**Threat to Honey Creek and nearby water supplies from proposed Honey Creek Ranch urban runoff and TLAP effluent disposal**

Effluent from irrigated land and urban runoff from the Honey Creek Ranch development present threats to the water quality of nearby public and private water supplies. Additionally, both contamination sources present a substantial threat for eutrophication of Honey Creek and even the Guadalupe River immediately downstream from the mouth of the creek.

Pollutants from the effluent-irrigated land can be transported to Honey Creek via at least three methods. Runoff from rainfall on land which received recent irrigation, or runoff from irrigation on previously wet soil can flush pollutants to the creek prior to the pollutants being attenuated by soil and vegetation. Additionally, the irrigated land would be in the Honey Creek basin—land in the basin slopes toward Honey Creek. Water-born pollutants in effluent could travel down slope in saturated soil and seep into the creek. Finally, recharge of effluent could be confined in the shallow subsurface by underlying low-permeability rock or soil and move along lateral bedding planes as “perched flow” to discharge into Honey Creek along the banks of the creek. Such flow systems are common in the Hill Country—the base flow for many if not most Hill country streams are sustained by such water movement.

Analysis of water quality from the natural Honey Creek basin and from Honey Creek Ranch

Water quality concentrations

A data-collection intensive 12-year USGS study on about 18 rural or urban basins in the Austin area (Veenhuis and Slade, 1990) documented storm-runoff water-quality values as shown below:

|  |  |  |  |
| --- | --- | --- | --- |
| Water quality constituent | Median value for rural basins (mgl/L) | Median value for urban basins (mgl/L) | Percent increase in value from rural to urban basin |
| Total suspended solids | 6.0 | 1,230 | 20,400 % |
| B.O.D. | 0.95 | 10.6 | 1,000 % |
| Total organic carbon | 4.0 | 29 | 625 % |
| Total nitrogen | 0.5 | 3.22 | 540 % |
| Total phosphorus | 0.02 | 0.96 | 4,700 % |

Runoff

The relation between basin impervious cover and runoff as percent of rainfall is based on many sites in Austin as shown below (City of Austin 2009):



The annual-mean rainfall in the area is about 37 inches per year. The drainage area for Honey Creek is about 6,000 acres and the drainage area for Honey Creek Ranch is 529 acres within the Honey Creek basin.

Estimation for annual runoff volume, both basins:

 Natural basin. As shown in the above figure, natural runoff for the area is about 5% of rainfall. 37 inches per year of rain with 5% runoff on 6,000 acres = 925 acre-feet per year.

The Honey Creek Ranch development is 529 acres in size and is estimated to have about 60% impervious cover. Therefore, from the above graph, runoff would represent about 55% of rainfall. 37 inches of rain per year with 55% runoff on 529 acres = 897 acre feet per year

Therefore annual runoff volumes are comparable between each basin.

Estimation for average annual water-quality load, both basins:

The water-quality load is the product of the water quality concentration and the runoff volume.

Nitrogen. The nitrogen concentration expected from the Ranch is 540 % greater (5.4 times greater) than that expected from the natural basin (above table). Therefore, the Ranch would double the runoff volume at the mouth of Honey creek (natural plus urban runoff) and produce 540% greater concentration thus the load (pounds) of nitrogen at the mouth of Honey creek would increase by 1080% or **10.8** times greater than that from the natural basin.

Phosphorus. The phosphorus concentration expected from the Ranch is 4700 % greater (47 times greater) than that expected from the natural basin (above table). Therefore the Ranch would double the runoff volume at the mouth of Honey creek and produce 4700% greater concentration thus the load (pounds) of phosphorus at the mouth of Honey creek would increase by 9600% or **96** times greater than that from the natural basin.

Threat of eutrophication from Honey Creek Ranch:

Based on the above, 3.22 mg/L of nitrogen would be almost **5** times greater than the threshold level of 0.56 mg/L of nitrogen that would cause eutrophication in streams <https://www.epa.gov/nutrient-policy-data/ecoregional-nutrient-criteria-rivers-streams>. Additionally, 0.96 mg/L of phosphorus would be **41** times greater than the threshold level of 0.023 mg/L that would cause eutrophication. Therefore, runoff from this development presents a substantial threat to cause eutrophication in Honey creek.

Additionally, the impervious cover for Honey creek Ranch is much greater than any basin included in the USGS study referenced above. Therefore, pollutant concentrations from the Honey Creek Ranch are expected to be greater than those shown in the above table.

 Threat to downstream water supply from effluent and Honey Creek Ranch runoff

Canyon Lake Water Service Company (Canyon Lake Shores), which services 24,000 people, would be threatened by the effluent and from the urban runoff as demonstrated here.

1. As shown below, during dry periods, total flow in Honey Creek would be dominated by (more than one half) effluent. Also, as explained below, after many small storms the only runoff in the creek would be that from Honey Creek Ranch.
2. Honey Creek empties into the Guadalupe River which, as documented by gaged flow, is no flow an average of about four days per year (<https://streamstats.usgs.gov/ss/>).
3. Therefore, effluent or urban runoff from Honey Creek could be the only flow in the Guadalupe River immediately downstream from the creek for some periods and could dominate total flow in the river for longer periods.
4. Based on a USGS streamflow gain/loss study on the river, the Guadalupe River is documented to lose at least 6.2 million gallons per day but probably looses at least 11 million gallons per day of flow to the underlying Trinity aquifer in the stream reach immediately downstream from the mouth of Honey creek (Slade and others, 2002).
5. Therefore at times, flow dominated by effluent or urban runoff could be entering the Trinity aquifer immediately under the river.
6. Canyon Lake Water Service Company (Canyon Lake Shores) has five public water supply wells proximate to the Guadalupe River a few miles downstream from the mouth of Honey Creek—within the flow loosing reach of the Guadalupe River. The wells are developed in the Trinity aquifer
7. Because of the proximity of the wells to the river, It is likely that pumpage from the wells at least occasionally draws water from the river and from the Trinity aquifer immediately under the river.
8. Therefore, it is possible if not likely that effluent or polluted urban runoff would at least occasionally be contained in the public water supply for Canyon Lake Shores.

The 2 points below provide background or detailed information for the threat as identified immediately above.

1. Based on streamflow discharge measurements made near the mouth of Honey Creek, the discharge there sometimes is no flow. Therefore, sometimes effluent would represent the only flow in the creek. Additionally, small storms generally do not create runoff in natural basins—soils and vegetation attenuate all or the vast majority of rainfall. However, fully urban basins produce runoff for even the smallest of storms. Therefore, after small storms, the only runoff in Honey creek would be from urban runoff which would produce high levels of contaminants—the rural part of the Honey Creek basin would not generate runoff to dilute the urban runoff.

2. The TCEQ allows high levels of nitrogen and phosphorus for TLAP effluent discharges based on the assumption that the nutrients and other contaminants would be absorbed by soils and vegetation in the irrigated area and by downstream vegetation and soils in the channel. However, the rock channel of Honey Creek contains little or no vegetation or soils thus reductions in effluent nutrients will be minimal or zero.

 Additional threats from effluent or urban runoff:

1. The Texas Parks and Wildlife Department operates Guadalupe River State Park which has a public water-supply intake on the Guadalupe River near the mouth of Honey creek and two nearby public water-supply wells. The public water supply for the park could be contaminated by subsurface movement or overland flow of irrigated effluent.

2. Many domestic water supply wells exist proximate to the lower reach of Honey Creek. During dry periods, the stream reach probably looses flow to the underlying aquifer. Such recharge would contain mostly if not all effluent which would present a substantial threat to the water quality of the nearby wells.

Other points regarding the TLAP permit

Based on the above, the water in Honey Creek from the effluent and urban runoff will likely be eutrophic, thus killing aquatic life, and contain substantial amounts of algae. Additionally, urban spills, improper use of fertilizers, leaking sewage transmission pipes, and spills or releases of effluent at the irrigation site would represent additional threats to Honey Creek.

The direct discharge permit would have allowed 500,000 gallons per day but the TLAP permit is only for 365,000 gallons per day. Based on 2,347 housing units, the revised permitted discharge is only 156 gallons per day per house. This likely is too low—irrigated effluent likely would exceed 365,000 gallons per day. However, even at that rate, the permitted irrigation would represent 58 inches per year on the 84 acres. Additionally, during extended rain periods, onsite soils would be saturated up to many consecutive days. The applicant would need the capacity to store many days of effluent during such periods. There have been many cases in Texas when effluent irrigation has occurred on saturated soils and even cases when irrigation has occurred during rainstorms. Such occurrences have resulted in contamination being documented in receiving streams.

Threat on water quality of wells from emerging contaminants in wastewater

1. Many pharmaceuticals, personal care products, surfactants, various industrial additives and numerous organic chemicals are identified as Endocrine Disrupting Chemicals (EDCs). Based on USGS studies that sampled at and downstream from 10 wastewater treatment plants, 78 EDCs were detected. One USGS study, Glassmeyer and others (2005, table 5) presents a list of 37 EDCs most often detected in wastewater. At least one-half of these 37 EDCs were detected at all sites and 11 of the EDCs were detected at every wastewater site. The same USGS study included sampling at many sites upstream from the wastewater sites. Detections of and concentrations of EDCs at the upstream sites were substantially less than found at wastewater sites, proving wastewater to be the major source for EDCs.

2. Studies suggest that the effect of EDCs exposure on human health includes a decrease in male sperm count, an increase in testicular, prostate, ovarian and breast cancer and reproductive malfunctions. The significant concern is toward fetuses and newborn babies since they are the most vulnerable (Bolonga and others, 2009, p. 234).

3. Some EDCs detected in wastewater represent estrogenic pesticides and pharmaceuticals , which operate through estrogen receptors in their target cells--their effects are additive. This means that there is no minimally safe exposure because any dose adds to natural estrogens already present (Norris and Vajda, 2007). Wastewater contaminated water supplies will produce continued exposure and cumulative levels of estrogenic hormonal chemicals in humans.

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Raymond Slade, Jr.

Certified professional Hydrologist

June 4, 2020