSZ are permitted at this relatively lax level of secondary treatment with no nutrient limits. The rationale for the state-wide lowest common denominator is that if the system is designed and operated in accordance with this section, no discharge of pollutants will be made through runoff and little effluent should infiltrate below the plant root zone. This regulation makes no mention of additional requirements for sensitive areas such as over karst terrain. Soil depth and type requirements are provided, along with water and nutrient balances to be provided by the applicant. These serve to make some site-specific provisions based on sensitivity; however, karst terrain, and recharge features are not considered adequately. This section was effective March 19, 1990 with only minor changes since. Both treatment technology and available impact evaluation methods have changed so drastically since this time such that this section is extremely outdated. Special conditions for land application in the BSZ in this section are few. However, in 30 TAC §309.3(i) TCEQ always has the authority to impose more stringent effluent limits on a case-by-case basis, which is encouraging given the always increasing technical acumen of their permit staff.

An assessment of these inadequacies and changes to this regulation proposed to address them are included in Ross (2011). Following is a brief review of the changes recommended in this report:

- Specific prohibition of both spray and subsurface land application in the BSRZ; removing case-by-case loophole.
- Consistent effluent limits on total nitrogen and total phosphorous.
- Require the same storage requirements for both subsurface and surface spray irrigation systems.
- Use a daily water balance with local climatological data over the period of record in engineering calculations of application rates and storage volume.
- Delete the leaching allowance included in current TCEQ regulations.
- Require downgradient monitoring using parameters that would identify wastewater signatures in wells, springs, and streams.
- Require soil monitoring to determine when saturated or frozen soil conditions occur and prevent irrigation in accordance with current regulations

- Require soil monitoring that could be used to determine trigger conditions for adaptive management requiring, re-examination of permit conditions and infrastructure before water quality impacts occur.

The location of these proposed regulatory changes could be made in 30TAC§309 or in 30TAC§213 Edwards Aquifer Rules. Unfortunately, little progress has been made and none of these improvements have been adopted in permits since this report was published in 2011.

30 TAC §222 – Subsurface Area Drip Dispersal Systems (SADDS)

This section of TCEQ rules is relatively new compared to other wastewater regulations (7/5/2006) and was designed to fill the gaps in other sections concerning design criteria for wastewater disposal by Subsurface Area Drip Dispersal Systems (SADDS). These rules primarily address slow rate drip infiltration systems with no surface features of wastewater distribution. The 30 TAC §222 rules allow for an application rate up to 0.1 gallons/ft^2/day statewide unless the applicant shows that a higher rate is justified or the rate is controlled by calculated annual nitrogen uptake requirements. Subsurface systems are required to have storage capacity for 3 days of effluent volume, drastically less than what is required for surface irrigation permits from the requisite water balance. These systems could be used with OSSFs or permitted under the TLAP rules if design flows are greater than 5,000 gpd. The design criteria under this section specifically state that SADDS "..shall not pollute groundwater quality" (30 TAC §222.77(a)). Although increasing vertical separation distance based on soil conditions and underlying geology are noted and may result in more stringent permits, no specific design effluent quality leading to SADDS in the BSZ is required beyond that applicable statewide. In 30 TAC §222.79, a survey of recharge features is required for permit applications and "berms, buffer zones, or other equivalent protective measures" are required. Monitoring is mentioned as an alternative to protection. If some form of trigger and response adaptive management were specified, then monitoring may be a suitable addition to protective design; but it is not a substitute.

As with surface spray systems, Ross (2011) identified several inadequacies in these regulations as applied in the BSZ and proposals for regulatory changes to address them. These are included in the recommendations for surface irrigation listed above. These conditions could be made either in 30TAC§222 or in 30TAC§213.

30 TAC §307 – Texas Surface Water Quality Standards

Although a statewide regulation, specific portions of these standards could provide additional protection in the BSZ in particular. Designated uses for potable water supplies recognize the contribution to surface water downstream as well as aquifers from which drinking water is pumped. This is recognized in TAC§307, but also in 30TAC§290 and the Source water Assessment and Protection Strategy (TNRCC 1999) covering requirements of the 1996 Safe Drinking Water Act Amendments. Segments of surface waters designated for sole source aquifer protection in 30 TAC §307 include Barton and Onion creeks. The principal purpose of this use designation is to protect the quality of water infiltrating into and recharging the aquifer. The designation for aquifer protection applies to those portions of surface waters that are on the

recharge zone, transition zone, or contributing zone as defined in 30 TAC §213. Also, 30 TAC §213 establishes the specific provisions for activities in the watersheds of segments that are designated for sole source aquifer protection in 30 TAC §307 including those that comprise the BSZ. Neither of these sections have been updated on the basis of new treatment technology allowing more stringent effluent limits to be required for aquifer protection. Due to the amount of conduit flow, a karst aquifer as a drinking water supply in a watershed with a discharge of treated wastewater above its recharge zone is the closest scenario we have in Central Texas to actual unintended Direct Potable Reuse (DPR) so far. This fact of karst hydrology, in addition to aquatic life and endangered species should be considered in setting permit limits.

For guidance on how the Texas Surface Water Quality Standards (TSWQS) apply to TPDES permit conditions, TCEQ published RG-194 Procedures to Implement the Texas Surface Water Quality Standards (TCEQ 2010, 2012 Draft). As far as specific superior protection in the BSZ, this guidance is relatively silent, although it does acknowledge the locations of federally endangered and threatened aquatic and aquatic dependent species including the BSS and singles out permits discharging to these locations for special review. However, the basis for this review is the MOU between EPA and TCEQ concerning the assumption of the TPDES program by the State of Texas and the USFWS biological opinion and update on the MOU (TCEQ 2010, 2012). These documents at least recognize the importance of endangered species protection and require a screening process for impacts; but provide no concrete protection commensurate with their sensitivity or enforcement provisions beyond that common to the entire state. Where a "high potential to adversely affect listed species of critical concern" additional permit limits may be suggested by staff, but typically are not. The only specific examples given are dechlorination and an ammonia-nitrogen limit of 3 mg/L. As seen in Figure 3, ammonia-nitrogen limits are already set at or below 3 mg/L (except Barton >10 miles upstream of recharge zone and Little Barton Creeks) and the guidance already requires dechlorination for discharges above 0.5 MGD. The section on discharge to the Edwards Aquifer Contributing and Recharge Zones only repeats what is said about endangered species. Likewise, the references to 30TAC§213 from this section do not contain any detailed guidance concerning wastewater permits in the BSZ (TCEQ 2010, 2012). In general, the failure of permit conditions in the BSZ to match the sensitivity of receiving waters originates with the state implementation of the Endangered Species Act protections through Clean Water Act permit programs. From a legal assessment of similar state-federal MOU, this has seldom worked in other states and was doomed from the beginning in Texas (Rosan 2000).

<u>30 TAC §311 Subchapter E – Watershed Protection: Colorado River Watershed – Onion Creek</u>

These regulations primarily set effluent limits for the discharge of treated wastewater into the Colorado River watershed and its tributaries downstream from Ladybird Lake to Smithville. This section specifically includes Onion Creek both below and above the recharge zone. The basic effect of this regulation on discharges in the BSZ is contained in 30TAC§311.4. This was also the section where the proposed Barton and Onion petition for rulemaking would have been promulgated as 30 TAC §311 Subchapter I. Additionally, 30 TAC §311.43 requires discharges to Onion Creek to meet a 5 mg/L BOD, 5 mg/L TSS, 2 mg/L NH_3-N, and 1mg/L TP on a 30-day average basis. Unfortunately, this effluent limit was based on modeling and technology circa 1986. At this time, TP removal was primarily chemical precipitation and 1mg/L TP was as good

as could be reliably accomplished. Neither TP nor TN are appreciably removed by standard secondary treatment processes available at the time (Carberry 1990). Nitrification was used to meet the standard of 2 mg/L ammonia nitrogen, but denitrification was not typically used or required and high TN discharges allowed high levels of available nitrogen for eutrophication of receiving waters. This regulation has never changed in its effluent limits for Onion Creek since it was originally written and based on water quality modeling for eutrophication impacts, it remains inadequate to protect BSZ from direct wastewater discharges.

30 TAC §285 On-Site Sewage Facilities (OSSF) Rules

This section is extremely important given the number of OSSFs in the BSZ. TCEQ delegates authority for permitting individual OSSF under this section to local authorities. In the Barton Springs Zone, there are 3 local entities with significant jurisdictional authority through delegation of state regulation: Travis County, Hays County, and the City of Austin. Hays County permitting authority includes the cities of Kyle and Buda and thru January 2010, also covered the City of Wimberley. The City of Dripping Springs assumed OSSF permitting authority from Hays County in November 2006, although they do not maintain electronic records of permits and have issued only approximately 80 permits from 2006 through 2010 (Herrington et al 2011). The log of permits issued since 2010 stands at 299 on 9/6/2018 (Berlad 2018). Roughly 50 permits per year have been issued for the past 5 years in Dripping Springs. 30 TAC§285 governs all OSSFs built in the state. TCEQ prepared a compilation of these on-site sewage facilities rules in 2013 (http://www.gchd.org/ech/State-OSSF-Rules-Effective-2013.pdf). Authorized agents like those discussed above, are required to meet, at a minimum, the requirements of 30 TAC §285 in developing their own OSSF regulations and permitting systems. However, since many of the parameters in design of OSSFs are based on site specific conditions, which are often poor in the BSZ, more protection is afforded these systems in the BSZ than elsewhere in the state. Characteristics of a BSZ site that often result in more stringent regulation include soil texture, restrictive soil horizons, nearby presence of groundwater, topography, presence of large cobble or rocks, depth to bedrock, presence of fractured or fissured rock, potentially contaminated site features, and likelihood of flooding. These conditions govern separation distances (vertical and horizontal), acceptability of backfill material, necessity of using ET or mound systems, and drainfield sizing.

As with TLAPs and SADDS, several third-party reviews of the OSSF regulations have been made and discrepancies have been noted. These recommendations would be even more important to implement for systems located in sensitive areas such as the BSZ. One recommendation that is common in the BSZ is the use of systems designed for advanced treatment and/or nutrient removal (reference). Other recommendations have been compiled for OSSFs using surface irrigation and aerobic treatment units (Fedler and Borrelli 2001):

1. All surface application systems designed for an on-site sewage facility should consider both a water balance and a nutrient balance for the final design.
2. The layout of the site for effluent application should be in a block pattern such that the sprinklers can be arranged to have a head-to-head overlap. If this is not available, then the system should be designed such that the proper overlap can be provided in order to achieve a uniformity coefficient of 80 percent or greater.

3. Spray head type of sprinklers should not be used in an OSSF system while the gear head type should be used.
4. All sprinklers are designed to operate at an optimum pressure range to obtain the specified pattern of water distribution and the OSSF design pressure should be in the middle of the specified range. Sprinklers operating at pressures lower or higher than designed will produce unreliable patterns that will result in very low water application efficiencies and low application uniformity.
5. The time used to apply the effluent should not exceed 1 hour and the average design should be 0.5 hours.
6. The base water intake rate of the soil should follow that described by Saxton et al. (1986) provided more precise information on the soil is not available.
7. The base soil infiltration rate should be set equal to the saturated hydraulic conductivity of the top 18 inches of soil.
8. A check-off list of design considerations should be developed and used on all new and renovated designs of OSSF where surface application of the effluent is utilized.

From review of the current rules, it appears that most of these recommendations from 2001 have not been implemented. In general, aerobic systems are relegated to those proprietary units that are more or less design black boxes. They must be tested and approved once by either TCEQ or NSF and meet performance criteria in 30TAC§285.32(e) during testing. Due to requirements for nutrient removal in some portions of the BSZ (ie. within the Austin ETJ), these units may become more prevalent.

30 TAC §285.40-.42 Subchapter E : Special Requirements for OSSFs Located in the Edwards Aquifer Recharge Zone

Subchapter E of 30TAC§285 provides specific limitations on OSSFs in the recharge zone referencing Chapter 213 Edwards Aquifer Rules in a number of instances. One requirement above the standard statewide rule is that application materials have to be submitted by a professional engineer or professional sanitarian. Minimum lot sizes and separation distances from recharge features provided in §285.40(c) and Section §285.91 (10) are presented as more restrictive than the base regulations for OSSFs in the RZ. Section 285.41(a) also requires preparation of an Edwards Aquifer Protection Plan for site-specific consideration of wastewater management as well as impervious cover and recharge features protection. The regulation of other forms of wastewater management as well as organized sewage collection systems in the BSZ are addressed in 30 TAC §213.6. Finally, Section §285.42 requires that recharge features discovered during construction of OSSFs on the Edwards effectively suspend work until void mitigation is completed including protection of the feature, methods to maintain structural integrity of the OSSF and means to protect water quality of the aquifer.

30 TAC §213 – Edwards Aquifer Rules

The purpose of these rules is to regulate activities that might damage the water quality of the Edwards aquifer. Mandate and authority for these rules comes from TWC §26.401 which clearly states "…..it is the goal of groundwater policy in this state that the existing quality of groundwater not be degraded". However, this policy is somewhat diluted by the caveat that "…

(t)his goal of nondegradation does not mean zero-contaminant discharge." Logically, this goal would also apply to contributing surface streams hydrologically connected to the aquifer although the application of this in practice through wastewater permitting is lost.
Although the Edwards Rules are primarily known for their regulation of development activities through Water Pollution Abatement Plans (WPAP), a significant amount of regulation of wastewater management is also included. Specific references include 30TAC§213.5 (b)(4)(A)(ii) which requires that the application for a WPAP must describe the volume and character of wastewater expected to be produced by a permitted project. 30TAC§213.5 (a) (4) (F) requires that for a WPAP technical report, the method of wastewater disposal from the site must be described including the conveyance to a particular wastewater plant for treatment and disposal. For on-site sewage facilities, the WPAP application must include certification from the designer that the site is suitable for the use of private sewage facilities and will meet the special requirements for on-site sewage facilities located on the Edwards Aquifer recharge zone as specified under 30TAC§285. In addition, Organized Sewage Collection Systems (OSCS) for public or private collection and conveyance to treatment and disposal are regulated under this section under authority of TWC §26. An OSCS may include lift stations, force mains, gravity lines, and any other facility necessary for conveying wastewater from a generating development to a treatment plant.

The most useful part of this section is §213.6(a)(1) which prohibits new or existing wastewater discharges on the recharge zone into or adjacent to the waters of the state that would create additional pollutant loading. In section §213.6(b)(1) land treatment systems that rely on percolation or downward movement of water within soil for treatment are also prohibited. This seems to be a blanket statement prohibiting any land application to recharge features. Such direct connection through infiltration or movement of water into the soil and then percolation below the root zone cannot be adequately prevented with assessment methods currently in place (Ross 2011). In fact, the current water balance used for design of such systems requires a calculated "leaching component" for salinity control in the soil column that guarantees percolation below the root zone. Section 212.6(b)(2) states that any land application though evaporation or irrigation will be considered on a case-by-case basis on the recharge zone. Section §213.67(c)(1) gives effluent requirements for discharge of wastewater up to 5 miles above the BSRZ in the BSCZ. This effluent set is not comparable to that found to be necessary for non-degradation of the aquifer. No total nitrogen limit is specified, and the total phosphorus limit of 1.0 mg/L is not protective of surface or groundwater (Herrington 2009). An even less stringent effluent set is set for facilities discharging more than 5 miles above the recharge zone. As usual, TCEQ reserves the right to set more stringent effluent limits as necessary on a case-by-case basis. However, judging from TCEQ draft permits, this has not been adequate either (TPDES permit WQ0014293001, TCEQ docket 2007-1426-MWD, SOAH docket 582-08-0202).
Collection systems in the recharge zone are held to a higher standard than the rest of the state. The requirements of §213 concerning organized sewage collection systems include additional measures and design criteria in the recharge zone in the following areas.

- Rehabilitation or construction of manholes and associated testing
- Performance criteria for PVC gravity and pressure lines
- Design of lift stations

- Certification of new sewage collection system lines by a Texas licensed professional engineer.
- Testing every 5 years of all existing sewer lines having a diameter greater than or equal to six inches, including private service laterals, manholes, lift stations and connections for structural damage and defects such as offsets, open joints, or cracked or crushed lines that would allow exfiltration to occur.
- Criteria for blasting in sewer line excavation.
- Provisions governing main line and private service lateral stub outs and extensions
- Locating and specialized designs for sewer lines within a five-year floodplain.
- Inspection of private service lateral connections
- Embedment material criteria
- Design of sewer lines bridging caverns or other sensitive features.
- Controls for erosion and sedimentation
- Equivalent environmental protection measures for alternative sewage collection systems
- Required corrective action if collection systems fail to prevent pollution to the Edwards Aquifer.

Although this section provides the basis for nearly all superior water quality and wastewater management control peculiar to the BSZ, a number of improvements have been suggested in the annual review of the regulations and Edwards Aquifer Protection Program (EAPP). Past recommendations regarding wastewater management have included prohibition of wastewater discharge in the Contributing Zone and tightening the prohibition of TLAPs over the Recharge Zone removing the Case-by case allowance. More stringent effluent limits, enhanced geologic assessments with field verification of applicant submissions, and continuous monitoring were recommended for TLAPs over the recharge zone if they were to be permitted. These proposed improvements are supposedly still under consideration by TCEQ but no revisions to the rules have been made in several cycles of reviews and comments. Responses to comments have been absent in the record. In the latest 2017 biennial review, the City of Austin and a number of other entities and jurisdictions suggested that a total review and rehabilitation of the rules be made based on the long period since initial promulgation and the advancement in aquifer science and technology since that time. At best, some addendums to the TGM on new stormwater controls have been made. Revision of wastewater regulation components in the BSZ would be a big part of a rule revision effort. Restrictions on land application in Subchapter A could be evaluated based on dye and infiltration studies conducted since the initial rules were written. Although there are some restrictions in Subchapter A on wastewater treatment and disposal systems that affect management in the CZ, it may be time to use the tools currently available to write a section for Subchapter B supported by the best available science for protection of surface streams and the aquifer.

In addition to the revision of the rules, review of the Technical Guidance Manuals and Appendices should be attempted. An actual scientific basis should be included for the Optional Enhanced Measures that shows sufficiency for protection of endangered species including both water quality protection for aquatic species and habitat protection for karst dwelling invertebrates. The 80% removal of TSS load from stormwater and no consideration for wastewater pollutants is not supported in technical literature as adequate protection for many of the endangered species listed in TGM 348a.

30 TAC §217 – Design Criteria for Domestic Wastewater Systems

This section of state regulations is applicable to design of wastewater collection and treatment systems statewide. Specific reference to design in the BSZ is not mentioned but the advanced treatment systems necessary for non-degradation of water quality are provided herein. For example, a relatively recent addition of a design section §217.157 for Membrane Bioreactors addresses advanced nutrient removal as shown in modeling studies to be necessary effluent quality for direct discharge and TLAPs in the BSCZ (Herrington 2006, Richter 2016, Porras 2016). Table 1 shows the performance standards included in §217.157(b) that, depending on location, may be adequate in the BSCZ as long as they are incorporated into TCEQ permit limits and rigorously enforced. In some areas of the BSCZ, these standards may also be necessary for TLAP permits to protect the BSEA. They also can be used to do a large portion of the treatment in a plant ultimately producing water for direct potable reuse. The smaller footprint and modular phasing available for these plants helps offset their higher energy and maintenance costs which have also been going down as operational familiarity and quality control has improved over time. In addition to MBRs, biological nutrient removal (BNR) has been a relatively recent upgrade to the design criteria. These are addressed as pretreatment to subsequent membrane separation in §217.157(c)(2). Methods suitable for sizing BNR systems are specified including Bardenpho, modified Ludzak-Etinger, or University of Capetown, or TCEQ executive director approved calculation protocols. This provides parity in vendor designs for BNR and consistency where applied correctly. With these changes, TCEQ is attempting to catch up with existing proven technology capable of meeting effluent limits for discharge or land application in sensitive areas such as the BSZ. Even more advanced designs for nutrient removal are on the horizon and section §217.163 directs approval of these systems to section §217.10(b)(2) as innovative and nonconforming technology.

Also, as with any treatment limit, non-degradation of water quality in the BSZ should be objectively determined through monitoring and modeling studies (water quality based) rather than limits of technology. Recent changes in the federal regulations governing anti-degradation of high quality waters in 40 CFR131.12 allow states to implement more stringent requirements for discharges by water body or by individual water quality parameters. This change also specifies that if water quality is to be degraded by a discharge, an alternatives analysis must be completed by the state and an alternative chosen that reduces, minimizes, or mitigates such degradation. Still, it is left up to the states to interpret language, document policy, develop procedures, apply these procedures, and enforce these new regulations.

Table 1 MBR Performance Standards for Conventional Pollutants and Nutrients (Figure 30TAC§217.157(b))

Parameter	Units	Expected Value
CBOD	milligrams per liter (mg/L)	5
TSS	mg/L	1
Ammonia	mg/L as N	1
Total Nitrogen (with only preanoxic zone)	mg/L	10

Total Nitrogen (with preanoxic and postanoxic zones)	mg/L	3
Total Phosphorous (with chemical addition)	mg/L	0.2
Total Phosphorous (with Bio-P removal)	mg/L	0.5
Turbidity	NTU	0.2
Bacteria	Log removal	<= 6 log (99.9999%)
Viruses	Log removal	<= 3 log (99.9%)

It should be noted that no discharge permit has been written with effluent limits for all of these expected values in the BSZ or anywhere else in the state. The Hays County Water Control and Improvement District (HCWCID) No. 1 and Dripping Springs South WWTP permits include Total Phosphorus limits seemingly lower at 0.15 mg/L median when discharging; however, statistically this limit allows only compliance with a 0.5 mg/L arithmetic average TP level. The lowest average Total Nitrogen limit set for discharge in the BSZ is 6 mg/L, twice what is expected to be produced from a MBR plant. Therefore, on this basis alone, the existing regulations and effluent standards for the region from TCEQ do not reflect current treatment technology capabilities. Finally, cross-references to 30TAC§213 requirements are made in this section to wastewater collection systems in the Edwards Aquifer. These references are included for both conventional 30TAC§217.52 and alternative collection systems 30TAC§217.91.

30 TAC §210 – Use of Reclaimed Water

Reclaimed water as defined by this regulation is any domestic or municipal wastewater that has been treated to a quality for beneficial use. Two levels of treatment are applicable, Types I and II in section 30TAC§210.33 (Table 2-2). This section addresses authorizations by the TCEQ for use of reclaimed water. It covers application requirements, design requirements, and operating requirements statewide. In section §210.4(d) reclaimed water facilities used for irrigation within the Edwards recharge zone are required to submit plans and specifications prior to construction for review and approval. In addition §210.23(c) requires all holding ponds in the Edwards aquifer recharge zone for effluent classified as either Type I or Type II to meet specific pond liner and embankment requirements. As with other TCEQ pond liner requirements, these criteria constitute good engineering practice for water quality protection, not particularly extravagant or cost prohibitive. Irrigation with reclaimed water under §210 may be possible under the regulations for the BSRZ, however, the same conditions apply to TLAP permits under §213 including site specific consideration.

Table 2 Type I and II Reclaimed Water Quality

Constituent	**Type I**	**Type II**	**Type II (pond)**
BOD5/CBOD5 (mg/l)	5	20/15	30
Turbidity (NTU)	3	NA	NA
Fecal coliform or *E. coli* (CFU/100 ml)*	20	200	200
Fecal coliform or *E. coli* (CFU/100 ml)**	75	800	800

Enterococci (*CFU/100 ml)	4	35	35
Enterococci (*CFR/100 ml)*	9	89	89

* 30-day geometric mean
** maximum single grab sample

Another issue discussed previously that has arisen in 2015 is that concerning the dedicated land requirement under TLAP permits versus the "as needed" land usage in the 210 reclaimed water authorizations.

With a discharge or TLAP permit, a 210 authorization can be obtained from TCEQ that enables the treated effluent, or reclaimed water, to be reused for beneficial purposes like toilet flushing, dust suppression or landscape irrigation. Reuse of effluent is an important water conservation tool in Central Texas, because the effluent is used in place of potable water withdrawn from the Highland Lakes that are susceptible to drought or the Edwards Aquifer.

However, even treated wastewater has very high concentrations of nutrients relative to natural levels in Hill Country streams. Studies have demonstrated over and over that direct discharge of wastewater to Hill Country streams can have dramatic negative impacts on water quality, including large algae blooms that can impair the recreational use of water bodies and can harm aquatic life (Davis 1986, Mabe 2007, Mahler et al. 2011a, 2011b, Herrington 2011). Land application of wastewater effluent in the Hill Country is environmentally-preferred, but is becoming prohibitively restrictive given the value of undeveloped land. Now that more land application facilities are reusing their effluent for beneficial purposes off-site, their required dedicated disposal fields and storage ponds are not fully utilized (Herrington 2016).

In some places, like within 10 miles of Lake Travis or over the recharge zone of the Barton Springs Segment of the Edwards Aquifer, discharges are prohibited by TCEQ and land application is the only option for centralized wastewater disposal. Case by case exemptions can be obtained from TCEQ for the BSRZ. In the past, there have been attempts by entities other than the City of Austin to modify or remove these important environmental limitations on discharge, or to convert land application facilities to discharge facilities, to provide a more cost-effective means for the permit holder to dispose of wastewater. An alternative proposed in 2016 by the City of Austin to provide a "beneficial reuse credit" to permittees for "firm reclaimed water demand" demonstrated by user contract or records of historical use may eliminate the need for continued assault on these discharge prohibitions. This petition for rule-making was taken up by TCEQ and proposed by staff to the Commission on 6/12/19. It was approved and is on track for a public comment period starting in late June, a public hearing in late July and if adopted, it may become effective in early 2020. The rule change will provide some much-needed flexibility in the BSCZ for expanding centralized wastewater treatment capacity without the need to discharge to surface water resources or purchase expensive property for potentially unused irrigation tracts and storage pond construction. It will require more diligent tracking of beneficial use end users, but the capital and operation savings; combined with the conservation and water quality benefits far outweigh these requirements.

Little has been published about this important addition to the TCEQ regulatory programs. Registrations are entered including Producers, Providers, and Users into a database using a modified version of the PARIS (Permit and Registration Information System) software that is used at TCEQ for several other permit tracking needs like petroleum storage tanks and industrial and hazardous solid wastes. Initial entries are made when the 210 is authorized and when producers add users, they send in new forms that are usually entered into the system. The data is imperfect like all databases, but the hard copies that come in are usually to be found in the files by producer/provider number, in the Water Quality Division. The application for a 210 authorization must include a map of the service area for the reclaimed water that provides some indication of where the wastewater will be applied. In many cases when the single user is the subdivision producing the wastewater, this will be the open space and irrigable land throughout the development. However, when the authorization says "users as approved by the provider" it could be anywhere in the larger service area. Monitoring data including total daily average flow sent to reuse users as a whole are recorded in Monthly Effluent Reports (MER) that are kept onsite or and in some cases sent to TCEQ. These are not entered into a database, but stored in paper copies elsewhere.

In order to make better use of the reclaimed water authorization system in the future, TCEQ might invest more in data management for the program. Tracking end users would seem to be an important component of the system since this is where the land application occurs; however, very little seems to be provided in the system to do that function. The single page provided for each users includes mailing addresses without any location information on the irrigation site. The contracts are usually fill-in-the-blank model documents with standard conditions for all users and no site specific information. Operation and maintenance plans are prepared in detail for only the largest of users and still boilerplate in nature. In addition, even though it is an on-demand program, the information about maximum hydraulic application rates and agronomic rates for nutrients should be provided to users. If nothing else, a version of the TLAP water balance for the plant could be provided to the 210 reclaimed water users. This would seem to be a necessity if credit were to be given for these users to be counted as firm reclaimed water demand.

Reclaimed Water Production (Satellite) Facilities 30 TAC §321 Subchapter P

This section of the administrative code fills the gap for permittees who have secondary treatment plants permitted under a TLAP or TPDES permit and further tertiary treatment units and disinfection located nearby irrigation areas in order to use the effluent as reclaimed water. Such authorizations may someday be used in the BSZ where treatment on some reclaimed irrigation tracts could be regulated by its sensitivity to groundwater or surface water resources. However, no such authorizations are known to occur among existing BSZ permittees. The authorizations are a scaled down version of wastewater permit requirements as would be expected since essentially only the additional remote treatment units are covered. A permit must be maintained for the units prior to the facility and a 30 TAC 210 authorization maintained for the irrigation system the facility provides reclaimed water to as needed. Cross references to the appropriate sections in 30TAC 305, 309, 210, and 217 are made from this section.

Contested Permits

Contested Case Hearings are the only method to gain water quality based permit limitations beyond the current inadequate TCEQ rules applicable in the BSZ. A certain amount of inefficiency and uncertainty is contained in contested permits. Once TCEQ is satisfied, at any point in the hearing process, a settlement between the parties can be made and the permit issued as drafted. In some situations, TCEQ will add certain provisions of settlement into the permit as long as they do not conflict with state rules or set a precedent for future permits. This has led to inconsistencies across the BSZ that has rarely improved the stringency of permit requirements.

New wastewater permits especially for direct discharge are likely to be contested by a range of protestants. These include citizens and environmental groups, property owners, and affected county and local governmental agencies. The contested case hearing process is long and expensive for applicants and protestants alike with a highly uncertain outcome. There is a need to clarify regulatory uncertainty and provide a clear path to permitting without jeopardizing environmental quality. The total costs of contested case hearings would include private, government, and non-profit entities all using staff, attorney, expert witness and volunteer time. The combined billing rates of these specialists is enormous. To this could be added the TCEQ staff and SOAH judge hours and administrative support.

The time required to advance through the process is also criticized because it equates to costs and delay in getting a project constructed and affects the return on investment for the development and the financing involved which may move on to more "shovel ready" projects. In the report to the 84th Texas Legislature in 2014 a General Timeline for Contested Case Hearings involving the SOAH was estimated at 390-525 days total (Harless 2014). This did not include processing up to placing on a TCEQ Commissioners agenda for referral to SOAH. A projected timeline for permit issuance via the contested case hearing process through SOAH was developed for non-Air Quality permits independently including the entire period from submission to approval that was estimated at 1.7 to 5.0 years maximum (Allmon et al. 2015). This estimate also showed the 180-day presumptive maximum time from preliminary hearing to a proposal for decision determined through SB 709 provisions passed in the 2015 was about half as long as needed. This presumptive period also did not include estimates for discovery, submission of prefiled written testimony, or additional preliminary hearings to resolve specific issues which are highly case specific. Table 3 shows the administrative and legal tasks and the range of time estimated for each. Table 4 shows a list of total processing times from some of the permits in the BSZ that have been contested. The original application dates were difficult to ascertain for a few of these, and file dates from the Central Records Database Online from TCEQ were used. Total time from application to issuance is highly variable and may just as easily be prolonged due to applicant variables (financing, responses to TCEQ questions, etc.); however, this is usually the time reported to the legislature when complaints are made. There have also been some further applications that were withdrawn or not ultimately submitted after negotiating alternative wastewater service extensions from other providers. These might be considered avoided contested case hearings.

Table 3
Legal Firm Estimate of Permit Process Time Periods (Allmon, 2018)

Time (days) Btwn Actions	Actions
1	Applications filed
30 to 60	TCEQ determination of administrative completeness.
10 to 30	Initial public notice. A public meeting, which is less formal than is a public hearing. may be requested although not always provided by the agency.
30	Deadline for comments on the application. (A public hearing request can and should be included). If there is a public meeting. the comment deadline is usually extended to the day of that meeting. if the meeting is after the normal 30-day comment period.
60 to 500	TCEQ determination of the technical completeness and, if the application is found to be complete, a draft permit is usually prepared.
10 to 30	Second public notice. The draft permit is usually issued now. too.
30	Deadline for comments on the draft permit (A public meeting may be requested. again.)
45 to 150	Unless there is a direct referral of the matter to SOAH, TCEQ will prepare a response to comments (RTC) after the comment deadline. (If the applicant does not oppose hearing requests or believes the request will be granted with most issues for trial approved, the applicant may refer the matter directly to SOAH for a hearing, reducing the time for the process by l to 4 months) Also, this deadline should be treated as a deadline for hearing requests. (Prior hearing requests will still be valid, but a new hearing request is usually important, because it allows the requestor a last chance to identify the issues to be referred to SOAH for the hearing)
30 to 90	Ii there were hearing requests and the application was not directly referred to SOAH, there will be a letter to requestors with notice of the date for the meeting of the three TCEQ Commissioners to grant or deny the hearing requests.
15 to 45	Deadline for applicant and others to file responses to hearing requests
14	Deadline for requesters to file replies to responses for hearing requests.
9	Meeting of Commissioners to consider hearing requests and determine which issues to refer to SOAH for trial and the recommended time period for the hearing if a hearing request is granted. Senate Bill 709 (2015) set a presumptive 6-month time from preliminary hearing to a proposal for decision: the TCEQ Commissioner are allowed to set either a shorter or a longer time period.
30 to 60	If a hearing request is granted, new public notice (newspaper) of the preliminary hearing is required. At the hearing, parties are named and a schedule for the hearing is set.
30	Preliminary hearing. Anyone who might be affected and who submitted comments on the permit application may attend and request to be named a party. Senate Bill 709 limits possible parties to people and groups that submitted comments on the permit application; it is not yet clear whether people or groups that submitted comments on the draft permit but not on the application may be named parties. Unless there is an agreement w1th the applicant that it will not oppose "party" status for a person or group, those who wish to be named as parties will need to be prepared to present evidence at the preliminary hearing to prove that they will be affected - that they have legal "standing\" to participate. There will usually be a schedule set for activities that precede the ultimate trial. The pre-hearing schedule usually includes: Discovery: Can include oral depositions of witnesses, of parties and others: exchange of written questions and answers. production of documents requested by parties. Submission of pre-filed written testimony for each witness. In question and answer form. When the witness is presented, the witness does not then repeat the testimony, instead the written testimony is accepted into the record cross-examination by others begins. One or more preliminary hearings to resolve issues.
90 to 300	The hearing on the merits (i.e., the trial) is held by a SOAH Administrative Law Judge (ALJ) or, sometimes two ALJs. Occasionally, the hearing or part of the hearing will be held in the local area, but the hearing may be and generally are held exclusively in Austin. The hearing

Time (days) Btwn Actions	Actions
	may last a few days or a few weeks. Historically, the time period from preliminary hearing to trial has been 120 to 180 days.
5 to 10	After the hearing is over the court reporter prepares the transcript of the hearing. (Each party can be required to pay a percentage of the costs of the full transcript, although the ALJs usually assess the largest share of costs to the applicant. Transcripts can often be in the range of $1,000 to $10,000, possibly more with all opponents shares often totaling 20% of the costs).
15 to 30	Filing of written final arguments, with references to the pages of the transcript and trial Exhibits for all facts. Legal briefing is also often included with the factual arguments. Often a party, to help the ALJ rule for that party, will also file proposed findings of fact and conclusions of law
5 to 15	Parties file responses to final written arguments of others
30 to 60	Recommendation of the ALJ(s) to the TCEQ Commissioners. (This is the "Proposal for Decision." It will include a proposed order including with findings of fact and conclusions of law) The Commissioners are the ones who actually make the agency's decision. So. Note that the trial only results in a recommendation to the Commission.
20	Deadline to file exceptions to the PFD.
10	Deadline to respond to exceptions of others.
10 to 90	Commiss1oners' meeting to consider the proposal for decision and exceptions and replies. If any. The Commission usually votes that day on a decision
10 to 60	Written order of the Commission is mailed to all parties
20	Deadline to file motion for rehearing to ask the Commission to reconsider the decision. This is a mandatory step, if one is to be able to appeal the agency's decision.
45 to 90	Commission grants or denies motion for rehearing.
30	If the motion is denied, deadline to file appeal to court.

Table 4
Various Contested Cases in BSZ

No	Permittee	Watershed	RZ/CZ	Type	Filed	Disposition	Completed	Length
13238-001	Senna Hills	Barton	CZ	TLAP	8/19/1983	Settled	8/4/1986	3.0
12786-001	Barton Creek West	Barton	CZ	TLAP	1/1/1994	Settled	9/14/1995	1.7
13206-001,14430-001	TC MUD 4	Barton	CZ	TLAP	1/1/1998	SOAH/Settled	2/2/2000	2.1
14293-001	HCWCID 1	Bear/Onion	CZ	TPDES	6/18/2001	SOAH/Partial Settlement	5/6/2009	7.9
14488-001	City of Dripping Springs-	Onion	CZ	TPDES	10/20/2015	SOAH/Partial Settlement	7/6/2018 (2/27/2019)	2.7
13594-001	Lake Pointe WWTP LCRA-SDG(CCNG)	L.Barton/Barton	CZ	TLAP	1/1/1994	Settled	7/22/1999	5.6
14785-001	Jeremiah Ventures	Onion	RZ	TLAP	2/20/2007	SOAH/Settled/Purchased	9/5/2013	6.6
14629-001	Lazy 9 MUD	Barton	CZ	TLAP	6/8/2005	Settled	11/19/2007	2.5
15201-001	JPHD	Barton	CZ	TLAP	11/25/2013	Settled	9/10/2015	1.8
11319-001	Lost Creek MUD	Barton	CZ	TLAP	8/23/1999	Settled and Annexed MUD	2/1/2001	1.4
15594-001	Sawyer Cleveland	Long Br/ Barton	CZ	TPDES	7/21/2017	In process	TBD	1.6
14664-001	Rocky Creek Ranch	Barton	CZ	TLAP	10/19/2004	SOAH/Settled	3/14/2008	3.4

Testimony at these hearings does occasionally solidify technical issues which could be useful in subsequent permit reviews and hearings. Negotiated settlement agreements could form a baseline for additional protection gained through the full hearing process that most parties could agree on. Crucial definitions and interpretations such as a clearer idea of what constitutes "non-degradation" can be made through SOAH judge rulings in these hearings (TPDES permit WQ0014293001, TCEQ docket 2007-1426-MWD, SOAH docket 582-08-0202). In this manner, they could be adopted by TCEQ in practice and ultimately in guidance, standard permit conditions, and regulations. However, neither applicants nor protestants are happy with the current process for contested permit hearings. The opposite rulings can just as often occur, and case interpretations can be used to water down previously decided TCEQ permitting practices. Despite that rules, TCEQ decisions, and legislative changes are usually biased towards applicants, their costs in just sitting through a hearing and the sometimes-poor publicity for their development, municipality, or companies are enough to sour applicants on the process. Since the protestants bear the same costs without the deeper pockets, goal of monetary gain/savings, or hope of outright winning a case, they too are not pleased with the process. Criticism and support for change can be seen in legal journals, environmental organization publications, and journalism surrounding specific cases. Reviews have also been published in a variety of forums (Fonken 2014, Reed 2014, O'Brien 2005, Allmon and Frederick 2014).

Costs and time for obtaining a permit if it is contested are likely to vary widely. There are as many variables as there are varying permit conditions in the BSZ. Naturally, discharge permits seeking to dispose of effluent at the maximum concentrations of pollutants allowed by the TCEQ regulations discussed above would be the most vigorously contested in the BSZ. However, even the most stringent limits that have been applied in previous permits are unsuitable for discharge in some tributaries at some locations in the BSCZ and would garner stiff opposition. Similarly, even the most stringent limits that have been applied in previous permits for TLAP land disposal are unsuitable on some land with some soil and geologic properties in some locations within the BSZ and would be opposed. An estimate for the time and cost to obtain the Dripping Springs Permit was given in the Preliminary Engineering Planning Report for the Dripping Springs South Wastewater System Regional Expansion (CMA 2013). Table 5 shows the projected timeline for the Dripping Springs permit along with the elapsed time. As can be seen, there are a number of diversions and alternative pathways that can lengthen the time and increase costs for obtaining a permit. Legal, consultant, and staff costs are seldom disclosed for contested permit hearings with the exception of those cases where court costs are awarded to one party by a judge if the case is ruled on appeal to district court. However, if Tables 3 and 5 are combined and used to create a generic settlement/SOAH hearing process and an attempt was made to assess time and materials costs for each of the elements listed using average time periods, it may look something like Table 6. The total cost for an applicant would be in the range of $533,900 or less for a case ending in a settlement and $866,160 where settlement was not achieved. Of course, this is a gross estimate based on many assumptions. However, if remotely accurate, the difference could pay a good portion of the capital costs for the upgrade to an MBR treatment plant or an advanced biological nutrient removal plant or enough land and equipment to irrigate with effluent at an acceptable application rate in the hill country.

Table 5
Permitting Estimated Time from Dripping Springs PER (CMA 2013)

Task Description	**Days**	**Actual Date[1]**
Preliminary Planning		
City Council Approves Preliminary Planning	1	3/12/2013
Complete Preliminary Planning Report	126	7/16/2013
Permitting		
Begin Selecting Permit Team Consultants	1	3/12/2013
City Council Approves Permit Contract	32	8/17/2013
Initiate meeting with COA WTCPUA LCRA SOS GW Districts	21	4/2/2013
Develop Permit Application	120	12/15/2013
Administrative Review and Comment Letter	14	12/29/2013
City Response	15	1/13/2014
Administratively Complete	9	1/22/2014
Publish First Public Notice - Intent to Obtain Permit	5	1/27/2014
30 Day Comment Period Ends - Intent to Obtain Permit	30	2/26/2014
Permit Renewal Application Dues to TCEQ	1	3/5/2014
Technical Review	180	7/21/2014
TCEQ Develops Draft Permit	15	8/5/2014
Applicant Review and Comment to Draft Permit	15	8/20/2014
TCEQ Responds to Applicant's Comments	21	9/10/2014
Applicant Request TCEQ to Proceed with Permit	7	9/17/2014
Draft Permit Issued and TCEQ Request Publish 2nd Notice	30	10/17/2014
Publish Second Public Notice - Draft Permit	7	10/24/2014
30 Day Comment Period ends for 2nd Public Notice	30	11/23/2014
Existing Permit Expires	1	9/1/2014
Public Meeting at City Hall	60	1/22/2015
TCEQ Response to Comments from public meeting	30	2/21/2015
Contested Case/TCEQ Hearing		
TCEQ request to publish preliminary hearing notice	30	3/23/2015
Publish Notice for Preliminary Hearing	7	3/30/2015
Preliminary Hearing at SOAH	30	4/29/2015
Deadline to provide technical copies of application and draft permit to aligned groups	10	5/9/2015
Deadline for submitting written discovery requests	10	5/19/2015
Applicant files direct case all testimony and exhibits order of witnesses	45	7/3/2015

Task Description	Days	Actual Date[1]
Other Parties file direct case all testimony and exhibits order of witnesses	25	7/28/2015
Objections to pre-filed direct testimony and exhibits with any motions to strike testimony	20	8/17/2015
Deadline for taking depositions	10	8/27/2015
Responses to objections and motions to strike Deadline for supplemental disclosures	5	9/1/2015
Pre-hearing conference to set times and order of witnesses and for ruling on and pending objections and motions to strike	17	9/18/2015
Hearing on merits	5	9/23/2015
Parties file closing arguments and briefs	14	10/7/2015
Responses to closing arguments and briefs	14	10/21/2015
Proposal for decision	14	11/4/2015
Parties can file Motion for Reconsideration	45	12/19/2015
Permittee Receives Permit if permit is not reconsidered	1	12/20/2015
WWTP Design & Construction		
City Approves Design Contract	1	12/20/2015
Develop MBR Preselection Solicitation Package	60	2/18/2016
Advertise MBR Solicitation	30	3/19/2016
Receive and Review MBR Proposals	21	4/9/2016
Preselect Membrane Manufacturer & Begin WWTP Design	1	4/10/2016
Post Submittals From MBM	90	7/9/2016
Complete Design	210	2/4/2017
Obtain TCEQ Approval and Bidding and Contract Award	60	4/5/2017
Construction	330	3/1/2018
WWTP Startup	45	4/15/2018

[1] Projected dates in CMA 2013 report. TCEQ TPDES Permit No. WQ0014488003

Table 6 Generic Time and Cost Estimate for Contested Discharge Permit in the BSZ

		Time Elapsed			Work Hours									State							
Task Description	Task Duration	Days	Months	Years	Applicant				Protestants					TCEQ/SOAH				COA			
	days				Principals (2)	Consultants (4)	Attorneys (2)	Support (6)	Principals (6)	Staff (4)	Consultants (4)	Attorneys (6)	Support (6)	Management (3)	Technical Staff (4)	Law Dept (2)	Support (2)	Management (3)	Technical Staff (6)	Law Dept (1)	Support (3)
Billing Rate ($/hr)					$180	$220	$400	$80	$180	$120	$180	$200	$50	$180	$130	$150	$60	$180	$140	$140	$80
Contracting for Permit Application Services	32	32	1.1	0.09	80		20	40													
Meetings with Stakeholders and Adjacent Property Owners	21	53	1.8	0.15	40	80	20	40													
Develop Permit Application - Submit to TCEQ	120	173	5.8	0.47	20	500	40	400													
Administrative Review and Comment Letter	14	187	6.2	0.51											10	2	5				
Applicant Response	15	202	6.7	0.55	5	10	5	20													
Administratively Complete	9	211	7.0	0.58										2	10	2	5				
Publish First Public Notice - Intent to Obtain Permit	5	216	7.2	0.59	2	5	2	4	10		4		10		4		4				
30 Day Comment Period Ends - Intent to Obtain Permit	30	246	8.2	0.67		2	2	4							10	5	10				
Technical Review	180	426	14.2	1.17	40	120	20	60	40		240		200	40	100	5	20	30	240	80	120
TCEQ Develops Draft Permit	15	441	14.7	1.21										80	200	10	4				
Applicant Review and Comment to Draft Permit	15	456	15.2	1.25	20	120	40	40													
TCEQ Repsonds to Applicant's Comments	21	477	15.9	1.31										5	30	10	10				
Applicant Request TCEQ to Proceed with Permit	7	484	16.1	1.33	5	20	10	5													
Draft Permit Issued and TCEQ Request Publish 2nd Notice	30	514	17.1	1.41										6	8	6	4				
Publish Second Public Notice - Draft Permit	7	521	17.4	1.43	2	6	4	6													
30 Day Comnent Period ends for 2nd Public Notice	30	551	18.4	1.51	20	40	60	30	20	80	20	40	20			4	6	20	80	20	30
No Request for Hearing - TCEQ Commission Issues Permit	9	560	18.7	1.53	8		8	2						3	4	2	2				
Subtotal with no requests for hearing		***560***	***18.7***	***1.53***	***234***	***903***	***223***	***649***	***70***	***80***	***264***	***40***	***230***	***133***	***372***	***44***	***68***	***50***	***320***	***100***	***150***
Uncontested Processing Time		387	12.9	1.06	$42,120	$198,660	$89,200	$51,920	$12,600	$9,600	$47,520	$8,000	$11,500	$23,940	$48,360	$6,600	$4,080	$9,000	$44,800	$14,000	$12,000
								$381,900					$89,220				$82,980				$79,800
Public Meeting requested and conducted	60	611	20.4	1.67	30	30	60	30	12	8	8	12	10	6	8	4	4	6	12	2	6
TCEQ Response to Comments and responses from applicants and protestants. Last chance for hearing requests.	75	686	22.9	1.88										30	80	20	20	30	30	10	9
Optional direct referal to SOAH (cut 1-4 months)																					
Letter to requestors with date for TCEQ meeting	60	746	24.9	2.04											2	2	4				
Deadline for applicant responses to hearing requests	15	761	25.4	2.08																	
Deadline for replies to applicant responses for hearing requests	15	776	25.9	2.13																	
TCEQ Commissioners meet to consider hearing requests and determine issues and time periods if hearing granted. SH709 presumes 6 months from PH to PFD	9	785	26.2	2.15	8		8	2						3	4	2	2				
Hearing Requested - Subtotal prior to Hearing		***785***	***26.2***	***2.15***	***272***	***933***	***291***	***681***	***82***	***88***	***272***	***52***	***240***	***172***	***466***	***72***	***98***	***86***	***362***	***112***	***165***
					$48,960	$205,260	$116,400	$54,480	$14,760	$10,560	$48,960	$10,400	$12,000	$30,960	$60,580	$10,800	$5,880	$15,480	$50,680	$15,680	$13,200
								$425,100					$96,680				$108,220				$95,040
Contested Case/TCEQ Hearing																					
TCEQ request to publish preliminary hearing notice	30	815	27.2	2.23											2	1	4				
Publish Notice for Preliminary Hearing	7	822	27.4	2.25	1	2	2	4													
Preliminary Hearing at SOAH	30	852	28.4	2.33	8	8	8	12	24	16	16	24	24	12	16	8	8	12	24	8	12
Deadline to provide technical copies of application and draft permit to aligned groups	10	862	28.7	2.36											8	4	8				
Deadline for submitting written discovery requests	10	872	29.1	2.39	20	40	60	30	60	80	80	120	60	15	40	20	20	30	60	30	30
Applicant files direct case, all testimony and exhibits, order of witnesses	45	917	30.6	2.51	20	240	40	60													
Other Parties file direct case, all testimony and exhibits, order of witnesses	25	942	31.4	2.58					60	80	240	240	120	30	80	80	80	60	120	60	60
Objections to prefiled direct testimony and exhibits with any motions to strike testimony	20	962	32.1	2.64	10	40	80	60	60	40	80	60	30	15	20	20	10	15	30	20	15
Deadline for taking depositions	10	972	32.4	2.66	40	200	200	120	60	200	200	300	120	15	200	200	120	30	300	200	120
Responses to objections and motions to strike. Deadline for supplemental disclosures	5	977	32.6	2.68			6	6				12	6			6	4			3	6
Pre hearing conference to set times and order of witnesses and for ruling on and pending objections to strike	17	994	33.1	2.72	2	4	4	3	6	4	4	6	2	1	4	4	1	1	6	3	1
Hearing on merits	5	999	33.3	2.74	20	160	80	60	60	160	160	240	60	30	160	80	20	120	240	80	30
Parties file closing arguments and briefs	14	1013	33.8	2.78	20	40	40	30	60	40	40	120	60	15	16	20	16	6	60	20	6
Responses to closing arguments and briefs	14	1027	34.2	2.81	10	20	20	15	30	20	20	60	30	10	8	10	8	3		10	3
Proposal for decision by SOAH Judge	14	1041	34.7	2.85												80	120				
Parties can file Motion for Reconsideration	45	1086	36.2	2.98																	
Permit Issued	1	1087	36.2	2.98																	
Subtotal Hearing	***302***				***151***	***754***	***540***	***400***	***420***	***640***	***840***	***1182***	***512***	***143***	***554***	***533***	***419***	***277***	***840***	***434***	***283***
From PH to PFD (6 months SB 709 presumptive maximum)	189				$27,180	$165,880	$216,000	$32,000	$75,600	$76,800	$151,200	$236,400	$25,600	$25,740	$72,020	$79,950	$25,140	$49,860	$117,600	$60,760	$22,640
								$441,060					$565,600				$202,850				$250,860
Total Permit Cost Contested Case Hearing								**$866,160**					**$662,280**				**$311,070**				**$345,900**
																					$2,185,410
Settlement/Permit Issuance (Best Case)	Best Case																				
Mediations for supplemental conditions in draft permit (Indeterminant)	15	800	26.7	2.19	26	84	52	68	58	84	84	116	116	34	42	26	26	34	116	36	34
Negotiations for other conditions outside of permit (Indeterminant)	15	815	27.2	2.23	26	84	52	68	58	84	84	116	116	34	42	26	26	34	116	36	34
Approval of TCEQ staff with conditions to be included in permit (Indeterminant)	15	830	27.7	2.27										1	16	1					
Approval of governing bodies to sign settlement agreements	30	860	28.7	2.36	4	4	4		6	4		6	6	6	8	4	4	36	72	12	6
Final draft permit from TCEQ	15	875	29.2	2.40										2	8	6	4				
30 day notice (only if substantially different from first draft permit)	30	905	30.2	2.48	2	8	6	2	6	8	8	12	3		8	3	4	6	12	3	3
Letters of withdrawal from contested case hearing from protestants	15	920	30.7	2.52					6	4		6	6			2	4	3		1	3
TCEQ agenda date to approve permit	30	950	31.7	2.60	2		2							1	4	2					
Permit Issued	7	957	31.9	2.62			2	2								2	2				
Subtotal Settlement (Best Case)	***172***				***60***	***180***	***118***	***140***	***134***	***184***	***176***	***256***	***247***	***78***	***128***	***72***	***70***	***113***	***316***	***88***	***80***
					$10,800	$39,600	$47,200	$11,200	$24,120	$22,080	$31,680	$51,200	$12,350	$14,040	$16,640	$10,800	$4,200	$20,340	$44,240	$12,320	$6,400
								$108,800					$141,430				$45,680				$83,300
Hearing requested, TCEQ Refers to mediation (from above)					***$48,960***	***$205,260***	***$116,400***	***$54,480***	***$14,760***	***$10,560***	***$48,960***	***$10,400***	***$12,000***	***$30,960***	***$60,580***	***$10,800***	***$5,880***	***$15,480***	***$50,680***	***$15,680***	***$13,200***
								$425,100					$96,680				$108,220				$95,040
Total Permit Process Settlement (Best Case)								**$533,900**					**$238,110**				**$153,900**				**$178,340**
																					$1,104,250
Settlement/Permit Issuance (Worst Case)	Worst Case																				
Mediations for supplemental conditions in draft permit (Indeterminant)	45	1007	33.6	2.76	52	168	104	136	116	168	168	232	232	68	84	52	52	68	232	72	68
Negotiations for other conditions outside of permit (Indeterminant)	30	1037	34.6	2.84	39	126	78	102	87	126	126	174	174	51	63	39	39	51	174	54	51
Approval of TCEQ staff with conditions to be included in permit (Indeterminant)	30	1067	35.6	2.92										2	32	8					
Approval of governing bodies to sign settlement agreements	30	1097	36.6	3.01	8	8	8		12	8	32	12	12	12	16	8	8	72	72	24	12
Final draft permit from TCEQ	30	1127	37.6	3.09										4	16	12	4				
30 day notice (only if substantially different from first draft permit)	30	1157	38.6	3.17	2	8	6	2	6	8	8	12	3		8	3	4	6	12	3	3
Letters of withdrawal from contested case hearing from protestants	45	1202	40.1	3.29					6	4		6	6			2	4	3		1	3
TCEQ agenda date to approve permit	45	1247	41.6	3.42	2		2							1	4	2					
Permit Issued	14	1261	42.0	3.45			2	2								2	2				
Subtotal Settlement (Worst Case)	***299***				***103***	***310***	***200***	***242***	***227***	***314***	***334***	***436***	***427***	***138***	***223***	***128***	***113***	***200***	***490***	***154***	***137***
					$18,540	$68,200	$80,000	$19,360	$40,860	$37,680	$60,120	$87,200	$21,350	$24,840	$28,990	$19,200	$6,780	$36,000	$68,600	$21,560	$10,960
								$186,100					$247,210				$79,810				$137,120
Hearing requested, TCEQ Refers to mediation (from above)								***$425,100***					***$96,680***				***$108,220***				***$95,040***
Total Permit Process Settlement (Worst Case)								**$611,200**					**$343,890**				**$188,030**				**$232,160**
																					$1,375,280

Proposed Legislation and Petition for Rule-making

In addition to the recent 30 TAC §210 / TLAP rule changes discussed above, there have been several attempts to pass legislation and/or adopt rules that would address concerns related to wastewater management in the BSZ.

In 2009 a proposal for rulemaking was developed by regulatory entities in the BSZ that directly addressed the need for a ban of wastewater discharge permits in the BSCZ. Rather than engage in the rulemaking process, TCEQ Commissioners required a series of stakeholder meetings to provide more data in support of the ban, and to look for alternatives that would allow discharge under certain conditions. Several presentations of data and modeling indicating that the impacts of wastewater discharge in the BSCZ would degrade water quality in surface and groundwater. Clearly, there was a weight of scientific evidence in support of the ban, but the effort faltered when TCEQ proposed effluent standards that were not proven to be protective of water quality in place of a prohibition. Stakeholders from jurisdictions covering over 90% of the contributing zone were in favor of a ban on wastewater discharge. Staff recommendations also endorsed this rule change. Unfortunately, the Commissioners determined that no further action was needed and no decision on the weight of evidence for a discharge ban was made.

HB 1508, filed in the 81st legislative session in 2009 to prohibit wastewater discharge in the Contributing Zone, was recommended favorably by the House Natural Resource Committee but did not receive a vote before the full House.

A modified approach that was offered via SB 853 proposed by Senator Kirk Watson in the 82nd legislative session in 2011 would have allowed discharges of wastewater treated to a higher standard. This level may have been adequate in some situations in the BSZ. SB 853, however, did not receive a committee hearing. There were concerns that more rigorous method of determining appropriate effluent limits would be necessary before a consensus set of standards could be proposed.

HB 2046, filed in the 83rd legislative session in 2013 by Representative Paul Workman, was designed to fund a study to provide the science and engineering basis to address concerns about appropriate limits. Although HB 2046 did not proceed very far through the legislative process in the 83rd session, the supporters of HB 2046 were successful in generating interest and support for the study through various meetings and conversations with the pertinent stakeholders including State Representative Paul Workman, Travis County, the City of Austin, Water Environment Association of Texas, Home Builders Association, Real Estate Council of Austin, SOS, Sierra Club, National Wildlife Federation and the Hill Country Alliance.

Unfortunately, in the 84th Legislative session two bills were proposed that would limit the ability for other government entities to protest permits impacting their jurisdiction. While applicable statewide, this legislation was obviously developed to limit cities like Austin's efforts to modify inappropriate wastewater discharges and land application of treated domestic sewage through the contested case hearing process. The language of HB912 would prohibit any municipality holding a TCEQ permit to oppose any new or amended permit applications that would discharge at effluent limits equal to or more stringent than the municipalities themselves. This totally

disregarded the fundamental reality that the characteristics of the receiving stream and its health ideally should control the TCEQ permit limits. A discharge into a headwater stream would be treated the same as a discharge to the Colorado river regardless of flow, designated uses, and modeled water quality. Fortunately, this bill was not passed in the 84th session; however, it was again proposed and tabled in the 85th Legislative session in 2017.

At the beginning of the 83rd Texas legislature the Speaker of the House of Representatives appointed a House Committee on Environmental Regulations and gave them four interim charges to report back on at the 84th legislature. One of the charges was to study the TCEQ permitting process, specifically the contested case hearing process and economic impact on manufacturing sectors and how other state and federal permitting timelines compared. The committees hearings prompted a variety of white papers in support and in criticism of the TCEQ contested case hearing process (Clivins and Braddock, 2015; Reed, 2015; Allmon and Frederick, 2014; Conway, 2012; Thompson, 2015, Fonken, 2015). In their response they presented a general timeline for contested case hearings as shown in Table 7 (Harless 2014). The committee's conclusions after their hearings were that both proponents and advocates for changing the contested case hearings process agreed that the timelines were too long and that the Legislature should "find a balance that protects the rights of private property owners and meets environmental regulations while not unnecessarily hindering economic development by an over burdensome and unpredictable permitting process".

Table 7. General Timeline for Contested Cases (Harless, 2014)

Hearing Task	Duration
Commission Agenda on Hearing Requests	45 days
Referral to SOAH	15 days
Notice and SOAH Preliminary Hearing Date	60 days
SOAH Evidentiary Hearing and PFD	180-270 days
Commission Agenda on PFD	45 days
Motion for Rehearing and Final Order	45-90 days
Total	390-525 days

Ultimately, the result of the Committee report in the 84th legislature was yet another bill effectively restricting anyone contesting discharge or land application permits in sensitive areas such as the BSZ, becoming law March 23, 2015. Passage of SB 709 includes a presumption that a draft permit meets all state and federal requirements including protection of receiving water through meeting all of 30TAC§307 water quality standards. Although not supported by any scientific evidence, this presumption is now part of the Texas Water Code and part of the State Government Code affecting administrative hearing practices. While TCEQ must always assume this when entering a SOAH hearing to defend its draft permit, this provision codifies the presumption making it universal. Unless proven otherwise by the protestants, a permit is assumed to meet all state and federal requirements whether it does in fact or not.

The end result is that the burden of proof that a permit does not meet all water quality standards shifts to those contesting the permit. In many cases, this is a subject of debate in permit hearings

because of the narrative portion of the water quality standards in 30 TAC §307 that prohibit affecting aesthetic, recreational, nuisance and other impairment in addition to numerical water quality standards. Expert witnesses for contesting parties often testify that the draft permit will not only affect numerical portions of the standards, but also the narrative criteria. The extent to which these experts can refute the presumption may sway the SOAH judge, but this will make it harder to both settle cases without a hearing or have more protective provisions placed into a final permit at the decision of the SOAH judge.

These legislative initiatives discussed above indicate the growing need for reform in the way TCEQ handles permitting in sensitive areas like the Barton Springs Zone. The fact that only one of these proposals made it all the way through the state legislative process, and it was one detrimental to the protection of high quality receiving waters is not encouraging. All of the efforts at legislation or rules to improve or deny permits that could affect sensitive areas such as the BSZ failed.

In 2015, the City of Austin proposed a new rule to TCEQ that, if adopted, would add another option for managing wastewater in Texas. The new rule would enable land application permittees to take credit for a portion of their beneficial reuse authorizations against the area of land that would otherwise be required for dedicated disposal of wastewater effluent, while adding some important environmental protections for beneficial reuse of effluent utilized for this credit.

The City met with local stakeholders several times to discuss methods and potential rule changes that would reduce duplicative disposal area requirement impediments to new TLAP in the BSCZ, specifically for permittees who will reuse most or all effluent under a 30 TAC §210 authorization. A petition was filed March 14, 2016 and TCEQ directed their staff to initiate their own stakeholder process and develop rules in response to the petition. This process may hold a significant role in the promotion of wastewater beneficial reuse in the BSCZ with less land commitment rather than wastewater discharge causing increasing water quality degradation (Herrington 2016). The TCEQ staff has made modifications and proposed a final rule for consideration by the Commission which was approved for publishing in the Texas Register for formal public comment. The comments to date and presentations on the rule change as it has been evaluated by the regulated community and stakeholders can be found at https://www.tceq.texas.gov/permitting/wastewater/city-of-austin-petition. If all goes well, the rule could be adopted and made effective in early 2020.

Overall Permit Time-Frame Tracking Reports

Texas Government Code 2005.007 requires the TCEQ to report every two years on its permit application system, showing the periods adopted for processing each type of permit issued and any changes enacted since the last report. The biennial update also includes a statement of the minimum, maximum, and average time periods for processing each type of permit—from the date a request is received to the final permitting decision (TCEQ 2018).

The biennial report does not consider any permits where EPA or USFWS had any influence on the decision to grant a permit and the time period of processing the permit. It also does not

consider any contested permits, so it is not quite as useful as it could be. Statewide, the range of processing times for new minor (<1 MGD) applications for water quality permits was 149 to 631 days in the last report. The average processing time was 291 days, and the target maximum processing time was 330 days. For major amendments to minor (< 1 MGD) permits the range of processing times for uncontested water quality permits was 180 to 1,138 days with an average processing time of 315 days. The target maximum set by TCEQ was 300 days. For FYs 17-18, TCEQ met all of its targets which were to review 90% of all water quality permit applications within established time frames while focusing on resolving backlogs of permits hung up on EPA objections or other issues.

Finally, the report describes specific actions taken to simplify and improve the entire permitting process, including application and paperwork requirements

The report also contains recommendations from the Office of Public Interest Counsel (OPIC) at TCEQ. One of their recommendations was to allow municipal applicants for TPDES permits to concurrently apply for 210 Reuse Authorizations. This was based on public concern during permitting of the City of Wimberley and City of Dripping Springs TPDES discharges to sensitive stream systems. Both cities told their citizens they didn't intend to discharge but would reuse as much effluent as possible. However, the cities had no choice under TCEQ rules but to apply for a discharge permit and apply for a 210 reuse authorization as a provider once it was granted. OPIC recommended that rule changes be initiated so these cities could at least show as an act of good faith that they would obtain the authorizations although they would never be required to use them by TCEQ if they had a discharge permit. Further recommendations of OPIC had to do with the practical application of SB 709 in the course of contested case hearings. Given a 180-day limit on completing a Proposal for Decision by SB 709, the SOAH ALJs were forced to reserve 60 days of this time for completing their report (TCEQ 2018). This leaves only 120 days for the entire contested case hearing from discovery, production, depositions, interrogatives, pre-filed testimony and exhibits, the hearing on merits proper, closing arguments, and all objections, disputes, motions, and hearings as necessary to resolve them. Of course the recommendation from OPIC to change the legislation is unlikely to have any effect.

Local Wastewater Rules in the BSZ

There are three main areas of local jurisdictional authority over wastewater management in the BSZ (Figure 2). Areas of jurisdiction include city limits, extraterritorial jurisdictions, and unincorporated county areas. The local entities covering the majority of the BSZ are Dripping Springs, Travis County, Hays County, and the City of Austin. The majority of local rules only apply to OSSFs and wastewater collection systems. TCEQ has a process through 30 TAC §285 that allows a local agency to become an authorized agent within its jurisdiction for regulation of OSSFs which can be used to apply more stringent provisions and controls than the basic design criteria found in the state administrative code. A model local ordinance is provided by TCEQ to implement this authorization on the local level. Likewise, wastewater collection system design, inspection, and maintenance are provided through state issued CCN to local entities although basic design criteria are contained in state administrative code. Local requirements to statewide design criteria can be more stringent and tailored to the community standards and needs.

TCEQ laws and rules governing authorized agents include Subchapter C of the Texas Health and Safety Code. Chapter 366 covers the designation of a local governmental entity as an authorized agent. Authorized agent status is useful to provide requirements in addition to those enforced by the state. Improvements to 30 TAC §285 have been included in a number of municipal and county ordinances in the BSZ due to potential for inadequate OSSFs to impact the BSEA. Likewise, some additional protection is provided in plumbing codes that can be amended locally. The most important differences in local OSSF requirements in the BSZ are lot sizes, setbacks from surface water or other environmentally sensitive features, surface application rules, and nitrogen reduction requirements. Other rules governing wastewater related issues such as greywater usage also differ in some localities.

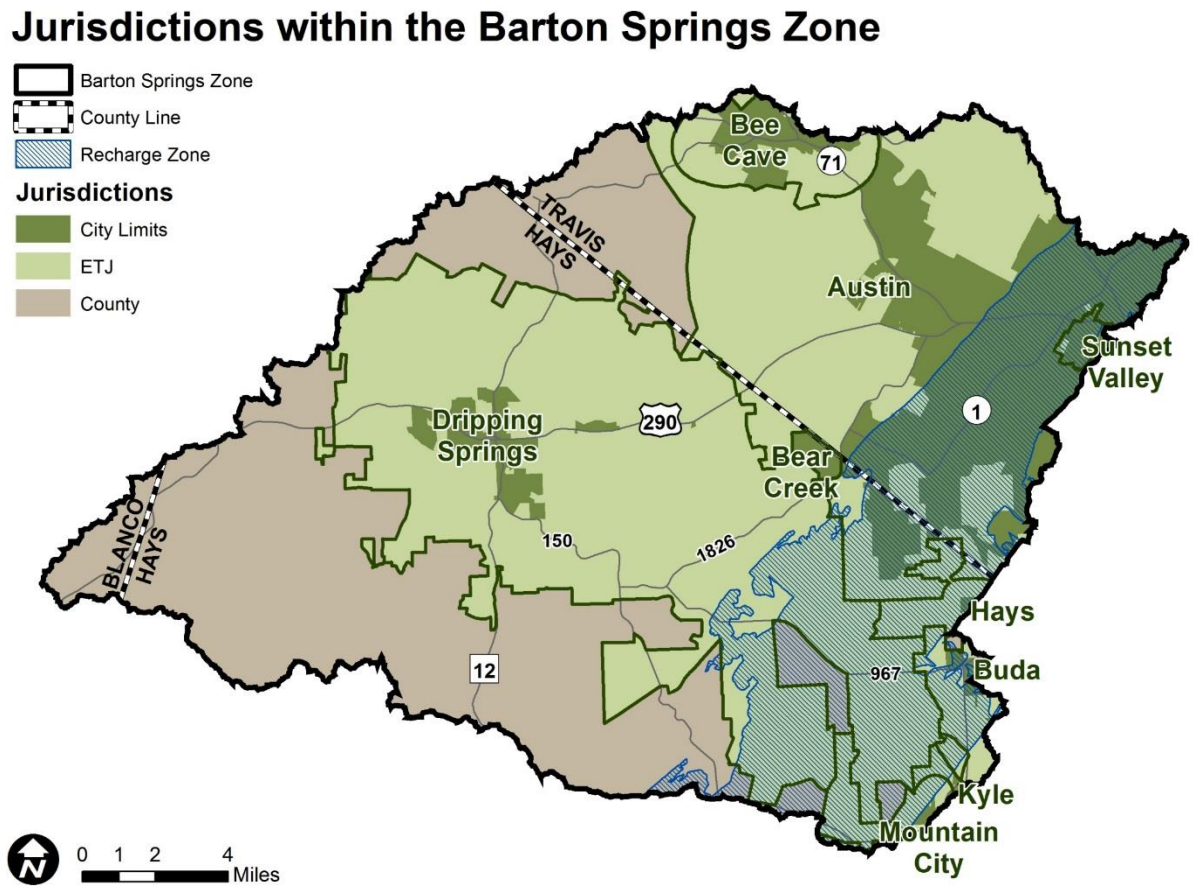


Figure 2 BSZ Jurisdictions

County Rules in the Barton Springs Zone

As shown in Figure 2.2, there are three counties with portions of their jurisdiction within the BSZ. Each has mention of wastewater management, primarily in its code of ordinances covering wastewater collection systems and/or OSSFs. These rules are most often a result of the counties assuming authorization as delegated authorities under TCEQ regulations. As a condition of these authorizations, the counties adopt the applicable TCEQ regulations and may add more stringent conditions as necessary. For example, county OSSF rules must meet 30TAC285 TCEQ

standards that include special provisions for the BSZ. Some have opted for more stringent requirements than these. These rules were discussed in the Regional Water Quality Protection Plan (RWQPP), although wastewater was not a primary focus (Naismith 2005).

Counties are subdivisions of the state created under the Texas Constitution or by act of the Texas Legislature, and have been given some authority to own and operate public infrastructure, including water, wastewater, drainage and waste disposal facilities. Counties may also institute civil actions and prosecute criminal actions including wastewater pollution, under the Texas Water Code and the Texas Health and Safety Code (Naismith 2005).

According to TCEQ records, Blanco County (620016) became an authorized agent on Jan 30, 1998. Its jurisdiction covers a small portion of the upper Onion Creek watershed is in Blanco County. Hays County (620098) was authorized February 18, 2014 and covers the majority of the unincorporated area in the BSZ. Travis County (620186) was delegated authority February 23, 2015 and covers an area to west of Austin and shares jurisdiction in the ETJ of Austin.

Travis County Wastewater Rules

Travis County Transportation and Natural Resources (TNR) has engaged in many of the state wastewater management activities impacting their jurisdiction. These have included wastewater discharge and TLAP applications at TCEQ and regional planning. Their own regulatory program primarily centers on design, construction and maintenance of collection systems and OSSFs.

The Travis County OSSF regulations are found in Chapter 48 of County Code Rules last updated in February 2015 (https://www.traviscountytx.gov/images/commissioners_court/Doc/county-code/chapter-48.pdf). This section adopts 30TAC§285 in its entirety and then provides additional requirements, sometimes applicable only to sensitive areas such as the BSZ. These include residential lot requirements within the "Edwards Aquifer recharge zone, within Edwards aquifer contributing zone, surface areas above the Trinity Aquifer, and other aquifers which have environmentally sensitive rapid recharge conditions". The main enhancement for the Travis County OSSF rules is the requirement to have a minimum 1-acre lot size regardless of location in the recharge or contributing zone or water supply. However, there is a provision for variances. It also appears that additional more stringent requirements are contemplated as a blank section is reserved for that purpose (48.031 Travis County's More Stringent Rules).

Hays County Wastewater Rules

Hays County Development Regulations (https://www.co.hays.tx.us/SharedFiles/Download.aspx?pageid=61&mid=65&fileid=4304) require preparation of a Water and Wastewater Plan in section 715.2.01. The plan requires laying out how a development will provide service either through a new TCEQ permitted facility, tying into an existing facility, or using OSSFs. Section 715.04.05 requires a separate design report for OSSF communities. The contents of the OSSF design report are found in an Order Adopting Rules of Hays County, Texas for On-Site Sewage Facilities (Cited as Appendix A of the Hays County Development Regulations (Hays County 2013) (http://www.co.hays.tx.us/SharedFiles/Download.aspx?pageid=61&mid=65&fileid=4831) .

Amendments of 30TAC285 in Section 10 of the Order to make the Hays Order more stringent include minimum lot sizes, setbacks, and impervious cover that are less stringent in other jurisdictions. Hays County has the most stringent lot sizes in the BSZ. Table 8 contains the restrictions found in Section 5.05 of their Development Regulations.

Table 8 Minimum Lot Sizes in Acres for OSSFs for Hays County

Location	Water Service	Advanced	Conventional	TCEQ Min.
EARZ [1]	Surface or Rainwater Collection System	1.50	2.00	1.00 [4]
EARZ	Public Groundwater Supply System[2,8]	2.50	4.50	1.00 [4]
EARZ	Private Well	3.00	5.00	1.00 [4,6]
EACZ [3]	Surface or Rainwater Collection System	1.00	1.50	0.50 [5]
EACZ	Public Groundwater Supply System	1.50	2.50	0.50 [5]
EACZ	Private Well	2.00 6.00[8]	3.00 6.00[8]	1.00 [6]
Any Other	Surface or Rainwater Collection System	0.50 1.00 [7]	1.00	0.50 [5] 1.00 [6]
Any Other	Public Groundwater Supply System	1.00	1.50	0.50 [5]
Any Other	Private Well	1.50 6.00[8]	2.00 6.00[8]	1.00 [6]

Notes:
1. Edwards Aquifer Recharge Zone as defined in 30 TAC §213
2. A Public System is a Public Water System as defined in 30 TAC §290
3. Edwards Aquifer Contributing Zone as defined in 30 TAC §213
4. TCEQ Minimum lot size as per 30 TAC §285.40(c)
5. TCEQ Minimum lot size as per 30 TAC §285.4(a)(l)(A)
6. TCEQ Minimum lot size as per 30 TAC §285.4(a)(l)(B)
7. Minimum lot size for use of surface application system as per 30 TAC §285.33(d)(2)
8. Applicable to new subdivisions and Manufactured Home Rental Communities served by individual private water wells located within the Priority Groundwater Management Area as defined by Texas Commission on Environmental Quality and required to demonstrate water availability as required by Hays County under the authority granted to the County under the Texas Water Code and the Texas Local Government Code.

http://www.co.hays.tx.us/files/4913/2312/3867/Hays_County_OSSF_rules_12-21-2010.pdf

Hays County OSSF permitting authority included the cities of Kyle and Buda and thru January 2010 and also covered the City of Wimberley prior to 2009.

Blanco County Wastewater Rules

A small portion of the BSZ is in the unincorporated area of Blanco County. This is primarily a 3,304 acre portion of the headwaters of Onion Creek. Rules governing wastewater are found in Blanco County "Rules for On-Site Sewage Facilities." As adopted in their TCEQ registration, several requirements more stringent than TCEQ are made for OSSFs. These include the rules in Table 9:

Table 9.
Blanco County Rules for OSSFs

a) MINIMUM LOT SIZES
   - i) Lots on which both on-site sewage facilities and private water wells shall be maintained shall be a minimum 5 acres in size.
   - ii) Lots on which on-site sewage facilities and public water supplies shall be maintained shall be a minimum 3 acres in size. All lots of 3.00 acres of less shall have systems designed by a Professional Sanitarian or Licensed Professional Engineer.
   - iii) Lots on which public sewage facilities and public water supplies shall be maintained shall be a minimum 1 acre in size.

b) EXEMPTIONS.
   All tracts on which on-site sewage facilities are to be installed shall be Permitted. No exemptions for large acreage tracts will be allowed

c) SEPTIC TANK CAPACITY
   The minimum capacity of any septic tank will be 1000 gallons.

d) PROPERTY SET BACK LINES
   Set back lines for the installation of drainfields and water wells shall be a minimum of fifty (50') feet.

e) WAIVING OF FEES
   Waiver of fee requirements will be solely at the discretion of the Commissioners Court.

Municipality Rules.

Municipal rules were addressed in general terms in the RWQPP in relation to land development regulations (Naismith 2005). Some of these include wastewater provisions, primarily OSSF rules. Authority for water quality regulations comes from the Texas Constitution and Texas General Municipal Code for Home Rule and General Law municipalities in Texas. Home Rule (or Chartered) municipalities are subdivisions of the state vested with the full power of local self-government through the adoption of a charter conforming to the requirements of the Texas Constitution. Home Rule municipalities have relatively broad powers to enact rules and ordinances to protect public health and water quality within their Municipal Boundaries (i.e. City Limits) and their Extra-Territorial Jurisdiction (ETJ). Zoning restrictions can also be adopted and enforced by Home Rule municipalities within their municipal boundaries, but not within their ETJ. The Home Rule municipalities in the Planning Region are the City of Austin and the City of Kyle.

Home rule municipalities have generally attempted to incorporate water quality protection measures as part of their plat and subdivision approval process as authorized under Chapter 212

of the Texas Local Government Code. Home rule municipalities also have legal authority to regulate water quality through the Texas Water Code. Under this section, a municipality may establish a water pollution control and abatement program for areas within the municipal limits and it's ETJ. Such a program generally entails water quality monitoring, sampling and inspection requirements for waste dischargers. Once the plan is developed it must be submitted to the TCEQ for its review and approval and any requirement under the program may be appealed to TCEQ or the district court. Under the Texas Water Code, home rule municipalities may also request delegation of water quality functions from the TCEQ.

A home rule municipality is also given the authority to "prohibit the pollution or degradation of, and may police, a stream, drain, recharge feature, recharge area, or tributary that may constitute or recharge the source of water supply of any municipality." This authority may be exercised in the municipality's ETJ, except that the authority to protect recharge features and groundwater aquifers in the ETJ may only be exercised by a municipality with a population of over 750,000 and only if that groundwater constitutes more than 75% of the municipality's source of water.

In Texas, General Law municipalities are also subdivisions of the state incorporated in accordance with the Texas Local Government Code.169 General Law municipalities are vested with less local self-government power than Home Rule municipalities but can still enact certain rules and ordinances to protect public health and water quality within their municipal limits and their ETJ. Like Home Rule municipalities, General Law municipalities can adopt and enforce zoning restrictions within their municipal boundaries, but not within their ETJ. The General Law and Home Rule municipalities in the Planning Region and their area in the RZ and CZ in their City Limits and ETJs are shown along with unincorporated areas of Hays and Travis Co. in Table 10.

Table 10.
City Limits and ETJ of municipalities with portions in BSZ

	Recharge Zone			Contributing Zone			Outside the BSZ			Total		
	City Limits	ETJ	Total Jurisdiction	City Limits	ETJ	Total Jurisdiction	City Limits	ETJ	Total Jurisdiction	City Limits	ETJ	Total Jurisdiction
	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres
Village of Bear Creek	0	0	0	685	0	685	0	0	0	919	0	919
Village of Lakeway	0	0	0	0	144	144	11,405	4,331	15736	11,405	4,475	15880
Village of Bee Cave	0	0	0	6,603	2,084	8687	2,859	2,392	5251	7,764	4,331	12095
City of Mountain City	10	2,912	2,922	0	0	0	350	865	1,215	360	4,764	5,124
City of Buda	427	1,930	2,357	0	0	0	7,514	8,465	15,979	7,941	11,051	18,992
City of Dripping Springs	0	16,411	16,411	5,325	49,101	54,426	0	471	471	7,152	88,363	95,515
City of Sunset Valley	780	58	838	0	0	0	413	0	413	1,193	78	1,271
City of Hays	88	2,475	2,563	0	0	0	93	771	864	181	4,090	4,271
City of Austin	17,951	7,183	25,134	6,830	41,448	48,278	216,623	216,185	432,808	241,388	252,356	493,744

City of Kyle	0	620	620	0	0	0	25,995	32,154	58,149	25,995	32,985	58,980
Total Incorporated	19,256	31,589	50,845	19,443	92,777	112,220	265,252	265,634	530,886	304,298	402,493	706,791
Travis Co. Unincorporated			34			12,191						
Hays Co. Unincorporated			4,842			67,716						
Total BSZ		Tot RZ	55,721	+	Tot CZ	192,127	=	247,848	Acres			

As with home rule municipalities, general law municipalities are also authorized to incorporate water quality protection measures as part of their plat and subdivision approval process under the Texas Local Government Code, and to regulate water quality under the Texas Water Code. General law municipalities may establish a water pollution control and abatement program for areas within the municipal limits and the ETJ and may also request delegation of water quality functions from the TCEQ.

In Hays County, additional permitting is done by the Village of Bee Caves and the City of Dripping Springs within their corporate limits. Wimberley has also issued approximately 17 permits since assuming permitting authority. The City of Dripping Springs assumed OSSF permitting authority from Hays County in November 2006, although they do not maintain electronic records of permits and have issued only approximately 80 permits since 2006 (Kyle Dayheart, RS, personal communication on 7 October 2010). The Village of Bee Caves assumed permitting authority from Travis County in 1987.

The following municipalities are authorized agents for OSSF permitting in the BSZ according to TCEQ records.

- City of Austin 620184 October 29 2013
- City of West Lake Hills 620187 November 48 2010
- Village of Bee Cave 620250 February 2 1994
- Mustang Ridge 620272 Dec 19 2007
- City of Rollingwood 620292 Sep 22 2009
- City of Uhland 620298 May 8 2006
- City of Dripping Springs 620379 Nov 2005
- City of Wimberley 620398 Dec 30 2009

City of Austin Rules

The City rules concerning wastewater management in the BSZ include those ordinances, codes, and technical manuals specifically designed to go beyond the state rules for facilities, and the land development rules that deal with wastewater through site and design restrictions.

Land Development Code (LDC)

Section 25-9 of the LDC provides regulations for water and wastewater and Article 4 specifically addresses reclaimed water supplied by the City of Austin wastewater treatment plants for

irrigation uses. Other references in the LDC cross reference regulations that are pertinent in City jurisdiction. 25-4-198 references Chapter 15-5 of the Utilities Code for regulation of OSSFs. Local amendments to the 2012 Plumbing Code are referenced in 25-12-153 including section 713.8 designating AWU as the designated authority (authorized agent) for regulating OSSFs. Section 25-8-361 (B) gives prohibition conditions on wastewater treatment by land application. Similarly, Section 30-5-361 (A) gives restrictions and prohibitions for wastewater treatment by land application in the cooperative Austin/Travis County Subdivision Regulations. LDC 25-8-281 prohibit land application irrigation areas from slopes greater than 15 percent, in the Critical Water Quality Zones, in the 100-year floodplain, or within 150' of a Critical Environmental Feature. Karst features are included as critical; therefore, some additional protection in the BSZ is provided through this reference.

Utility Regulations for Private Sewage Facilities

Chapter 15-5 of the City Code - Utility Regulations concerning private sewage systems or OSSFs. In general, this section adopts all of the state requirements in Chapter 366 of the Texas Health and Safety Code and Chapter §285 Title 30 of the Texas Administrative Code. Section 15-5 has been recently revised to include additional requirements for the BSCZ including nitrogen reduction systems when standard OSSF drainfields cannot meet the requirements of 30TAC§285.91 and vertical separation distances in the 15-5-3 (H) (1) and lot sizes in 15-5-3 (E).

Other City of Austin Codes

A number of City of Austin codes besides the LDC and Utility Code are pertinent to wastewater management. Title 6 Section 6-5-12 gives general prohibitions against discharge of sewage, effluent, or other substance that causes pollution. City Plumbing Code Code Section 1602.16.3 regulates Gray Water Systems. 1601.2 gives designer requirements for gray water systems and waiver for residential systems less than 250 gpd. Similarly, Laundry to Landscape systems are capped at 60 gpd. Table 603.5 provides requirements for Backflow Prevention for Reclaimed water, Grey water, Re-Irrigation, and Disposal of Pressurized Auxiliary Water Sources. Section 320.5 plumbing code requires septic tanks and drainfields to be out of the out of the 25-flood hazard area. Section 104.0 of the City plumbing code references the City specific OSSF rules discussed above.

Environmental Criteria Manual (ECM)

The ECM has several references to wastewater management as part of the implementation of the Land Development Code. First in 1.11.0 there are guidelines for evaluation of land proposed for application of treated wastewater effluent. Guidelines for determining depth of "effective soil" when a request is made to provide 7,000 square feet of irrigated land per living unit equivalent when a minimum of six (6) inches of top soil is present rather than 8,000 square feet per living unit equivalent, as allowed by the LDC. The second reference in this section are guidelines for determining appropriate areas for irrigation, excluding environmentally sensitive areas unsuited to irrigation, such as steep slopes and floodplains.

When applying for a development permit from the City of Austin an Environmental Resource Inventory is required including a Wastewater Utilities Report specifying type, sizing, location, and if over the Edwards Aquifer, treatment level and what effects to receiving watercourses or

the aquifer are anticipated. Land application and drainfield sizing is called out specifically. Delineation of irrigation areas is required in application materials.

Another more stringent criteria in the BSZ provided in the ECM is section 1.6.9.1 which specifies that "Runoff resulting from areas which store or receive irrigation of wastewater shall meet the pollution reduction requirements of the SOS Ordinance". This would presumably apply to BSRZ land application systems and require a non-degradation standard be met. However, this is seldom applicable as TCEQ permitting provides a water balance showing no discharge will be made by runoff from land application areas. Refuting this presumption through monitoring or more accurate water balances during permit hearings has not been effective. In addition, to date, no large scale land application system has been permitted in the BSRZ, although a planned development obtained a draft permit which was contested and subsequently abandoned after the City of Austin purchased the property. It is still a possibility, given that TCEQ permits land application on the recharge zone on a case-by-case basis.

Section 1.12.6 void mitigation measures are also important to protection of the BSEA from wastewater collection system impacts. Over the years, COA has worked with TCEQ Austin Region to have consistent or comparable void mitigation requirements under the ECM and Edwards Rules. This has also been extended to cooperative work in designing mitigation measures to protect the structural integrity of caves encountered during construction.

Utilities Criteria Manual (UCM)

Section 2 of the UCM addresses reclaimed water and wastewater criteria and design requirements are addressed in 2.9.0. Reclaimed water systems are covered in 2.9.3, and wastewater in 2.9.4. In general, these sections may contain requirements more stringent than required by TCEQ, but those in the BSZ are not distinguished from other parts of the city. One aspect of reclaimed water distribution that is of concern is its used in CEF buffers and Critical Water Quality Zones adjacent to streams. Irrigation of stormwater is restricted in these areas, and nutrient values for reclaimed water are significantly higher than stormwater. The definition of "wastewater" in City rules does not specifically include "reclaimed water" although common sense would classify it as "highly treated wastewater". Several clients of the AWU reclaimed water program currently irrigate in these restricted areas and prospective clients want to irrigate in there. The additional acreage to be irrigated represents a potential market for AWU and use of reclaimed water is a conservation use. However, irrigation of wastewater is prohibited in the CEF buffers and CWQZ of streams in Austin. Therefore, recommendations from water quality studies completed by COA WPD include enforcement of the prohibition of irrigation using reclaimed water on CEF buffers and CWQZ areas (Clamann et al 2014)

Dripping Springs Wastewater Rules

The largest area of the BSZ covered by a municipality is that of Dripping Springs. Their OSSF ordinance includes lot size restrictions similar to Hays county according to location within recharge, contribution or water quality. Lot sizes for the ETJ and City limits are shown in Table 11 and those for residential cluster systems are shown in Table 12.

Table 11. Minimum Lot Sizes in Dripping Springs Based on EARZ, Water Supply, and Wastewater Service.

14.6. Minimum Lot Sizes in ETJ

As part of the City's comprehensive Water Quality Protection Program, the minimum lot sizes in the ETJ shall be in accordance with this chart:

Wastewater System	Aquifer Zone	Surface or Rainwater	Public Water Supply	Private Well
Public Sewer	Recharge	1.5	1.5	2.0
	Contributing	.75	.75	1.5
	WQBZ	2.0/Av 3.0	2.0/Av 3.0	2.0/Av 3.0
Private Septic	Recharge	2.0	2.0	2.0
	Contributing	1.5	1.5	2.0
	CWQZ	2.0	2.0	2.0
	WQBZ	2.0/Av 3.0	2.0/Av 3.0	2.0/Av 3.0

(Ordinance 1230.6 adopted 4/19/05)

14.7. Minimum Lot Sizes in City Limits

The minimum lot size in the City Limits shall be three-quarters (3/4) of an acre for lots served by a public water supply, and one (1) acre for those served by a private well.

	Public Water Supply	Private Well
Private Septic	.75	1.0

(Ordinance 1230.7 adopted 4/19/05)

Table 12. Residential cluster development density and dimensional standards for Dripping Springs based on Wastewater Management

(e) Density and dimensional standards. The following density and dimensional standards shall apply to residential cluster development:

	Lots or Parcels Served by Private On-Site Waste Treatment Systems	Lots or Parcels Served by Centralized Sewer Facilities
Maximum density [a]	1 dwelling unit per 1 net buildable acre	1 dwelling unit per 0.75 net buildable acre
Minimum lot area [a]	35,000 square feet	5,000 square feet

Minimum lot width, measured at front lot line	50 feet	40 feet
Minimum front yard	25 feet	25 feet
Minimum rear yard	15 feet	15 feet
Minimum side yard	5 feet	NA
Accessory building setback [b]		
From side lot lines	5 feet	5 feet
From rear lot line	10 feet	10 feet
Minimum usable common open space (percentage of gross acres)	40%	40%
Maximum height	35 feet	35 feet
Principal structure	35 feet	35 feet
Non-agricultural accessory structures	25 feet	25 feet
Agricultural accessory structures	25 feet	25 feet
	Lots or Parcels Served by Private On-Site Waste Treatment Systems	**Lots or Parcels Served by Centralized Sewer Facilities**
Maximum building coverage per lot	20 percent	Detached: 50 percent Attached: 70 percent

[a] Existing dwellings that will remain on the site shall be included in the calculation of maximum density.

[b] Accessory buildings shall not be permitted within the front yard.

Other Municipality Rules

Section 20.04.058 of the Bee Cave City Code includes regulations of wastewater facilities and wastewater treatment by land application. Living Unit Equivalent (LUE) and square foot of irrigation area depending on soil depth is addressed in this section. Similar prohibitions on land application as in the Austin LDC are given. Water Quality Buffer Zone (WQBZ) restrictions are given in section 20.04.045 including prohibitions on OSSFs in the zone. Wastewater facility design is addressed in 30.03.009 and reference is made to both Travis County requirements and the Bee Cave Technical Construction Standards and Specifications (TCSS) Manual (Code Section 13.106) which is roughly equivalent to the City of Austin ECM (including requirements for environmental assessments with a designated Wastewater Report. Section 3.00 of the TCSS addresses water and wastewater facilities and adopts COA LDC 25-9 in its entirety and then follows with local exceptions. The Village of Bee Cave has its own OSSF rules and is designated by TCEQ as having permitting authority within its corporate limits. No unique additional wastewater management regulations were found for Rollingwood or Westlake Hills as they have service contracts for wholesale wastewater treatment service by the City of Austin and collection service by the Lower Colorado River Authority (LCRA). As a result of the USFWS-LCRA

waterline settlement in 2001, a set of development conditions were agreed to that addressed typical land development issues but did not tackle wastewater directly. These were agreed to as mitigation for LCRA to avoid a take determination arising from indirect and cumulative impacts anticipated to be caused by the waterline. This is discussed further below.

Groundwater Conservation Districts (GCD)

The Barton Springs/Edwards Aquifer Conservation District (BSEACD), the Hays Trinity Groundwater Conservation District (HTGCD), and to a very limited extent, the Blanco-Pedernales GCD, are all in the BSZ with authority to manage well drilling and groundwater pumping but no direct authority to regulate land use. Limited by regulations charter, cost of service restrictions, and continued scrutiny by the legislature, the bulk of the wastewater management influence of these agencies is through contested case hearings, research, and education. Chapter 36 of the Texas Water Code governing Groundwater Conservation Districts does not mention sewage or wastewater. It also does not mention authority for landuse restrictions in any direct way. Permitting water well pumping by use could conceivably be seen as a way to direct land use; however, permits are seldom denied outright, and restrictions on permits are based on the conservation of the resource and within the charter of the districts. A new district with jurisdiction partially within the BSZ is the Southwestern Travis County GCD.

Barton Springs/Edwards Aquifer Conservation District (BSEACD)

The enabling legislation for the BSEACD (Special District Local Laws Code Title 6, Subtitle H Chapter 8802) was reviewed and no mention of authority over wastewater collection, treatment or disposal was found. Likewise, BSEACD Rules do not mention wastewater management; however, protection of water quality can be used in groundwater permit decisions. Despite the limited regulatory authority, the BSEACD strives to take an active role in wastewater management in the BSZ. Since its mandate includes protection of groundwater supplies in general, potential threats to surface recharge are of particular concern, and this is a logical role for the District. Both direct discharge and TLAP permits within the boundaries of the BSZ are reviewed by technical staff at BSEACD, and an evaluation is made on whether an impact to groundwater quality could be expected from granting a permit. The BSEACD application for pumping permit even requires notice from the applicant of "any application to the TCEQ to obtain or modify a Certificate of Convenience and Necessity (CCN) to provide water or wastewater service with water obtained pursuant to the requested production permit...(and)…notice of any pending, denied, or remanded authorization from a local, state, or federal agency relating to water or wastewater". As with other GCDs, BSEACD rules contains prohibitions against waste and pollution, groundwater pollution specifically, and can enact emergency temporary orders to initiate enforcement civil actions in court against polluters to obtain penalties under Texas Water Code 36.102 of up to $10,000 per day per violation.

The BSEACD has applied for a Section 10(a)1(b) incidental take permit to cover their own activities in regulating pumping from the BSEA (BSEACD 2016). Very little is included in their proposed HCP related to wastewater control. Unfortunately, the regulatory authority of the District does not extend to allow a more active role in wastewater management. They have engaged as an affected party in several SOAH contested case hearings on discharge and land application permits in the BSZ. This HCP has not been approved by the USFWS yet, a public

hearing was held 9/11/14 and the current draft includes provisions after technical review. In evaluation of the impact of wastewater management on the BSZ, the District's HCP states that:

> The population growth that takes place in areas that are outside the various municipal limits will create wastewater treatment and disposal challenges that may have adverse effects on water quality. Increasing use of centralized wastewater treatment systems that directly discharge even highly treated wastewater into small streams upstream from the Recharge Zone is likely, along with continued proliferation elsewhere of land-application systems and septic tanks. These facilities have the potential for surface-water and groundwater quality degradation if they are not adequately sited, designed, and/or maintained.

Also in the HCP Mitigation Measure M-5 it is stated that:

> The District will respond actively and appropriately to legislative initiatives or projects that affect Aquifer characteristics, provided such actions are consistent with established District rules, ongoing initiatives, or existing agreements. (Examples include contesting unsustainable wastewater management or actions)

Hays-Trinity Groundwater Conservation District (HTGCD)

The Hays-Trinity Groundwater Conservation District was created by Senate Bill 2 in 2001 and was codified under 8843 of the Special District Local Laws Code. Groundwater regulated by the HTGCD includes all of Hays County not contained within the boundaries of the Edwards Aquifer Authority, the Barton Springs Edwards Aquifer Conservation District, or the Plum Creek Conservation District. The district has engaged in some TCEQ wastewater permit negotiations and hearings, including the Hays County Water Control and Improvement District (HCWCID) No. 1 (Belterra) and Aqua Utilities permits. During the Belterra permit case, the District contracted for a consultant study of the potential impact of the discharge to the USGS gage in Bear Creek at FM 1826 (Slade 2006). The conclusion of the study also indicated that the discharge would likely impact wells between FM1826 and Barton Springs to varying degrees depending on hydrologic conditions and recommend a flow loss study in the discharge route.

The HTGCD initially opposed approval of a direct discharge permit by Dripping springs (Resolution No. 20160707); however it ultimately passed a resolution endorsing the Dripping Springs wastewater discharge permit in 2014, but encouraged them to add beneficial reuse as much as possible. The District participates in regional planning activities that may peripherally include wastewater management including the Hays County Regional Water Supply and Wastewater Facilities Plan. In their Groundwater Management Plan (GMP), HTGCD goals including "maintaining base flow contribution to streams….at a rate of stream/spring base flow that maintains a sound ecological environment". One of their guiding principles is to "Maintain and prevent degradation of water quality in surface water and groundwater". Still, neither their enabling legislation nor rules give an indication that wastewater management is one of their principal roles or responsibilities in aquifer protection. One reason for this may be the difficulty in managing the quantity resources of Groundwater Management Area (GMA) 9 to which the District belongs. The complication in allocating the Managed Available Groundwater (MAG) under Desired Future Conditions (DFCs) in accordance with the requirements of the Texas Water Development Board (TWDB) rules according to Texas Water Code 36 are daunting in this

area where the flow in Cypress Creek is primarily controlled by the baseflow in Jacob's Well which depends on allowed pumping levels (HTGCD 2016).

Blanco-Pedernales Groundwater Conservation District (BPGCD)

The Blanco-Pedernales Groundwater Conservation District was created by TNRCC (TCEQ) in 2000. The district regulates pumping in all 6 aquifers in Blanco County. It has jurisdiction over the small portion of the BSEACZ in the Onion Creek watershed in Blanco County. Since dye studies in this area have shown a hydrologic connection to the Barton Springs aquifer during drought conditions (BSEACD 2013), the regulation of this small area was reviewed. In their rules, they do have "water quality" degradation within the definition of "adverse groundwater conditions" "which may harm or threaten to harm the health, safety and welfare of well owners and aquifer user ". These conditions are used in Rule 5.2 to designate a Critical Groundwater Depletion Area (CGDA) which could be subject to more stringent measures of permit approvals, pumping limits, monitoring, and record-keeping. Water quality degradation can be used in determining whether a well operating permit should be granted under Rule 3.4. "Hazardous Groundwater Conditions" (HGC) are defined as quality condition in Rule 5.3.A. that "may be detrimental to the health, safety, and welfare of the residents or livestock of Blanco County". Presence of these conditions is used to issue an "Aquifer Emergency Warning" that includes agency and user notifications and recommendations for protection. Contamination from wastewater into wells is included in the general conditions that may be defined as HGC.

The BPGCD also has general prohibitions on waste and pollution in Rule 6.1.A and specific prohibitions against groundwater pollution in Rule 6.1.D. This later prohibition states that "No person shall pollute or harmfully alter the character of the groundwater in Blanco County by causing or allowing the introduction of undesirable water, pollutants, or other deleterious matter from another stratum, from the surface of the ground, or from the operation of a well." In practical terms, this should apply to any groundwater pollution caused by releases of wastewater to recharging surface waters or land application. In Rule 6.1.E, the District can identify a responsible party in an emergency order and initiate civil enforcement actions against them in court according to Rule 9.1 that cites the Texas Water Code 36.102 fine of $10,000 per day per violation to prompt compliance.

Despite these references to water quality in the BPGCD rules, no mention is made about wastewater management. However, any adverse impact to the aquifers under BPGCD jurisdictions from wastewater collection treatment or disposal could presumably be handled from the more general water quality rules above. Still, on the subject of land use and wastewater management planning, the rules are relatively silent. The BPGCD management plan states that their policy is to limit pumping to current levels and deny any applications for new non-exempt wells; therefore, development controls would primarily be based on utility provisions from surface water in the Region K Water Plan. At the micromanagement levels, the only rules resembling landuse controls would be distances set between new wells existing wells and setback provisions from property lines based on the pumping rate of new wells in section 4.2.A. These result in some vague density maximums if used for residential subdivision development without explicit impervious cover limits (Table 13).

Table 13. Setbacks from wells causing indirect density limits in BPGCD rules.

Any subdivision of existing tracts of land shall be done in such a fashion that new property lines shall be located no closer than the spacing requirements of this Rule from any existing or proposed well

Projected Pumping Capability of Proposed Well in Gallons per Minute	Spacing Required Between Existing Wells and the Proposed Well	Distance of Proposed Well from Property Lines
Up to 17.36	100 feet	50 feet
17.36 - 200 GPM	300 feet	150 feet
201 - 400 GPM	750 feet	375 feet
401 – 800 GPM	1200 feet	600 feet
>800 GPM	1500 feet	750 feet

Southwestern Travis County GCD

The 85th Texas Legislature created a new GCD for the Trinity aquifer resources in western Travis County via limited power granted through HB-4345. The Southwestern Travis County Groundwater Conservation District encompasses all of the county south of the Colorado River and west of the Barton Springs/Edwards Aquifer Conservation District's border, which runs southwest from the Colorado River along Westlake Drive and Camp Craft Road in West Lake Hills. The district covers roughly 200 square miles, making it smaller than many in the state. The long road to the District's creation starting with a report in 1990 by the Texas Water Commission noting the rapid growth in the area, the anticipated depletion of the aquifer, and citing the need for a PGMA to conserve this resource. Although a GCD was not formed at that time, aquifer depletion in 2001 saw the approval of SB 2 which mandated that threatened counties not part of a GCD must form one immediately. Still no District was formed and despite further attempts in 2007 and 2009 at the Texas Legislature, a western Travis county GCD was not formed. In 2010, TCEQ recommended to Commissioners to form a multi-county Hill Country GCD by agency rule (Byrd et al. 2010). This too was not successful as well as several subsequent legislative attempts until in 2017 HB 4345 was approved. The law contains restrictions on the District as a regulator but recognizes that the resource will be depleted shortly without some controls and depletion will begin to impact wells, springs and the regional economy. Despite authorization, the District is currently hampered by lack of a funding source for operations in the enabling legislation. The interim board was forced to cancel elections this year due to lack of funding and is currently limping along until some legal questions are answered by the AG office. Once the confirmation hearing is held, funding can be obtained through well registration fees, commercial well production fees, and other user fees (Cicale 2018). In the recent 86th Texas legislature, Senate Bill 669 was passed to change the next possible confirmation election date to November 2019 with a second chance of November 2020 instead of May 2020 stipulated in the creating legislation. Having the election during a general election period will saves money. If the creation of the district is confirmed by the voters, and a board is elected, the more routine GCD

functions can begin. Given the location of their 200 square mile jurisdiction, the new District could have a beneficial role in protection of groundwater resources of the Trinity aquifer from wastewater impacts if funded appropriately (Figure 3).

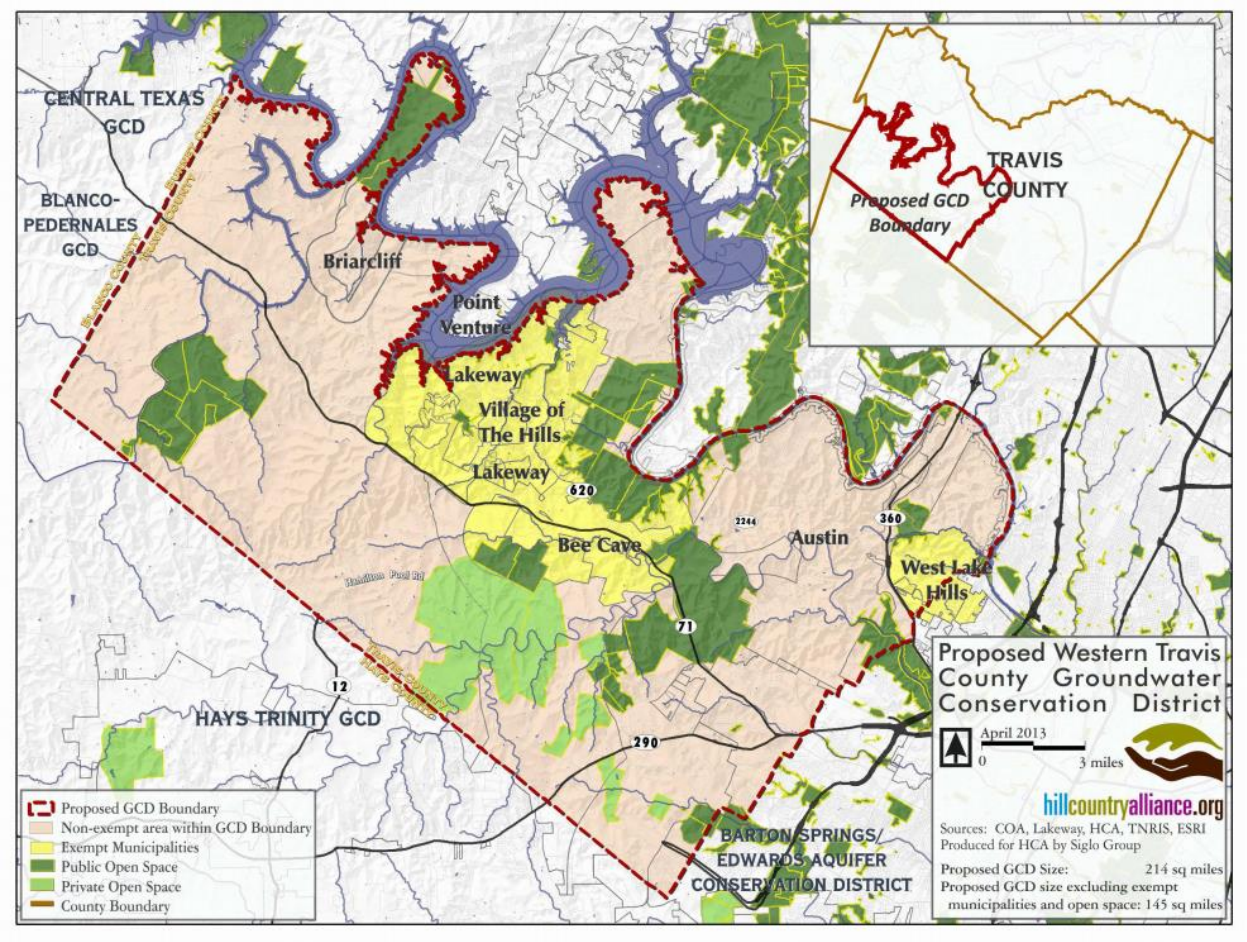


Figure 3 Boundaries of Western Travis County Groundwater Conservation District

Regional Planning

Not all of the governmental influences on wastewater management in the BSZ are contained in regulations. A number of mandatory and voluntary plans have been developed. Some were required by regulations also governing funding from state agencies, and some were through settlement agreements over major developments in the BSZ and their potential impact to water quality in the zone.

TWDB Regional Water Management Plans

The current (2016) Water Plan for the Lower Colorado Basin (Region K) includes some mention of wastewater management but does not provide the authority to dictate conditions specifically for the BSZ. Primarily addressing water supply throughout the basin, the main influence this plan could have on the BSZ is the use of TWDB brokered funds for water and wastewater treatment and distribution/collection system infrastructure. Voluntary programs such as the State Revolving Loan Fund may be used by municipalities in the BSZ to provide service to areas

coming off failing OSSFs, or regionalizing treatment for future development. In those cases, consistency with overall Region K plan recommendations would be a favorable factor in deciding on loan applications. Consistency could also include consideration of the TCEQ 303(d) list impairments, and 305(b) concerns listing in their Integrated Water Quality report. The 2016 plan lists Barton Creek, Barton Springs, Tributaries to Barton Creek, and Slaughter Creek under this category. The Region K plan also specifically mentions the Water and Wastewater Facilities Plan for the portion of Hays County, Texas West of the I-35 Corridor as a local plan that influenced the Region K recommendations. Although the Region K plan may address mainly supply-side portions of local plans, wastewater is by necessity a factor in integrated water planning.

LCRA Water Line Environmental Study Settlement

Another planning and regulatory document with implications for wastewater management in the BSZ was developed as part of the LCRA NW Hays County waterline Environmental Study conducted by Bio-West, Inc. for LCRA and approved by USFWS in 2002. Figure 4 shows the proposed water lines and service areas. This document set out conditions whereby the waterline and service from it could be obtained without an individual incidental take permit (for the Barton Springs Salamander). References to wastewater management were not significant, and the focus was primarily on water service and growth (Biowest 2002). A Watershed Stormwater Management and Mitigation Strategy was produced with requirements for stream buffers, low-impact development, impervious cover, stormwater treatment, erosion and sedimentation construction controls, maintenance plans, and environmental education. This document was proposed to be updated by USFWS with more detail on wastewater management and added to the Recovery Plan for the Barton Springs Salamander (Lechner, 2002). The update included more focus on wastewater management including onsite systems including the following conclusions:

> Water quality impacts from onsite wastewater disposal systems can be controlled or minimized for the Edwards Aquifer through the implementation of state-of-the-art designs, installations, and management systems. A wide range of chemical contaminants, including nutrients, pesticides, polyaromatic hydrocarbons, and suspended solids are a concern. Disposal and treatment systems should be specifically designed to reduce total nitrogen concentrations to near background levels prior to the effluent reaching ground and surface waters. Water quality monitoring of un-impacted shallow springs in the area indicate that background concentrations of total nitrogen would be less than 1.0 mg/L (City of Austin, 2002). Comparable previous levels used as standards below the root zone that will not prompt degradation at Barton Springs are 2.0 mg/L Nitrate-Nitrogen (Santos and Associates, 1995) and 5.3 mg/L TN (Barrett 1996).

The recommendation to treat wastewater to near background levels of contaminants at the root zone using OSSF technologies available at the time was the result although no final standard was proposed. Given that in the ESA, Recovery Plans have little regulatory consequence, this was not much of a loss. Rather than use any additional conditions, TCEQ and USFWS came to an agreement that if a facility met Optional and Enhanced Measures for Construction over the Barton Springs Edwards Aquifer (TCEQ 2004), the settlement agreement terms for the waterline

did not need to be updated. Guidance for implementation of these optional enhanced measures is found in RG-348a for Travis and Hays Counties. The RG-348a and RG-348b guidance measures were originally developed as part of an MOU between the State of Texas and USEPA and USFWS concerning the Construction General Permit coverage in the areas covered by 30 TAC 213 or the Edwards Aquifer Rules. Unfortunately, this meant that wastewater management in the BSZ did not receive any further attention in TCEQ rules than the original Edwards rules had given it. The system and service area covered by this waterline is shown in Figure 4.

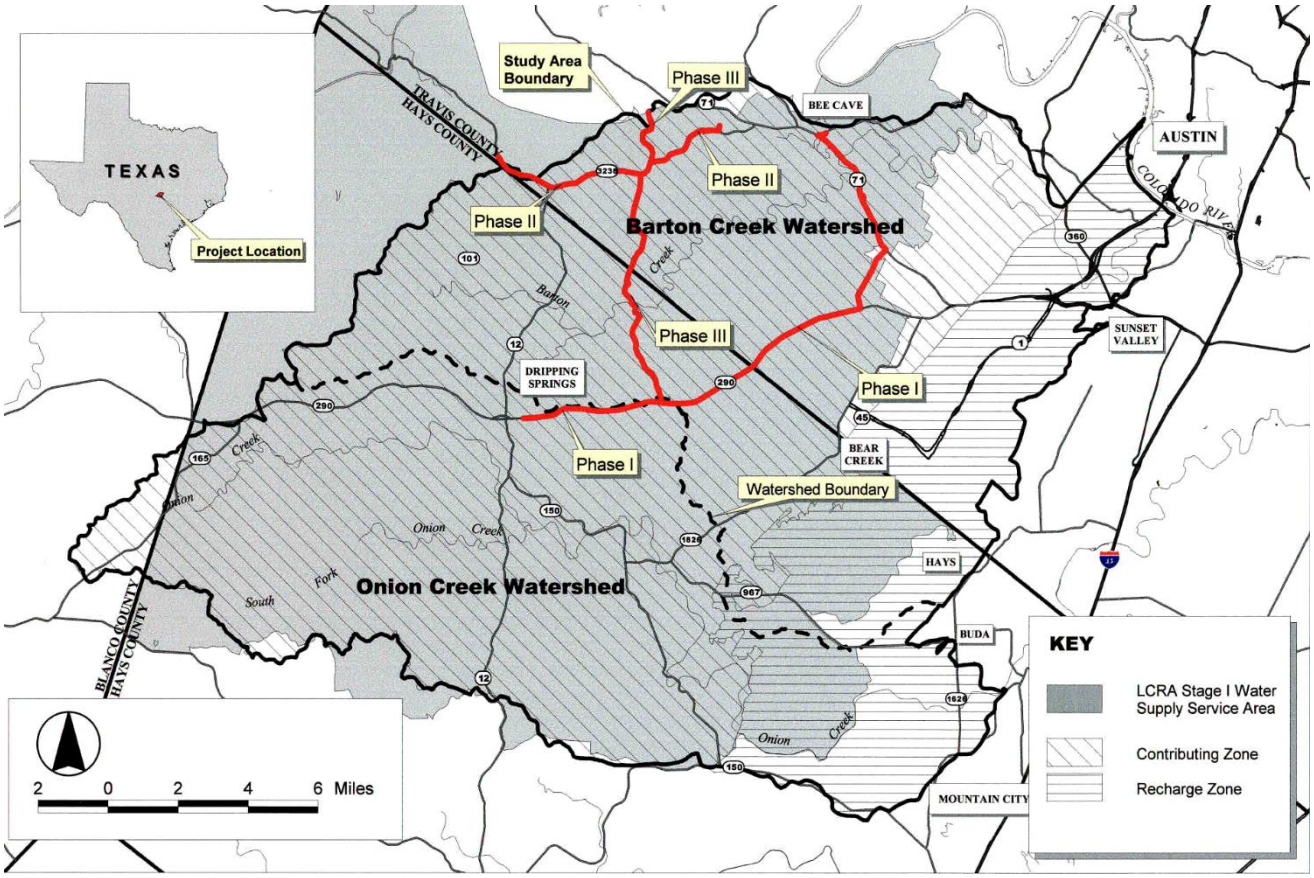


Figure 4 Map of LCRA NW Hays County Waterline Environmental Study

BSZRWQPP

The Barton Springs Zone Regional Water Quality Protection Plan stakeholder process addressed wastewater management practices at the beginning through its goals and workplan, and the final document devoted a section of general recommendations. It identified domestic wastewater collection, treatment and discharge as a major threat to the BSEA from biological constituents and nutrients through unintended discharges, inadequate treatment, or improper design and application of treated wastewater effluent. At the time, this issue was too complicated and controversial to address in the scope of the RWQPP along with more important development issues. Much of the information on the projected impacts of wastewater management in the BSZ has been developed since the 2005 RWQPP. Many of the water quality monitoring and

modeling studies done by federal, university, and local scientists were not available for inclusion in the plan. However, important general recommendations included the following:

- Increased inspection frequency of centralized wastewater collection systems through complete television monitoring or other means.
- Providing secondary treatment of wastewater at OSSFs and elsewhere.
- Limitations on the characteristics of the receiving site for wastewater effluent land application
- Controlling the hydraulic loading rate of wastewater effluent land application including a 1.5 safety factor for measured infiltration rate
- Additional design and inspection requirements for OSSFs
- Requiring an operations, maintenance and funding plan (Naismith 2005)

Water/Wastewater Service Agreements

Service Agreements, Planned Unit Development, Municipal Utility Districts, Development Agreements, ETJ Release Agreements, Settlement Agreements for protested wastewater permits, multi-jurisdictional actions, and annexations can all provide vehicles for gaining superior wastewater management in the BSZ and elsewhere. Potential improvements to the status quo could be negotiated in upgraded collection system design and inspections, OSSF system selection for nutrient removal or local conditions, increased setbacks to recharge features or springs, increased buffers of reclaimed water irrigation from watercourses or rock outcrops, or specific effluent limits or treatment technology in wastewater plants. Agreements that have commonly been made with the City of Austin as a party are for compliance of another jurisdiction with City land development code, special permit conditions in the case of TCEQ permits, and negotiated improvements to wastewater management and monitoring wherever scientifically warranted.

One example of a long-standing utility agreement is a Consensus Document on service for wastewater and water in a portion of the Barton Springs Zone as developed by a multi-jurisdiction task force. In 1997, this effort created guidelines for restricting water and wastewater service by geographic area in the Barton Springs Zone to implement a City of Austin policy to neither help nor hinder continued growth in this area. Participants included LCRA, City of Westlake, City of Rollingwood, the Austin Water Utility, and various citizen groups. The resulting policy document limited City of Austin retail service from extending west of Loop 360. Specific infrastructure retrofits were also identified in the document to safeguard surface and groundwater, and several projects like the Barton Creek lift station replacement have been implemented as a result. The Austin Water Utility continues to follow these guidelines when evaluating service extension requests and other projects in the area. When Service Extension Requests are reviewed by the Watershed Protection Department for making recommendations to the Environmental Commission, the original logic behind the Consensus Document is sometimes

re-evaluated as applied to individual cases, but in terms of environmental protection, the intent was sound.

Part II - Current WW Practices in BSZ

There are currently multiple methods of wastewater collection, treatment and disposal occurring in the BSZ governed by several overlapping regulatory jurisdictions. Collection exists as either onsite or centralized systems. Very few decentralized cluster collection systems exist, and these are mostly small groups of commercial facilities or short distance mobile home collection lines (Venhuizen 2014, Pope 2013, personal communication). Disposal consists of direct discharge, centralized spray and subsurface land application, onsite drainfields, and beneficial reuse through secondary distributed land irrigation. Greywater systems are also sporadically used; however, these are primarily unpermitted homeowner laundry to landscape systems for residential irrigation (Ott 2012).

The bulk of inventory information about wastewater practices in BSZ comes from two reports (Herrington 2011 and Ross 2011). The inventory data for number and distribution of current practices discussed below comes primarily from these two reports. In addition, valuable data concerning on-site systems in the study area was provided by the Austin Water Utility.

Direct Discharge

Over the state, there are more direct discharge systems than any other form of wastewater disposal (TCEQ 2009). Approximately 2,199 domestic TPDES discharge permits are active, as compared to 471 domestic TLAPs (TCEQ 2009). Economically, discharge to surface water is the most attractive method of management. The land required to be purchased or leased for irrigation disposal is a major expense. In contrast, the treatment cost for direct discharge may be higher due to the stringent effluent limits and advanced technology. A detailed comparison based on objective construction and operating data would be necessary to quantify the cost differential between discharge and land application; however preliminary estimates can be made with existing data. For Dripping Springs, Callegari (CMA 2013) estimated direct discharge expansion alternatives to cost $13.27/ GPD whereas a land application alternative cost $20-25 per GPD gallons. In another recent study, direct discharge for upgrades to Wimberley's WWTP was found to cost $10.27/ GPD whereas land application was noted to cost $15.09/GPD. This was estimated for an increased flow of 75,000 gpd (APAI 2014)

Hays County Water Control and Improvement District (HCWCID1)

One direct discharge facility is currently constructed for the Hays County Water Control and Improvement District No. 1 serving the Belterra subdivision. In this development, a Membrane Bioreactor WWTP designed to one of the most stringent set of effluent limits in the state is followed by discharge to Bear Creek. Operational plans for the facility include discharge only when the capacity of the irrigation system is exceeded, or a sustaining flow is measured in the receiving water. This hybrid system also shows promise for future facilities in the CZ if effluent quality and discharge restrictions can be improved and the technology shown to be reliably operated. Unfortunately, additional modeling of the system since permit issuance indicates that a non-degradation standard will not be achieved (Turner 2009). So far, this facility has been able to operate without discharge by utilizing all of its effluent in land (Herrington 2014 Personal Communication). The final permitted average flow for this plant is 0.350 MGD discharge with capacity for 0.150 MGD of drip irrigation.

City of Dripping Springs

In addition to HCWCID No. 1, the Dripping Springs WWTP now has a permit for discharge into Onion Creek. Areas served by the proposed plant are located in both Barton Creek and Onion Creek watersheds which have previously been identified as environmentally sensitive watersheds. Projections of growth may be overestimated, and projections of existing capacity may be underestimated. In addition, effluent quality including nutrient levels suitable for discharge into Onion creek will be difficult to meet consistently regardless of advanced technology (GEI 2014). Indications of necessary treatment levels have been analyzed through water quality data collection and modeling of future scenarios (Richter 2016, Porras 2016). A feasibility study concerning direct potable reuse opportunities for Dripping Springs that would obviate the need for some amount of discharge has been completed, but no commitments have been made to pursue a direct potable reuse project (CEI 2015). The final permitted flow for this plant was reduced from the initial 0.995MGD to a negotiated 0.8225MGD with capacity for 0.1625MGD of drip irrigation at the location.

Although direct discharge of wastewater effluent into a receiving stream/river is the most attractive solution to effluent disposal economically; it can be the most harmful to the environment as the effluent flows directly into the surface waters of the stream without removal of pollutants in the soil column (Herrington 2011). A number of studies have contributed to the understanding of wastewater impacts on the surface streams and aquifer in the BSZ (Mahler et al. 2011a, 2011b, Mabe 2007, Herrington 2011, Turner 2010, Ross 2011).

Discharging outside the BSZ

City of Kyle

The City of Kyle's service area utilizes the plant under TCEQ permit No. 11041-002 operated by AquaTexas which discharges at a final permitted rate of 4.5MGD with limits of 10/15/3 which are recommended to be reduced to 5/5/2/1 to Plum Creek due to a Watershed Protection Plan (WPP) completed for bacteria impairment and nutrient concerns under the TCEQ TMDL program (Dictson 2012). It is unknown what portion of the Kyle collection system service area is within the BSZ or the population that may generate wastewater in this area where treatment capacity is provided outside.

The City of Mountain City also has a contract with Kyle for the Anthem development in their ETJ which also added to the Kyle contract with Aqua Texas. This was another case of development on BSRZ made possible by increased discharge to another watershed stream, in this case Plum Creek. It would be part of the wastewater generated on the BSZ, and any pollutant loading resulting from the collection system would occur to the BSZ, but the treatment and disposal would occur elsewhere.

City of Buda

In this case, a portion of the City of Buda in the BSZ is in the service area of a treatment plant under TCEQ permit 11060-001 owned by the GBRA. The permit is for a discharge of 1.5 MGD

at permit limits of 5/5/2/.8TP to Plum Creek also under the Watershed Protection Plan completed for bacteria and nutrient impairment (Dictson 2012). The plant has recently undergone a re-rating study and there are plans to upgrade the capacity to 3.5 MGD. Buda has also completed a study of Direct Potable Reuse and is the only entity in the Region K planning area with tentative plans for pursuing a DPR Water Treatment Plant (LCRWPG 2015). It is unknown how much of the Buda service area is within the BSZ or the population or wastewater generation rates from this area.

Land Application Facilities

From examination of regulatory records, there were 27 permitted land application facilities in the BSZ in 2011 (Herrington 2011). This was reviewed in 2018 and although two new permits were issued, two other permits were cancelled, so there are still 27 permits. Several are listed under the same facility number but separate outfalls. One permit is categorized as an industrial evaporation facility. They range in final phase flowrate from 3,700 gpd to 1.325 MGD (TCEQ, 2/6/2018). The location of these permits is show in Figure 5. Of these, there are seven (7) that were listed as operationally inactive in 2018. The required effluent quality set in the issued permits vary widely as indicated in Table 14. Of the TLAPs identified, 17 are secondary treatment activated sludge treatment plants. Several of the systems include single stage nitrification modification of activated sludge to reduce ammonia nitrogen and effluent filters to further reduce particulate BOD and TSS. As mentioned previously, more advanced treatment has been negotiated on some permits requiring biological nutrient removal (BNR), membrane bioreactors (MBR), or chemical precipitation for phosphorous removal. These treatment processes are also indicated by permit on Table 14. Two of the permits (HCWCID No. 1 and the City of Dripping Springs South Regional Plant) also have separate TPDES discharge outfalls as well as irrigation disposal fields. These discharge outfall locations are shown in red on Figure 5. One of the systems (Stonebridge Health Center) is a conventional septic tank/drainfield system with a recirculating filter system at a design flow above 5,000 gpd, thus requiring a TCEQ permit. One additional system (The Park at Barton Creek) is a proprietary Cycle-let system. The Cycle-let system was an early pressurized hollow tube membrane package system including pretreatment, biological oxidation, membrane ultra-filtration, granular activated carbon and UV disinfection (Hotchkles undated, Judd 2011). Operation and maintenance problems have been noted at this facility which might be related to the age of the system or attention required to successfully make use of the technology on a relatively small scale. Austin Water Utility had evaluated the system for possible service extension of centralized sewer and closure of the plant (Ross 2011), but the permit remains active (TCEQ 2018).

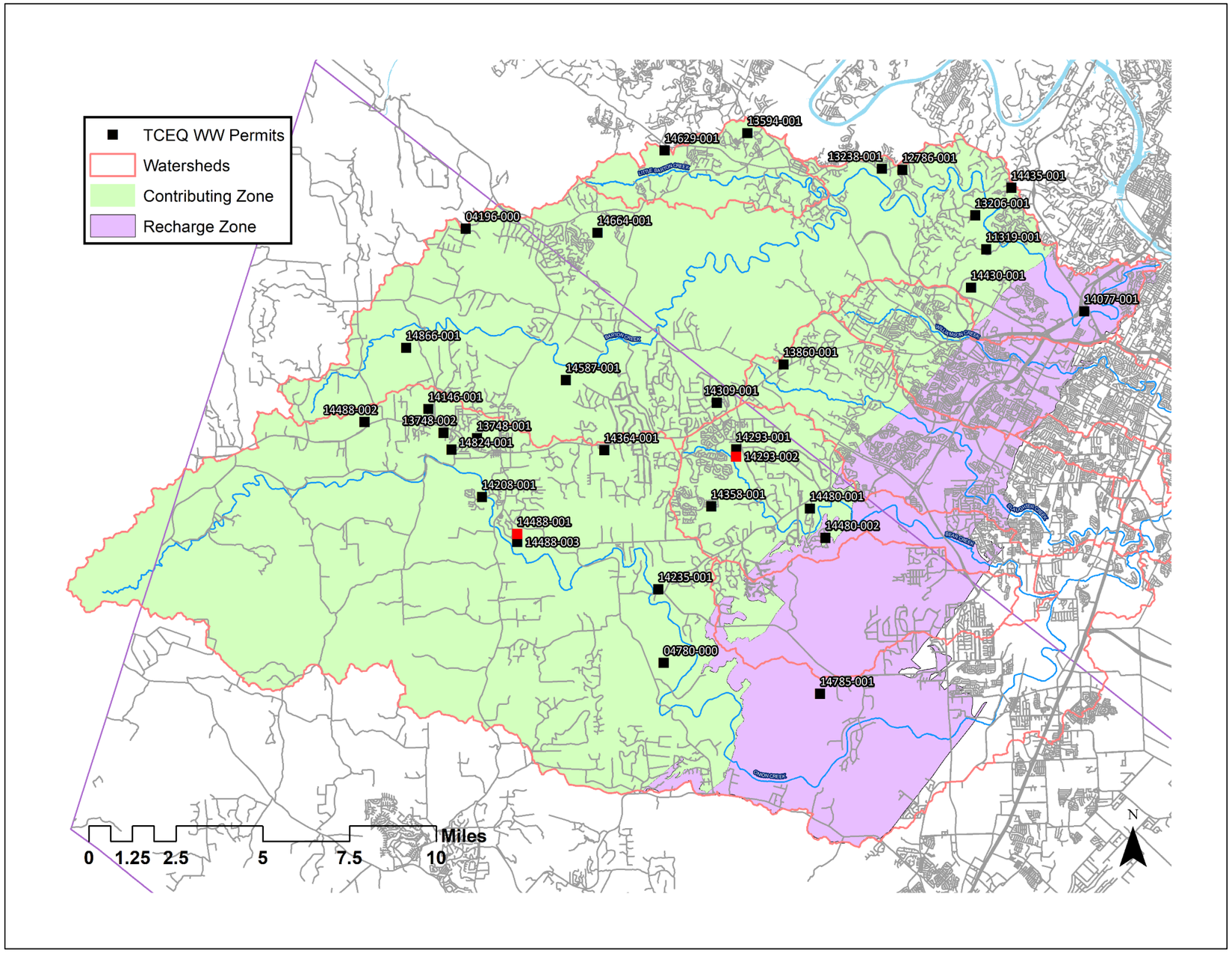


Figure 5 Land Application Facilities in the Barton Springs Recharge and Contributing Zones

Herrington and others examined wastewater disposal by Texas Land Application Permit (TLAP) and by individual on-site sewage facility (OSSF) from 2000 to 2010 along with historical population, impervious cover, companion animal estimates, and cumulative length of wastewater mains in the BSZ (Herrington et al. 2011). Ross (2011) also identified all of the land application facilities in both the Southern and Barton Springs segments of the Edwards Aquifer and their contributing zones. These two reports provided a clear picture of the wastewater management practices in the BSZ at the time.

Some TLAP facilities may take multiple OSSFs offline if an organized sewage collection system is constructed. As of 2010, 5.69 million gallons per day of wastewater irrigation volume was permitted for disposal by TLAP facilities on the BSZ. This reflects total final phase flowrates. Total flows at Interim I levels (where applied) were permitted up to 1.97 MGD and at Interim II levels to 3.72 MGD. It is unknown how many onsite systems will ultimately be diverted to these centralized treatment and land application systems. However, some documentation was available from the case of Dripping Springs. The City of Dripping Springs TLAP came online on November 13, 2008 and had taken approximately 300 OSSF off line in two years of service (Susan Zachos, personal communication, 8 October 2010). It is usually the case that when this conversion from onsite to centralized treatment is made, the onsite systems are failing at the time and the goal is an improvement in groundwater or surface water quality. Ideally, the reduction in OSSFs from conversion could be seen in the GIS analysis; however, the different geolocating methods between the Herrington et al. 2011 report and the update in 2018 complicated any 1:1 point overlays and any reduction in OSSFs shown would likely have been within the error of address matching.

Since 2010, population growth has resulted in plans for plant expansions in several permits and a few new facilities. The total amount of irrigation disposal capacity in final permits has increased to 6.23 MGD plus the TPDES permits brings the total final centralized disposal capacity to 7.42 MGD for the BSZ. By digging deeper into the technical basis for these flowrates in permit applications and preliminary engineering reports/facility plans, it may be possible to get a per capita or per LUE value and projections used for each permit in the BSZ. Combining this with LUE, capacity, and population from OSSF data might provide another population estimate for the BSZ to reconcile with census data. Given that anticipating growth with built capacity is a priority for planning wastewater service, this might also allow planning for appropriate treatment levels or disposal methods in advance depending on watershed location rather than hammering them out ad hoc in contested case hearings.

One unfortunate aspect of TLAP and SADDS permit programs in the BSZ is the absence of any long-term monitoring of environmental impact. TCEQ regulations do not require stream, river, well, spring, or seep water monitoring downstream from irrigation areas in TLAP and SADDS permits, even in sensitive areas. However, 30 TAC §309.20 (b)(4) does require pre-operational and annual soil testing of pH, total nitrogen, potassium, phosphorus, and conductivity. This requirement is included as part of each TLAP in its Special Provisions “The permittee shall

submit the results of the soil sample analyses to the TCEQ Regional Office and Water Quality Compliance Monitoring Team of the Enforcement Division during September of each year." (Ross 2011). Even though no triggers for remedial action or permit limits are specified, some record is supposed to be made in the hopes that TCEQ staff may notice buildup of nutrients in the soil over time upon receipt and review. However, a search of TCEQ records in 2011 reported soil monitoring results for only two of the 64 TLAPs in the entire Barton Springs Segment and Southern Edwards Aquifer study area. Even for these limited reported data, only 2 out of the 18 samples collected include the required nitrogen measurements. (Ross 2011).

The main question would be whether a buildup of nutrients were occurring in the soils on TLAP sites and if it would eventually leach into groundwater in a mobile form such as nitrate-nitrogen and contribute to the rising nitrate levels in Barton Springs. The next natural question would be how much of the aquifer nitrogen balance would this represent, and would its contribution be ecologically relevant to the aquatic life in the streams or springs in the BSZ. Regardless, without any enforcement of the soil monitoring required under the Special Provisions of the TLAP permits, or compilation of these data for analysis, we will never know the answers to these questions. This gap may be due to manpower needs at the Region 11 office of TCEQ for inspections. The TCEQ WQ Land Application Checklist Worksheet Items 13-16 cover questions about whether a facility has collected the required annual soil samples at the required depth intervals, analyzed them for the correct parameters, and submitted them to the Regional Office annually in accordance with their TLAP permit, but it is unclear how often a permitted facility is routinely inspected or whether these checklists are even used routinely by staff during a complaint investigation.
https://www.tceq.texas.gov/compliance/investigation/checklists/waterchecklists

Centralized Spray Irrigation

There are nearly twice as many subsurface drip TLAP facilities in the BSZ as surface irrigation facilities, although on a final permit phase volume basis there is approximately 3.5 times more wastewater applied thru surface irrigation than subsurface drip. The minority of land application facilities in the BSZ are for spray irrigation of effluent on turf grass or native vegetation. As of 2018, nine of the 27 land application facilities in the BSZ are centralized spray irrigation systems. One system is using turf grass, four are using native vegetation, and four are using golf courses for irrigation areas (Table 14). Total disposal by surface spray irrigation is 3.94 MGD in the BSZ. Treatment for these facilities includes six activated sludge, one single stage nitrification, and one membrane bioreactor system. Eight are in the Barton Creek watershed and one is in the Onion Creek watershed.

Table 14 TCEQ Permits in the BSZ

TCEQ Permit #	Permittee Name	Facility	30TAC210 Provider	Watershed	Irrigation Type	Vegetative Cover Crop	Final Flow (gal/d)	Irrig. Area (acres)	App. Rate (gal/ft2/day)	Storage (Days)	Treatment Process (final phase)	Permitted Effluent Quality (mg/L)	Issued	Expires
04196-000	Monarch Utilities LP	River Oaks Ranch Estates		BAR	Evaporation	NA	15,800	5.3	0.068	200.44	Evaporation/Pond	pH 6-9	2015	2024
11319-001	City of Austin	Lost Creek MUD WWTP		BAR	Surface & Evap.	Golf Course Turfgrass	520,000	186.42	0.056	43.36	Contact stabilization and complete mix AS	BOD=10, TSS=15	2010	2019
12786-001	Barton Creek West WSC	Bartron Creek West WWTP		BAR	Surface	Native Grass/Cedar	126,000	53.3	0.055	162.15	Contact stabilization AS	BOD=10, TSS=15	2015	2019
13206-001	Travis Co MUD No. 4	Barton Creek WWTP		BAR	Surface	Golf Course Turfgrass	720,000	298.7	0.055	75.13	Extended aeration and Biological nutrient removal (BNR) AS	BOD=5, TSS=5, NH3=2	2014	2024
13238-001	Senna Hills LTD	Senna Hills MUD WWTP		BAR	Surface	Turfgrass	157,000	70.3	0.051	112.08	Membrane bioreactor (MBR)	BOD=5, TSS=5, NH3=2, FC=200	2017	2024
13594-001	West Travis Co. PUA	Lake Point WWTP	Y	LBA	Surface	Golf Course /Native Grasses	1,325,000	350	0.07	32.59	Single stage nitrifiction AS	BOD=5, TSS=5, NH3=2	2017	2019
13748-002	Dripping Springs ISD	Dripping Springs High School WWTP		ONI	Subsurface drip	Turfgrass	25,000	3.83	0.15	0	Complete mix Activated sludge (AS)	BOD=65 (grab)	2014	2019
13860-001	Granit Stonebridge Health Center LLC	Stonebridge Health Center WWTP		SLA	Subsurface drip	Turfgrass	10,000	1.6	0.15	0	Septic tank recirculating filter	BOD=30, TSS=30	2015	2024
14077-001	Prentiss Properties Acquisition LP	The Park at Barton Creek WTF		BAR	Subsurface & surface	Turfgrass/Trees	3,700		0.06	70.45	Cycle-let MBR	BOD= 5, TSS=10	2015	2024
14146-001	Dripping Springs Apartments LP	Dripping Springs Apartments WWTP		ONI	Subsurface drip	Native Grasses/Trees	14,000	3.57	0.09	58.19	Extended aeration activated sludge	BOD=20, TSS=20	2019	2029
14235-001	Driftw ood Equities LTD	The Salt Lick WWTF	Y	ONI	Subsurface drip	Bermuda	10,000	2.3	0.1	2.53	Extended aeration activated sludge	BOD= 10, TSS= 15	2014	2024
14293-001	Hays Co WCID 1	Hays Co WCID 1 WWTF (Belterra)	Y	BER	Subsurface drip	Turfgrass/Trees	150,000	35	0.1	2.2	Extended aeration activated sludge	BOD=20, TSS=20	2016	2019
14293-002	Hays Co WCID 1	Hays Co WCID 1 WWTF (Belterra)	Y	BER	Discharge	NA	350,000	NA	NA	NA	Membrane Bioreactor	BOD =5,TSS=5, NH3=2, TP=.15, TN=6	2016	2019
14309-001	Hays Co MUD No. 4	Hays Co MUD No. 4 WWTF	Y	BAR	Subsurface drip	Bermuda	150,000	34.44	0.1	2.22	Single state nitrification AS	BOD=20, TSS=20	2014	2024
14358-001	Hays Co. MUD No. 5	Highpointe Subdivision WTF	Y	BER	Subsurface drip	Bermuda/Rye	300,000	68.87	0.1	2.22	Extended aeration activated sludge	BOD= 20, TSS= 20	2017	2019
14430-001	Travis Co MUD No. 4 WWTF	Travis Co MUD No. 4 WWTF	Y	BAR	Surface	Golf Course	600,000	220	0.06	76.03	Nitrification/Dentrification AS	BOD=5, TSS=5, NH3=2	2014	2019
14435-001	Stonew all Ridge Utilites LLC	Stonew all Ridge Subdivison WWTP		BAR	Subsurface drip	Native Grasses/Trees	5,000	1.15	0.1	3.0	Extended aeration activated sludge	BOD=20, TSS=20	2016	2026
14480-001	Driftw ood Utility Company LLC	Reunion Ranch A WWTP	Y	BER	Subsurface drip	Bermuda	50,000	11.5	0.1	3.98	Extended aeration AS w ith sequencing batch reactor	BOD=20, TSS=20	2019	2024
14480-002	Driftw ood Utility Company LLC	Reunion Ranch B WWTP	Y	BER	Subsurface drip	Bermuda	96,200	22.1	0.1	4.88	Extended aeration AS w ith sequencing batch reactor	BOD=20, TSS=20	2014	2019
14488-001	City of Dripping Springs	Dripping Springs South Regional WWTP	Y	ONI	Subsurface drip	Athletic Fields/ Pasture	162,500	37.43	0.1	2.05	Extended aeration activated sludge	BOD=20, TSS=20	2015	2019
14488-002	City of Dripping Springs	Dripping Springs Scenic Greens WWTF	Y	BAR	Subsurface drip	Bermuda	250,000	57.39	0.1	3.0	Extended aeration activated sludge	BOD=20, TSS=20, Ecoli=126	2013	2019
14488-003	City of Dripping Springs	Dripping Springs South Regional WWTP - Discharge	Y	BAR	Discharge	NA	822,500	NA	NA	NA	4-stage Bardenpho BNR w / methanol addn and alum TP precipitation	BOD =5,TSS=5, NH3=2, TP=.15, TN=6	2019	2022
14587-001	Austin Highw ay 290	Headw aters Water Reclamation Facility	Y	BAR	Subsurface & surface	Native Grasses/Trees	325,000	75	0.1	7.0	Complete mix AS w ith nitrification/denitrification TP precipitation	BOD=5, TSS=5, NH3=2, TP=1, FC=200	2017	2020
14629-001	Lazy Nine MUD	Lazy Nine MUD WWTP	Y	LBA	Surface	Native Grasses/Trees	490,000	199.5	0.056	60.05	Single state nitrification AS	BOD=10, TSS=15	2017	2019
14664-001	Travis Co. MUD No. 16	Rocky Creek Ranch WWTP	Y	BAR	Surface	Native Grasses/Trees	125,500	50	0.058	61.67	Single state nitrification AS w / anoxic selector	BOD=5, TSS=5, NH3=2	2014	2019
14824-001	Forestar	Arrow head Ranch WWTP		ONI	Subsurface drip	Bermuda	125,000	29	0.1	3.0	Single state nitrification AS	BOD=10, TSS=15	2017	2021
14866-001	Bella Vista Dripping Springs LP	Bella Vista WWTP		BAR	Subsurface drip	Bermuda	23,000	5.28	0.1	3.0	Extended aeration activated sludge	BOD=10, TSS=10	2014	2019
15201-001	JPHD Inc.	JPHD WWTP		BAR	Subsurface drip	Bermuda/Rye	450,000	104.79	0.1	3.56	Extended aeration activated sludge	BOD=10, TSS=15, Ecoli=126	2018	2019
15289-001	Rotter, Robert L	Nutty Brow n Development WWTP		ONI	Subsurface drip	Bermuda/Native Grasses	14,000	3.21	0.1	3.0	Complete mix Activated sludge (AS)	BOD=20, TSS=20, Ecoli=126	2015	2019

TLAP facilities are regulated primarily under two sections of Title 30 of the Texas Administrative Code (TAC). Chapter §309 Subchapter C contains the specifications for surface irrigation of effluent. TLAP facilities are designed to provide for effluent disposal without contamination of groundwater or surface waters. In design of a central spray irrigation system, water and nutrient balances for disposal areas (30TAC§309). These are used to establish wastewater application rates commensurate with the ability of vegetation to uptake and assimilate pollutants without impact to surface and groundwater. Storage requirements to avoid discharges of effluent under normal conditions are based on the water balance. For conservative design and an adequate safety factor, the applicant water balance is required for the wettest year of record. The wettest year of record does not, however, necessarily capture critical rainfall and evapotranspiration conditions. Weather conditions during 2007, a year with a lower rainfall total than 2004, are more restrictive in terms of both effluent irrigation area and storage volume.

Centralized Subsurface Disposal

Subsurface Texas Land Application Permits (TLAPs) require some level of treatment of wastewater followed by distributing the treated wastewater throughout an irrigation field most commonly through a drip emitter system. In 2006, TCEQ developed 30 TAC §222 rules containing specific design and operating provisions for subsurface drip irrigation of effluent in designated irrigation areas. A total of 16 treatment plants at a total volume of 1.83 MGD is disposed solely through subsurface irrigation in the BSZ as shown in Table 14. Treatment for these systems includes 11 extended aeration, 2 complete mix, and one single stage nitrification modification of the activated sludge plant. Another subsurface drip permit uses septic tanks/drainfield with recirculating filtration and one permit with partial subsurface drip irrigation uses the Cyclet membrane system. Surface cover in these systems is primarily bermuda or other turfgrass including one pasture/athletic playing field and another and three on native grasses. Due to the near absence of storage requirements in TCEQ regulations, SADDS have been considered to be more of a point source environmental threat to rivers, streams, wells, and springs than surface irrigation TLAPs despite their generally smaller size (Ross 2011). The large storage volume based on a water balance prepared in design of surface irrigation disposal provides a buffer against unauthorized discharge of wastewater in saturated soil conditions.

TCEQ Authorized Reclaimed Water Use

Authorizations for these practices are regulated under 30 TAC §210, and there were at least 285 domestic reuse authorizations active in Texas (TCEQ 2009a). These providers are supposed to provide TCEQ with up to date records on their reclaimed water users. Geolocating the users in the BSZ would be a relatively easy task if correct data is obtained from TCEQ. It is not currently available from the TCEQ online permits database. TLAP facility owners may also obtain reclaimed water use authorizations from TCEQ to irrigate wastewater onsite and in additional areas outside of the TLAP irrigation fields. Regardless of authorization for use of reclaimed wastewater, the facility must have either a TLAP or TPDES permit for the entire wastewater effluent flowrate from the plant. The wastewater must have somewhere to go that is regulated for discharge effluent quality and/or land application practices. Due to the extreme drought conditions experienced in Texas, it is anticipated that water conservation efforts will promote

more of these authorizations as population grows in the BSZ and reclaimed water becomes even more of a valuable commodity here (BSEACD 2013).

An updated retrieval from the online system at TCEQ indicated 438 domestic reuse providers in the state in 2018, with 13 in the BSZ. These facilities are identified on Table 14. A total flow of about 5.21 MGD would be available for reclaimed water users with all of these facilities in their final phases of operation and at capacity. Currently, data on the end user land application tracts has not been required through the 30TAC210 program, but with proposed changes to provide flexibility in TLAP permits under 30TAC309, these data should become more readily obtainable.

City of Austin Auxiliary Water Use and Reclaimed Water Distribution System

A study of auxiliary water uses in the City of Austin covered reclaimed water as well as graywater (CDM-S 2013). This summarized guidance and regulations provided in several identified national publications, used various stakeholder groups to develop issues facing those directly involved in auxiliary water supply development within Austin, and summarized state regulations specific to auxiliary water for treatment requirements dependent on the allowable uses and required product water quality. Subsequent work also reviewed current and proposed local amendments to the Uniform Plumbing Code (UPC) and identified impediments to expanding auxiliary water reuse. Best Practices for water reuse were recommended for adoption by the City including methods to remove impediments to expansion. Since reclaimed water makes up a significant portion of the auxiliary water available for reuse, the study gave significant attention to its development as a resource. Finally, public health risk analyses were reviewed and applied to the regulation, design criteria, and management or reclaimed and other auxiliary water reuse in Austin. Although not a quantitative analysis, the study provided specific recommendations that can be implemented to manage relative public health risks from reclaimed water, graywater, and other auxiliary water uses. The end result should be more streamlined reclaimed water program and expansion of the City system.

More than 50 miles of reclaimed water runs in specially colored purple pipes beneath Austin streets--and that number is continuing to grow. Reclaimed water is recycled from wastewater generated by homes and businesses and treated for virtually any use not requiring higher-quality drinking water. Such uses may include irrigation, cooling towers, industrial uses and toilet flushing. Reclaimed water is less expensive to use or treat and can be as little as one-third the price of drinking water.

The current City of Austin Reclaimed Water system can be seen in Figure 6. The furthest it is proposed to extend to the south is a 16” line to the Onion Creek Subdivision east of IH-35 with 10” existing distribution lines. The extension will be fed by a 24” line at IH-35 and William Cannon originating from the Central Service Area served by the 51st Reservoir and pump station. This 24” line will also feed the proposed South Service area which will extend a 16” line W across William Cannon then N back up Manchaca and a 12” line S. down 1st to Slaughter reducing to 8” down to FM 1626. Although it appears that these service lines come close to areas of the BSRZ, they do not cross the boundary. Service from the Austin Reclaimed Water system may be possible in some areas of the BSZ; therefore, precautions were evaluated through study of other reclaimed water areas operated by the City (Clamann et al. 2014, Porras, 2016).

This led to some policy standards at AWU for operations near creeks and water bodies for application of reclaimed water including no irrigation in the Critical Water Quality Zone which are more restrictive in the BSZ commiserate with the sensitivity of these watersheds (C. Herrington, e-mail message August, 2, 2016).

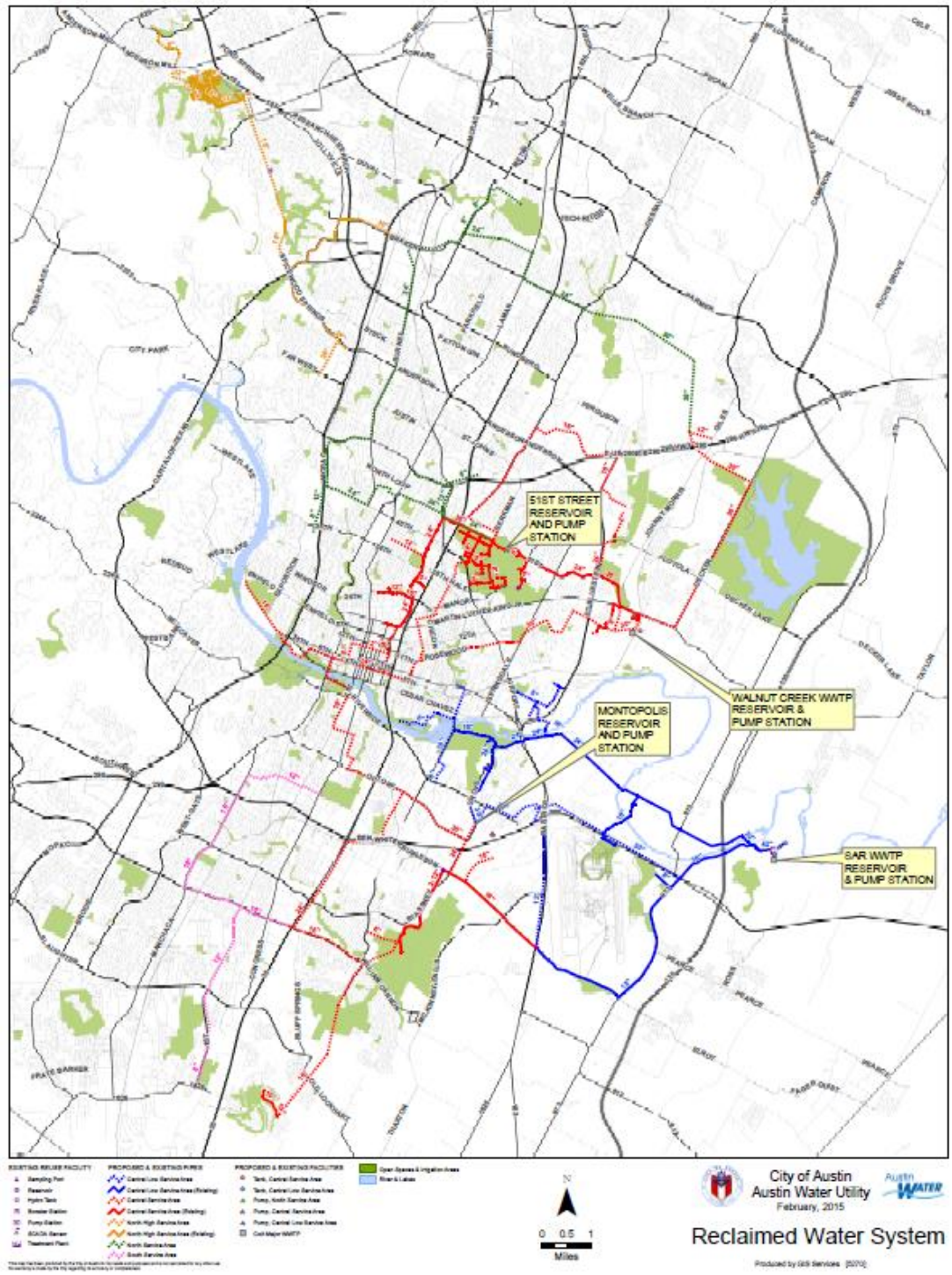


Figure 6. City of Austin Reclaimed Water System

Conventional and Advanced Onsite Sewage Facilities (OSSF)

An On-Site Sewage Facility (OSSF) can be considered a decentralized wastewater treatment option. When properly managed, an OSSF system can be a cost-effective wastewater treatment option for meeting water quality and public health goals (USEPA 2002). OSSF communities and developments do not connect to sewer pipe networks and all the treatment is done on site. Thus wastewater management by OSSF systems has been proposed to limit or eliminate the financial and environmental difficulties inherent in the construction and maintenance of sanitary sewer pipe networks which typically run through the channels of creeks (Venhuizen 2014).

The conventional OSSF is composed of two parts: a settling or septic tank and the drain or absorption field (USEPA 2002). In the settling tank, gravity and microbiological action separate and decompose human household wastes. The septic tank utilizes the same mechanisms of primary wastewater treatment whereby floating scum and settled suspended solids are separated from the liquid. Accumulated tank bottom sludge is occasionally pumped and removed by licensed contractors. A distribution box may contain a pumping apparatus but is generally responsible for dispensing the liquid into the perforated pipes which make up the leach- or absorption-field where final treatment by soil microbes and discharge of liquid effluent occurs. Typical pollutants treated by OSSF are biochemical oxygen demand, nitrogen, phosphorus and pathogenic microorganisms (USEPA 2002). Figure 7 shows the typical layout of homeowner OSSF for conventional system.

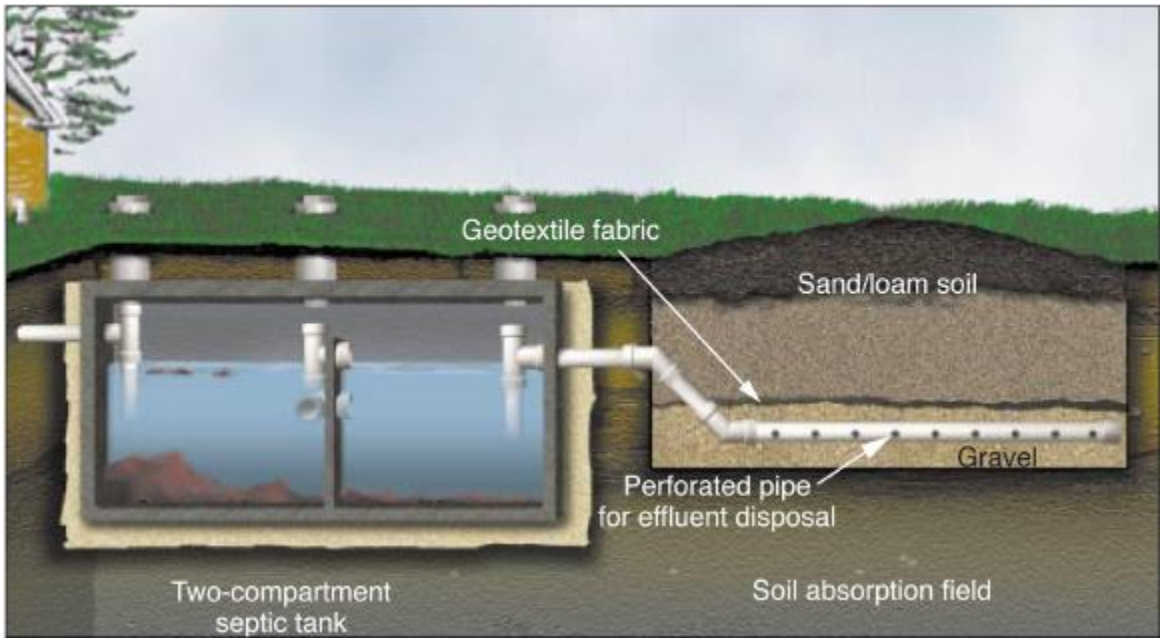


Figure 7. Conventional OSSF System

Due to their wide range of age and spatial distribution, it is always a challenge to locate and compile information on OSSF's in any area. This is especially true in the BSZ which crosses several jurisdictions involved in regulating OSSFs. Perhaps at some future assessment a combined database with locations of each system along with age, size, treatment type, disposal type and maintenance records of each system would be maintained.

By 2010, there were 9,470 OSSF permits reported in the Barton Springs Zone, with the highest density of 0.065 permits/acre observed in the Bear Creek watershed (Herrington 2011). With additional records from Dripping Springs and the other entities with delegation from TCEQ, this estimate was revised upward to 9,555. Of the systems in the City of Austin jurisdiction, it was found that almost 100 were aerobic units providing secondary levels of treatment without additional nutrient removal. An example of an aerobic unit configuration is shown in Figure 8. At least one of these systems is permitted with a holding tank sufficiently sized to allow pump and haul; therefore, no disposal is made to land onsite. The majority of the systems are conventional septic tanks. Disposal methods for the City of Austin permitted OSSFs in the BSCZ are primarily through conventional drainfields; however, a number of other methods including advanced treatment are used. (Katherine Jashinski, Austin Water Utility, personal communication 1/23/2014). A typical configuration for advanced nitrogen removal is shown in Figure 9.

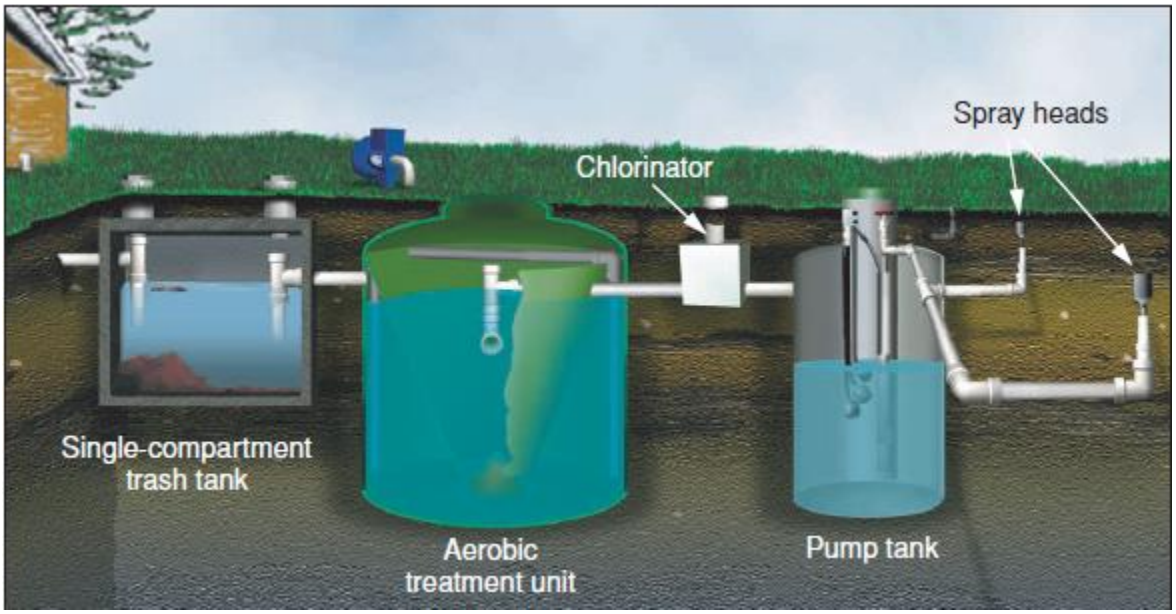


Figure 8. Typical Aerobic OSSF System

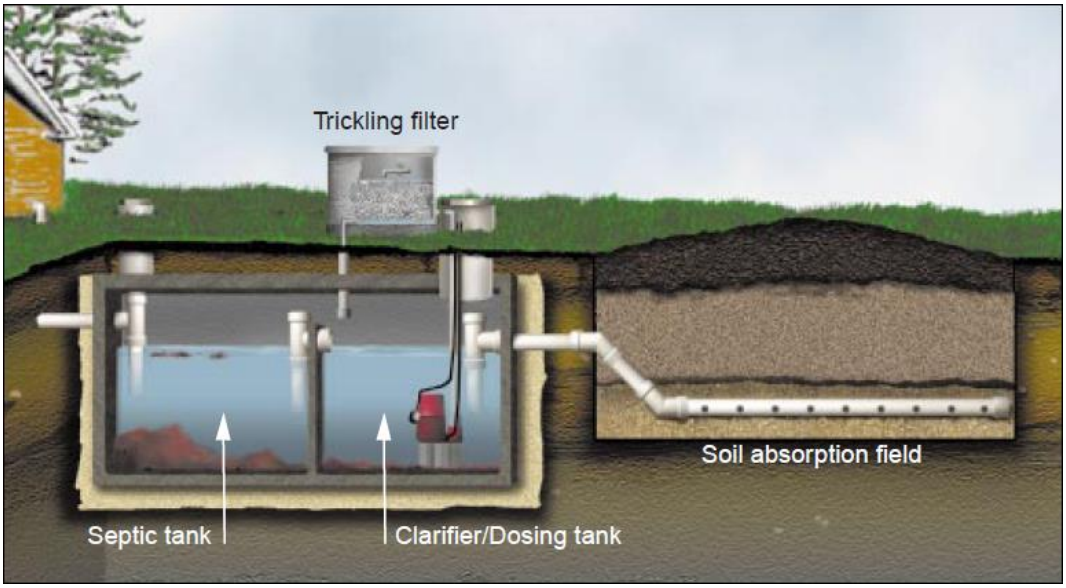


Figure 9. Example Nitrogen Reduction OSSF System

The City of Austin maintains an approved list of the nitrogen reduction systems that have been found to be acceptable for local use. These can be found in http://www.austintexas.gov/sites/default/files/files/Water/UDS/OSSF/Nitrogen_reduction_table_without_reports.pdf and the current systems are shown in Table 15. Instructions for obtaining approval of a proprietary system can be found at http://www.austintexas.gov/sites/default/files/files/Water/UDS/OSSF/Guidelines_for_obtaining_City_of_Austin_approval_for_Nitrogen_Reduction_Systems.pdf

Table 15 City of Austin Approved Nitrogen Reduction Systems

Manufacturer	Model No./Name	Rated Capacity (Gallons/Day)	Technology Description	Restrictions	Supporting Documentation
Aquapoint, Inc.	*Bioclere Model 16/12*	400	Fixed film trickling filter biological treatment system		EPA ETV Report
Bio-Microbics	*MicroFAST 0.5 System*	375	Submerged attached-growth biological treatment system	500- to 1,000-gallon compartment for the treatment media	EPA ETV Report
SeptiTech, Inc.	*STAAR 0.5 System*	440	Fixed film trickling filter biological treatment system		EPA ETV Report
Orenco Systems, Inc.	*AdvanTex Models AX20, AX20-RT, and AX25-RT*	500, 625	Media filter biological treatment system	Mode 3 or 50/50 Combo Mode configurations	VA Report 1 VA Report 2 PA Report 1
N/A	*Non-proprietary recirculating sand filter*	Varies by filter area	Media filter biological treatment system	3:1 recirculation ratio 3-5 gal/ft^2-day hydraulic application rate (HAR)	EPA Fact Sheet 1 EPA Fact Sheet 2 EPA Fact Sheet 3
N/A	*Non-proprietary vegetated recirculating gravel filter*	Varies by filter area	Fixed media, attached growth biological treatment system	8:1 recirculation ratio 1.9 gal/ft^2-day hydraulic application rate (HAR)	EPA ETV Report
N/A	*Non-proprietary recirculating gravel filter and vegetated woodchip bed*	Varies by filter area	Fixed media, attached growth biological treatment system	6:1 recirculation ratio 3 (RGF) & 48.5 (woodchip bed) gal/ft^2-day hydraulic application rate (HAR)	EPA ETV Report

OSSF records from the individual permitting authorities (i.e. the City of Austin, Travis County, Hays County and the Village of Bee Cave) were compiled in Herrington 2011. City of Austin permits issued by the Austin Water Utility were already spatially located. Hays County, Travis County and Village of Bee Cave OSSF had to be located by other means. The spatial areas of the cities of Westlake and Rollingwood are small, and groundwater from these jurisdictions most likely recharges Lady Bird Lake potentially through Cold Springs. The City of Dripping Springs, which assumed permitting authority within the corporate limits from Hays County in November 2006, did not maintain electronic records of permits and thus could not be examined in detail in 2010. There were only approximately 80 OSSF permits in 2010 that had been issued in Dripping Springs since the city assumed authority (Kyle DeHart, R.S., personal communication 7 October 2010). However, updated records were obtained in 2018 indicating that over 380 OSSF permits have been issued (DeHart 2018).

There were 6,862 OSSF permits in 2010 in all of Travis County with records beginning in 1977. The majority (59.5%) of OSSF permitted by Travis County are conventional anaerobic systems, although aerobic spray systems account for 39.2% of permitted facilities. From 2010 to 2018 another 4,460 OSSF were added (Haynie 2018). The breakdown of treatment types was not available for the OSSFs permitted after 2013 due to contracting the permit database to a new vendor system. There were 19,278 OSSF permits in all of Hays County in 2010. By 2018 there had been 3,686 systems added to the permit database (Berlad 2018). There were 237 permits in Bee Cave in 2010 and in 2018, this had expanded by another 48 systems (Polley 2018). Geo-locating these systems allowed compilation by watershed in the BSZ similar to the previous effort (Herrington 2011). Unfortunately, Google Maps utilities do not allow batch geolocating in the same routines and Google Earth methods were unable to duplicate the 2010 results. Therefore, geolocating using the ESRI ArcGIS Pro tools and existing address locator for Travis County was used for Travis Co., and City of Bee Caves OSSF data. A new address locator had to be built from an address point layer provided by Hays Co. GIS in order to locate OSSFs from Hays Co. and Dripping Springs.

Since densities of OSSF units per acre are often used as a metric to compare potential impacts to water quality, this value is shown by watershed for the BSZ in Figure 10. Bear Creek watershed shows the highest density of OSSFs whereas Williamson Creek shows the lowest with the exception of the smaller tributary Little Barton. Williamson Creek also has the highest impervious cover (COA 2018) and likely still has the most miles of central sewer system (Herrington 2011). The relative impact from development of higher density of OSSF managed wastewater residential communities with larger lots compared to the higher development density central sewer managed wastewater residential communities is a question that arises often in the BSZ. The comparison is many times situational and dependent on water supply, water reuse, location of recharge features, location of recharging creeks, low impact development design, landscape and irrigation management, soil heterogeneity, and other site-specific conditions.

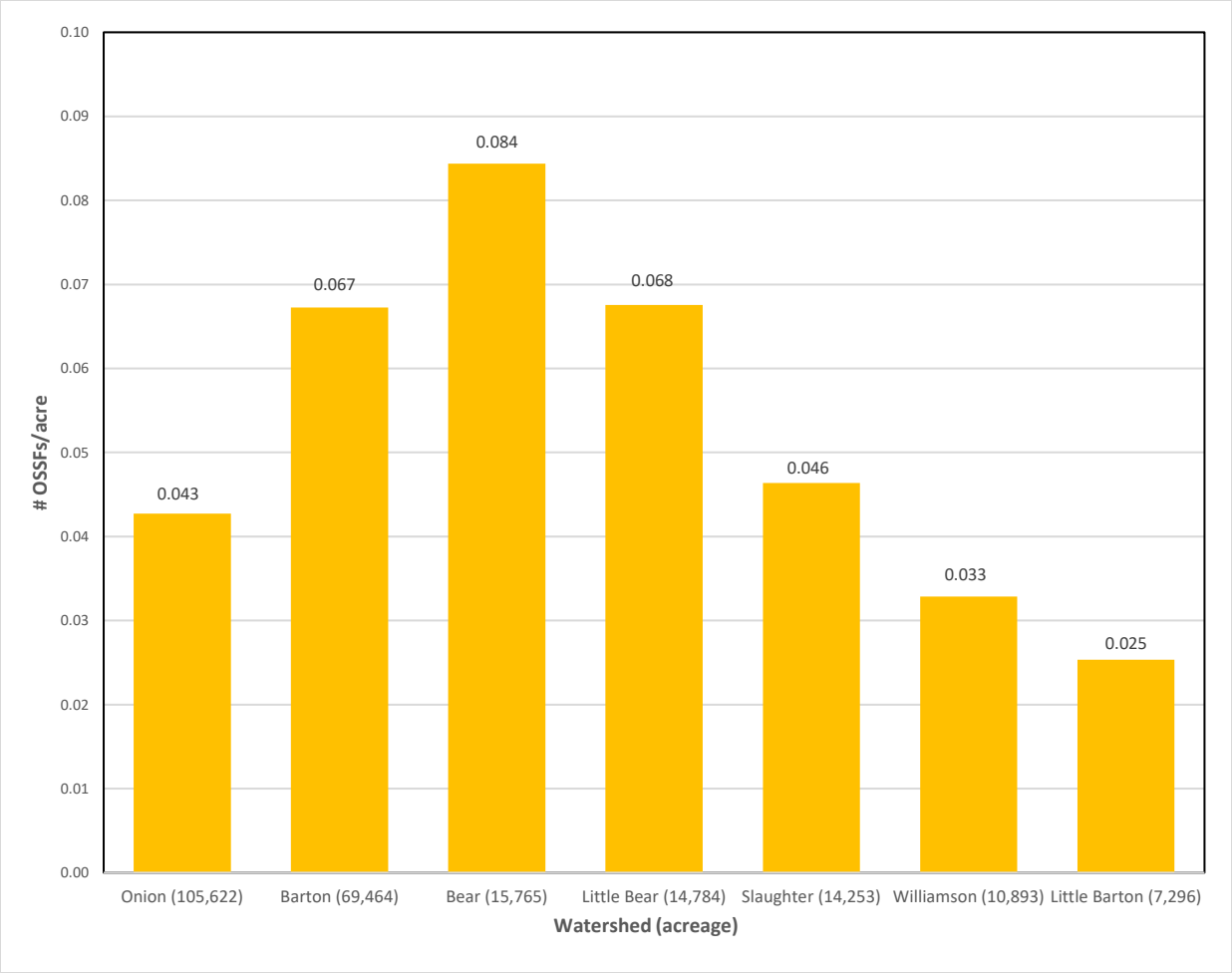


Figure 10. Density (# OSSF permits per acre of drainage area) of OSSF permits by watershed. Drainage area shown in acres in parentheses. Watersheds shown in decreasing size left to right.

Figure 11 shows the results of geolocating OSSFs for systems with permit applications before 12/31/2010 and Figure 12 shows the additional systems geolocated from updated data as of mid-2018. Overall density has increased from 0.040 to 0.054 OSSF/ac across the entire BSZ; however, the increases in growth are still very clustered as developments fill in along with several scattered homesteads. Overall, the total number of OSSFs in the BSZ from all jurisdictions increased from about 9,555 to 12,718. The percent increase in density ranged from 12% in Bear to 68% in Little Barton. Bear Creek density remained the highest increasing from 0.075 to 0.084 OSSF/acre.

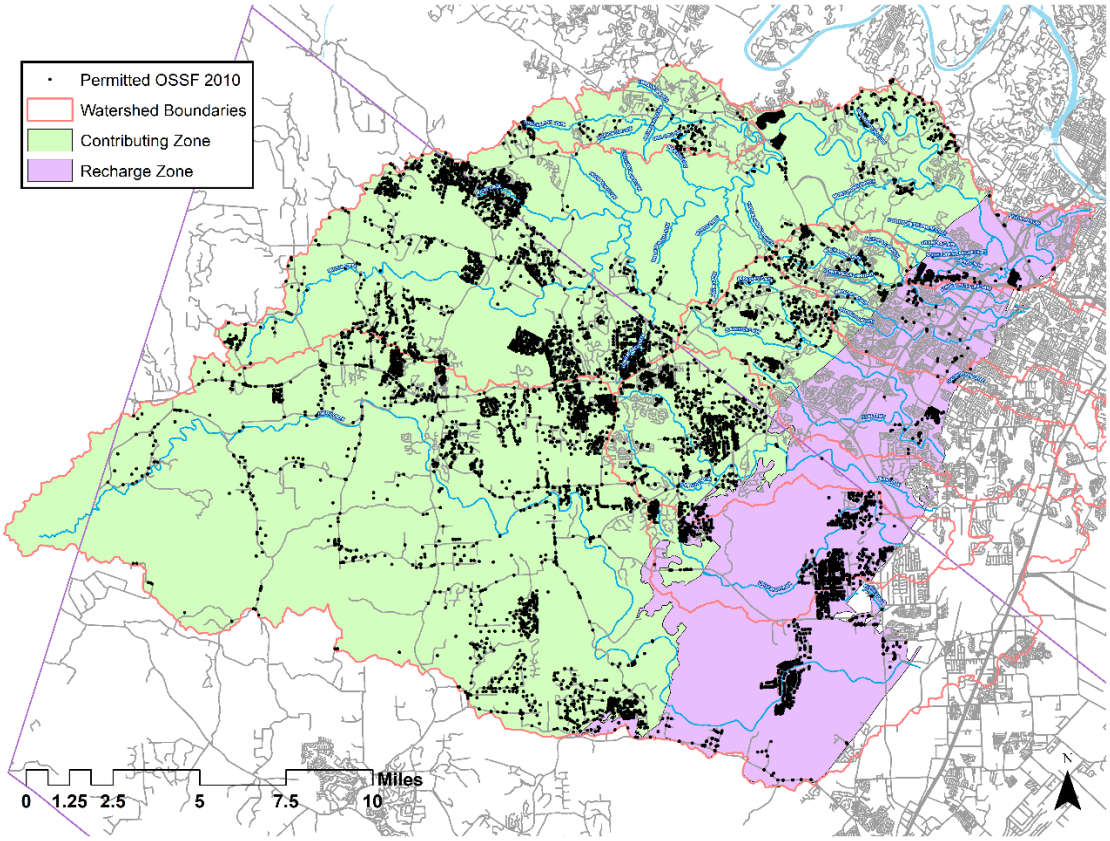


Figure 11. Permitted OSSF in the Barton Springs Zone permit applied by the end of 2010.

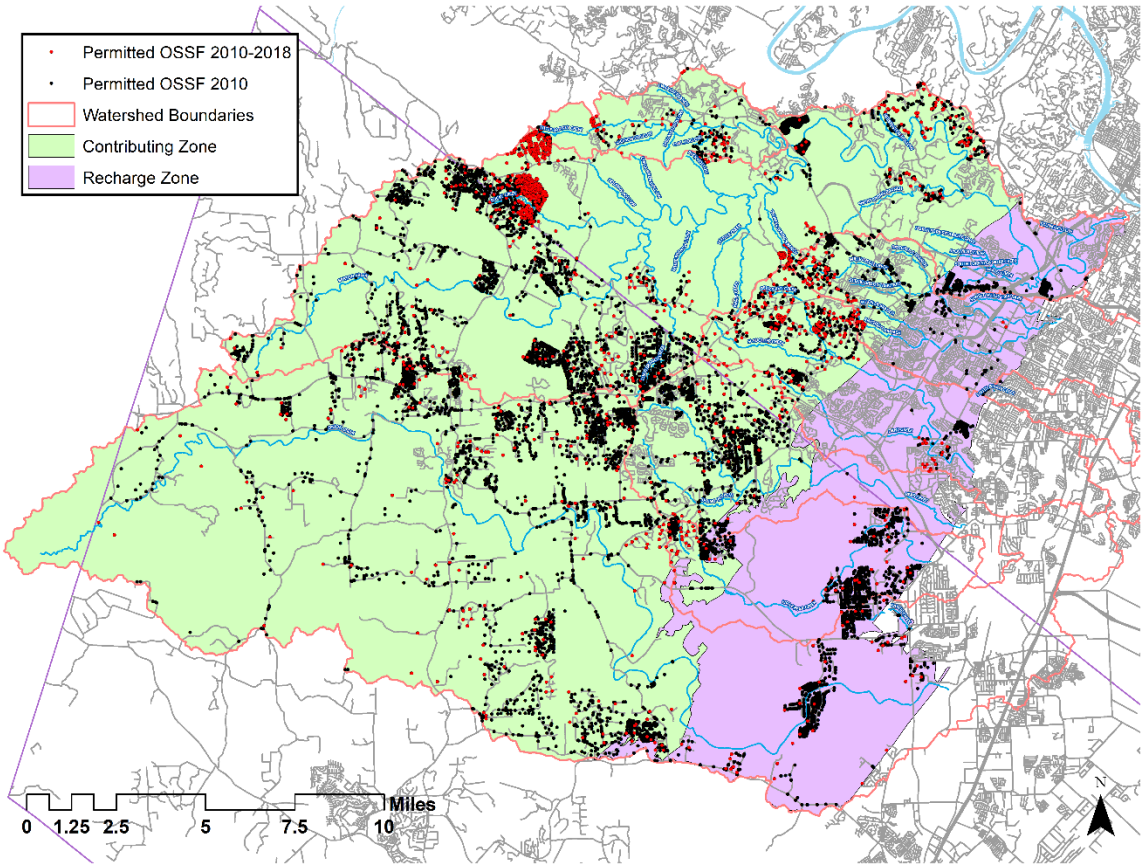


Figure 12. Permitted OSSF growth in the Barton Springs Zone 2010-2018.

Decentralized Wastewater Management

Although this technology has not been used significantly in the BSZ, several of the systems deserve mention as they may be a bigger part of future wastewater management here. Limited information is currently available on these systems, so additional investigation of their operating record may be warranted. In general, the decentralized wastewater concept is to have not just cluster OSSFs, but to use several methods of treatment and reuse in concert to serve small communities and developments. Some examples of local systems were found although there may be others in operation in either the BSZ or similarly sensitive watersheds nearby. Data are limited on design of these systems; however, some information was obtained from designers familiar with these systems (Venhuizen 2014, Loomis 2014).

The One World Theatre system located in the BSRZ along RM 2244 required advanced water quality systems design commensurate with its location in the Barton Creek watershed. This was accomplished by a small collection system leading to a high performance biofiltration treatment unit and subsurface drip dispersal fields. This was technically considered an OSSF due to the

flowrate being less than 5,000 gpd, but it had many of the features to be found in larger decentralized systems (Venhuizen 2014).

Other comparable systems that are in the area in similar terrain were looked at for examples of what may be considered to be working in Central Texas. A decentralized system located near the watershed divide between Lake Austin and Barton Creek on Commons Ford Road includes a small collection system also using biofiltration and subsurface drip dispersal fields more common to cluster or decentralized systems. The system on Commons Ford Road is in the Lake Austin watershed although it may be a model for systems in the BSZ (Venhuizen 2014). Also, a subsurface drip collective system serves the small Madrones Ranch subdivision, This could be considered an "innovative" decentralized system, although it does not provide much advanced treatment and just physically filters septic tank effluent prior to dispersal. Again, it is considered an OSSF due to size. (Venhuizen 2014).

All of these existing decentralized systems are worthy of additional analysis in order to compare their water quality protection to the other systems currently in place in the BSZ. It should be considered a technologically proven wastewater management approach and option for future use in the BSZ at some locations. Each can be upgraded with more advanced units to obtain higher levels of nutrient removal. A recent report outlines additional case studies of decentralized systems that have been installed and have shown promise for both smaller and “missing-middle” size applications in lower density developments (CES 2019).

Another wastewater management method that may be considered to be decentralized would be collection systems typically used for large regional treatment facilities subdivided into smaller facilities capable of efficient and cost-effective land application of effluent. This was suggested as an alternative to a 995,000 gpd discharge initially planned from the Dripping Springs Wastewater Treatment Plant into Onion Creek (subsequently reduced to 822,500 gpd). The practical purpose of this proposal was to eliminate the need for direct discharge to surface waters from a centralized regional plant while serving the growing areas outlying the City (GEI 2014).

While this is antithetical to the TCEQ regionalization policy where package plants were discouraged in favor of fewer large central plants discharging to surface waters, the decentralized approach suggested here keeps the effluent at home with a TLAP permit irrigating a nearby field. The future of this approach looks good in some areas, especially when integrated with 30TAC§210 reclaimed water certifications to provide flexibility in irrigation and a source of income for the permittee. It is far superior to the discharge into local streams without the assimilative capacity to withstand the pollutant loadings of growing local community or regional plants.

Watershed Transfers

There are several developments that have centralized wastewater collection systems that are partially located within the BSZ watersheds yet their treatment and disposal by land application takes place outside the BSZ. Similarly, there are areas of development with centralized collection systems located outside the BSZ that collect wastewater to be treated and disposed of by land application within the BSZ. Moving around the watershed divide of Barton and Onion Creek from the adjacent basins and looking at the service areas of permitted facilities in these

areas, there are several facilities that are in these categories. They may not be of singular importance to water quality conditions regionally but could have an impact on the headwater tributary conditions of small creeks at the watershed divides or play a role in negotiations for water supply and wastewater service.

The most significant ones where overlap of service area and disposal area conflict appear in Kyle and Buda. The main reason for considering these systems as unique is that transfers out of the basin may not require the same degree of treatment if the alternate receiving water has a higher assimilative capacity than the creeks of the BSZ and the Edwards Aquifer. However, the opposite is also true as land application in the BSZ should be based on the ability of the land to process and assimilate the level of pollutants in the wastewater wherever it originates. Fortunately, TCEQ evaluates the characteristics of the land application areas for a TLAP permit and would consider each soil and receiving water separately in a permit application regardless of where the service area, or plant resides. A case in point would be the Lazy Nine WWTP, WQ0014629001 serving the Sweetwater development. The plant site and 700 acre development within its 1,400 acre service area are in the Bee Creek watershed draining to Lake Austin (TCEQ Segment 1404); whereas the TLAP spray irrigation area is in the Little Barton Creek watershed draining to Barton Creek (TCEQ Segment 1430). Given the location on Figure 1, TCEQ could have permitted secondary treatment systems such as activated sludge with no nitrification or a lagoon system with limits of either 20 mg/L BOD and 20 mg/L TSS or 30 mg/L BOD5and 90 mg/L TSS respectively. However, through a negotiated settlement agreement based on what is more appropriate for this watershed and technology available, the plant is required to produce effluent quality of enhanced secondary level or 10 mg/l BOD and 15mg/L TSS. Again, this would only be acceptable for land application and not discharge as no nutrient limits were specified.

Summary and Recommendations

Wastewater regulations that result in higher costs for treatment and disposal or restrictions on reuse are liable to receive the highest degree of scrutiny in the coming years. There are indications that roll-backs in all areas of environmental regulations, contested case hearing requirements, water quality standards, enforcement, funding, and government sponsored research will be mandated from the federal and state level. However, local community standards still carry a degree of influence in the BSZ, and the quality of the environment, especially the water environment, has been a focal point in the region for many years. Improvements may still be made in the regulation of wastewater management in the BSZ regardless of state and federal trends. Below are the major themes on the current regulations available for management of wastewater with preferential consideration of the unique characteristics of the BSZ. Also, information gained from looking at the recent situation of wastewater management and current technology used in the BSZ is noted.

- From an inventory of the wastewater management laws, rules, ordinances, and codes currently in use in the BSZ, it can be seen that there are a multitude of overlapping regulations with different preferential consideration of the sensitivity to wastewater impacts that the BSZ represents.

- Multiple municipalities and counties have jurisdiction within the BSZ and have varying land use/development rules and on-site sewage facility regulations. The lowest common denominators for wastewater management are the TCEQ - Design Criteria for Sewerage Systems, Edwards Rules, and OSSF Rules followed by the Universal Plumbing Code. Aspects of the TCEQ Edwards Rules ensure at least some geographic recognition of the BSZ as more sensitive than other areas of the state to water quality impacts.

- The Barton Springs/Edwards Aquifer Conservation District, the Hays Trinity Groundwater Conservation District (GCD), and to a limited extent, the Blanco-Pedernales GCD and SW Travis County GCD, are all GCDs in the Region with authority to manage well drilling and groundwater pumping but limited authority to regulate land use, wastewater management, or groundwater quality.

- The BSZ Regional Water Quality Protection Plan (Naismith 2005) addressed wastewater management practices but only in a cursory manner and without the wastewater industry technology or local hydrogeology and water quality data that has been developed since the plan was completed almost 15 years ago.

- The Texas Commission on Environmental Quality (TCEQ) regulates discharge of wastewater and land application of wastewater for municipal systems over 5,000 gpd through individual permits. TCEQ is the regulatory body having authority pursuant to the Texas Water Code, §26 and Title 30 of the Texas Administrative Code, §213 (the Edwards Rules) for regulation of activities having the potential for polluting the Edwards Aquifer.

- Existing regulations and effluent standards for the BSZ from TCEQ do not reflect current treatment technology, are not based on site specific water quality assessments, and are not required to be shown through the best science available to protect this sensitive region. However, permits can be written on a case-by-case basis and there is nothing stopping the agency from writing them appropriately other than perhaps external political pressure filtering down and delays in development of nutrient criteria and vetting modeling and assessment tools.

- There is a wide variation in the permitting of land application by TCEQ in the region, and limited resources may affect the TCEQ's ability to effectively enforce permit conditions on the ground. The soil monitoring required under Special Provisions in all TLAP permits is seldom being provided by permit holders to the TCEQ Regional Offices and compliance of permittees with this requirement is doubtful. Therefore, there may be no objective monitoring of buildup of nutrients in TLAP or SADDS soils or monitoring of the potential for leaching of elevated nitrate nitrogen concentrations into groundwater from these irrigation sites. This is troubling considering the significant upward trend in nitrate-nitrite nitrogen in Barton Springs.

- New wastewater permits especially for direct discharge in the BSCZ are likely to be contested by a range of protestants including downstream landowners, citizen environmental groups, public entity owners of downstream and adjacent conservation lands, and endangered species conservation groups. The contested case hearing process is long and expensive for applicants and protestants with a highly uncertain outcome. Even the process of determining standing in permit cases is unclear, arbitrary, and inconsistent. Negotiated and sometimes

partial settlements contribute to the inconsistent and widely varying permit conditions across the region. There is a perceived need to clarify regulatory uncertainty and provide a clear path to permitting. So far, every change in the process at the legislative level has reduced the ability of environmental and citizen interests to improve protection of the BSZ from wastewater impacts.

- An inventory of the wastewater disposal methods currently in use in the BSZ from available sources showed primarily centralized collection system and treatment with land application of wastewater and Onsite Sewage System Facilities (OSSF) as the primary methods of wastewater management although interest is rising in discharge options from centralized treatment facilities due to treatment technology improvement, cost of land, storage requirement regulations, and dedicated land use for irrigation required by permit regulations. The first two large scale discharge permits in the BSCZ have been approved by the TCEQ since the BSZRWQPP was completed in 2005.

- The inventory of wastewater disposal occurring in the BSZ includes many centralized wastewater collection systems, 2 permitted direct discharge facilities, land application disposal via approximately 12,718 on-site sewage facilities and 27 centralized facilities issued a TCEQ Texas Land Application Permit with seven (7) of these listed as inactive operations in 2018. Thirteen (13) of the facilities also are authorized as providers of reclaimed wastewater for distribution to users within a designated service area. Total centralized treatment capacity in the BSZ in final permitted phases would be about 7.42 MGD.

- Updating the inventory of wastewater permits in the BSZ and keeping track of these facilities is not a trivial exercise. In addition to the data easily obtained from the TCEQ permit status database, applications filed for amendments would need to be retrieved from TCEQ for TPDES and TLAP permits. More detail on the capacity and expansion plans for all these plants should also be gathered to determine if there is potential, feasibility, economic need, and actual plans for them to be converted to discharge facilities in the future. In this way potential impact to surface streams may be evaluated while there is time to consider alternatives.

- Similarly, to update the database for OSSFs, a retrieval from Hays, Travis, and Blanco Counties OSSF programs would be necessary on a regular basis. In addition, retrievals from the delegated entities of the City of Austin, City of Dripping Springs, and Village of Bee Cave are needed for completeness. For systems permitted after 2018, a similar process of geolocation to that performed for this report could be completed for future facilities. Also, some corrections may be warranted for the historical data and additional parameters might be useful for future analytical purposes. Again, for communities that are experiencing difficulties with OSSFs, or as part of a larger plan for centralizing their collection system, this information should continue to be documented to determine if there is potential for any other central treatment plants to be considering discharge options.

- Finally, the data on end user land application under the 30TAC210 Certifications in the BSZ should be compiled and land application areas geolocated for reference. Data for source of wastewater and any particular contract stipulations affecting quality or quantity of effluent applied should be kept with the parcel location in GIS. This has not been compiled to date

but may be more important in future conditions. The TCEQ online database for domestic reuse only contains the provider of wastewater, not the end users. The application information required for end users does not give the exact location and acreage or a map of the destination for the reclaimed water other than the gross service area. Hopefully, TCEQ will approve the proposal for rulemaking to provide a "beneficial reuse credit" for "firm reclaimed water demand" demonstrated by user contract or records of historical use. If so, the areas of user application will be required under the newly proposed 30TAC 309.21 (c).

- To complete the wastewater management picture, expansion and phasing plans for the centralized collection systems would have to be gathered and maintained in some manner to correspond to the plant expansion plans. Some of this information is contained in long range planning documents such as facilities plans for Hays County West of IH-35 (HDR 2011) or even preliminary engineering reports for individual plants such as Dripping Springs (CMA 2013). The collection system growth has implications for subsurface leakage from wastewater collection lines as well as changes in impervious cover and non-point source pollution in comparison to the same growth facilitated by on-site systems. To consider the overall impacts of our development of the BSZ, wastewater management has to be considered alongside the other environmental stressors that come with it. Once the development picture is quantified, decisions on mitigation and optimization of regulatory controls can be made to allow the best use of natural resources within the carrying capacity of the BSZ.

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