APPENDIX L: 404(b)(1)

2020 SUPPLEMENT NO. 2 TO THE 2007 FINAL SUPPLEMENT NO. 1 TO THE 1982 YAZOO AREA PUMP PROJECT FINAL ENVIRONMENTAL IMPACT STATEMENT (FEIS)

404 (b) (1)

404 (b) (1) EVALUATION

1.1 Introduction

As required by Section 404(b)(1) of the Clean Water Act, this evaluation assesses the short- and long-term impacts associated with the discharge of dredged and/or fill materials into waters of the U.S. resulting from this project at the proposed Yazoo Backwater Pump Station (Deer Creek Site) and the proposed borrow area for the pump station. The project will also include the installation of no more than 34 supplemental low flow groundwater wells within the Big Sunflower, Upper Deer Creek and Steele Bayou basins.

1.2 Project Description

1.2.1 Location

The Yazoo Backwater Project Area is located in west-central Mississippi and is bordered by the left descending bank of the mainline Mississippi River levee on the west, the west bank levees of the Whittington Auxiliary Channel, the connecting channel on the east, and the Yazoo River on the south. The area which includes portion of Humphreys, Issaquena, Sharkey, Warren, Washington, and Yazoo counties, Mississippi and part of Madison Parish, Louisiana, contains approximately 926,000 acres. In addition, this area is subject to headwater flooding from the Yazoo and Sunflower Rivers and backwater flooding from Steele Bayou that is induced from high stages on the Mississippi River. The proposed location of the Yazoo Backwater Pump Station is in Warren County, Mississippi. The proposed site lies to the east of the Steele Bayou water control structure between the Yazoo Backwater Levee and the Yazoo River; approximately three miles northeast the intersection of Highway 465 and Highway 61 (Figure 1). The supplemental low flow groundwater wells will be located within 30,000 feet of the Mississippi River Channel in Washington, Bolivar and Coahoma counties (Table 2 & Figure 3-6).

1.3 General Description of Yazoo Area Backwater Plan

The Yazoo Area Backwater Plan (YABP) addressed flooding in the Yazoo Backwater Area. The YABP includes both structural and nonstructural features. The structural component consists of a 14,000-cubic-foot-per-second (cfs) pump with a year-round operational pump elevation of 87.0 feet, National Geodetic Vertical Datum (NGVD), at the Deer Creek Pump Site. The pumping station shall be located approximately 3.0 miles northeast of the intersection of Highway 465 and Highway 61, between the Yazoo Backwater levee and Yazoo River near Deer Creek, Mississippi. Construction of this structural feature shall include the pump station, inlet channel, outlet channel and a new levee associated with the pump station. This feature will also require the removal of part of the existing levee for construction of the inlet channel and subsequent construction of a bridge over the inlet channel to connect the existing levee. The pump station right of way (ROW) will be approximately 211.76 acres. The pump station will also require the construction of enlarged access roads and utility installations from Highway 61. The ROW for the access road and subsequent levee widening will be approximately 25.07 acres. The ROW for the utility installations will be approximately 10.54 acres. All of the borrow material which is suitable for construction of these features will originate from excavation of the inlet and outlet channels and from a borrow area designated from within the boundaries of the Pump Station

ROW. Borrow material from these sources shall be referred to as the Deer Creek Borrow Area. A comprehensive soil borings analysis shall be conducted prior to final design of the pump station and supporting features. If the analysis shows that the quantity and quality of borrow material found at the Deer Creek Borrow Area does not meet the needs of the project features, additional material shall be collected from a supplemental borrow area. .The Supplemental Steele Bayou Borrow Area is located north of Highway 465 and north of the Yazoo Backwater levee, approximately eight miles southwest of the pump station, and approximately 0.5 miles northwest of the Steele Bayou structure. The borrow area ROW is approximately 35.92 acres. An access road will be constructed to access the borrow area from Highway 465. From Highway 465, approximately 0.1 miles of site work will be required in order to construct an access road to tie into an existing coffer dam. The access road will be constructed on the coffer dam and continue for approximately 0.25 miles and intersect with the existing Yazoo Backwater Levee road. The access road will then continue west along the levee road for approximately 0.2 miles. From the levee road, the access road construction will turn north for approximately 0.15 miles to the borrow area. The access road will require the construction of a crossing over an existing tributary. The borrow area access road ROW is approximately 9.74 acres (Table 1 & Figure 2).

Additionally, the nonstructural feature includes voluntary perpetual easements and establishment of forests/conservation features on up to 2,700 acres of open agricultural land primarily below 87.0 feet, NGVD. Water levels in the Yazoo Backwater Area would be maintained between 68.5 and 70.0 feet, NGVD, during low or no flow periods.

The compensatory mitigation feature of the YABP includes the acquisition of 2,405 acres of land at or below the 2 year flood frequency elevation. These acres shall be used to compensate for the unavoidable impacts incurred as a result of construction and operation of the Yazoo Backwater Pump.

Additional compensatory mitigation includes the construction of 34 independent supplemental low flow groundwater wells strategically spaced within 30,000 feet of the Mississippi River Channel and along headwater streams of the Big Sunflower, Upper Deer Creek and Steele Bayou Basins. The proposed wells will help alleviate the negative environmental impacts resulting from the observed changes during minimum flow conditions within the three watersheds of the Yazoo Basin. The locations of these well sites are upstream of the backwater area in the counties of Washington, Bolivar, and Coahoma. Each groundwater well will mimic a common design capable of delivering a maximum of 5.0 cfs during low or no flow periods which have historically been observed in the fall months. The pump for each well field will be situated on the top bank of a headwater stream with a pipe discharging water onto a splash pad which will then flow down a constructed reaeration trough to the channel. A negligible quantity of material will be moved for construction of each well. Each well site will be complemented with riprap for stabilization. An access road will be constructed for each well site. The total right of way for the 34 well sites will be approximately 30.9 acres and the right of way for the access roads to the well sites will be approximately 12.19 acres. This information along with the coordinates for each proposed well site is presented in Table 2. Maps of the proposed well locations are presented in Figures 3 – 6.

The proposed pumping plan at the Deer Creek site comes as a result of over 20 years of extensive analysis of 87 structural and nonstructural alternatives leading up to the 2007 SEIS report. A Least Environmentally Damaging Practicable Alternative (LEDPA) analysis resulted in a pumping station situated at the lower end of the Yazoo Backwater Area capable of discharging 14,000 cfs during flood events when interior stages exceed 87.0' NGVD. Features of the proposed Deer Creek Pump Site and the onsite designated borrow area, are subject to Section 404 of the Clean Water Act. This evaluation shall address construction activities involving the discharge of dredged or fill materials into waters of the U.S., including emergent wetlands, scrub-shrub CRP wetlands, forested wetlands, and open water.

1.3.1 Purpose and Authority

The purpose of the proposed Deer Creek Pump Site is to reduce flooding in the Yazoo Backwater Area. The purpose of the proposed well sites is to provide increased flow during low or no flow periods in headwater streams that flow into the Yazoo Backwater Area. The flow would help to sustain aquatic resources during these critical periods. The aggregate flow derived from these 34 wells will help to maintain a flow rate of 0.1 to 0.2 cubic feet per second (cfs) per square mile in the three basins during the critical low flow periods. Project authority is the Flood Control Act of 18 August 1941.

1.3.2 General Description of Dredged or Fill Material

1.3.2.1 General Characteristics of Material

Fill material used in the proposed Yazoo Backwater Project (Deer Creek Site) construction would predominantly consist of clay with some silt, sand, gravel, cement, and riprap for other project features. Dredged material from the periodic maintenance dredging would predominantly consist of silt and clay. The construction of the well sites would predominantly consist of sand, gravel, cement, and riprap.

1.3.2.2 Quantity of Material

Approximately 657,000 cubic yards of fill material will be required to construct the new preload pad, new cofferdam, new levees, and structural backfill. The new north and south levees combined along with the cofferdam will require roughly 66,000 and 105,000 cubic yards of fill material respectively. The new preload and backfill for the pump station will require roughly 268,000 and 218,000 cubic yards of fill material respectively. Most of this material will come from excavation of the inlet and outlet channels and the onsite borrow pit (Deer Creek). If the material acquired during the excavation of the channels and onsite borrow area (Deer Creek) is deemed unsuitable for construction, additional fill material may come from the Supplemental Steele Bayou Borrow Area. Approximately 14,000 and 20,000 cubic yards of fill material will be required to construct the access road from the Yazoo Backwater Levee to the borrow area and the access road from the previously constructed coffer dam to Highway 465 respectively. Anticipated project maintenance requirements over the project life will entail the periodic removal and deposition of sediment accumulations from the inlet and outlet channels. This material will be deposited in the disposal area located within the ROW of the Deer Creek borrow area.

Each supplemental low flow groundwater well shall utilize a reaeration trough to deliver water from the well head on top bank down to the water surface of the channel. Fill material in the form of concrete or rip rap will be placed on the channel slope for this purpose. The portion of the slope determined to exist below ordinary high water will likely be impacted. The reaeration trough will likely be 15 feet wide with 10 foot rip rap buffers on either side that extends approximately 30 linear feet below ordinary high water level to the low water surface depending on existing channel slopes. This geometry would impact approximately 1,050 square feet. The cumulative fill from the 34 well sites would equate to less than 1.0 acre. The geometric dimensions presented are believed to be adequate for impacted areas below ordinary high water for each reaeration trough. However, the design of each trough will likely be subject to minor modifications through an adaptive management strategy until an accepted model is reached. Actual Impacted area of each trough shall be computed at the time of final design.

1.3.2.3 Source of Material

With exception of gravel, riprap, and concrete, fill materials would be generated onsite from construction associated with the pump station site, inlet and outlet channels, and various roadways and levees. A minimal quantity of filter material will be used around the annulus of each supplemental low flow groundwater well screen. Concrete and bentonite will be used to seal each well at the surface.

1.3.3 Description of the Proposed Discharge Sites

1.3.3.1 Location

The discharge would be at the pump station site, inlet and outlet channels, various roadways and levees, and borrow area.

1.3.3.2 Size

Total area impacted by proposed project construction would be approximately 336.12 acres, of which 193.52 acres are considered wetlands or open waters. A Preliminary Jurisdictional Determination of the various classes of Wetlands associated with the construction of the pumping station and the borrow area has been defined by personnel from the U.S. Army Corps of Engineers – Vicksburg District, Regulatory Division as well as personnel from the U.S. Department of Agriculture – National Resources Conservation Service. All the various wetland and non-wetland classes within the project boundaries have been identified in Figures 7-10. Given the uncertainty associated with the preliminary design of the overall footprint of the pump station, the entire pump station ROW has been assumed to incur permanent impacts to wetlands where applicable. It is likely that much of the area contained within the pump station ROW but outside of the pump station footprint (labeled as "Clear and Grubb") will not incur permanent impacts to existing wetlands. However, a conservative approach to wetland impacts has been assumed. A more detailed assessment of both temporary and permanent impacts will be determined upon final design of the pump station after soil borings and related design criteria has been collected. The construction area for the pumping station, surrounding ROW, access road enlargement, and utility boundary contains the following classes of wetlands and non-wetlands: Jurisdictional Lake (1.68 acres), Jurisdictional Emergent Wetland (2.01 acres), Excluded Emergent Wetland (72.73 acres), Forested Wetland (58.71 acres), Excluded Scrub-Shrub CRP

Wetland (24.58 acres), Jurisdictional Rivers (10.25 acres), and Uplands (77.35 acres) (Figures 7-9).

The construction for the borrow area and the two access roads contains the following classes of wetlands and non-wetlands: Jurisdictional Emergent Wetlands (23.14 acres), Jurisdictional Tributary (0.42 acres), and Uplands (21.73 acres) (Figure 10).

Well sites would be installed within five miles of the Mississippi River Channel and on the top bank of low flow channels to provide easy access for water to discharge into the stream. The location of each well site has been identified in Table 2 and Figures 3–6. Each well site footprint will disturb no more than 1.25 acres. The associated access roads for the well sites will predominantly utilize unimproved, existing agricultural roads. The average overall acreage for each access road will be 0.36 acres. No more than 34 wells shall be installed for this project. Due to the uncertainty associated with the availability of land for the identified well field sites from willing landowners, a formal Jurisdictional Determination (JD) was not conducted. It should be noted that each well site may move up to 1,000 feet up or down stream and/or to the opposing bank from the proposed locations. These relocations could result from unforeseen limitations with HTRW, cultural artifacts, power availability, or unwilling land sellers. Upon approval of the Yazoo Area Backwater Pump Project and after funding has been allocated, JD's shall be conducted on the well sites. As such, no disposal of fill material is anticipated by the installation of the common well field design.

Tables 1 and 2 describe the overall acres associated with The Deer Creek Pump Station and the Supplemental Steele Bayou Borrow Area for the Yazoo Area Backwater Project. It should be noted that slight rounding error discrepancies can be seen in the totals.

1.3.3.3 Types of Sites

According to preliminary plans, material taken from the channel and cofferdam excavation will be used to build the new levee, cofferdam, and structural backfill. If any of this material is deemed unsuitable for construction, fill will be collected from the Deer Creek Borrow Area or the Supplemental Steele Bayou Borrow Area. Up to 1.68 acres of the total 247.37 disturbed acres for the Deer Creek Pump Station, which comprises the old Deer Creek Channel, will be filled during the construction of the new levee. Approximately 10.25 acres of Jurisdictional Rivers (Diversion Channel and Yazoo River) will be temporarily impacted during the construction of the inlet and outlet channels to the Deer Creek Pump Station. A maximum of 158.03 acres of wetlands will be filled during the construction of the proposed Deer Creek Pump Site.

Approximately 10.25 acres of Jurisdictional Rivers (Diversion Channel and Yazoo River) will be temporarily impacted during the construction of the inlet and outlet channels to the Deer Creek Pump Station. A maximum of 158.03 acres of wetlands will be filled during the construction of the proposed Deer Creek Pump Site. If needed, a maximum of 0.42 acres of Jurisdictional Tributary and 23.14 acres of Jurisdictional Emergent Wetland of the total 45.29 disturbed acres outlined in the Supplemental Steele Bayou Borrow Area, will be filled during the construction of the Yazoo Area Pumping Plant.

The well sites will be located primarily on agricultural lands adjacent to headwater streams. Disturbed areas around each well site shall be permanently stabilized with concrete and riprap. Any other minimal disturbances shall be seeded for permanent stabilization.

1.3.3.4 Types of Habitats

Habitat types include forested wetlands, agricultural wetlands, uplands, and open water. The forested wetland habitat is dominated by sugarberry, boxelder, bitter pecan, and buttonbush, with rattan vine and muscadine as common vines. Other less common species include Nuttall oak, bald cypress, and black willow.

1.3.3.5 Timing and Duration of Discharge

Discharge timing during the period of pump construction would depend on preconstruction planning and construction activities. The timing of periodic maintenance dredging in the inlet and outlet channels will depend upon hydrologic events and the rate of deposition in these channels. Well installations shall take place as environmental conditions dictate from the associated adaptive management plan. Each well installation shall occur independent of other well sites. The time frame for the overall construction for all well sites will be one to five years contingent on the findings from the adaptive management plan.

1.3.4 Description of Disposal Method

Fill material for disposal, realignment of levee, backfill around the pump station, and construction of roadways would be transported and deposited by truck, bulldozer, and/or dragline. With the exception of gravel, riprap, and concrete, all fill material would be generated onsite or from the borrow area. Material from the periodic maintenance dredging will be placed in a government approved upland disposal area. No disposal of fill material is anticipated by the installation of the well sites during construction.

1.4 Factual Determinations

1.4.1 Physical Substrate Determinations

1.4.1.1 Substrate, Elevation, and Slope

The inlet and outlet channels will form a secondary means of transferring floodwaters from the Yazoo Backwater Project Area into the Yazoo River via a pump station to reduce the damages from interior ponding resulting from Mississippi River backwater flooding. There will be no change in substrate, elevation, or slope within the Yazoo Backwater Channel or the Yazoo River. When completed, the inlet channel will be 1,200 feet long and have a bottom elevation of 65.0 feet, NGVD, and side slopes of 1 on 4. When completed, the outlet channel will be 1,800 feet long and have a bottom elevation of 76.0 feet, NGVD. Side slopes for the outlet channel will also be 1 on 4. The banks of the inlet and outlet channels will be armored to prevent erosion at their confluence with the Yazoo Backwater Channel and the Yazoo River. Any erodible soils on the channel slopes will be protected by filter fabric and riprap to reduce the potential for erosion. Erosion that would arise from the discharge pipe of water from the wells placed in the receiving streams shall be mitigated with the placement of an impervious reaeration trough and riprap.

1.4.1.2 Sediment Type

Sediments will consist predominantly of clays and silts.

1.4.1.3 Dredged/Fill Material Movement

Any movement of dredged or fill material after placement at the pump station site would be disposed of onsite in the Deer Creek Borrow Area. This may include fill materials derived from the coffer dam and preload pad. If the soil borings analysis at the Deer Creek Pump Station shows that the quantity and quality of borrow material does not meet the needs of the project features, additional material shall be collected from the Supplemental Steele Bayou Borrow Area and moved to the Deer Creek Pump Station for use.

1.4.1.4 Physical Effects on Benthos

During construction, deposition of fill material would unavoidably impact benthic organisms in the 1.68 acres of surface water affected by the filling of the old Deer Creek channel. Temporary impacts to benthic organisms from fill material would also be unavoidable within the 10.25 acres of Jurisdictional Rivers (Diversion Canal and Yazoo River) after the removal of the coffer dam. Periodic maintenance dredging of the inlet and outlet channels would unavoidably disturb benthos inhabiting the channels. Maintenance dredging, however, is only predicted to be needed once or twice during the life of the project. The benthic organisms found in the Jurisdictional Tributary identified between the Yazoo Backwater Levee and the Supplemental Steele Bayou Borrow Area would experience unavoidable impacts on 0.42 acres during the installation of the culvert crossing to facilitate access. The physical effects on benthos shall be positively influenced during traditionally low or no flow periods by the supplement of water from the proposed well sites on as much as 750 miles of streams in the Big Sunflower, Deer Creek and Steele Bayou basins, with 340 miles of those streams located within the Yazoo Backwater area.

Actions Taken to Minimize Impacts

The impacts associated with construction of the pump station in the lower end of the drainage basin and the deposition of dredged or fill material in the identified open waters and wetlands are unavoidable. The major portion of lands impacted by construction and deposition of fill material will be isolated from neighboring water bodies by dikes and existing levees. Unavoidable impacts will be further minimized by the application of best management practices (BMPs) for nonpoint source pollution at the construction site. These nonpoint source control measures will include silt screens, buffer zones, and containment dikes. The construction site will be reseeded to stabilize the soil and prevent aerial drift of dust once construction activities are completed. Other control measures associated with the installation of utility lines from Highway 61 to the pumping station may include the use of drill and bore techniques as opposed to open trench methods. A Stormwater Prevention Plan (SWPP) that outlines the specific steps that will be utilized to minimize nonpoint source runoff will be filed with the Mississippi Department of Environmental Quality (MDEQ). The greatest potential for substrate movement would be when the inlet and outlet channels are connected to the Yazoo Backwater Channel and the Yazoo River. Effects would be temporary and would be minimized using land-based equipment wherever possible. When completed, the banks of the inlet and outlet channels will be armored to prevent erosion at their confluence with the Yazoo Backwater Channel and the Yazoo River. Any erodible soils on the channel slopes will be protected by filter fabric and riprap to reduce the

potential for erosion. Channel banks will be seeded once slopes are completed. Material removed from the channels during periodic maintenance dredging will be placed in government approved borrow/disposal areas.

Well installation will disturb a minimal amount of land at each site. The impacts to these disturbed areas shall be minimized with BMPs.

1.4.2 Water Circulation, Fluctuations, Chemical, and Physical Determinations

1.4.2.1 Water

Most of the changes to water quality will be within the normal range of values observed during any year. Impacts will depend upon the time of year and the ambient concentrations in each of the receiving water bodies. Impacts to water quality could be caused by stormwater runoff at the construction site, by increases in turbidity when the inlet and outlet channels are de-watered, by increases in turbidity when the inlet and outlet channels are connected to the Yazoo Backwater Channel and the Yazoo River, and by increases in turbidity during periodic maintenance dredging. Impacts to water quality resulting from project construction activities include short-term localized increases in turbidity and suspended solids due to rainfall runoff at the construction site.

The addition of 34 independent supplemental low flow groundwater wells in the headwaters of the Big Sunflower and Steele Bayou basins shall supply as much as 170 cfs during traditional periods of low or no flow which will have a positive effect on the hydrology in the three basins. Base flow shall be enhanced to levels that can better sustain aquatic life year-round. Increased base flow will likely reduce the effects of low dissolved oxygen (DO) during stagnant conditions.

1. Salinity.
    a. No impacts to existing salinity conditions are anticipated from the construction of the Yazoo Backwater Pump.
    b. The well sites will draw from the Mississippi River Alluvial Aquifer. The basin already receives significant volumes of well water during the irrigation season. The discharge of well water will not alter the normal range of salinity the surface waters have experienced over the last 40 years. This additional water is not believed to influence salinity conditions in existing channels.
2. Water chemistry.
    a. Changes to water chemistry could occur within the mixing zone such that adsorped materials on soil and sediment particles become dissolved or suspended in the water column. During construction, most of the pump station site will be isolated from the Yazoo Backwater Channel and the Yazoo River by a cofferdam. The most likely periods for increases in suspended sediment would be during unwatering of the inlet and outlet channels, particularly as the water levels in the two channels approach the channel bottom surface elevations and when the channels are connected to the Yazoo Backwater Channel and the Yazoo River. Increases in turbidity would depend upon the time of year and the ambient

concentrations in each of the receiving water bodies. Turbidity outside the mixing zone will be monitored to ensure concentrations do not exceed the state criterion. Other than localized short-term increases in suspended solids and turbidity, there will be no impacts to water chemistry from construction activities at the pump station site or from periodic maintenance dredging of the inlet and outlet channels.

3. Clarity.
    a. The localized increases in turbidity caused by construction of the Yazoo Backwater Pump would influence clarity. The preexisting condition for clarity should return shortly after the proposed construction is completed.
    b. Water from well sites may be high in dissolved iron. When the well water meets the stream, the iron will precipitate. If present in large enough quantities, the precipitates will stain the stream bottom. Before settling, these precipitates may have a local impact on water clarity at the point of discharge. These impacts should quickly diminish.
4. Color.
    a. Any changes in watercolor at the construction site of the Yazoo Backwater Pump would be temporary and minor.
    b. Color could potentially be influenced by the precipitation of iron at the point of discharge from the well sites.
5. Odor.
    a. Construction operations for the Yazoo Backwater Pump may result in the release of odors otherwise contained. However, this condition is not expected to be hazardous and would be localized and short-lived.
    b. Sulfides have been traditionally associated with the Mississippi River Alluvial groundwater. A local change in ambient air conditions may occur at the point of discharge from the well sites.
6. Taste.
    a. Not applicable. There are no potable water intakes in the immediate vicinity of the proposed Yazoo Backwater Pump site.
    b. The presence of iron and hydrogen sulfide from extracted well water from the MRVA (Mississippi River Alluvial Valley) may have an impact on the taste at the point of discharge into the streams influenced from the well sites.
7. Dissolved gas levels.

    b. Local DO concentrations of surface waters could be reduced with the addition of well water containing low DO concentrations as it is pumped to the surface. Reaeration troughs shall be incorporated into each well site design to mitigate for low DO concentrations associated with groundwater. The design of each trough will likely be subject to minor modifications through an adaptive management strategy until an accepted model is reached. The addition of overall water supply

to existing low flow channels will further stimulate agitation and reaerate low DO levels in surface water pools. The cooler temperature regime typically associated with groundwater will also have a positive effect on the DO saturation when mixed with warmer surface waters.

8. Nutrients.

    a. Sediment disturbance during construction of the Yazoo Backwater Pump may cause temporary increases in nutrient levels. Such increases would be of short duration, and nutrient levels would return to preconstruction levels following completion of construction.

    b. Any iron present in the groundwater that has not been oxidized prior to introduction to the stream will have the potential to bind with total phosphorus present in the stream. This chemical reaction will promote precipitates that will enhance removal of phosphorus from the water column via settling. This will have an overall positive impact to the ambient phosphorus concentrations from agricultural runoff.

9. Eutrophication.

    a. No change in the trophic state of the waters around the construction site is expected to result from the temporary and minor increase in nutrients that may reach area surface waters during construction of the Yazoo Backwater Pump Site.

    b. No change in the trophic state is expected to result from the addition of water from the well sites.

10. Current patterns and circulation.

    a. Completion of inlet and outlet channels will connect the pump station to the Yazoo Backwater Channel and the Yazoo River. This will allow floodwater to be pumped across the Yazoo Backwater levee when Steele Bayou and Little Sunflower water control structures are closed. While this would result in a slight change in current pattern, impacts will not be significant.

    b. Addition of water from the well sites to the headwaters of the Yazoo Backwater Area shall have a positive effect on the minimum flow conditions observed in the basin. These additional flows shall enhance stream flow for many of the primary tributaries, which have suffered from reduced base flow

11. Velocity.

    a. Deposition of dredged or fill material into the designated disposal areas will have no effect on velocities within the Yazoo Backwater Study Area. Operation of the backwater pump station should not impact velocities within the Mississippi River, Yazoo River, Yazoo Backwater Channel, and Big Sunflower River. Velocities of flow in the pump inlet and outlet channels at full capacity will be less than 2 feet per second. During low-water periods, both channels will become slack-water areas. Water levels in the outlet channel will fluctuate with water levels in the Yazoo River, while water levels in the inlet channel would fluctuate with water levels in the Yazoo Diversion Channel.

b. Addition of water from the well sites will increase the velocities in the streams of the headwaters of the Yazoo Backwater Area. Flow from each well will not exceed 5 cubic feet per second. The addition of this water at each site will not adversely influence stream morphology but will be beneficial to aquatic life.

12. Stratification.

a. Water temperatures in the immediate construction area may be affected due to short-term increases in turbidity during construction. Any impact resulting in a change in stratification processes would be minor and temporary.

b. Water from the well sites will likely decrease the ambient temperature of the streams. The addition of well water will likely take place during the hot and dry fall months and will likely be beneficial to aquatic life.

13. Hydrologic regime.

a. The Yazoo Backwater project would provide for the reduction in interior flooding during backwater flood events. Pumping will lower the water surface of floods greater than the 1-year frequency flood, which will reduce the extent and duration of the flood. These changes to flood extent and duration would be slow and gradual. The actual change in the water surface elevation will be greatest near the pump station and less in the headwaters. At the Steele Bayou Structure, a 14,000 cfs pump would reduce the 2-year flood from 90.20 to 88.39 feet, NGVD, and reduce the flood volume by 35.8 percent. The pump would reduce the 100-year flood from 98.35 to 95.23 feet, NGVD, and reduce the flood volume by 39.7 percent. Both are significant volume reductions for a backwater flood. Flood elevations of the 1-year flood would remain the same, 87.63 feet, NGVD. Similar reduction would be seen at the Steele Bayou Structure. An estimated 97,677 acres are currently supported by flooding (i.e., ≥14 consecutive days of flood inundation; federal threshold for wetland hydrology), and the majority of those wetlands (69,352 acres) will not exhibit a change in hydrology due to operation of the pumps. The pumps may reduce the flood inundation duration of 28,325 acres of wetlands. However, while these wetlands will no longer be exposed to ≥14 consecutive days of flood inundation, their wetland hydrology will be sustained by precipitation, the predominant source of wetland hydrology in the region. The analysis that determined impacts to these wetland acres was worst case, and upstream impacts at the proposed Deer Creek Pump Site could be slightly lower. Impacts from these physical changes are minimized by virtue of conservative assumptions, mitigation, and reforestation. Impacts to wetlands from changes in hydrology will be fully compensated for through mitigation efforts.

b. The addition of water from the well sites will increase flow during traditionally low or no flow periods. The wells will only be operated during periods of low or no flow (generally during the fall) and will not contribute to water levels during backwater flood events. Well operations will be monitored, and some or all of the wells would be closed during significant precipitation events. It should be noted that the use of the supplemental low flow wells comes as stream stages begin to decline from diminished irrigation return flow after the agricultural growing

season. The supplemental flow delivered to the streams should not be viewed as a water source for irrigation (via surface water) to nearby farming operations.

14. Normal water level fluctuations.

    a. Deposition of fill material into the designated government approved areas will have no impact on normal water level fluctuations. Conversion of up to 1.68 acres of open water at the construction site will permanently alter normal water level fluctuations in these areas since they will no longer be open water. The actual change in water surface elevation will be greatest at the Deer Creek Pump Site and less in the headwaters. Water levels on the Yazoo River side of the Deer Creek Pump site would be impacted by less than a 0.25 of a foot during pump operation. Water levels in the completed 17.5 acre outlet channel will fluctuate with water levels in the Yazoo River. The increased stage of the Mississippi River at the Vicksburg gage from the additional 14,000 cfs flow from the Yazoo River should be less than 0.2 foot (2.4 inches). This minor increase will not likely have a significant impact on the local downstream communities in the Vicksburg area during a flood event. Water levels should not be impacted in the Jurisdictional Tributary identified between the Yazoo Backwater Levee and if utilized, the Supplemental Steele Bayou borrow area where a culvert crossing shall fill 0.42 acres to facilitate access.

    b. The addition of water from the well sites shall have a positive influence on stages during low or no flow conditions.

15. Salinity gradients.

    a. Not applicable for the proposed Yazoo Backwater Pump Site.

    b. This additional water, supplied by the well field, is not believed to influence salinity conditions in existing channels.

1.4.2.2 Actions Taken to Minimize Impacts

During construction, most of the pump station at the Deer Creek site will be isolated from the Yazoo Backwater Channel and the Yazoo River by levees and dikes. Impact of stormwater runoff will be minimized by implementation of BMPs in accordance with the State of Mississippi laws and regulations. Adverse impacts to water quality associated with removal of vegetation will be minimized by seeding disturbed areas after construction. Disposal areas shall be located on the construction site or the defined borrow area. Turbidity will be monitored during activities that remove or resuspend sediment.

Additionally, the reforestation/conservation measures on up to 2,700 acres (nonstructural feature) below elevation 87.0, NGVD, (from willing landowners) within the study area are anticipated to have beneficial hydrologic impacts and provide significant long-term benefits to water quality. This nonstructural reforestation feature would improve the functional capacity of the reforested wetlands.

The compensatory mitigation measures of the YABP which includes the acquisition of 2,405 acres (compensatory mitigation feature) of land at or below the 2 year flood frequency elevation

will also have beneficial hydrologic impacts and provide significant long-term benefits to water quality.

Each supplemental low flow groundwater well installation shall incur minor disturbances of soils at the well head and the area associated with installation of the reaeration trough to the receiving stream. The reaeration trough will deliver water from the well head on top bank down to the water surface of the channel. Fill material in the form of concrete or rip rap will be placed on the channel slope for this purpose. The portion of the slope determined to exist below ordinary high water will likely be impacted. The geometry for a typical reaeration trough will be approximately 15 feet wide with 10 foot rip rap buffers on either side that extends approximately 30 linear feet below ordinary high water level to the low water surface. This linear distance is largely dependent on existing channel slopes. With these estimations, the geometric area impacted would cover 1,050 square feet. The cumulative fill of these impacts from the 34 well sites would equate to less than 1.0 acre. The geometric dimensions presented are believed to be adequate for impacted areas below ordinary high water for each reaeration trough. However, the design of each trough will likely be subject to minor modifications through an adaptive management strategy until an accepted model is reached. Actual Impacted area of each trough shall be computed at the time of final design.

1.4.3 Suspended Particulate/Turbidity Determinations

The temporary effects of clearing, filling, and/or dredging associated with the proposed project construction of the Yazoo Backwater Pump and well sites may induce localized increases in soil erosion and/or turbidity. Eroded material from the construction site may be transported into near waterways. This could result in short-term and localized increases in suspended particulates and turbidity levels. Unwatering the inlet and outlet channels at Deer Creek Pump Station could also cause temporary increases in turbidity, particularly when the water levels in the two channels approach the channel bottom surface elevations. Turbidity increases will also occur when the channels are connected to the Yazoo Backwater Channel or the Yazoo River. Increases in turbidity would depend upon the time of year and the ambient concentrations in each of the receiving water bodies. Increases in turbidity are expected to be short term. Well site installations will have little effect of turbidity.

1. Light penetration. Short-term reductions in light penetration are likely to occur during construction activities at the Deer Creek Pump site. These reductions in light penetration are anticipated to be short term and localized to the area adjacent to construction operations. Light penetration levels should return to preconstruction levels soon after construction is completed.

    1. DO. Temporary decreases in light penetration from localized increases in turbidity could cause reductions in photosynthesis. This could result in temporary, localized decreases in DO concentrations. The DO should return to preconstruction concentrations once the turbidity clears and photosynthesis rates return to normal at the Deer Creek Pump site. A minimal disturbance of suspended sediments will likely be incurred at the point of discharge of the wells. These disturbances are perceived to be minimal, and sediments should settle out of the water column quickly. The increased turbidity will have minimal impacts on light penetration and DO.

1.4.3.1 Toxic Metals and Organics

Because the proposed Deer Creek pump station site lies primarily on agricultural fields, the soil potentially contains organic contaminants. Past elutriate tests show that there is little reason to believe that the disturbance of the sediments will increase the concentration of toxic metals. Prior to periodic maintenance dredging, sediments to be dredged will be sampled and analyzed for toxic metals or organics that have known potential sources in the watershed. Dredged materials will be placed in government approved disposal areas. Given the minimal area associated with the construction of each well site, there is little reason to believe that the disturbance of the sediments will increase the concentration of toxic metals in the adjacent streams.

The water extracted from the MRVA is known to have higher levels of iron concentrations. Currently there are more than 20,000 wells in use for agricultural irrigation in the Yazoo Backwater Area. While the operation of these irrigation wells has had a significant contribution to Yazoo Basin via irrigation return flow, the surface water quality has not experienced a noticeable change. The ferrous iron pumped by each supplemental low flow groundwater well will likely precipitate in the reaeration trough adjacent to the channel and should not have an adverse effect on stream water quality (may improve water quality by removal of phosphorus). The clean groundwater taken from the MRVA has been found to be free of harmful contaminates and should have a positive impact on the overall water quality in the Yazoo Basin.

1.4.3.2 Pathogens

While coliform and enterococci bacteria may be present in project waters, project construction would not affect this condition.

1.4.3.3 Aesthetics

Construction of the pump station and well sites will have short-term impacts on the natural esthetics adjacent to the sites. Turbidity plumes may be created as a direct response to construction activities in and adjacent to area surface water by the Deer Creek Pump Station. If created, these plumes would be infrequent and short term. The loss of up to 193.52 acres of wetlands or open waters would adversely impact esthetics until vegetation is reestablished. However, the green space resulting from reestablishment of forest via perpetual conservation easements will improve esthetics significantly.

The well sites shall cause minimal disturbance to turbidity at the point of discharge into the receiving waters. The induced turbidity should dissipate in a relatively short distance downstream. In addition to a well head and service panel, completed well site installations shall utilize power poles for needed power. The esthetics associated with these features will not look out of place given the existing 20,000 well heads installed in the study area for agricultural irrigation.

1.4.3.4 Pesticides

The primary source of pesticides is from runoff from agricultural fields in the basin. Because the proposed Deer Creek pump station site lies on agricultural fields, the excavated soil may contain pesticides within the top two to five feet from the surface. The excess material excavated from the inlet and outlet channels shall be confined using onsite storage. The topsoil shall be

permanently capped with additional material. The proposed construction activities will not increase the levels of pesticides in runoff.

The minor disturbance of soils at the well sites, will not likely have an impact on pesticide levels in adjacent streams.

1.4.3.5 Effects on Biota

The temporary reduction in light transmission as a result of erosion associated with construction may temporarily reduce photosynthesis and primary productivity to a minor degree in aquatic areas adjacent to the construction site.

The addition of water to the headwater streams of the Big Sunflower, Upper Deer Creek and Steele Bayou basins during low flow periods will have a positive effect on the overall health of the aquatic ecosystems. The additional supply of ground water will stimulate agitation and potentially lower water temperatures of stagnant pools during warmer months thus enhancing DO concentration levels. The additional water supply will also increase water depths providing for a more diverse aquatic habitat. These benefits will increase the fish passage opportunities in each basin. The increased water depth will also increase the wetted perimeter of the channel bottom during low flow periods providing for year-round habitat for endangered mussel species. These benefits are further explained in Section 1.4.5, Aquatic Ecosystem and Organism Determinations.

These temporary effects on light transmission as a result of erosion are not anticipated for the construction of the supplemental low flow well sites.

1.4.3.6 Suspension/Filter Feeders

No significant effects.

1.4.3.7 Sight Feeders

No Significant Effects. These organisms are generally highly mobile and would avoid or escape any areas of high turbidity.

1.4.3.8 Action Taken to Minimize Impacts

BMPs will be utilized to minimize impacts from stormwater runoff. Temporarily disturbed areas would be revegetated as soon as possible following construction at the Deer Creek Pump site.

Efforts shall be taken to minimize disturbance at the point of discharge of the well sites into the receiving streams.

1.4.4 Contamination Determinations

A preliminary onsite hazardous, toxic, and radioactive waste (HTRW) assessment of the proposed construction areas was conducted by USACE personnel. This included a search of MDEQ Office of Pollution Control records for known hazardous or potentially hazardous waste sites, landfills, leaking underground storage tanks, and national priorities list sites. The

preliminary assessment can be found in HTRW Section and Appendix of this report. An in depth HTRW assessment on proposed easement properties will be conducted after they have been identified and prior to any real estate transaction for the Yazoo Backwater Pump and each of the 34 well sites prior to construction.

1.4.5 Aquatic Ecosystem and Organism Determinations

1.4.5.1 Effects on Plankton

Any existing plankton in the immediate area of fill material deposition for the Deer Creek Pump site would be adversely impacted due to elevated turbidity levels. However, these impacts would be localized and short- term. Waters (up to 1.68 acres) to be filled would, unavoidably, no longer be available for use by plankton. This unavoidable adverse impact would be offset by up to 28 acres of water that would be gained by completion of the inlet and outlet channels. Plankton found in the Jurisdictional Tributary adjacent to the borrow area would also be adversely impacted by deposition of fill material on 0.42 acres of needed for an access crossing.

There would be no adverse effect on Plankton by the installation of each well site. Plankton communities downstream of each well site should benefit from the additional water to the streams during low or no flow periods.

1.4.5.2 Effects on Benthos

Some benthic organisms would be adversely impacted by deposition of fill material and by unwatering the inlet and outlet channels to facilitate completion of these channels. The 1.68 acres of water to be filled would, unavoidably, no longer be available for use by benthic organisms. Completion of the inlet channel would create 7.5 acres of permanent open water behind the proposed Deer Creek Pump Site. Completion of the outlet channel would create up to 17.5 acres of open water that would fluctuate with the water level of the Yazoo River. Benthic organisms would also be minimally impacted by deposition of fill material and by unwatering of 0.42 acres of Jurisdictional Tributary needed for an access crossing to the borrow area. It should be noted that flow along the tributary will be maintained using culverts which shall be installed with inverts set to facilitate passage.

There would be no adverse effect on benthos by the installation of each well site. Benthos communities downstream of each well site should benefit from the additional water to the streams during low or no flow periods.

1.4.5.3 Effects on Nekton

Those waters (1.68 acres) to be filled would, unavoidably, no longer be available for use by nekton. However, up to 28 acres of permanent open water would be created by completion of the inlet and outlet channels. The open water will fluctuate with the water level of the Yazoo River and the Auxiliary Channel. Nekton would also be unavailable in 0.42 acres of waters found in the Jurisdictional Tributary adjacent to the borrow area when an access crossing is constructed. It should be noted that flow along the tributary will be maintained using culverts.

Installation of wells would have no effect on nekton however the addition of water during low or no flow periods shall improve the habitat for nekton in as much as 750 miles of streams in the Big Sunflower and Steele Bayou basins, with 340 miles of those streams located within the Yazoo Backwater area.

1.4.5.4 Effects on Aquatic Food Web

The aquatic food web would, unavoidably, be adversely impacted due to the loss of up to 193.52 acres of wetlands or open waters from the Deer Creek Pump site and borrow area and the Supplemental Steele Bayou Borrow Area. The aquatic food web would be beneficially impacted by the proposed nonstructural feature (reforestation/conservation measures on up to 2,700 acres via perpetual conservation easements) and the compensatory mitigation feature which includes the acquisition of 2,405 acres of land at or below the 2 year flood frequency elevation. In the warm, humid climate characteristic of the study area, the bioenergetics of the aquatic system increase during the spring, summer, and fall months. As such, phytoplankton and microbial systems are quick to recover from stress situations during these periods. Effects to the aquatic food web will be minimized by the limited construction impacts to a small area (the Deer Creek Pump construction site) relative to the study area.

There would be no effect on the aquatic food web by the installation of the well sites. However, hydrologic conditions sustained by supplemental flow in the upper watershed of the Yazoo Basin shall help to maintain aquatic biota year-round.

1.4.5.5 Effects on Special Aquatic Sites

Aquatic sites within the Delta National Forest, as well as several other aquatic areas in the basin, would experience a long-term improvement in water quality as a result of reforestation/conservation measures on up to 2,700 acres (nonstructural feature) of current agricultural land and the acquisition of 2,405 acres (compensatory mitigation feature). Any direct impacts, e.g., increased erosion during the construction of the Deer Creek Pump site or the well sites, would be minor and temporary.

1. Wetlands. Within the direct impact area (i.e., the area within the footprint of the pumping plant and associated infrastructure), a jurisdictional wetland delineation was conducted by staff from the Vicksburg District Regulatory Branch and the results of that assessment are as follows: up to 2.01 acres of Jurisdictional Emergent Wetlands, 72.73 acres of Excluded Emergent Wetlands, 58.71 of Forested Wetlands and 24.58 of Excluded Scrub-Shrub CRP Wetlands at the Deer Creek Pump construction site along with 23.14 acres of Jurisdictional Emergent Wetlands at the Supplemental Steele Bayou Borrow Area. As outlined in the Wetlands Appendix, the indirect impact area (i.e., those areas subject to potential decreases in flood duration), the USACE Vicksburg District determined that areas occurring within the 2-year floodplain that display flood duration during ≥5.0% (i.e., ≥14 days) of the growing season will be the focus of the wetlands assessment. Within that area, the wetlands assessment assumed that all forested and agricultural lands were wetlands.

   This represents a conservative approach to determine indirect impacts because many forested, agriculture, pasture, and other areas within the Yazoo Study Area would not meet the hydrophytic vegetation, hydric soils, and/or wetland hydrology criteria

outlined in Environmental Laboratory (1987) and the delineation procedures detailed in USACE (2010). Additionally, this approach incorporates any forested and agricultural lands within the 2-year floodplain and ≥5.0% flood duration intervals that are non-wetlands, may be considered isolated wetlands, meet the definition of prior converted croplands, not be considered jurisdictional wetlands, or may otherwise be excluded from consideration during a traditional wetland delineation and functional assessment. The presence of non-wetlands within the Yazoo Study Area was reported in the 2007 FSEIS when a number of areas occurring within the ≥5.0% flood duration intervals were determined to be non-wetlands using traditional wetland delineation techniques (e.g., field indicators of hydric soils, hydrophytic vegetation, and wetland hydrology). For example, EPA data collected in the Yazoo Study Area within areas exhibiting ≥5.0% flood duration zones reported that five of the 52 data points (9.6%) examined were determined to be non-wetlands.

Based on this information, the execution of a full, traditional wetland delineation within the assessment area would result in a decrease in the extent of wetlands, the estimated wetland functions associated with those wetlands under the no-action alternative, and the compensatory mitigation required to offset impacts to wetland resources under the Proposed Plan. While we acknowledge that the assumption that all of the forested and agricultural lands in the assessment area meet the wetland criteria varies from a more traditional wetland delineation approach, the selected approach 1) ensures that no wetlands in the assessed area were not accounted for and 2) very likely resulted in an overestimation of wetlands in the assessed area and associated compensatory mitigation requirements.

The USACE Vicksburg District determined that those wetlands exhibiting a minimum of 14 days duration of flood inundation at a frequency of 5 years in 10 would be included in the wetlands assessment. This determination was made in accordance with the guidance in the 1987 US Army Corps or Engineers Wetland Delineation Manual and associated guidance documents that established the 14 day minimum criteria for wetland hydrology. Areas that experience less than 14 days of flood inundation in at least 5 years in 10 would not meet the wetland criteria as a result of flooding. Thus, only the subset of lands that are inundated by flooding for ≥14 days (i.e., the minimum wetland hydrology duration threshold) occurring within the 2-year floodplain (i.e., those with a flood frequency return interval of 5 years in 10) were considered during the assessment of potential impacts to wetland resources.
Notably, the Vicksburg District acknowledges the presence of wetlands outside of the 2-year floodplain elevation and in areas that experience <14 days of flood inundation, but those wetlands are sustained by precipitation. The project will not have any impact on precipitation or the wetland functions provided by wetlands outside the area of influence of the project.

Additional text has been added to the Engineering Appendix and cross-referenced with the Wetlands Appendix to provide more details on the rationale used to select the areas included in the assessment of wetland resources.

The Wetland Appendix discusses why the 5-year floodplain was not incorporated into the assessment, highlighting that the available data demonstrates the limited effect of flooding on wetland hydrology in the 5-year floodplain. For example, all ground water monitoring wells above the 2-year floodplain, but within the 5-year floodplain either failed to exhibit wetland hydrology or precipitation provided the sole source of wetland hydrology. Table 69 in Wetlands Appendix provides the anticipated shifts in flood duration for the areas included in the wetlands assessment.

No disposal of fill material is anticipated by the installation of the common design for the 34 supplemental low flow groundwater well sites.

2. Mudflats. Not applicable.
3. Vegetated shallows. Not applicable.
4. Coral reefs. Not applicable.
5. Riffle and pool complexes. Not applicable.
6. Threatened and endangered species. Eleven federally-listed threatened and endangered species where identified by the U.S. Fish and Wildlife Service (USFWS) that should be addressed as part of the proposed project. The eleven species are Piping Plover, Red Knot, Wood Stork, Least Tern, Eastern Black Rail, Northern Long-eared Bat, Pallid Sturgeon, Fat Pocketbook, Rabbitsfoot, Sheepnose, and Pondberry. The USACE made the determination that any impacts that might occur would be insignificant and the proposed project may affect but would not likely adversely affect any of the listed species, with the exception of Pondberry. Additional Section 7, of the Endangered Species Act, consultation is currently ongoing with the USFWS with regard to Pondberry however it is anticipated that a may affect but not likely to adversely determination will be reached. Refer to the Threatened and Endangered Species section and appendix for additional information.
7. Other wildlife. Forested wetland habitat (up to 58.71 acres) and associated wildlife would experience unavoidable adverse impacts due to loss of this habitat at the Deer Creek Pump site. Because of the mitigation and reforestation/conservation measures, unavoidable adverse impacts to wildlife wetland habitat would be fully compensated. The installation of the well sites would have no effect on wildlife.
8. Actions to minimize impacts. Impacts to terrestrial and aquatic biota will be minimized by limiting impacts to a small area (the Deer Creek Pump construction site) relative to the study area. Impacts at the Deer Creek pump construction site will be minimized by the application of BMPs for stormwater runoff. A SWPP Notice of Intent will be filed with MDEQ, outlining the steps that will be used to reduce nonpoint source runoff. Control measures will include those recommended in the *Mississippi Stormwater Pollution Prevention Plan (SWPPP) Guidance Manual for Construction Activities.* The location of well sites would be situated in areas primarily utilized for agricultural production and will enhance the environment for terrestrial and aquatic biota.

1.4.6 Proposed Disposal Site Determinations

1.4.6.1 Mixing Zone Determinations

The mixing zone will be 750 feet from the boundary of the defined work area at the Deer Creek Pump site. No water quality criteria should be exceeded by the discharges.

The supplemental groundwater wells are designed to operate during periods of low flow. As such, the volume of water added will be proportionally high compared to the existing stream flow during low flow conditions. During the late summer and early fall months, minimal flow rates in many of the headwater streams of the Yazoo Basin were observed between 1.0 to 10.0 cfs. The addition of 5.0 cfs will significantly increase the overall volume and expedite mixing times after the point of injection. Minimal turbidity values may increase at the point of injection. These increases should dissipate in a relative short distance downstream. There should be no problem with the mixing of ground water from the wells into the receiving streams.

1.4.6.2 Determinations of Compliance with Applicable Water Quality Standards

Changes to water quality conditions as a result of construction or operation of the Yazoo Backwater Pump project are not anticipated to cause long-term changes in the existing water quality within the study area. Only temporary, short-term impacts to water quality are anticipated as a direct result of project construction. These impacts include temporary increases in suspended solids and increases in turbidity levels, which would occur only during construction operations. Completion of the nonstructural flood reduction feature (reforestation) should improve water quality during most times of the year. However, during flood events the utilization of organic carbon from leaf litter will likely aggravate low DO conditions.

Changes to water quality conditions, as a result of the supplemental flow from the well sites to the headwater streams in the Yazoo Backwater Area, shall have minimal local impacts at the point of introduction. Water quality impacts should include local increases in suspended solids, turbidity levels, and thermal stratification, as well as changes in conductivity and pH. However, the local impacts to water quality are far outweighed by the positive impacts resulting from the increase in flow during periods of low or no flow.

The residual effects of reforestation on up to 2,700 acres of land below elevation 87.0 (NGVD) and the acquisition of 2,405 acres (compensatory mitigation feature) at or below the 2 year flood frequency elevation should have a positive impact on Water Quality in the basin.

1.4.6.3 Potential Effects on Human Use Characteristics

1. Municipal and Private Water Supply. No significant effects are anticipated from the construction of the Yazoo Backwater Pump or the well sites. Municipal and private water wells located in the zone of depression for each of the well field sites may temporarily experience change in operation during operational months.
2. Recreational and Commercial Fisheries. No significant effects are anticipated from the construction of the Yazoo Backwater Pump. Recreational and commercial fisheries will likely be enhanced by the introduction of additional water from the well sites during low or no flow periods. By maintaining minimal levels of flow in the primary tributaries of

the Yazoo Backwater Area, fisheries will have a chance to reestablish in areas that have suffered in recent decades. Recreational activities would be temporarily curtailed in the vicinity of the proposed discharge site during construction of the Deer Creek Pump project. Temporary increases in turbidity and suspended sediments during construction activities at the pump site would adversely impact recreational fishing downstream of discharge sites. These impacts would be minor and localized and occur only during actual construction.

1.4.6.4 Significant Changes Between the 2007 and 2020 Hydrologic Analyses

There are several areas with updated or completely new information that will result in significant changes to the 2007 FSEIS. Updated information includes flooding since 1997, revising the period-of-record (POR) used in the hydrologic analysis of the project, the acquisition of a higher resolution digital elevation model (DEM) using an airplane based LIDAR, the application of the HEC-RAS 2D to model the POR to provide daily stages for the base and with-pump condition, the determination of the areal extent of floods (frequency and duration) based on the new POR utilizing the LIDAR DEM, and finally obtaining new land-use/land-cover information using the NASS-2015 coverage. New information includes daily water elevations in 57 shallow groundwater wells in the project basin and paired groundwater-surface water gages. For more detail, please refer to the Engineering Appendix G – Approach.

1.4.6.5 Determination of Impacts on Fish and Other Aquatic Organisms

Impacts on spawning and rearing fish were determined using ENVIROFISH 1.0. The output is Average Daily Flooded Acres (ADFA), which is an area equivalent to one acre that is inundated on average every day of a defined season for a specified number of years. The ADFAs were calculated using the elevation data and hydrologically modeled water surface elevation. A new dataset was used to calculate Average Daily Flooded Acres that included hydrologic data up to 2019 (1978 - 2019) and improved elevation mapping data (10-meter versus 30-meter resolution) compared to the 2007 FSEIS report. The acreage analysis area was constrained to lands within the 2-year flood frequency and the spawning and rearing season was defined as 1 March – 30 June. The aerial measure of inundation (ADFAs) is multiplied by the appropriate Habitat Suitability Index (HSI) value in ENVIROFISH to output HUs with which to compare alternatives and annualized over the 50-year project life.

Seasonally flooded habitat types were delineated from satellite imagery and verified with ground-truthing to characterize the majority of floodplain landuse in the Yazoo Study Area. The actual acres of each habitat type by stage elevation (i.e., stage-area curves) were entered into the ENVIROFISH software to calculate ADFAs. Habitat types are defined as follows:

1. Agriculture – all areas in which an agricultural product was grown.

2. Fallow – agricultural lands that have been abandoned where there is a prevalence of herbaceous, non-woody cover.

3. Bottomland Hardwoods – all forested areas

For this application, only agriculture, fallow, and bottomland hardwood cover types within the 2-year flood frequency were considered. The percentages of each land use in the Yazoo Study Area were based on 2019 Landsat imagery. Bottomland hardwoods represented the highest landuse percentage (76%), followed by agricultural (12%) and fallow fields (4%). The channel and other waterbodies represented 8% of the 2-year floodplain. An increase in bottomland hardwoods between the 2007 and 2020 assessment in the 2-year floodplain was largely due to reforestation.

ENVIROFISH calculates ADFAs for spawning and rearing separately. Spawning acres were restricted to a minimum depth of one foot, maximum depth of 10 feet and restricted to lands flooded for a minimum duration of 8 consecutive days. A minimum water depth of 1.0 foot allows adults to access shallow, flooded areas; a water depth less than 1.0 foot is not considered realistic due to physical limitations in the spawning process. Flood duration of at least 8 consecutive days ensures suitable time for nest construction and other spawning activities by the adults and recognizes that shorter durations may result in the eggs becoming stranded and desiccated if water recedes too quickly. Alternatively, if the water recedes too rapidly off the floodplain, organic matter, nutrients, and newly hatched aquatic organisms may be carried into the river instead of remaining in the floodplain and permanent backwaters. The minimum one foot, 8-day duration rule is considered a conservative value to delineate spawning requirements for warm water fish species found in the Mississippi River basin. This rule guarantees an effective spawning window, emphasizes longer development times, and provides a margin for temporal variation in spawning activities (i.e., adult movement onto the floodplain, nest construction, and guarding/dispersal of fry). Rearing acres were calculated for water depths of 0.1 - 20 feet with a flooding minimum duration of 1 day. Once hatched, rearing fishes, including yolk-sac and post yolk-sac larval phases, have volitional behaviors to change locations within the floodplain. The maximum depth of 20 feet assumes that mostly channel habitat occurs beyond 20 feet in depth and hypoxia occurs in deeper water during inundation.

The majority of species that spawn and rear in riverine floodplains are pre-adapted to structurally complex habitats such as bottomland hardwoods. Therefore, cleared lands have less value for spawning and rearing habitat and eggs and larvae have a higher risk of becoming stranded or preyed upon in cleared lands as floodwaters recede. The HSI values reflect this trend, with optimum conditions occurring for bottomland hardwoods (HSI = 1.0); intermediate values for fallow fields (HSI = 0.5); and the lowest value for cleared, agricultural lands (HSI = 0.2). These values represent a community-level perspective on the biological response (i.e., spawning and rearing) of the fishes of the Yazoo Study Area to flooding. Further information on HSI development and modeling spawning and rearing habitat in floodplains are provided in the ENVIROFISH 1.0 manual (Killgore et al. 2012), which was certified in October 2020 by the Ecosystem Restoration National Planning Center of Expertise for this project.

Because the Proposed Plan would reduce flooding within the Yazoo Backwater, loss in Average Annual Habitat Units between the No Action Alternative and the Proposed Plan was calculated and mitigation requirements determined to offset loss in aquatic habitat.

This analysis made certain assumptions on the application of ENVIROFISH to calculate ADFAs:

1. Larval fish have the potential to utilize the same habitat as spawning sites. Larval fish have smaller physical dimensions that allow access to shallower (< 1.0 feet) water than physically available for spawning needs (typically ≥ 1.0 feet depth, 8 days duration). The ENVIROFISH software was used to define minimum and maximum allowable depths for spawning and/or rearing to accurately represent a specific situation.

2. Habitat acres were quantified for floodplain habitat only. This was done because the project would impact the extent of floodplain habitat with no/minimal effect on channel and other permanent aquatic habitat.

3. Many factors dictate the overall timing of the spawning and rearing period. Optimum conditions for spawning occur when the flood pulse and warmer temperatures are coupled. Although there are multiple variables that dictate when fishes will spawn, the model assumed that spawning takes place from 1 March to 30 June.

4. Flooded bottomland hardwoods in the 2-year flood frequency are the preferred spawning and rearing habitat. A 2-year frequency flood was used to evaluate hydrology and land use of the floodplain using the following assumptions:

    a. Most fish species reach sexual maturity at Age One or Two. Thus, a flood that typically occurs once every two years is considered necessary to maintain reproductive populations in the basin. The more extreme hydrologic events may result in higher fish abundance, but do not represent flooding regimes that maintain baseline population levels over the life of the project (i.e., 50-year project life)

    b. The life span of small-sized species is 2 to 3 years and some may only reproduce once. Thus, a flood frequency less than 2-years may result in successive reproductive failures by species with short life spans. Flood frequencies greater than two years are an overestimate of the usable floodplain utilized by species with short life spans. Larger-sized species can live up to 10 years, but those that utilize floodplains to reproduce on an annual basis require regular flooding to maintain population integrity.

The relative value index (i.e. weighting factor) determines the ecological worth of the reforestation feature of compensatory mitigation and takes into account the true value of this effort on the aquatic environment. Reforestation has been the primary method of mitigating impacted floodplains habitat, however monitoring studies have documented extensive hypoxia (low dissolved oxygen) in the Yazoo Study Area during inundation questioning the value of reforestation to fully address aquatic impacts. Additionally, long-term trends in fish species

composition indicate little change in diversity despite previous reforestation and repeated flooding events. Additional reforestation is not expected to benefit aquatic resources since extensive hypoxia will continue to occur in the floodplain and channels The 0.6 relative value index was determined by the percent difference in total abundance of larval and juveniles fishes in hypoxic (<3.0 mg/l) versus normoxic water collected with larval light traps within the Yazoo Study Area between 1990 and 2008. In other words, out of 100% of all individuals collected, 60% were collected in normoxic water and 40% were collected in hypoxic water. Those individuals collected in hypoxic water were mostly dead. The assumption was that the 40% reduction in the abundance of larval and juvenile fishes indicates that reforestation will only partially compensate for impacts. Therefore, the RVI of 0.6 was used to decrease the functional value of reforestation due to hypoxia. However, environmental flow establishment with the groundwater wells were assumed to offset negative impacts of hypoxia in the forested floodplain. These assumptions will be monitored in the Monitoring and Adaptive Management Plan.

1.4.6.6 Determination of Cumulative Effects on the Aquatic Ecosystem

The requirement for deposition of fill material during construction of the Deer Creek Pump site would add a relatively minor amount of pollutants to the proposed study area's aquatic ecosystem. Pollutants would primarily be in the form of temporarily increased sediment loads that would result in minor increases in both suspended solids and turbidity. The proposed construction of the Deer Creek Pump would impact 1.68 acres of open water and create up to 17.5 acres of permanent water adjacent to the Yazoo River and up to 10.3 acres adjacent to the Little Sunflower Auxiliary Channel. In addition, reforestation of up to 2,700 acres (nonstructural feature) of current agricultural land and the acquisition of 2,405 acres (compensatory mitigation feature) will reduce erosion and increase their floodwater filtering capacity for sediment, pesticides, and nutrients.

The aquatic community in the upper headwater streams in the Yazoo Backwater Area have suffered from reduced stages during low or no flow months of most years. This annual condition has hampered aquatic species diversification. The addition of supplemental flow to the headwater streams in the Yazoo Backwater Area will have a significant impact on the ability of aquatic species to reestablish and proliferate on a year-round basis.

1.4.6.7 Determination of Secondary Effects on the Aquatic Ecosystem

The secondary benefits of reforestation of up to 2,700 acres (nonstructural feature) of current agricultural land and the acquisition of 2,405 acres (compensatory mitigation feature) shall continue to strengthen with time. These reforested areas will continue to trap sediment from runoff and reduce the amount of sediment that enters the stream. Secondary impacts on the aquatic ecosystem due to construction of the Yazoo Backwater Pump would be minimal. The secondary impacts on the aquatic ecosystem derived from supplemental low flow groundwater well flows shall enhance the ability for tertiary and surrogate aquatic communities to thrive.

1.5 Finding of Compliance for Flood Control

1. No significant adaptations of the Section 404(b)(1) guidelines were made relative to this evaluation.

2. The proposed Yazoo Backwater project will not have an effect on operation of the Muddy Bayou water control structure. Currently, the Eagle Lake community (Warren County, Mississippi, and Madison Parish, Louisiana) receives protection from a 50-year frequency flood. Implementation of the proposed Yazoo Backwater project would increase the level of protection for the Eagle Lake community to the 100-year frequency flood.

3. Deposition of fill material associated with construction requirements for the proposed Yazoo Backwater Project would adversely impact up to 25.15 acres of Jurisdictional Emergent Wetlands, 72.73 acres of Excluded Emergent Wetlands, 58.71 of Forested Wetlands and 24.58 of Excluded Scrub-Shrub CRP Wetlands. The construction requirements associated with the project would also impact up to 1.68 acres of Jurisdictional Lake, 10.25 acres of Jurisdictional Rivers and 0.42 acres of Jurisdictional Tributary. Integral to the project's design is the inclusion of a plan for voluntary perpetual easements and reestablishment of forest/conservation measures on up to 2,700 acres (nonstructural feature) of open land. This measure would result in significant benefits to fish and wildlife habitat in addition to the acquisition of 2,405 acres (compensatory mitigation feature). Construction of the well sites would temporarily affect adjacent agricultural areas. Supplemental flow, provided by the well sites in the headwater of the Yazoo Basin, would help to reestablish the native aquatic fisheries that have suffered from low or no flow periods.

4. The planned deposition of fill material from the Yazoo Backwater Pump would not violate any applicable State Water Quality Standards. Further, the planned fill action would not violate the Toxic Effluent Standards of Section 307 of the Clean Water Act. The construction of the well sites will also not violate any state law standards.

5. No endangered species or their critical habitat are anticipated to be adversely impacted by the planned action. Refer to the Threatened and Endangered Species section and appendix for additional information.

6. The proposed deposition of fill material would not result in unacceptable adverse effects on human health and welfare, including municipal and private water supplies, recreational and commercial fishing, plankton, fish, shellfish, wildlife, and special aquatic sites. Further, the proposed discharges would not result in unacceptable adverse effects on the life stages of aquatic or semiaquatic organisms, the aquatic ecosystem, diversity, productivity, stability, recreation and esthetic resources, and economic values. However, the long-term benefits provided by supplemental flow to the headwaters of the Yazoo Basin shall have a positive impact on the aquatic ecosystems and fisheries throughout the Yazoo Delta. Reforestation of up to 2,700 acres (nonstructural feature) and the acquisition of 2,405 acres (compensatory mitigation feature) would also benefit the study area by reducing erosion and increasing the filtering capacity for sediments, pesticides, and nutrients.

7. Appropriate steps to minimize potential adverse impacts of the fill action on aquatic systems include cessation of fill activities during extreme flood events and avoidance of discharges into open water, where possible.

8. On the basis of the Section 404(b)(1) guidelines, the proposed sites for the deposition of dredged and fill material are specified as complying with the requirements of these guidelines.

1.6 Compensatory Mitigation

The HGM model developed for application in the Yazoo Study Area addresses a number of wetland subclasses. For the purpose of the current assessment, all wetlands are assumed to occur within the Riverine Backwater subclass. This selection was made because 1) the wetlands examined occur within the 2-year flood frequency interval and 2) the Riverine Backwater subclass encompasses the full suite of wetland functions described in Smith and Klimas (2002). Notably, the selection and application of other wetland subclasses that occur in portions of the Yazoo Study Area, such as Flats or Depressions, would decrease the estimated impacts to wetland resources (and associated mitigation requirements) because those wetland subclasses only provide a subset of the wetland functions provided by River Backwater wetlands. As a result, the assumption that all of the wetlands included in the assessment are Riverine Backwater wetlands represents the most conservative approach possible for selecting wetland subclasses

A watershed approach for compensatory mitigation of adverse impacts of the project on fishery resources was considered during the planning process. A watershed approach recognizes the overall resource needs of the entire riverine system during all seasons rather than on-site mitigation that considers only locally important functions and values. Reforestation of agricultural lands has been the primary in-kind mitigation feature of the project area. However, despite over 30 years of reforesting lands in the project area, increases in fish diversity and/or richness has not been evident since monitoring began in the 1990's. Hypoxia within the floodplain during prolonged inundation periods has been identified as a primary deterrent to mitigating adverse impacts in the project area using reforestation. Therefore, reforesting agricultural lands in the project area does not fully compensate adverse impacts justifying consideration of out-of-kind mitigation that provides greater ecological importance to the overall aquatic resources in the watershed.

Low flows during late summer and autumn has been identified as a major contributor to depressed fishery resources in the watershed. Fish spawning and rearing during the spring must cope with low dissolved oxygen during prolonged flooding that reduces the ecological value of reforestation in the floodplain, and those individuals that do survive are further impacted by prolonged periods of low flows during the summer-fall thereby affecting annual fishery recruitment strength. Meaningful mitigation must consider the entire life cycle of fishes and the associated anthropogenic impairments to each life stage. These ecological issues can more effectively be addressed through both in-kind and out-of-kind mitigation.

To compensate for unavoidable losses to environmental resources from the construction, operation, and maintenance of the proposed project, compensatory mitigation requirements were calculated based on impacts from the entire calendar year, various flood frequencies, and variable flood depths. In-kind mitigation will include reforestation up to 2,405 acres in the Yazoo Project Area at or below the 2-year floodplain, in fee title, that fully compensates wetland, terrestrial, and waterfowl impacts and partially compensates aquatic impacts. In-kind

mitigation requirements for aquatic resources calculated by ENVIROFISH was 3,998 and 4,553 acres for spawning and rearing, respectively. Mitigating rearing impacts will fully compensate for spawning impacts. However, these values were reduced to 2,399 and 2,732 acres for spawning and rearing when adverse impacts of hypoxia on reproductive success were included. Recognizing that low flows during the summer-autumn season provides greater ecological lift than simply more reforestation, 34 supplemental low flow groundwater wells are proposed to augment stream flows in multiple stream systems within the Big Sunflower-Steele Bayou drainage (i.e., environmental flows). Well field operation will occur on an annual basis regardless of flooding conditions in the lower reach of the Yazoo Project Area. Re-establishing perennial flow with supplemental low flow groundwater wells is considered out-of-kind mitigation but will benefit all reaches from the headwaters to the mouth at Steele Bayou structure. This approach offsets the high mortality of larvae and juvenile fishes occurring in the spring during hypoxic events with increased survival rates of juvenile and adult fishes during autumn. Environmental flows also benefit mussels, including federally endangered species, as reproductive success in freshwater mussels is dependent on diverse and functional fish assemblages. Environmental flows benefit a total of 9,321 acres of streams, and based on a statistical habitat model, yields 1,678 AAHU's, which is a 40% increase compared to existing conditions. A maximum loss of 3,232 AAHU's for fish rearing without hypoxia calculated by ENVIROFISH will be partially mitigated by reforesting 2,405 acres and the remainder will be compensated by the well fields. This analysis demonstrates compliance with (40 C.F.R. § 230.10(d)) using the watershed approach described in the rule (see § 332.3(c) [§ 230.93(c)]) that out-of-kind compensatory mitigation will better serve the aquatic resource needs of the watershed. Using both in-kind and out-of-kind mitigation fully compensates for adverse impacts of the project, takes a watershed approach rather than localized, and addresses all life stages of fishes during the year.

While the FSEIS does not identify specific location for reforestation, the Wetlands, Mitigation, and Monitoring and Adaptive Management Appendices indicate the conditions that will be present at mitigation tracts based on data from HGM wetland assessments conducted within the Yazoo Basin. That data demonstrates that of the 19 HGM assessment variables, only five of those variables differ at potential mitigation parcels. These five variables include 1) the size of the wetland tract associated with the mitigation parcel and the surrounding area, 2) the core area of the parcel, 3) the habitat connectivity of the parcel, 4) the flood frequency of the parcel, and 5) the flood duration of the parcel. The remaining 14 variables display the same HGM variable subindex scores at all agricultural lands in the project area that would be considered for mitigation establishment. For example, all potential mitigation parcels display the same degree of soil integrity and cation exchange capacity (as determined in the assessment approach), do not contain appropriate vegetation or vegetation characteristics (tree basal area and density, ground vegetation cover, snags, species composition), do not contain woody debris biomass, and display consistent of O- and A-horizon characteristics.

As a result, the selection mitigation sites will be guided by the values outlined in Tables 5-9 of the Wetlands Appendix which establish the minimum criteria used to target parcels for mitigation. As outlined in the FSEIS, mitigation sites should display a minimum tract size of 987 ha, a minimum core area of 49%, a minimum habitat connectivity of 50%, a minimum flood frequency of 4 years, and a minimum flood duration of 5% of the growing season. These values were derived from existing mitigation sites in the Yazoo Basin, demonstrating that the targets are achievable. The fact that the FSEIS provides specific data-based HGM metric values for mitigation site selection will ensure that appropriate mitigation lands will be acquired. As a result, we do not believe that identifying specific mitigation tracts is required at this time. However, if the conditions at mitigation tracts, once identified, differ from those provided in the FSEIS, the amount of mitigation acres (or types of mitigation activities initiated) will be adjusted as outlined in the Monitoring and Adaptive Management Appendix based on HGM data collected at each mitigation tract and subsequent monitoring conducted as the mitigation areas mature over time. Additionally, the Corps process requires that more detailed analysis will be conducted during the project design phases, including refinements to the hydrologic analysis and other project components (to include mitigation) using a data-driven approach. This process will incorporate additional input from the Agencies to ensure that mitigation efforts achieve the outcomes required to offset impacts to wetlands and other natural resources resulting from project implementation.

An HGM assessment of actual mitigation sites was not conducted on potential real estate tracts (easement or fee title) in the Yazoo Delta due to federal limitations which govern use of public funds. It is the belief of the Vicksburg District that detailed identification in this public forum (DSEIS) of potential mitigation locations would artificially induce inflation for real estate acquisition, hyper inflating the overall cost of the project. The Vicksburg District has purchased several thousand acres of land in the Yazoo Area Basin for conversion of use as compensatory mitigation. The Vicksburg District has developed a keen understanding of HGM value and long-term monitoring and feels well suited to implement the calculated mitigation plan when adequate resources are authorized for the project. In the interim, the Vicksburg District will continue to identify tracts of land in house which are well suited for this purpose. See Mitigation Appendix for further details. If needed, compensatory mitigation requirements would be calculated, and additional mitigation would be acquired to offset impacts created by construction of the 34 supplemental low flow groundwater wells. The MVK would also obtain water quality certification from the Mississippi Department of Environmental Quality (MDEQ) under Section 401 of the Clean Water Act (CWA) for the Proposed Plan upon completion of final design.

YBW FEATURES		
Pumping Plant Area (Deer Creek)	**acres**	
Access ROW Limits	25.07	
Utility ROW Limits	10.54	
Pump Station Limits	95.96	
Pump Station ROW Limits ***(does not include the pump station limits, therefore total pump station ROW is 211.76ac*** ***(95.96ac + 115.80ac = 211.76ac))***	115.80 **(total = 211.76)**	
TOTAL	**247.37 acres**	
Supplemental Borrow Area (Steele Bayou)	**acres**	
Access ROW Limits	9.74	
Borrow Area ROW Limits	35.92	
TOTAL	**45.66 acres**	

Table 1: Overall acres associated with the Pumping Plant Area and Borrow Area described for the Yazoo Area Backwater Project

YBW FEATURES						
County	**Site Name**	**Water Body**	**Latitude**	**Longitude**	**Area (Acres)**	**Access Road acres**
Coahoma	YBP-HB-RB-1	Ritchies Bayou	34 16 23.97	90 42 12.22	1.25	0.01
Coahoma	YBP-HB-RB-2	Ritchies Bayou	34 15 58.58	90 41 43.83	1.25	0.47
Coahoma	YBP-HB-RB-3	Ritchies Bayou	34 14 22.73	90 41 21.95	0.75	0.52
Coahoma	YBP-HB-HB-4	Harris Bayou	34 12 36	90 41 58.13	1.00	0.40
Coahoma	YBP-HB-HB-5	Harris Bayou	34 11 56.5	90 42 03.88	0.75	0.38
Coahoma	YBP-HB-HB-6	Harris Bayou	34 11 29.5	90 41 59.22	0.50	
Coahoma	YBP-HP-HP-7	Hushpuckena River	34 08 54.31	90 46 55.7	0.75	0.05
Coahoma	YBP-HP-HP-8	Hushpuckena River	34 08 15.62	90 46 18.67	1.00	0.21
Coahoma	YBP-HP-MS-10	McNeil Slough	34 07 31.98	90 49 05.41	1.00	
Bolivar	YBP-HP-SB-12	Upper Stokes Bayou	34 02 46.25	90 49 14.8	1.25	0.13
Bolivar	YBP-HP-EB-13	Edwards Bayou	34 01 10.4	90 51 17.92	0.75	
Bolivar	YBP-BP-BP-14	Bogue Phalia	33 59 21.2	90 54 30.41	0.50	0.03
Bolivar	YBP-BP-BP-15	Bogue Phalia	33 57 35.52	90 53 42.1	1.25	0.95
Bolivar	YBP-BP-BP-16	Bogue Phalia	33 56 15.99	90 55 05	1.00	0.03
Bolivar	YBP-BP-LB-18	Lane Bayou	33 53 31.9	90 57 04.02	1.25	0.14
Bolivar	YBP-BP-LB-19	Lane Bayou	33 51 56.91	90 57 27.04	0.75	0.42
Bolivar	YBP-BP-LB-20	Lane Bayou	33 53 40.58	90 56 52.45	1.25	0.32
Bolivar	YBP-BP-LB-22	Laban Bayou	33 49 56.2	90 58 47.65	1.00	0.15
Bolivar	YBP-BP-LB-23	Laban Bayou	33 49 12.94	90 57 44.89	0.75	0.09
Bolivar	YBP-BP-LB-24	Laban Bayou	33 47 57	90 57 57.95	1.25	0.12
Bolivar	YBP-BP-SB-26	Lower Stokes Bayou	33 45 40.48	90 58 42.05	0.50	2.02
Bolivar	YBP-DC-SB-27	Straight Bayou	33 38 29.69	91 01 11.03	1.00	0.23
Bolivar	YBP-DC-BB-28	Browns Bayou	33 38 29.25	91 00 01.99	0.75	0.25
Bolivar	YBP-DC-DC-29	Deer Creek	33 35 34.08	91 04 18.96	0.75	1.69
Bolivar	YBP-DC-DC-30	Deer Creek	33 35 15.99	91 03 45.3	0.75	0.04
Washington	YBP-DC-WB-32	Williams Bayou	33 30 05.44	91 03 19.84	0.75	0.06
Washington	YBP-MC-MC-33b	Main Canal	33 27 10.9	91 01 55.46	1.00	0.05
Washington	YBP-BB-HB-34	Horshoe Bayou	33 27 22.32	91 01 23.97	0.75	1.72
Washington	YBP-BB-HB-35	Horshoe Bayou	33 25 39.19	91 00 42.18	1.00	0.29
Washington	YBP-MC-No8-39	Ditch No8	33 19 34.82	91 04 19.98	0.75	0.03
Washington	YBP-MC-No6-40	Ditch No6	33 19 52.99	91 02 46.29	0.75	0.61
Washington	YBP-MC-No8-41	Ditch No8	33 18 37.89	91 04 53.86	0.75	0.45
Washington	YBP-MC-No9-43	Ditch No9	33 17 10.54	91 02 14.22	0.75	0.22
Washington	YBP-MC-No6-44	Ditch No6	33 19 12.66	91 02 06.97	1.25	0.11

Table 2: Location and acres associated with Well Sites described for the Yazoo Area Backwater Project. Please note that these locations are based on preliminary assessments and may move up to 1,000 feet up or down stream and/or to the opposite bank at final design.

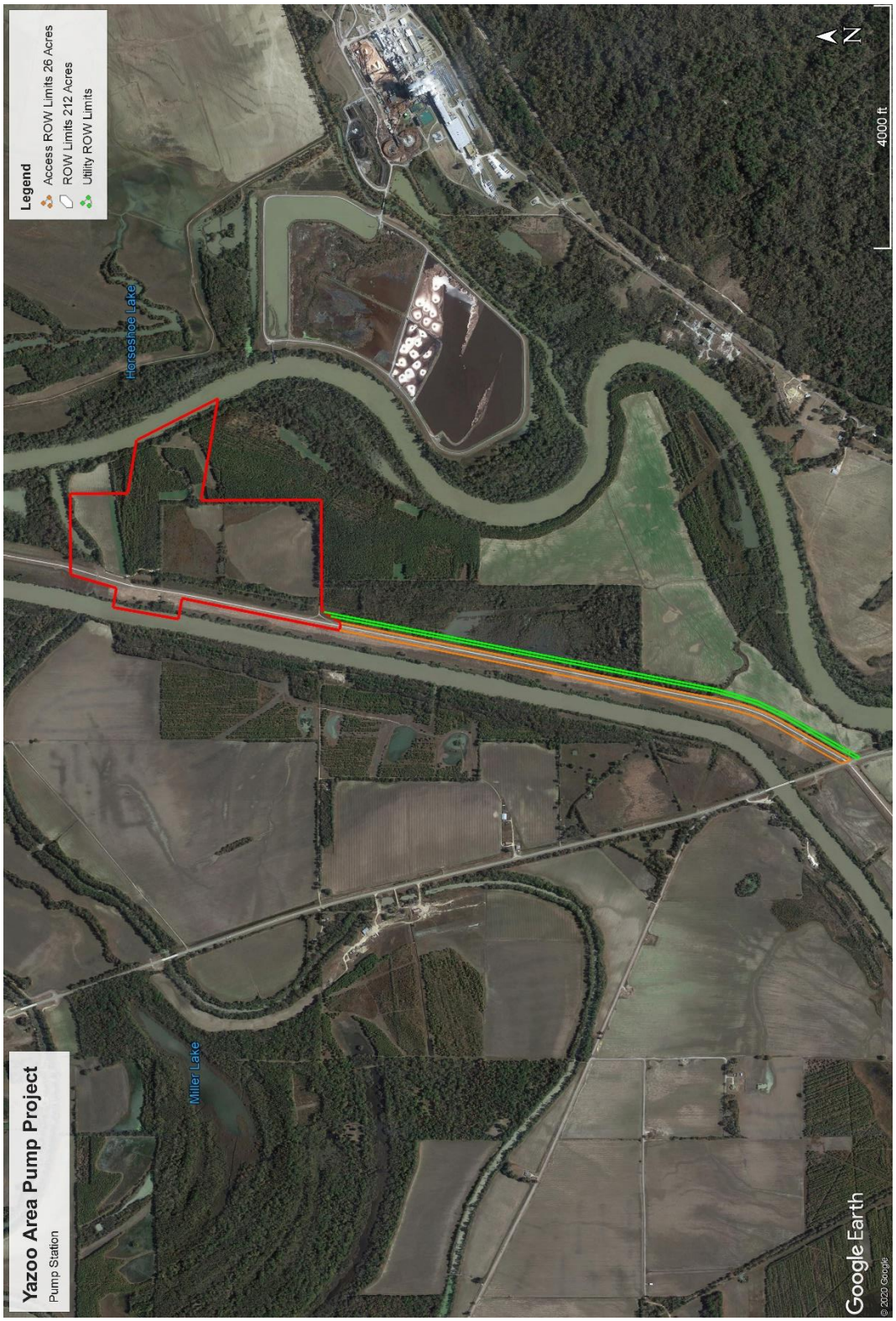

Figure 1. Location of the Pump Station (Deer Creek) which includes the Pump Station footprint, the Pump Station ROW limits, the Access Road ROW limits and the Utility ROW limits

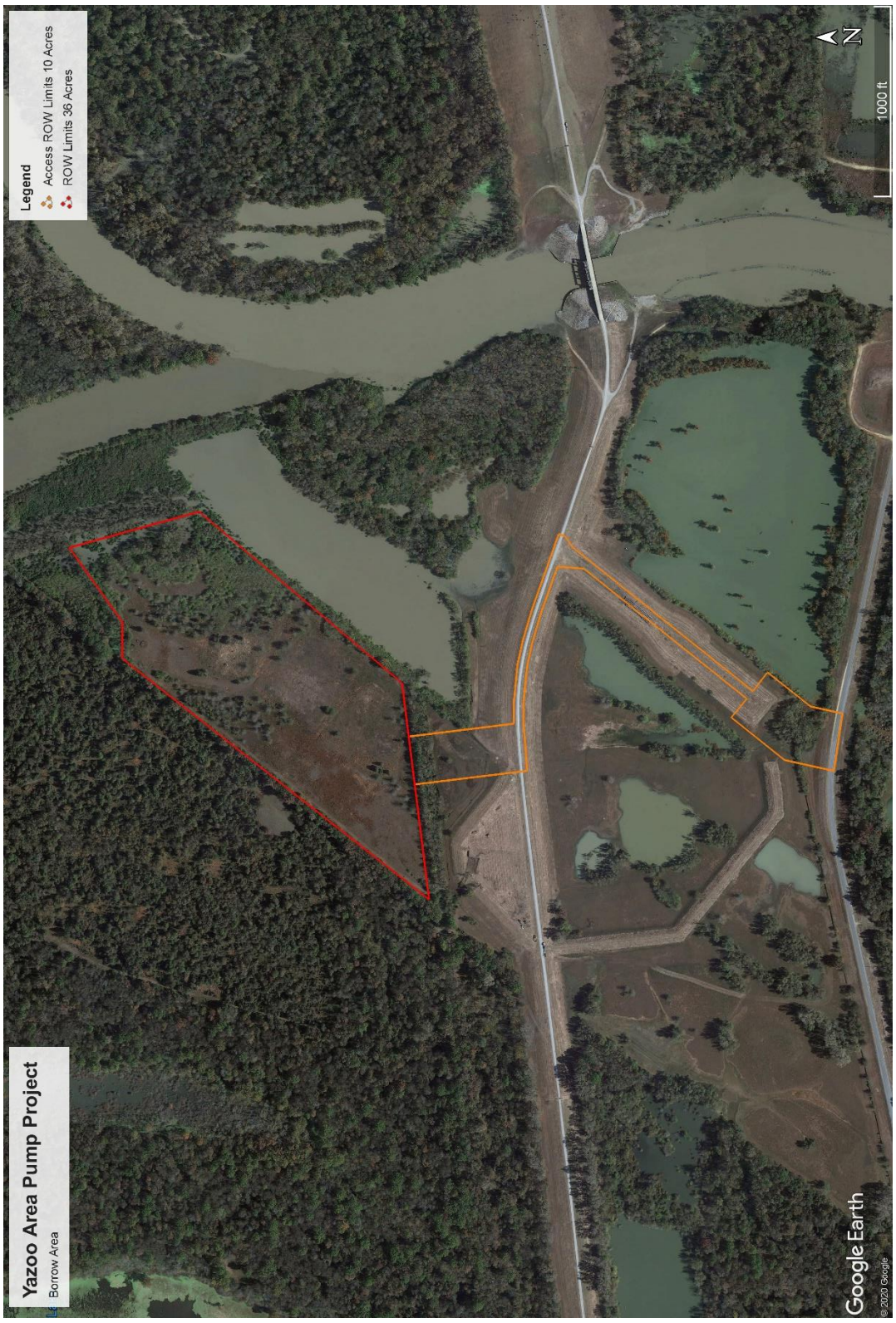

Figure 2. Location of the Supplemental Steele Bayou Borrow Area which includes the Borrow Area ROW and the Access Road ROW limits

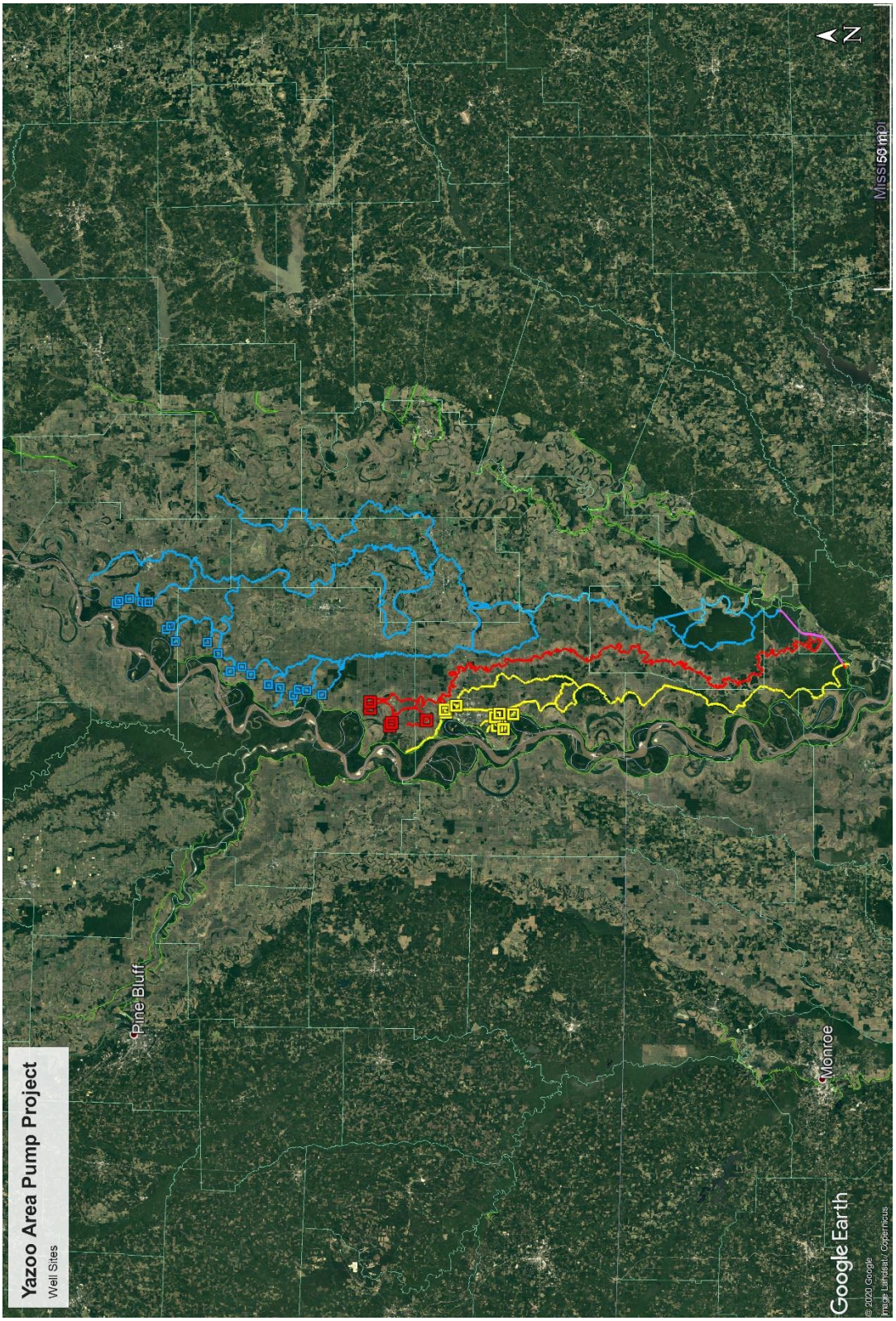

Figure 3. Location of the Well Sites for the Yazoo Area Pump Project

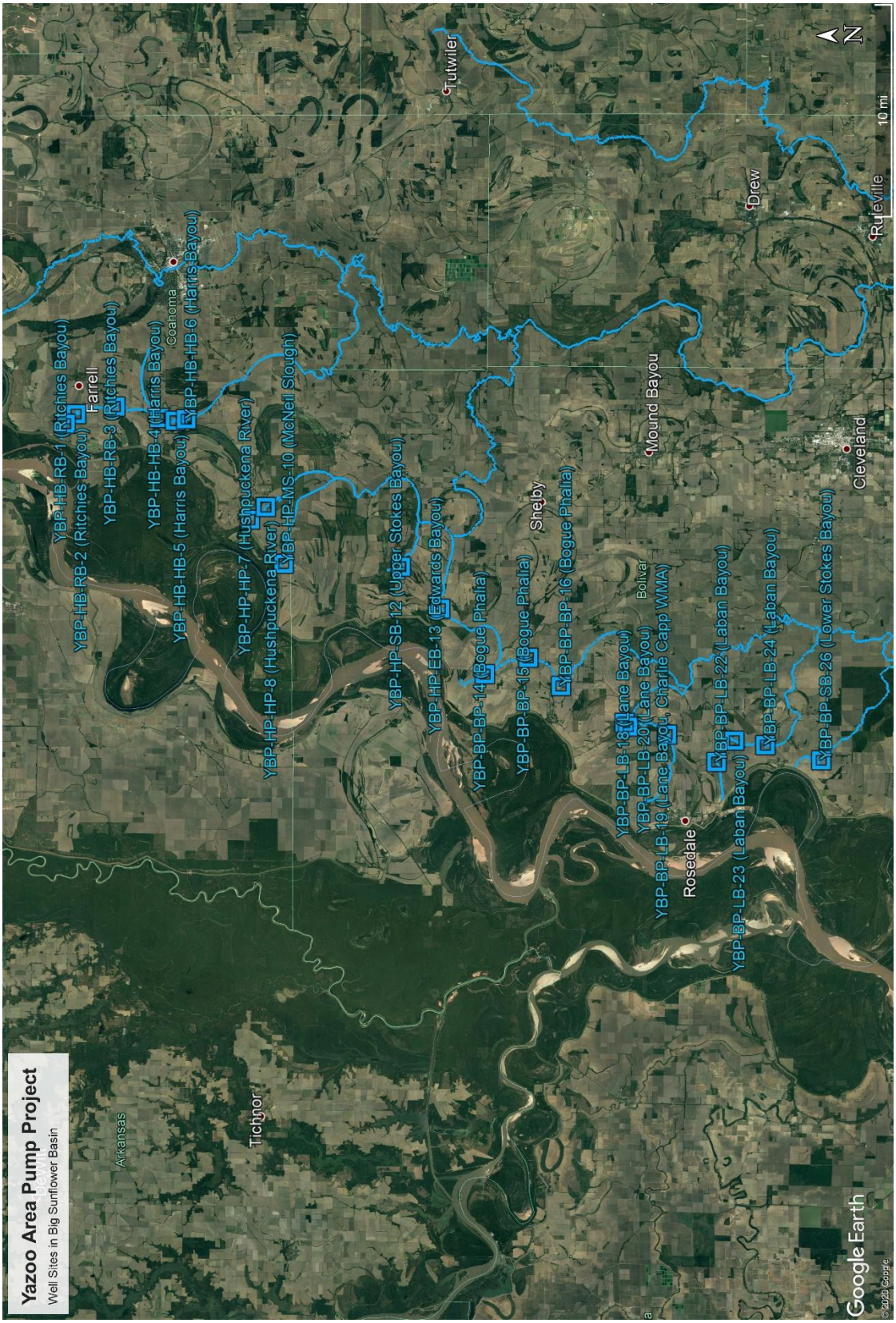

Figure 4. Location of the Well Sites within the Big Sunflower Basin

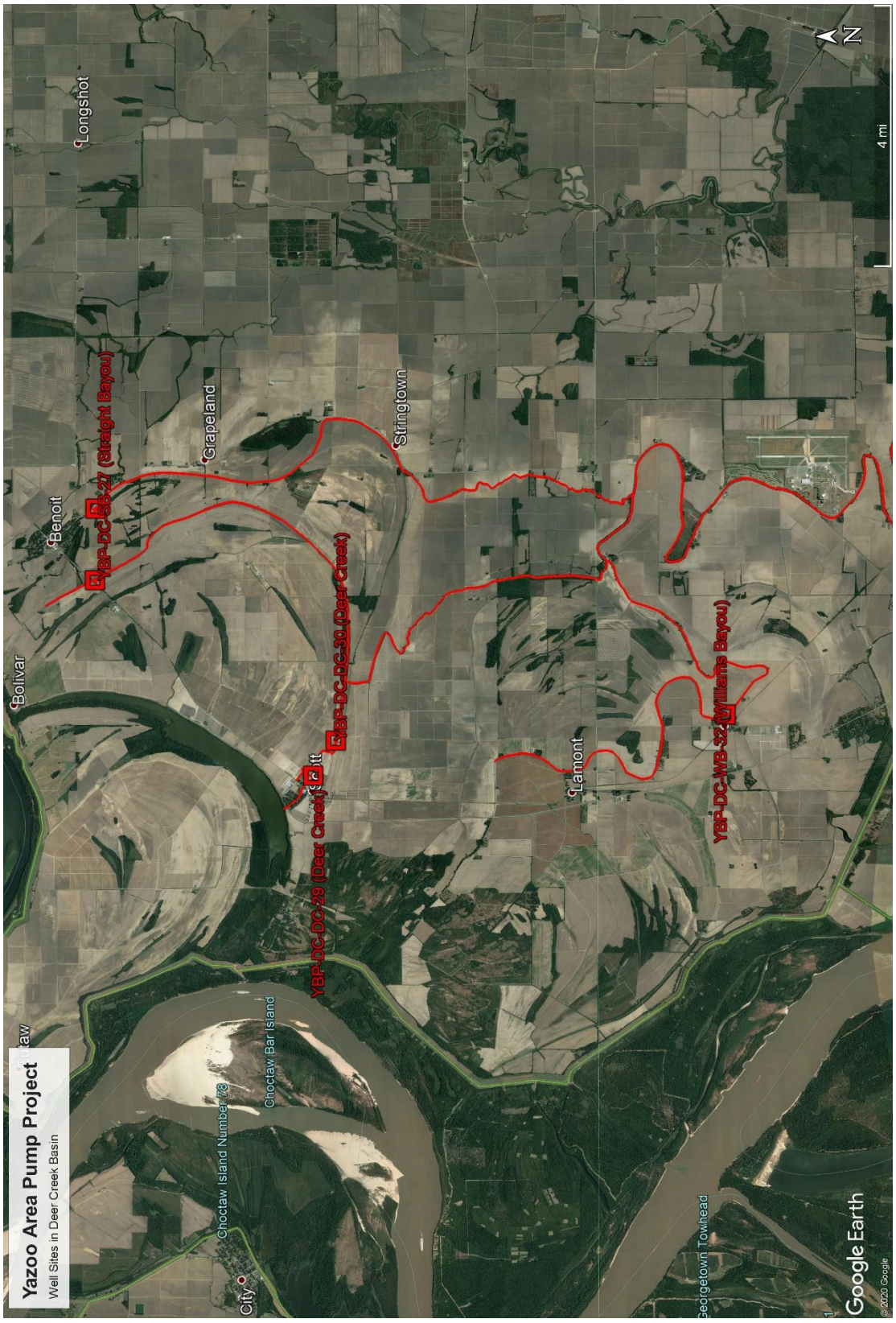

Figure 5. Location of the Well Sites within the Upper Deer Creek Basin

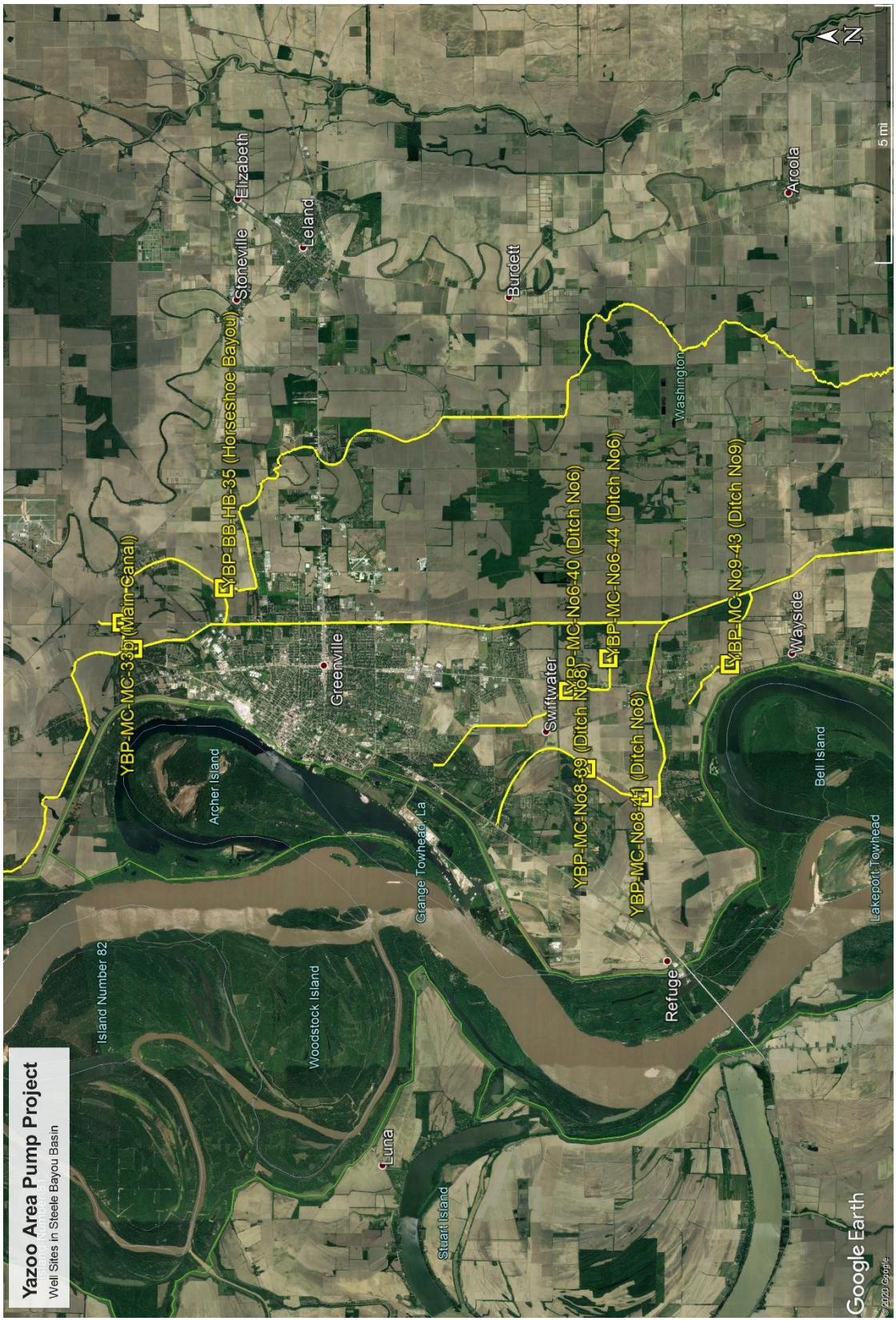

Figure 6. Location of the Well Sites within the Steele Bayou Basin

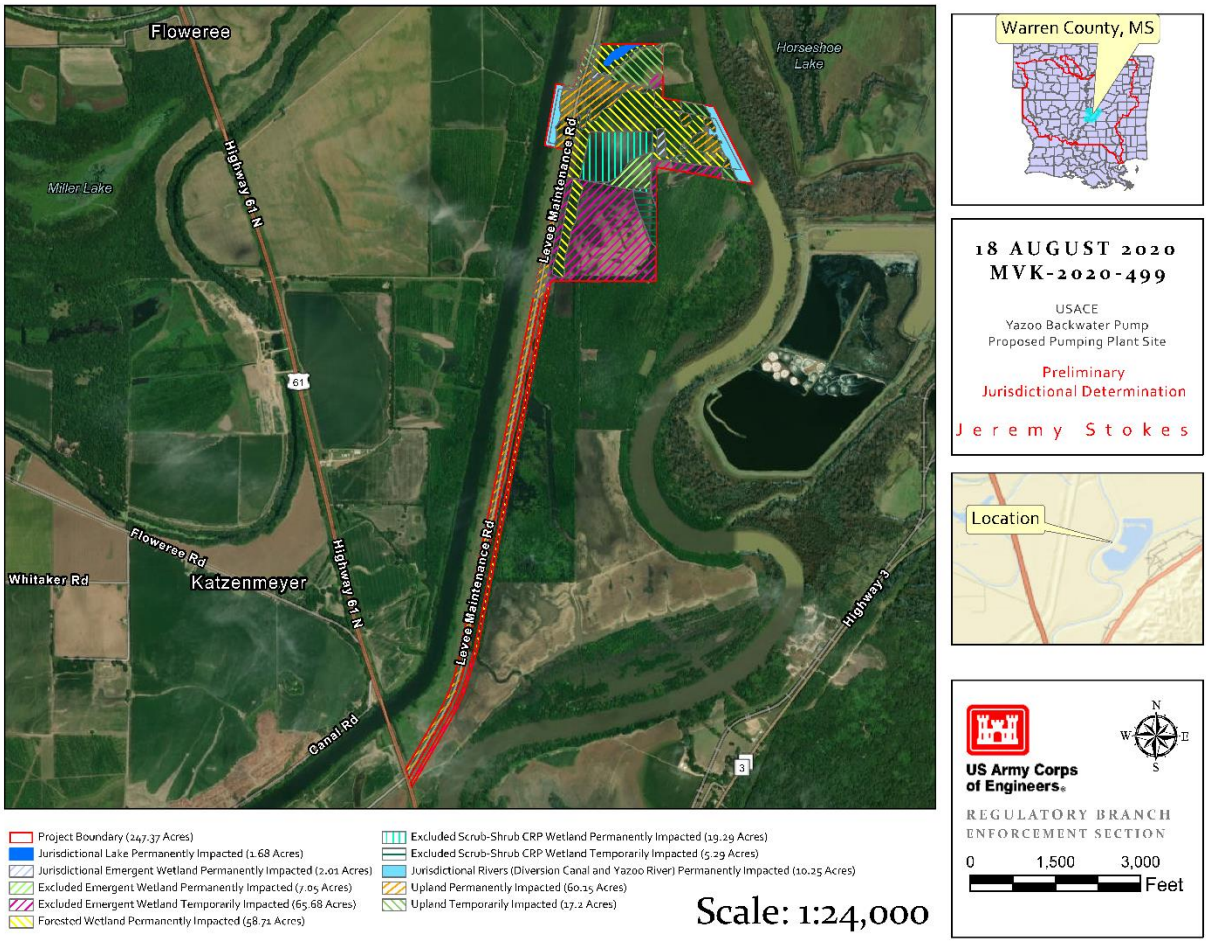

Figure 7. Jurisdictional Wetland Determination of Pump Station which includes: Pump Station footprint, Pump Station ROW, Access Road ROW, and Utility ROW

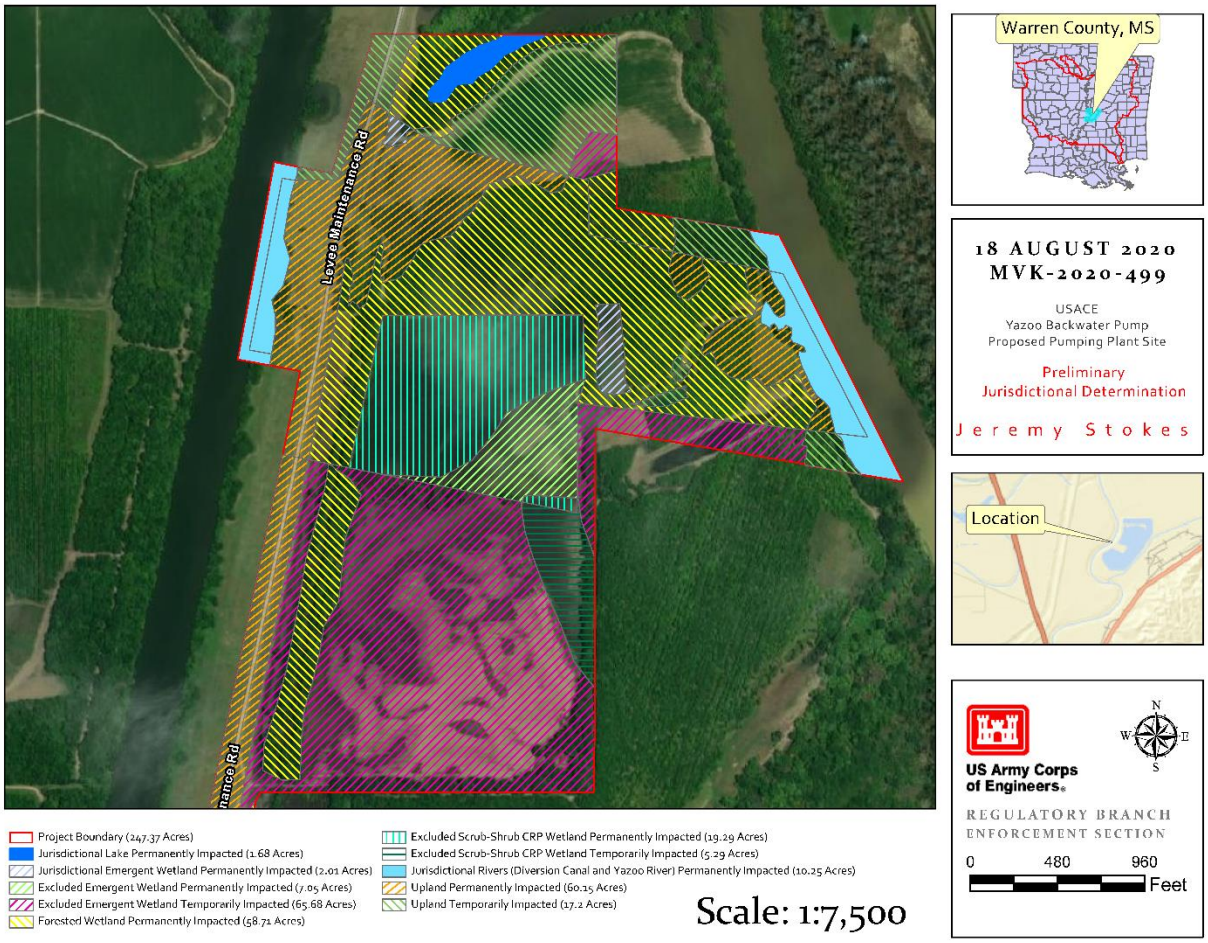

Figure 8. Jurisdictional Wetland Determination of Pump Station which includes: Pump Station footprint and Pump Station ROW

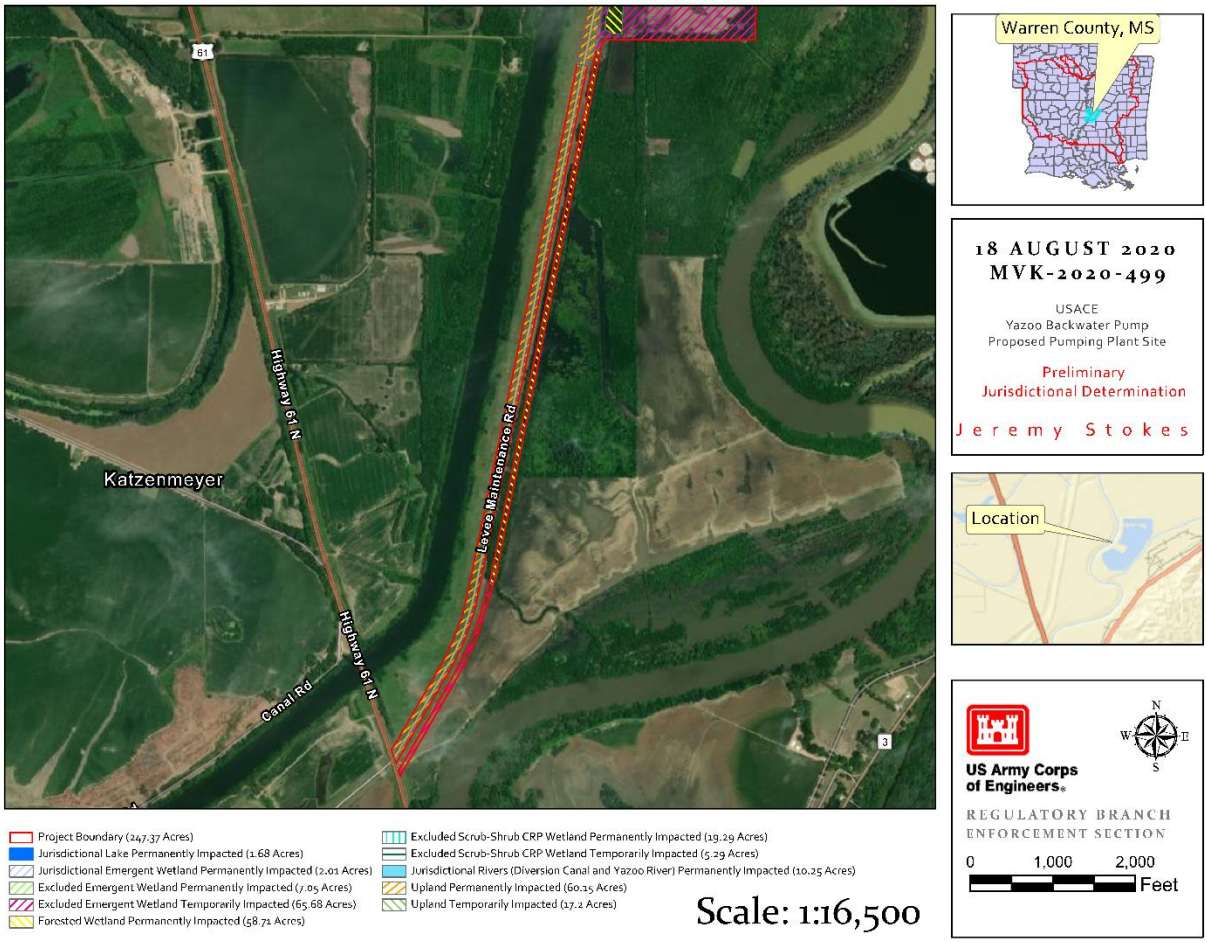

Figure 9. Jurisdictional Wetland Determination of Pump Station which includes: Access Road ROW and Utility ROW

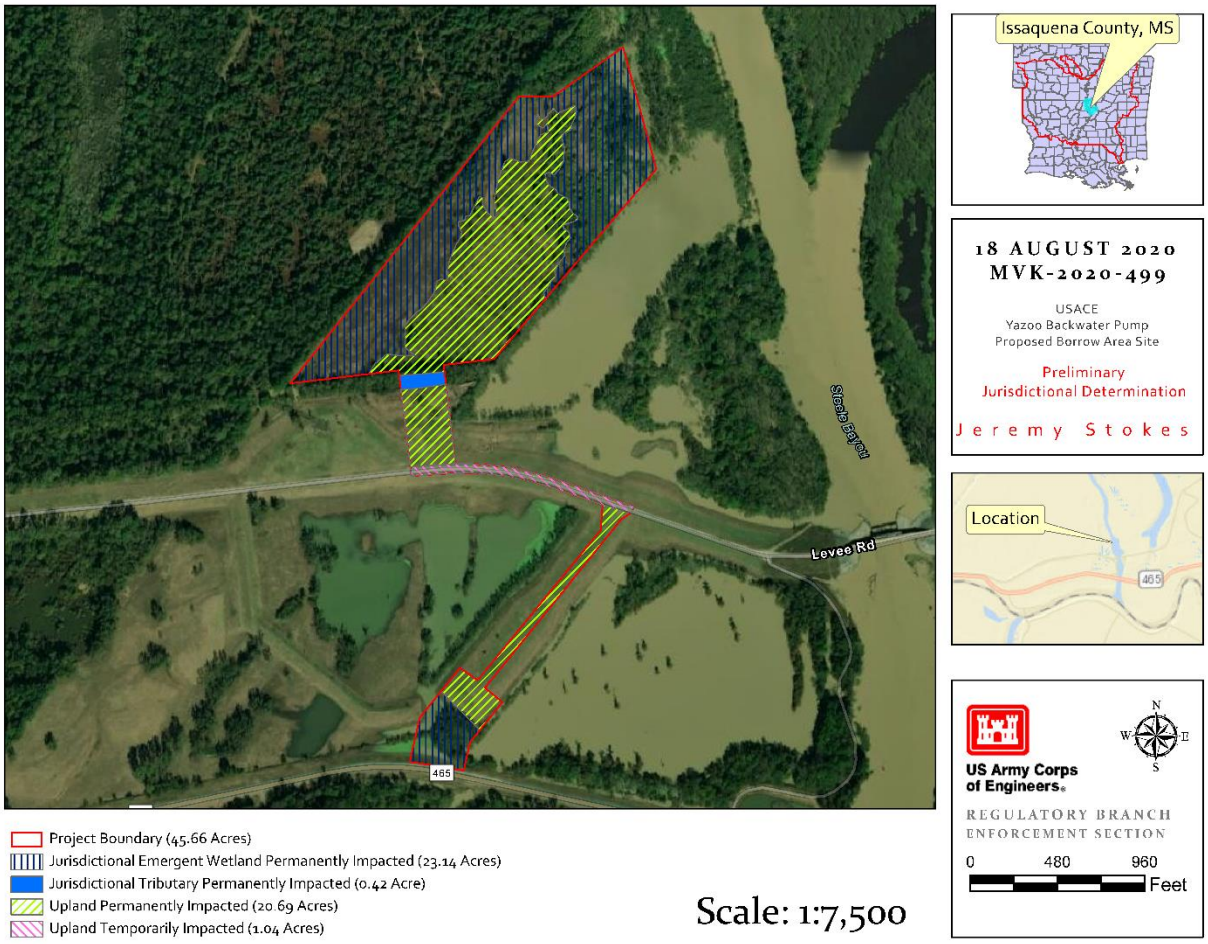

Figure 10. Jurisdictional Wetland Determination of Borrow Area which includes: Borrow Area ROW and Access Road ROW