

Koon, Nancy

From: Laura Ruhl-Whittle <lsruhl@ualr.edu>
Sent: Tuesday, April 5, 2022 3:11 PM
To: Water Draft Permit Comment
Subject: Discharge Permit Number AR0053210, AFIN 60-05010
Attachments: Mill Bayou Letter_Ruhl_Final.pdf; Mill Bayou NPDES comments figures.pdf

Attention: Faizan Khan, Permits Branch, Office of Water Quality, Division of Environmental Quality

Hello,

Please find my comments and figures/maps attached to this email in regards to Discharge Permit Number AR0053210, AFIN 60-05010. I am happy to address any questions regarding my comments. Feel free to reach out.

Regards,

Laura S. Ruhl, PhD, P.G.
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Little Rock, AR 72204

The views and evaluations in this email and attached documents are my professional work, and do not necessarily reflect the views or policies of the University.

To: Arkansas Division of Environmental Quality within Arkansas Energy and Environment

Re: *Comments concerning Paradise Valley Wastewater Treatment Plant (NPDES permit # AR0053210) in Roland, Arkansas within the Mill Bayou Watershed.*

I would like to express my serious concern over the NPDES permit # AR0053210 for the Paradise Valley Subdivision. My concerns are scientifically based on the wetland conditions of Mill Bayou, little to no flow for waters receiving treated wastewater, and water quality issues pertaining to treated wastewater (excess nutrients and pharmaceuticals). My analysis of the hydrology, geology, and water geochemistry based on data available from the DEQ, AR Dept of Health, USGS, FEMA, and AR Geological Survey, as well as site visits and water quality testing lead me to believe that discharging up to 0.05 MGD (50,000 gallons per day) of treated wastewater will be problematic because of the following:

1) **Bayou/wetland conditions:** According to AR DEQ engineers and my site observations, Mill Bayou has a 7Q10 of 0 cfs flow (i.e. is it standing water and has no flow). Water flows in this area only after a precipitation event. If a second wastewater treatment plant (WWTP) is permitted to discharge up to 50,000 gallons per day in the upper watershed, the **only** flow during non-storm conditions would from the WWTP. If the volume is too low, then the wastewater would not flow and would remain in the vicinity until the next storm event. The U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency define wetlands as “*areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.*” (EPA, 2022). Mill Bayou meets these conditions with the land surrounding Mill Bayou inundated with surface water throughout the year with hydrophytes growing in the saturated soil conditions.



Figure 1: Pictures of standing water in Mill Bayou in the middle (left) and lower (right) portions of the watershed. Cypress trees can be seen in the image on the left.

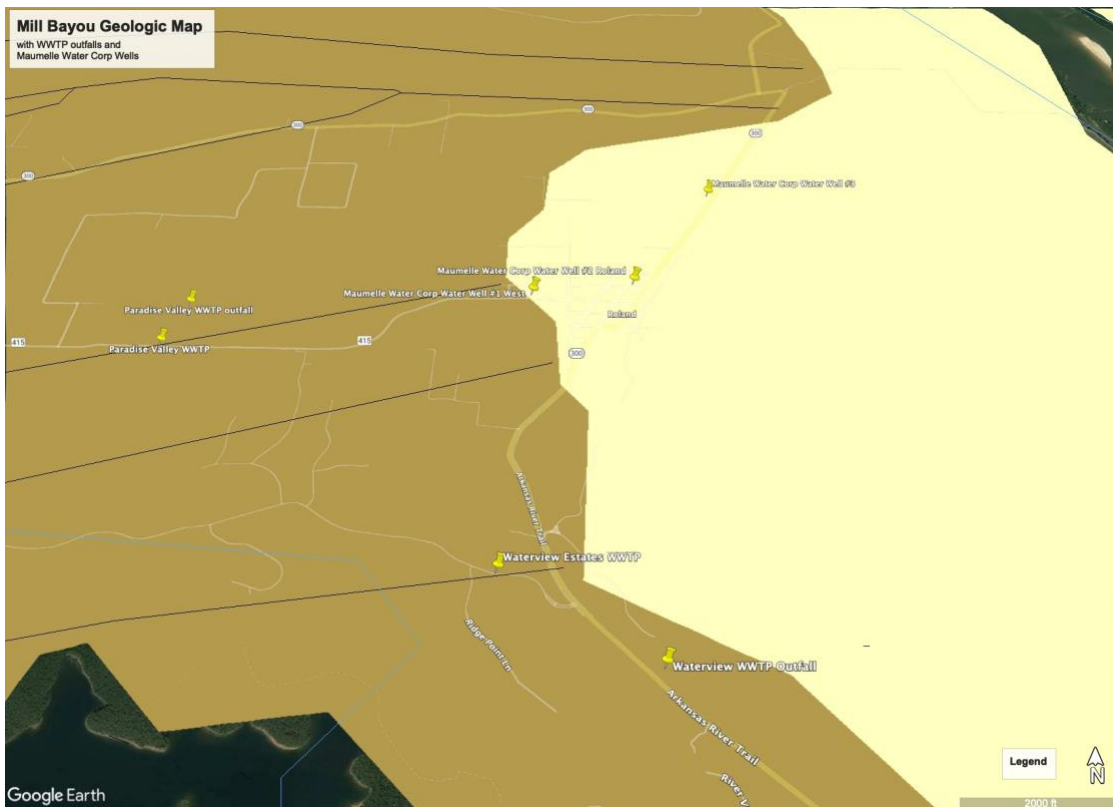
A major concern is if the WWTP does not meet treatment standards. Part of the proposed permit requires the water leaving the outfall at the “end-of-pipe” to meet standards (and no dilution to meet standards). If

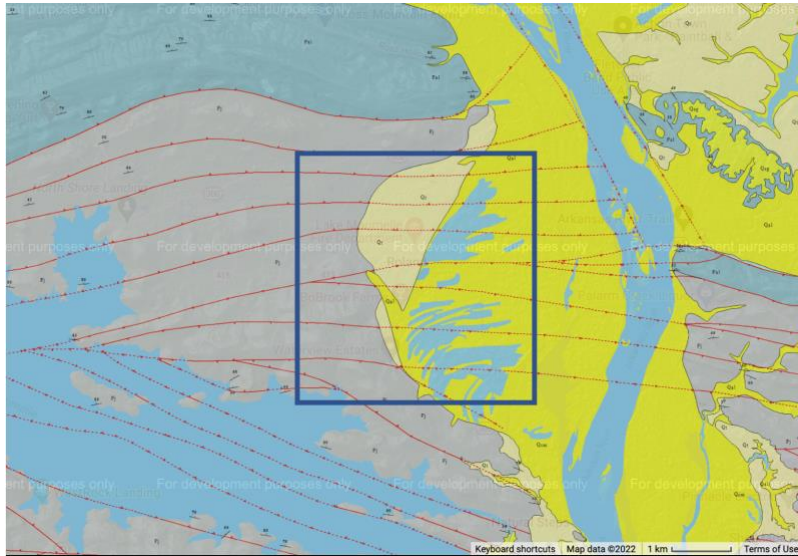
there is a violation with any constituent (TRC, CBOD, etc), the watershed would receive discharge that exceeds water quality standards until it is identified and corrected. This means biological hazards or excess treatment byproducts would flow directly into the waterway and impact those downstream, which includes several farms, residences, and the town of Roland, AR. The other wastewater treatment plant within the watershed by the same developer has had several violations in their treatment process and measurements (AR DEQ Inspection Reports for Permit # AR0050393).

2) **Surfacewater infiltration into groundwater drinking water source:** The town of Roland is dependent on Maumelle Water Corporation for their drinking water, which is supplied from 3 groundwater wells into the Quaternary System Aquifer (Maumelle Water Corp, 2022) (Figure 2). The drinking water source for the Maumelle Water Corporation is the Quaternary Alluvial Aquifer. These geologic units, Qcm, Qal, and Qt (Figure 3), consist of gravel, sand, silt, and clay in channel, floodplain, and terrace deposits. The hydraulic conductivity of these units range from $10^{2.5}$ - $10^{4.5}$ ft/day (gravel) to 10^{-3} to 10^{-7} feet per day (clay) (Heath, 1983) and the deposits can be very heterogenous based on the historic river flow path. Depending on the distribution of the high permeability units like gravel and sand (10^0 to 10^3 feet per day), there is a high probability that the water from the surface will infiltrate into the alluvial aquifer in a fairly short time period. If treated wastewater is discharged to Mill Bayou, where it will have some residence time due to little to now flow, there is a high likelihood that it will infiltrate down to the Quaternary Alluvial Aquifer. While the WWTP outfall is further west and not in the same geologic unit as the groundwater wells, as the water in Mill Bayou makes its way downstream, it will move into the section where it overlies the quaternary alluvial units (Qcm, Qal, and Qt). If it resides in these sections, it will infiltrate into the ground and eventually make its way to the aquifer system. The hydraulic gradient will be from the west to east based on the topographic and hydrologic profiles/gradients of the area. The groundwater will move towards a region with lower hydraulic head like a pumping well or towards the river. Another groundwater source water assessment should be performed with these new facilities (WWTPs) to evaluate the likelihood of treated wastewater infiltrating into the aquifer.



Figure 2: Map of the Mill Bayou area with the WWTPs, Outfalls, and Maumelle Water Corp Well locations labeled.





DESCRIPTION OF MAP UNITS

- Qcm** **Alluvium (Quaternary) (Channel Meander)** - The unit represents the more recent channel meanders and current flood plain deposits of significant streams. Channel meander scars are distinct in this unit. The partition of this unit from other Holocene alluvial deposits was based more on geomorphic considerations than lithic or age considerations. Fossils are rare. The lower contact is unconformable. The thickness is variable.
- Qal** **Alluvium (Quaternary)** - Variably sized gravel overlain by unconsolidated sand, silt, and clay comprises the unit. This unit occurs in the floodplains of streams and rivers. The sediments form a rich loam and are excellent for agriculture. Gravels, primarily novaculite, originated in the Ouachita Mountain region and from local Cretaceous formations. Thickness varies from 0 to 25 feet. Areas of alluvium are presently receiving sediment deposition.
- Qt** **Terrace Deposit (Quaternary)** - Terrace deposits generally grade from basal gravel to silt and clay at the top. Gravels, primarily novaculite, originated in the Ouachita Mountain region and from local Cretaceous formations. Thicknesses are generally less than 50 feet. Terraces are topographic features which are former floodplains of nearby streams and/or rivers. The sediments form a rich loamy soil. The basal gravel is sometimes utilized for water-well production and gravel-mining operations.

Figures 3A (top), 3B (bottom left), and 3C (bottom right): Geologic Maps and unit descriptions of the Mill Bayou watershed. 3A: cream color is the quaternary alluvial units, while the tan is the Pennsylvanian Jackfork Sandstone (Pj). 3B and 3C: Geologic map and the unit descriptions. The area of interest is outlined with the blue box

3) **Nutrients (P & N) from wastewater:** The standard wastewater treatment process does not remove nutrients like phosphorus (P) and nitrogen (N) from the water (Perera, 2019). Municipal wastewater plays a main role in the acceleration of eutrophication in surface waters (Bhagowati & Ahamad, 2019). Eutrophication leads to the disturbance of aquatic ecosystems and secondary water pollution (Preisner et al., 2020). If treated wastewater that contains excess nutrients is discharged to Mill Bayou, in addition to the Waterview Estates wastewater (outflow less than 0.02 MGD), the excess nutrient load could result in eutrophication of this watershed, including excessive plant and algae growth and low dissolved oxygen levels.

4) **Wastewater and contaminants of concern:** Some personal care products and pharmaceuticals are also not removed during the wastewater treatment process. Effluent from WWTPs has been shown to be a significant source of these contaminants of concern entering the aquatic environment. Kreuzinger et al. (2004) revealed that neutral substances such as diazepam (Valium) and carbamazepine (anti-epileptic) are not removed during the treatment process and remain in the treated wastewater. A study by Glassmeyer et al. (2005) revealed that treated wastewater contained substances such as caffeine, benzophenone (fixative in perfumes and soaps), cholesterol, cotinine (nicotine metabolite), and many other compounds associated with treated wastewater. I am concerned that pharmaceuticals and personal care products will not be removed during the treatment process and will therefore make their way into the watershed impacting the aquatic organisms and organisms that drink this surface water. Additionally, I am concerned that these compounds could infiltrate the aquifer and drinking water source. Kreuzinger et al. (2004) also showed that some of these compounds behaved conservatively geochemically, meaning that they were not adsorbed and removed from the water as it traveled through the ground.

5) **FEMA Flood Zone changes:** The proposed WWTP outfall at Paradise Valley is currently located within a FEMA Flood zone with a 0.2 % annual chance of flooding (orange edge in Figures 4 & 5). Mill Bayou near this location is a wetland with little to no flow (unless there is a precipitation event), and lies

within the FEMA special flood hazard zones (Zone AE). If this WWTP is permitted, I am concerned about the flooding potential in this region. The permit has discharge rates of up to 0.05MGD (critical % flow is 0.04MGD or 40,000 gallons per day; 80 %) of treated wastewater into a tributary in the upper portion of the Mill Bayou Watershed. I am concerned that the additional water within this portion of the watershed will alter the current flood hazard zones, and therefore a re-evaluation of the flood zones should take place.

Additionally, if this WWTP is installed it will be the second within this small watershed. The other outfall is NPDES permit #AR0050393 located downstream in the watershed. The amount of wastewater from the 2 outfalls within the 10mi^2 watershed is concerning especially since there is little to no flow in these streams, therefore most of the water within the streams would consist of treated wastewater. Depending on the Arkansas River levels and the surrounding flat topography, this could result in backing up of water in the watershed and additional flooding of the surrounding lands.

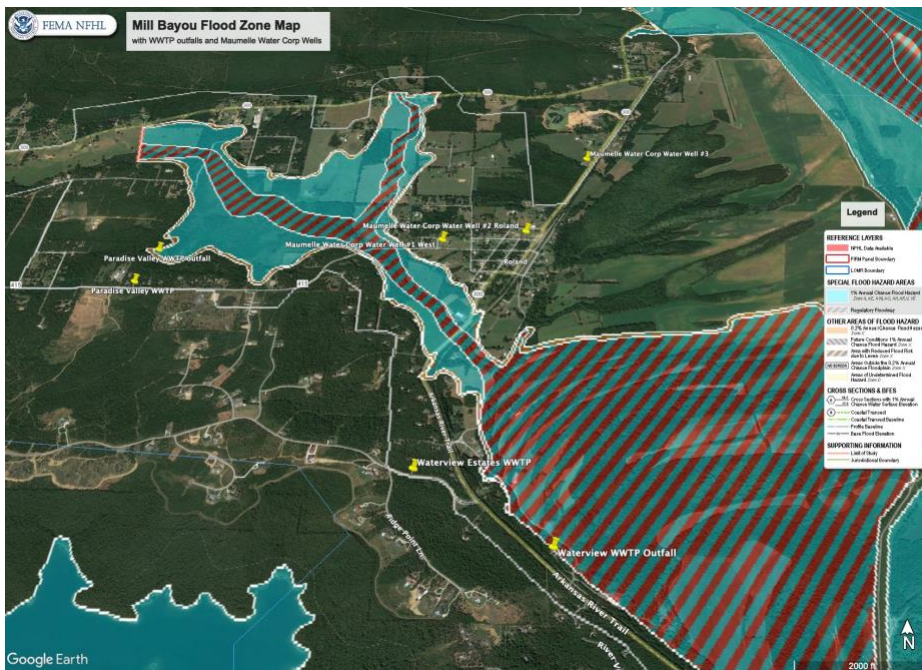
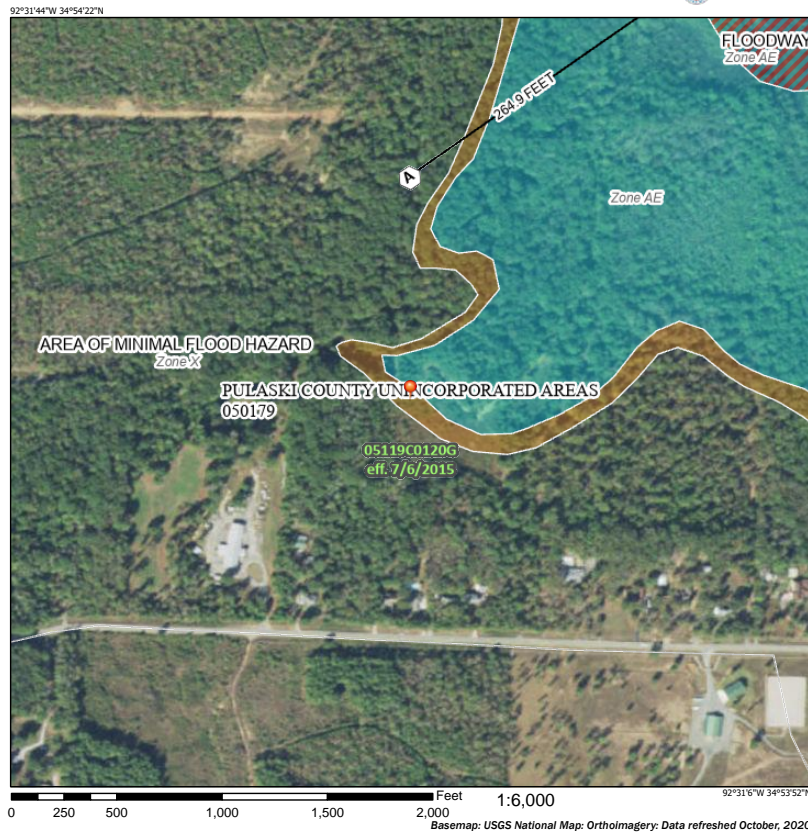


Figure 4: Map of the Mill Bayou Watershed and the FEMA flood hazard zones (source Google Earth and FEMA, 2022).

National Flood Hazard Layer FIRMette



Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS

- Without Base Flood Elevation (BFE) Zone A, A99
- With BFE or Depth Zone AE, AO, AH, VE, AR
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD

- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
- Future Conditions 1% Annual Chance Flood Hazard Zone X
- Area with Reduced Flood Risk due to Levee. See Notes, Zone X
- Area with Flood Risk due to Levee Zone D

OTHER AREAS

- NO SCREEN Area of Minimal Flood Hazard Zone X
- Effective LOMRs
- Area of Undetermined Flood Hazard Zone D

GENERAL STRUCTURES

- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES

- Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transact
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transact Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS

- Digital Data Available
- No Digital Data Available
- Unmapped

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

Figure 5: Close up FEMA map of the proposed Paradise Valley WWTP outfall (Source FEMA, 2022).

This permit (#AR0053210) for an additional wastewater treatment plan in the Mill Bayou Watershed is of serious concern for flooding, surface water, and groundwater issues. I strongly recommend re-evaluating the FEMA flood hazard zones if 0.05MGD could be released. Additionally, another source water assessment should be performed to evaluate whether treated wastewater could make its way to the Alluvial Aquifer System that provides drinking water to the Roland community.

I am willing and able to discuss my findings and evaluations further with the AR Division of Environmental Quality.

Sincerely,

Laura S. Ruhl, Ph.D., P.G.
 Associate Professor
 Department of Earth Sciences
 University of Arkansas at Little Rock
 501-916-5762
 lsruhl@ualr.edu

References:

Bhagowati, B. Ahamad, K. U. 2019. A review on lake eutrophication dynamics and recent developments in lake modeling. *Ecohydrology and Hydrobiology* 19 (1), 155-166. <https://doi.org/10.1016/j.ecohyd.2018.03.002>.

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Perera, M.K., Englehardt, J.D., and Dvorak, A.C. 2019. Technologies for Recovering Nutrients from Wastewater: A critical Review. *Environmental Engineering Science*, Vol. 36, No. 5. DOI: 10.1089/ees.2019.0436.

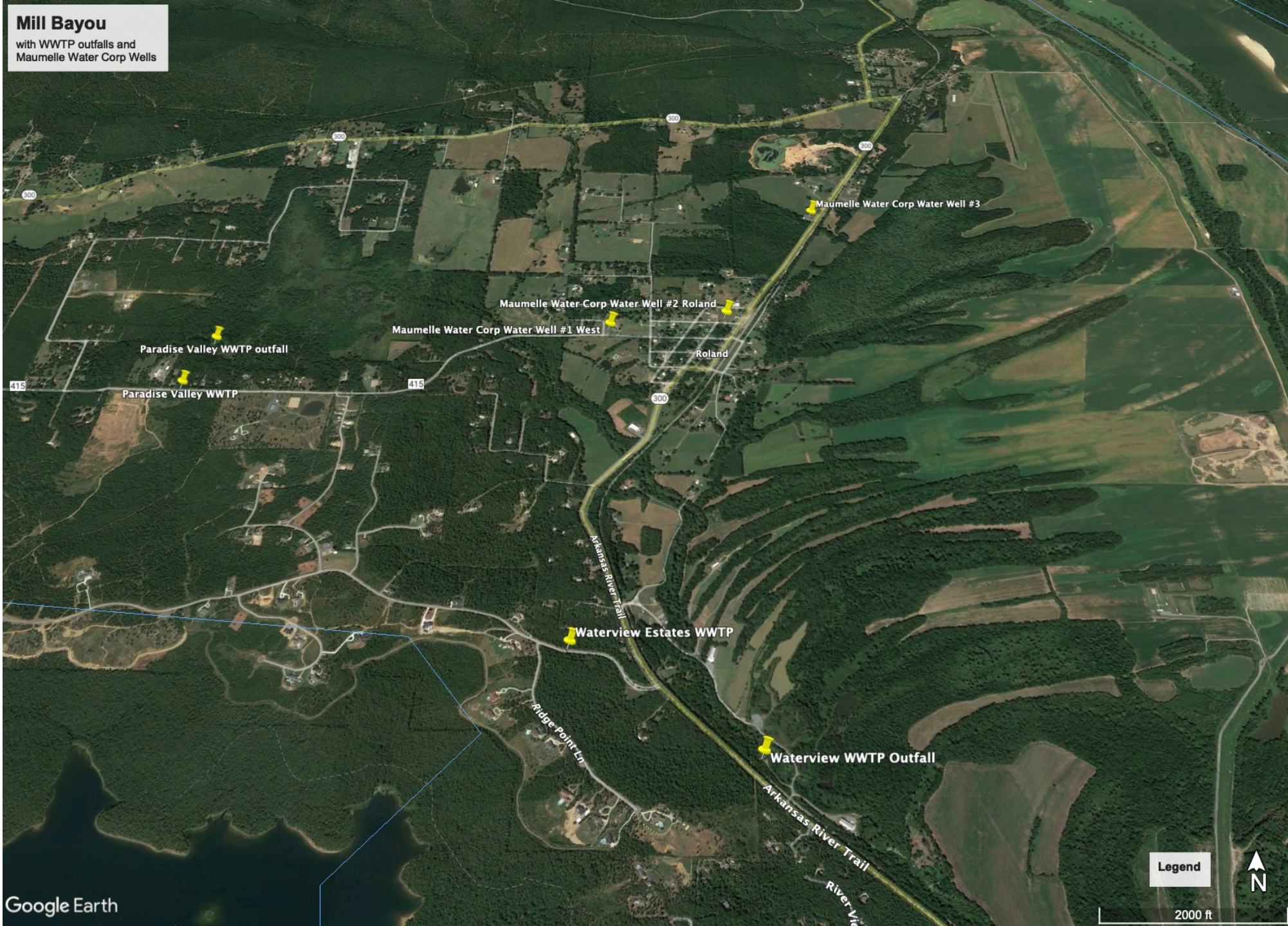
Preisner, M., Neverova-Dziopak, E., Kowalewski, Z. 2020. Analysis of eutrophication potential of municipal wastewater. *Water Science & Technology*. Vol 81, Issue 9. <https://doi.org/10.2166/wst.2020.254>

Figures for DEQ Comments on NPDES Permit #AR0053210

submitted by Laura S. Ruhl, Ph.D., P.G.

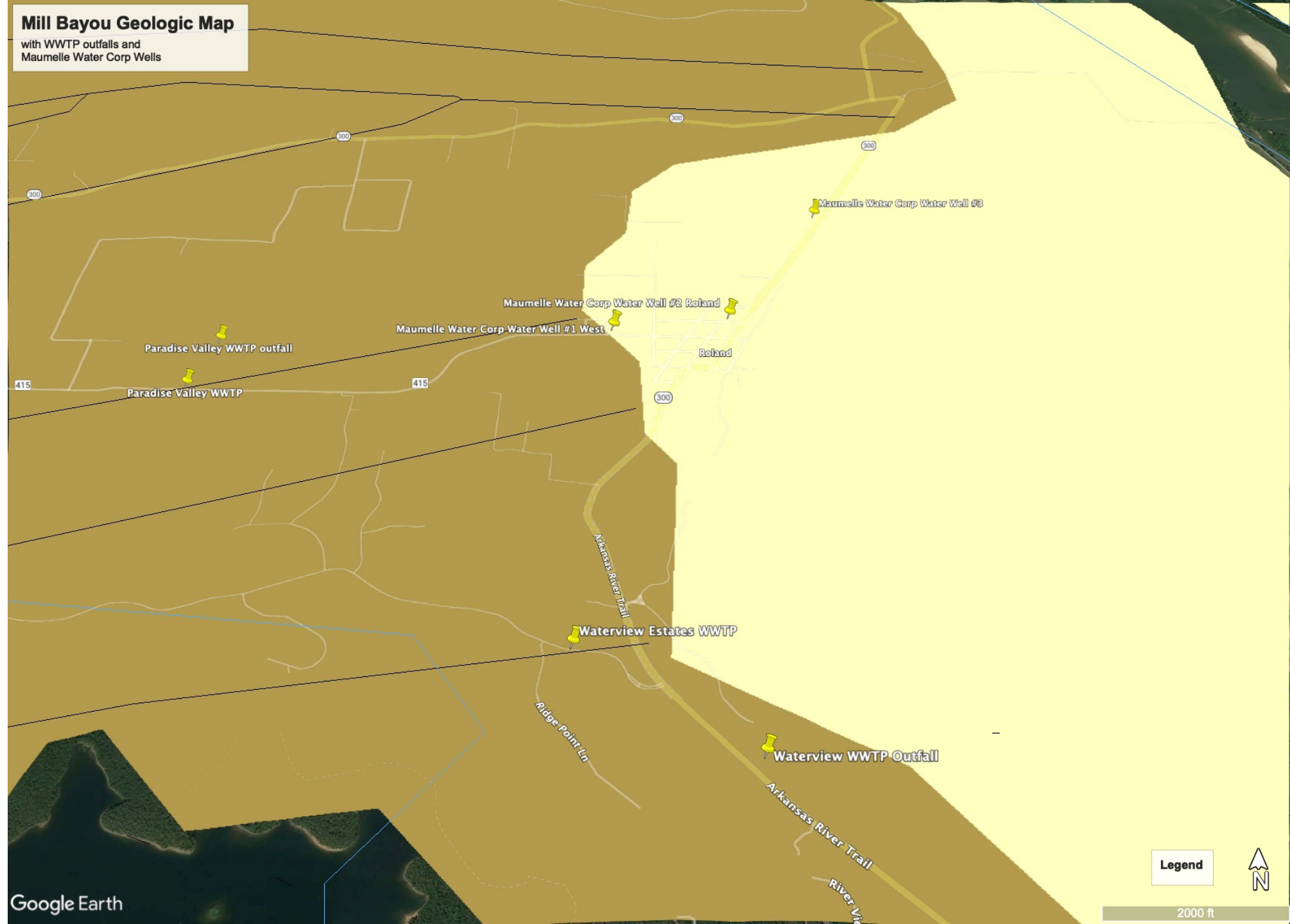


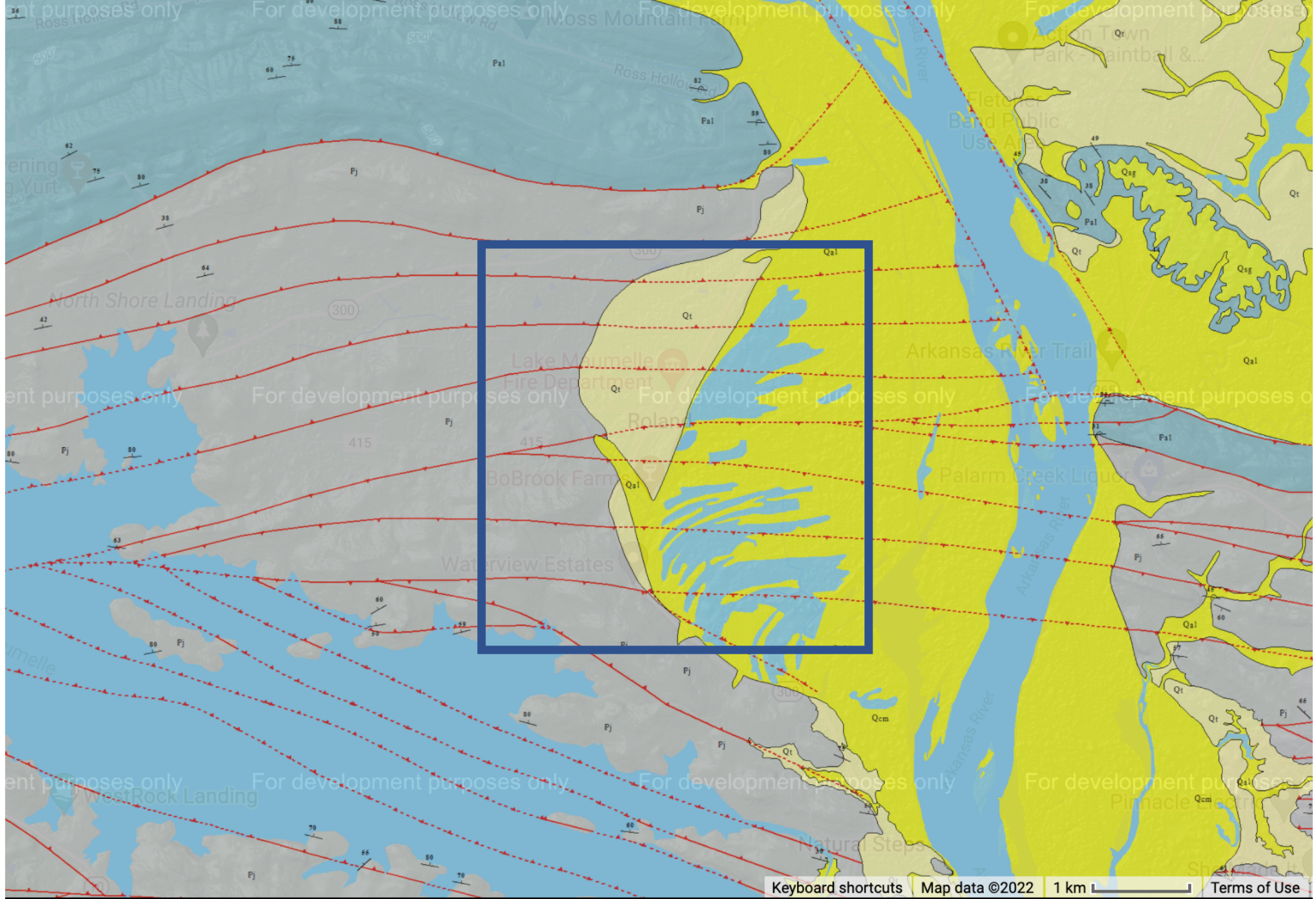
Mill Bayou
with WWTP outfalls and
Maumelle Water Corp Wells



Mill Bayou Geologic Map

with WWTP outfalls and
Maumelle Water Corp Wells





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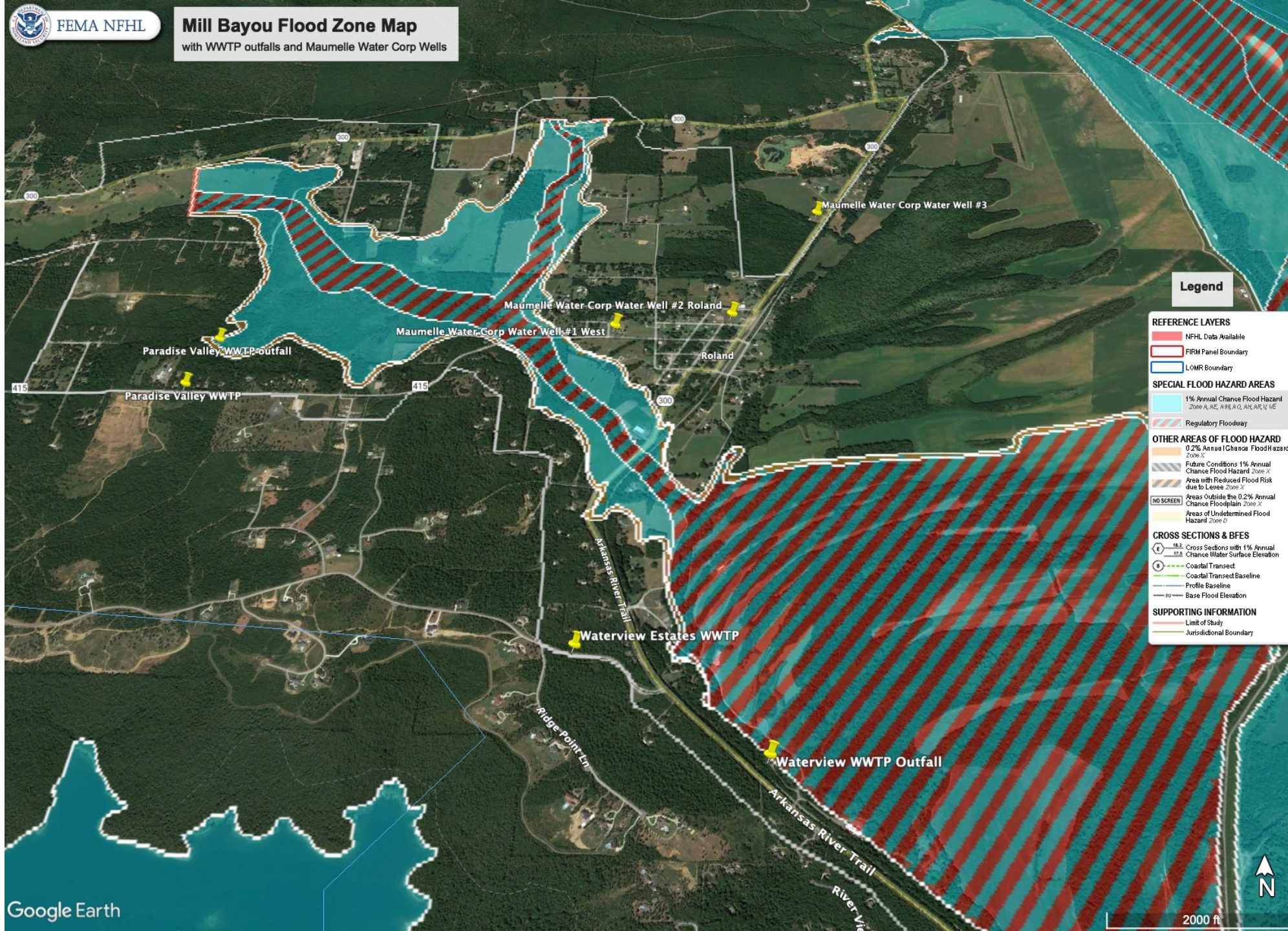
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Mill Bayou Flood Zone Map

with WWTP outfalls and Maumelle Water Corp Wells



Legend

- REFERENCE LAYERS**
- NFHL Data Available
 - FIRM Panel Boundary
 - LOMR Boundary
- SPECIAL FLOOD HAZARD AREAS**
- 1% Annual Chance Flood Hazard (Zone A, AE, A99, A.O, AH, AR, X, VE)
 - Regulatory Floodway
- OTHER AREAS OF FLOOD HAZARD**
- 0.2% Annual Chance Flood Hazard (Zone X)
 - Future Conditions 1% Annual Chance Flood Hazard (Zone X)
 - Area with Reduced Flood Risk due to Levee (Zone X)
 - Areas Outside the 0.2% Annual Chance Floodplain (Zone X)
 - NO SCREEN
 - Areas of Undetermined Flood Hazard (Zone D)
- CROSS SECTIONS & BFES**
- 16.8 Cross Sections with 1% Annual Chance Water Surface Elevation
 - 17.8 Cross Sections with 1% Annual Chance Water Surface Elevation
 - Coastal Transect
 - Coastal Transect Baseline
 - Profile Baseline
 - Base Flood Elevation
- SUPPORTING INFORMATION**
- Limit of Study
 - Jurisdictional Boundary



National Flood Hazard Layer FIRMeTte



92°31'44"W 34°54'22"N



0 250 500 1,000 1,500 2,000 Feet 1:6,000
 Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS	Without Base Flood Elevation (BFE) Zone A, V, A99
	With BFE or Depth Zone AE, AO, AH, VE, AR
	Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD	0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
	Future Conditions 1% Annual Chance Flood Hazard Zone X
	Area with Reduced Flood Risk due to Levee. See Notes. Zone X
	Area with Flood Risk due to Levee Zone D
OTHER AREAS	NO SCREEN Area of Minimal Flood Hazard Zone X
	Effective LOMRs
	Area of Undetermined Flood Hazard Zone D
GENERAL STRUCTURES	Channel, Culvert, or Storm Sewer
	Levee, Dike, or Floodwall
OTHER FEATURES	Cross Sections with 1% Annual Chance Water Surface Elevation
	Coastal Transect
	Base Flood Elevation Line (BFE)
	Limit of Study
	Jurisdiction Boundary
	Coastal Transect Baseline
	Profile Baseline
	Hydrographic Feature
MAP PANELS	Digital Data Available
	No Digital Data Available
	Unmapped
	The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards


The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 4/4/2022 at 11:13 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Mill Bayou Flood Zone Map

Unnamed tributary of Mill Bayou with the proposed Paradise Valley WWTP outfall

Legend

 Paradise Valley WWTP

Beaver Creek Rd


Beaver Creek Rd

Beaver C

265 FEET

265 FEET

Paradise Valley WWTP-outfall

34.899556, -92.524472  Paradise Valley WWTP

415

415

264 FEET

Woodstone Dr



Google Earth

2000 ft

