Sankofa Wetland Park Monitoring Report

October – December 2023

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December 14, 2023

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Summary of Activities: October-December 2023

Monitoring Sampling Design

A monitoring sampling design was developed, shown below, consisting of five monitoring sites (S1 through S5) set approximately equidistant and in the planned path of the linear pond of the Sankofa Wetland Park. The St. Bernard drainage ditch at the bridge to the Viola wastewater treatment plant is also being monitored (site SB), as well as a site in the Bayou Bienvenue Wetland Triangle (site T1).

Location of sampling sites at the Sankofa Wetland Park (S1-S5), the St. Bernard drainage ditch (SB), and the Bayou Bienvenue Wetland Triangle (site T1) .

Site visits

October 25, 2023: Comite Resources field technicians visited the Sankofa Wetland Park to carry out monthly monitoring. Dissolved oxygen and temperature, were measured at monitoring sites S1 through S5 and SB using a handheld probe. Other parameters could not be taken due to probe failure. An avian census was carried out by sight and sound. The staff gauge was at 37.0 cm at 12:30 pm. Several wood ducks were observed in the park, which have not been seen before. Generally, the presence of wood ducks is suggestive of good ecological conditions.

An image of a wood duck (Aix sponsa; downloaded from the internet).

Dissolved oxygen was at or below 0.61 mg/L at the bridge site (SB) and sites S1 and S2, whereas it was at or above 7.65 mg/L at site S3, S4 and S5. We believe this discrepancy was due to the large algae mat on sites S1 and S2 and the lack of the algae mat at sites S3, S4 and S5. Those later sites had broad expanses of open water that had wind induced fetch that most likely increased DO concentrations. The impact of the algae mat was also evident in temperature, which was at or below 22˚C where the mat was present, and above 26˚C where it was not.

Discrete water quality data from October 25, 2023.

Site	Date	DO (mg/l)	Cond. (mS)	Salinity (ppt)	Temp. (˚C)	pH	TDS (mg/L)
SB	10/25/23	0.61	.	.	25.4	.	.
S1	10/25/23	0.21	.	.	21.8	.	.
S2	10/25/23	0.19	.	.	22.0	.	.
S3	10/25/23	7.65	.	.	26.7	.	.
S4	10/25/23	10.2	.	.	26.2	.	.
S5	10/25/23	8.3	.	.	27.0	.	.

Probe measurements taken at site S3 on October 25th, 2023. Notice wind fetch on the water.

November 9, 2023: Jason Day carried out monthly monitoring at the wetland park. Dissolved oxygen, conductivity, temperature, salinity and pH were measured at monitoring sites S1 through S5, SB and T1 using a handheld probe. An avian census was carried out by sight and sound. Water samples for nutrient (NOx, NH_3, TN, PO4, TP), BOD_5 and sediment analysis were collected at sites S1 through S5, SB, and T1, and put on ice for transport to Pace Analytical in Baton Rouge for analysis. The staff gauge was 33.0 cm at noon. The wetland pond was completely dry near site S4. Monitoring was carried out where there was pooling water (i.e., ponds) as close as possible to site locations.

Discrete water quality data from November 9, 2023.

Site	Date	DO (mg/l)	Cond. (mS)	Salinity (ppt)	Temp. (˚C)	pH	TDS (mg/L)
SB	11/09/23	2.2	1087.6	0.59	21.6	7.5	0.94
S1	11/09/23	1.5	1369.5	0.76	20.5	7.3	0.98
S2	11/09/23	2.0	1692.7	0.98	19.2	7.5	1.24
S3	11/09/23	17.3	1862.1	0.99	24.4	8.8	1.25
S4	11/09/23	7.8	24.99	1.30	24.5	8.2	1.60
S5	11/09/23	10.3	1079.4	0.54	24.6	8.5	0.70
T2	11/10/23	2.4	5610.1	3.20	22.2	7.2	3.80

Dissolved oxygen was at or below 2.2 mg/L at the bridge (SB) and sites S1 and S2, but like last month was very high at the other sites, ranging from 7.8 to 17.3 mg/L. DO was 2.4 mg/L at the wetland triangle site (T1). Conductivity was ~1090 mS at the SB site, and ranged from ~1080 mS to ~1860 mS in the wetland park, except for site S4 which had a reading of ~25 mS (that site was nearly dry). The wetland triangle site (T1) had a conductivity reading of ~5610 mS. Salinity was <1.0 ppt at all sites except S4 where it was 1.30 ppt and T1 where it was 3.20 ppt. Water temperature ranged from 19.2˚C to 24.6˚C, and pH ranged from 7.2 to 8.8. Total dissolved solids (TDS) was 0.94 mg/L at the bridge (SB), ranged from 0.70 to 1.60 mg/L, in the wetland park, and was 3.80 mg/L at site T1.

Dry conditions in the wetland park near site S4 on November 9, 2023.

Water quality results from November 9, 2023.

Site	Date	NO_x (mg/L)	NH_3 (mg/L)	TN (mg/L)	PO_4 (mg/L)	TP (mg/L)	TSS (mg/L)	BOD_5 (mg/L)
SB	11/09/23	0.091	10.6	10.7	1.6	2.0	37.0	5.7
S1	11/09/23	<0.050	2.8	4.0	0.81	0.82	36.0	4.3
S2	11/09/23	<0.050	0.46	3.5	0.33	0.66	24.5	10.5
S3	11/09/23	<0.050	0.11	3.7	<0.050	0.21	60.0	5.5
S4	11/09/23	<0.050	0.16	4.1	<0.050	0.22	105	5.6
S5	11/09/23	<0.050	<0.50	6.3	<0.050	0.78	288	18.0
T1	11/10/23	<0.050	1.1	2.8	0.38	0.48	20.0	2.8

Nitrate+nitrite (NO_x) concentrations were below detection (<0.05 mg/L) at all of the sites except at the bridge site (SB), which had a concentration of 0.091 mg/L (very low). Ammonia (NH_3) concentrations were 10.6 mg/L at site SB, 2.8 mg/L at site S1, 0.46 mg/L at site S2, 0.11 mg/L at site S3, 0.16 mg/L at site S4, below detection (<0.10 mg/L) at site S5, and 1.1 mg/L at site T1. **These data indicate that the St. Bernard drainage canal is a source of ammonia pollution entering the park.** Total nitrogen (TN) concentrations were 10.7 mg/L at the bridge site (SB), and ranged from 3.5 to 6.3 mg/L at the wetland park sites, and 2.8 mg/L at site T1. Phosphate (PO_4) concentrations were 1.6 mg/L at the bridge site (SB), 0.81 mg/L at site S1, 0.33 mg/L at site S2, below detection (<0.05 mg/L) at sites S3-S5, and 0.38 mg/L at site T1. **These data indicate that the St. Bernard drainage canal is a source of phosphate pollution entering the park.** This is collaborated by Total phosphorus (TP), which was 2.0 mg/L at the bridge site (SB), 0.82 mg/L at site S1, 0.66 mg/L at site S2, 0.21 mg/L at site S3, 0.22 mg/L at site S4, 0.78 mg/L at site S5, and 0.48 mg/L at site T1. Total suspended solids (TSS) concentrations were 37.0 mg/L at site SB, 36.0 mg/L at site S1, 24.5 mg/L at site S2, and then very high concentrations ranging from 60 to 288 mg/L at sites S3-5, presumably due to construction in the area. TSS concentration was 20.0 mg/L at site T1. Five-day biological oxygen demand (BOD_5) was 5.7 mg/L at the bridge site (SB), ranged from 4.3 to 18.0 mg/L at the wetland park sites, and was 2.8 mg/L at the T1 site.

Water quality samples on November 9th, 2023.

December 13, 2023: Dr. Robert Lane and Comite field technician Jason Day visited the Sankofa Wetland Park to carry out monthly monitoring. Dissolved oxygen, conductivity, temperature, salinity and pH were measured at monitoring sites S1 through S5, SB, as well as at the boardwalk on the wetland triangle (T2) using a handheld probe. Water has returned to the western sites of the park. The staff gauge was 41.5 cm at 9:16 am.

Discrete water quality data from December 13, 2023.

Site	Date	DO (mg/l)	Cond. (mS)	Salinity (ppt)	Temp. (˚C)	pH	TDS (mg/L)
SB	12/13/23	4.9	895.7	0.57	13.2	7.1	0.74
S1	12/13/23	7.5	836.4	0.57	11.1	7.7	0.74
S2	12/13/23	4.7	957.8	0.64	11.9	7.4	0.83
S3	12/13/23	11.0	1027.4	0.69	11.6	8.3	0.89
S4	12/13/23	8.9	1098.8	0.72	13.0	7.4	0.92
S5	12/13/23	11.1	649.5	0.41	14.0	7.7	0.54
T2	12/13/23	5.0	1691.2	1.2	11.6	7.2	1.4

Dissolved oxygen was 4.9 mg/L at the bridge site (SB), ranged from 4.7 to 11.1 mg/L at the wetland park sites, and 5.0 mg/L at site T2. Conductivity was 895.7 mS at the bridge, ranged from 649.5 mS to 1098.8 mS at the wetland park sites, and 1691.2 mS at site T2. Salinity was 0.57 ppt at the bridge (SB), ranged from 0.41 to 0.69 ppt at the wetland park sites, and 1.2 ppt at site T2. Water temperature was 13.2˚C at site SB, ranged from 11.1 to 14.0˚C at the wetland park sites, and was 11.6˚C at site T2. pH was 7.1 at the bridge (SB), ranged from 7.4 to 8.3 at the wetland park sites, and was 7.2 at site T2. Total dissolved solids (TDS) was 0.74 mg/L at the bridge (SB), ranged from 0.54 to 0.92 mg/L at the wetland park sites, and was 1.4 mg/L at site T2.

Site S5 on December 13, 2023.

Avian Survey

A total of 24 bird species were observed in October, 27 species in November, and 36 species in December. A total of 47 species were sited this quarter.

Bird species observed at the Sankofa Wetland Park for Q4 2023.

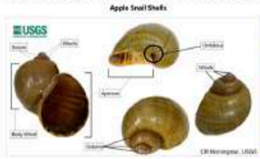
Common Name	Scientific Name	10/25/23	11/10/23	12/13/23
American Coot	*Fulica americana*			X
American Crow	*Corvus brachyrhynchos*	X	X	X
Anhinga	*Anhinga anhinga*		X	X
Bald Eagle	*Haliaeetus leucocephalus*			X
Belted Kingfisher	*Megaceryle alcyon*		X	
Black Vulture	*Coragyps atratus*	X	X	X
Black-Bellied Whistling-Duck	*Dendrocygna autumnalis*		X	
Black-Winged Stilt	*Himantopus himantopus*		X	
Blue Jay	*Cyanocitta cristata*	X	X	X
Blue-Grey Gnatcatcher	*Polioptila caerulea*	X		X
Brown Pelican	*Pelecanus occidentalis*			X
Carolina Chicadee	*Poecile carolinensis*	X	X	X
Carolina Wren	*Thryothorus ludovicianus*	X	X	X
Common Grackel	*Quiscalus quiscula*			X
Common Moorhen	*Gallinula chloropus*		X	X
Coopers Hawk	*Accipiter cooperii*			X
Downy Woodpecker	*Dryobates pubescens*	X	X	
Eastern Phoebe	*Sayornis phoebe*	X	X	X
European Starling	*Sturnus Vulgaris*		X	X
Fish Crow	*Corvus ossifragus*			X
Great Blue Heron	*Ardea herodias*	X	X	X
Great Erget	*Ardea alba*		X	X
Green Heron	*Butorides virescens*	X		X
House Finch	*Haemorhous mexicanus*	X		
Killdeer	*Charadrius vociferus*	X	X	X
Laughing Gull	*Larus atricilla*			X
Limpkin	*Aramus guarauna*		X	X
Mockingbird	*Mimus polyglottos*	X	X	X
Mourning Dove	*Zenaida macroura*		X	X
Northern Cardinal	*Cardinalis cardinalis*	X	X	X
Palm Warbler	*Setophaga palmarum*	X	X	
Red Shouldered Hawk	*Buteo lineatus*	X	X	X
Red Tailed Hawk	*Buteo jamaicensis*			X
Red Winged Blackbird	*Agelaius phoeniceus*	X	X	X
Ruby-Crowned Kinglet	*Corthylio calendula*			X
Semipalmated Plover	*Charadrius semipalmatus*			X
Song Sparrow	*Melospiza melodia*			X
Swamp Sparrow	*Melospiza georgiana*	X	X	
Tree Swallow	*Tachycineta bicolor*		X	
Tricolor Egret	*Egretta tricolor*	X		
Tuffted Titmouse	*Baeolophus bicolor*	X		
Turkey Vulture	*Cathartes aura*	X		X
White Ibis	*Eudocimus albus*	X	X	X
White Pelican	*Pelecanus erythrorhynchos*			X
White-Eyed Vireo	*Vireo griseus*	X		
Wood Duck	*Aix sponsa*	X		X
Yellow-Rumped Warbler	*Setophaga coronata*		X	X

Miscellaneous Activities

October 11-13, 2023: Dr. Rob Lane and Jason Day were tasked with developing a companion curriculum for teachers of K-2 students for their visits to the wetland park. Below is what was delivered.

Kindergarten Science Scope & Sequence 2023-2024
Needs of Plants and Animals
Limpkins were not in Louisiana until the Apple Snail migrated from Florida. Apple snails first appeared in Louisiana in the middle 2000s and about 10 years later, the limpkin followed. At the park there are numerous Apple Snail shells that are easily found and can be shown to students. Limpkins are also present in the wetland park and can be pointed out to students.

Apple Snail Shells



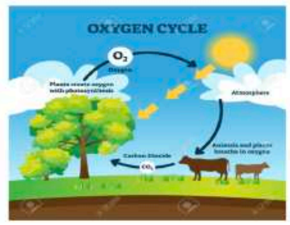
Limpkin with Apple Snail

How can kids in Mariposa Grove attract monarch caterpillars to their neighborhood?
Various wetland plants attract butterflies and humming birds, such as Irises. Plants with red, orange, yellow, or pink flowers are especially alluring to butterflies. The best way to bring butterflies is to have plants that have nectar that butterflies feed on.

Louisiana Irises

How can humans make sure that other living things will be able to live and grow?
Living things need things like water, food, and shelter. The wetlands provide these things to animals such as the American Alligator, Otters and a variety of birds, snakes, turtles and frogs, all of which can be seen in the park and pointed out to students.

Sunlight and Weather
Sunlight is the primary source of energy to the planet and fuels life on earth. Plants utilize sunlight to convert carbon dioxide and water to sugars (i.e., glucose), which are used to fuel plant growth in a process called photosynthesis. A waste product of photosynthesis is oxygen, which animals need to breath. When animals breath they release carbon dioxide as a waste product, which in turn is used by plants, thus linking animals and plants together. Plants breathing is fun thing for kids to think about.



Why are the playgrounds at two schools different temperatures?
When sunlight touches a surface the energy within the sunlight is converted to heat. If a playground is in direct sunlight, all the surfaces, such as the ground, swings and slides will warm up. This can be felt by the students by touching a surface where it is sunny compared to where it is shaded. Plants, on the other hand, use the energy of the sun to fuel photosynthesis, and thus do not become hot like other surfaces. This also can be felt by touching leaves compared to a nearby surface like cement.

1st Grade Science Scope & Sequence 2023-2024
Animal and Plant Defenses
Like in the class lesson, there are turtles living in the Sankofa wetland. If possible, show the students some turtle shells of species that live in wetland. The wetland park provides food (they eat vegetation and some animals such as worms), shelter and protection from predators by burrowing in the mud or dense vegetation. Also, turtles have many offspring (i.e., babies) that are relatively on their own with the anticipation that many will be eaten by predators, whereas other animals, such as birds and mammals, only have a few offspring that are fed and sheltered for several months by their parents before they go off on their own. Other species that have many young include Apple Snails and fish.

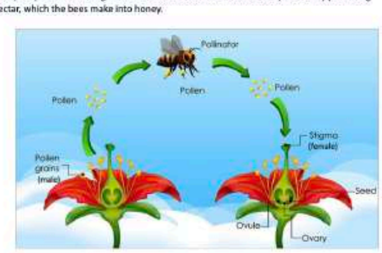
Red-eared Slider · **Snapping Turtle** · **Box Turtle** · **Spiny Softshell**

Spinning Earth
As described in the lesson plan, the earth is a globe that is spinning in space whereas the sun is relatively stationary. This can been seen by the movement of the sun across the sky and also by how shadows move throughout the day. This can be demonstrated by marking the edge of a shadow formed by the gazebo at the park when students first enter the park and then seeing the difference in the shadow edge location while they are leaving. Or use a post placed in the ground and marked like a solar clock.

2nd Grade Science Scope & Sequence 2023-2024
Plant and Animal Relationships
Like in the lesson plan, many plants in the wetland park depend on birds to eat their seeds, fly away and then poop out the seeds in a different location. In this way, plants are able to move far distances. An example of such a plant in the park is Wild Rice, which can be shown to the students. We can also find other similar species while at the park.

Wild Rice

Bees are very important to flowering plants for pollination, which is the act of transferring pollen grains from the male anther of a flower to the female stigma. If flowers are present in the park, students can be shown the male and female parts of the flower and how bees help transport pollen to the stigmas. Flowers entice bees to inadvertently do this by producing nectar, which the bees make into honey.



Changing Landforms

The earth is constantly changing due to the processes of erosion (i.e., soil loss) and accretion (i.e., soil gain). Examples of both can be found in the wetland park to show the students. Erosion can be found along the edges of the pond where there are areas that have sloughed off into the water. This is occurring when water levels rise and fall in the pond during storms, and when there are winds that cause small waves to strike the edge. Accretion can be found in the drainage ditches near Florida Avenue that have been filling in with sediment during rain storms. The sediment is pickup by running water as it passes over the ground and is deposited in the drainage ditches when the water becomes still. Accretion is also occurring in the wetland pond through the same process as well as from the sinking of the algal mat that can be seen in the wetland pond. Could also show leaf litter on the ground in different stages of decomposition, demonstrating how soil is formed.

October 24, 2023: Dr. Lane was tasked with determining the carbon sequestered by 3000 trees planted at the park. Below is what he submitted.

The Sankofa Wetland Park will have planted 3000 cypress and tupelo trees in the park by the time it is complete. In order to calculate the carbon sequestered, aboveground tree carbon sequestration was derived from FVS modeling (https://www.fs.usda.gov/fvs/). Results indicate that in the first ten years, 51.0 metric tons of carbon dioxide equivalents (tCO2e) will be sequestered. A carbon dioxide equivalent, abbreviated as CO2e, is a metric measure used to convert the amount of carbon to the equivalent amount of carbon dioxide. In 50 years, 967 tCO2e will be sequestered, and in 100 years a total of 1922 tCO2e will be sequestered. To put this into perspective, an average size car burns a half a ton of CO2e per year. Thus, in the first ten years of growth, the trees in the Sankofa wetland park will sequester the equivalent of what 10 cars burn during that time. Over 50 years, this will increase to 38 cars due to increased sequestration capacity of larger trees.

Aboveground (AGB) biomass, and belowground (BGB) of trees over 100 years as modeled in FVS.

Year	Tree AGB C (tCO2e)	3000 trees AGB (tCO2e)	3000 trees BGB (tCO2e)	3000 trees Total (tCO2e)
0	0.0000	0.0	0.0	0.0
10	0.0137	41.1	9.9	51.0
20	0.0793	237.9	57.1	295.0
30	0.1351	405.2	97.3	502.5
40	0.1836	550.9	132.2	683.1
50	0.2600	780.0	187.2	967.2
60	0.2830	849.0	203.8	1052.7
70	0.3135	940.5	225.7	1166.2
80	0.4888	1466.3	351.9	1818.2
90	0.5012	1503.6	360.9	1864.4
100	0.5169	1550.6	372.1	1922.7

November 7, 2023: Rob Lane met virtually with Nikolaus Richard of the Corps of Engineers, Rashida F., Tom Willis and others for a kickoff meeting of Phase II of the Silver Jackets program. Dr. Lane requested the final report from Phase I, which Mr. Willis said he would send.

November 9, 2023: Jason Day traveled to the Sankofa Wetland Park to oversee stocking of the pond with 70 triploid grass carp. The grass carp will help keep the pond from covering with algae, which occurred during the summer but now seems to have dissipated. The carp should live up to ten years, but are sterile and thus will not reproduce. Jason had to purchase a license for $50 from LW&F to carry out this endeavor.

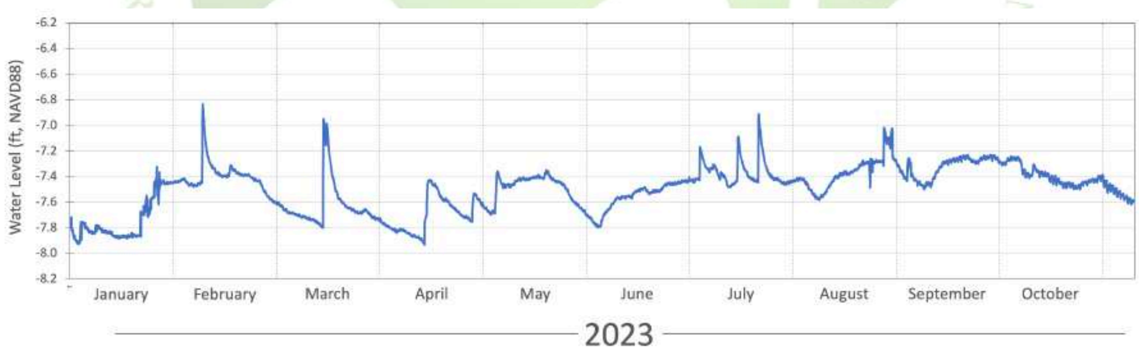
Triploid grass carp being released into the Sankofa Wetland Park.

November 9, 2023: Rob Lane and Jason Day traveled to the Sankofa Wetland Park to assist with a visit by sixty or so 1^{st} grade students. They brought several turtle shells for the students to observe. Dr. Lane gave a brief talk about the marsh fire near New Orleans East.

First grade students at the Sankofa Wetland Park.

After the class, Rob Lane and Jason Day went to the Sankofa office for a virtual meeting with Kiarra Keith to discuss signage. After the meeting, Rob and Jason returned to the park and downloaded the water level recorder, then went to the Veolia WTP and installed a new water level recorder in the wetland triangle. The T1 staff gauge was 51 cm at 1:15 pm.

Water level recorder in the wetland triangle.



Water level in the Sankofa Wetland Park.

December 13, 2023: Dr. Rob Lane gave a lecture on wetlands and water quality monitoring to students from Delgado Community College. He prepared a new curriculum, which was given as handouts to the class. Below is what was provided.

Class Outline: Sankofa/Delgado Workforce Development Program
Topic: Wetland Habitats

Overview of wetland habitats
Can anyone name the types of wetlands in Louisiana?

Swamps:
- Cypress-Tupelo Swamps: Characterized by the presence of bald cypress and water tupelo trees, these swamps are common in the lower reaches of bayous and estuaries.
- Bottomland Hardwood Swamps: These swamps are dominated by hardwood trees and are often found along rivers and streams.

Marshes:
- Freshwater Marshes: Found in areas with freshwater input, these marshes support diverse vegetation and wildlife.
- Brackish Marshes: Found in areas where saltwater and freshwater mix, these marshes are home to species adapted to variable salinity.
- Saltwater Marshes: Dominated by salt-tolerant plants, these marshes are typically found in coastal areas with exposure to tidal influences.

Bogs:
- Cypress-Tupelo Bogs: Similar to swamps, these wetlands are characterized by the presence of cypress and tupelo trees without direct connection to rivers, usually in depressions.
- Sphagnum Moss Bogs: These acidic bogs are characterized by the growth of sphagnum moss and are typically found in northern parts of the state.

What is causing these different types of wetlands?
An interaction of hydrological, geological and ecological factors.

Hydrology:
- Salinity: Tidal fluctuations bring a mix of saltwater and freshwater, influencing the types of plants and animals that can survive in these environments.

Geography and Topography:
- The elevation of the land influences hydrology and flooding.
- Proximity to Coastline: Interactions between freshwater and saltwater.

Vegetation:
- The presence of specific plant species, such as cypress and tupelo trees in swamps or marsh grass in saltmarshes, contributes to the classification of wetland types.

Has anybody been down to Grand Isle?
- Used to be saltmarsh, but now has mangroves through much of the area.
- South of Louisiana, coastal wetlands are mostly mangroves (Florida, Mexico), north of LA they are all mostly saltmarsh.

What is causing saltmarshes to form to the north and mangroves to the south?

Temperature Gradient:
- **Cold Tolerance:** Salt marsh plants are generally more cold-tolerant than mangroves and are found in areas where winter temperatures may drop below freezing.
- **Warmer Temperatures to the South:** Mangroves are adapted to tropical and subtropical climates with consistently warmer temperatures.

Estuaries
Has anyone heard of an estuary?
An estuary is a partially enclosed coastal body of water where freshwater from rivers and streams meets and mixes with saltwater from the ocean. Estuaries are unique and dynamic environments that serve as transition zones between terrestrial and marine ecosystems. '

Mixing of Waters:
- Estuaries are areas where freshwater flowing from the land mixes with saltwater from the ocean. This mixing creates brackish water, which has a salinity intermediate between freshwater and seawater.

Tidal Influence:
- Estuaries are strongly influenced by tides. The rise and fall of tides bring in seawater, and the ebb and flow of tides contribute to the flushing of estuarine waters.

Biodiversity:
- Estuaries are among the most productive ecosystems on Earth. The mixing of nutrients from both freshwater and marine sources creates a nutrient-rich environment that supports diverse and abundant life, including various species of fish, shellfish, birds, and plant life.

Nursery Habitats:
- Estuaries serve as important nursery habitats for many marine and bird species and provide abundant food and protection from predators.

Buffer Against Storms:
- Estuarine ecosystems provide a natural buffer against storm surges and flooding by absorbing wave energy and decreasing surge height.

Human Interaction:
- Almost all human civilizations began near estuaries due to the abundance of food. Indians used to thrive throughout the Mississippi Delta

Can anyone name some Indian tribes that live in the delta?
Choctaw, Chitimacha, Houma tribes Others: Apalachee, Caddo, Tunica-Biloxi, Coushatta

The Mississippi River delta is made up of six estuaries, from east to west:
- Biloxi estuary (Hopedale, Shell Beach) to the east
- Breton Sound estuary (Chalmette, Delacroix) to the southeast
- Barataria estuary (Grand Isle, Lafitte) to the southwest
- Mississippi River runs between those two – to the Bird-foot Delta (Venice)
- Further west Terrebonne estuary (Houma, Chuavin, Dulac)
- Atchafalaya delta estuary (Morgan City) – Atchafalaya River

Has anyone heard of the Atchafalaya River?
If not for human intervention, the Mississippi River would have started flowing down the Atch.
Beginning of the century (1920 or so), increasing flows to Atch. measured
Old river control structure completed in 1963
Now 1/3rd of Miss. R. discharge goes down Atchafalaya
Atchafalaya only growing estuary in Louisiana, all others are eroding.
75 square miles of wetlands lost annually

Does anyone know why Louisiana wetlands are being lost?
Louisiana's wetlands are facing significant loss due to a combination of natural and human-induced factors. Some of the key reasons for the ongoing loss of wetlands in Louisiana include:

Subsidence:
- Subsidence is the settling and sinking of the wetland surface. Natural wetland subsidence is exacerbated by factors such as the withdrawal of groundwater and oil and gas.

Sea Level Rise:
- Rising sea levels associated with global climate change contribute to the loss of wetlands. Higher sea levels increase saltwater intrusion into freshwater areas, leading to changes in vegetation and habitat loss.

Hurricane Impact:
- Hurricanes and tropical storms can cause storm surges that inundate wetlands and erode shorelines. The frequency and intensity of storms in the Gulf of Mexico is increasing and are exacerbating wetland loss.

Human Activities:
- <u>Canal Construction:</u> The construction of navigation canals for oil and gas exploration has altered water flow patterns, allowing saltwater intrusion and accelerating land loss.
- <u>Oil and Gas Extraction:</u> The extraction of oil and gas has contributed to subsidence and activation of geologic faults.
- <u>Levee Construction:</u> Levees built along the Mississippi River for flood control prevents the natural replenishment of sediment in wetland areas during annual flooding. Without sediment, wetlands cannot build and maintain elevation, making them more vulnerable to erosion and subsidence.

Ecology of wetland habitats
Does anyone know what ecology means?
Ecology is the study of the interactions among organisms and their environment. It is a branch of biology that focuses on understanding the relationships, distribution, abundance, and dynamics of living organisms in their natural environments.

Food Webs
Represents the complex network of feeding relationships within an ecosystem. Different species are interconnected through the transfer of energy and nutrients as they consume and are consumed by one another. Unlike a food chain, a food web is more realistic, reflecting the multiple and often overlapping interactions that occur in natural ecosystems.

Predator-Prey Relationships: Predators hunt and consume prey, and this dynamic is crucial for regulating population sizes within an ecosystem.

Interconnectedness: The loss or introduction of one species can have cascading effects on the entire ecosystem. Human activities, such as exotic species introductions, can disrupt food webs, leading to ecological imbalances.

Trophic Levels:
- <u>Primary Producers:</u> Typically, plants and algae that produce their own food through photosynthesis. They form the base of the food web by converting sunlight into energy.
- <u>Consumers:</u> Organisms that consume other organisms for energy. Consumers are further classified into different trophic levels:
  - <u>Herbivores:</u> Eat primary producers.
  - <u>Carnivores:</u> Eat the herbivores or other carnivores.

Energy Transfer: Energy flows through the food web as organisms are consumed. However, most energy (90%) is not transferred and is lost at each trophic level.

An interesting characteristic of estuarine food webs is the importance of the bottom
Can anyone tell me why the bottom of the estuary is important?
The bottom of an estuary, often referred to as the benthic zone, is of critical importance for various ecological processes and the overall health of the estuarine ecosystem.

Benthos:
- The estuarine bottom provides a habitat for a diverse community of benthic organisms, such as worms, clams, crustaceans, and various larvae.

Decomposition:
- Decomposition of organic matter, including dead plants and animals, occurs at the estuarine bottom. This decomposition process releases nutrients back into the water, supporting the nutrient cycling essential for the overall productivity of the estuary.

Filter-Feeding:
- Many benthic organisms are filter feeders, actively filtering organic particles and detritus from the water column. This process helps maintain water clarity and nutrient cycling.

Carbon Sequestration:
- The estuarine bottom can sequester and store significant amounts of carbon. Organic material that accumulates and is buried in sediments contributes to long-term carbon storage, helping to mitigate the impacts of climate change.

Indicator of Environmental Health:
- The condition and diversity of benthic communities at the estuarine bottom can serve as indicators of the overall environmental health of the estuary.

Benefits of wetland habitats (humans and wildlife)
Wetland habitats play crucial roles in supporting biodiversity, maintaining water quality, and providing valuable ecosystem services, such as flood control, to surrounding communities.

<u>Wetland Benefits for Wildlife</u>

Habitat and Biodiversity:
- Wetlands support a diverse array of plant and animal species, many of which are specially adapted to the unique conditions of wetlands.

Birds:

Many bird species, including waterfowl, shorebirds, and wading birds, use wetlands as nesting and breeding grounds. The sheltered and nutrient-rich conditions of wetlands provide essential resources for raising young.

Wetlands play a crucial role in the migration routes of many bird species. They provide important stopover points where migratory birds can rest and refuel during their long journeys.

Fish:

Juvenile fish use wetland areas as nurseries, finding abundant food and shelter.

<u>Wetland Benefits for Humans</u>

Flood Control:

Wetlands act as natural buffers against flooding by absorbing and storing excess water during heavy rainfall or storm events. They help reduce the risk of downstream flooding and protect nearby communities.

Filtering & Purification:

Wetlands act as natural filters, trapping sediments and filtering pollutants from water. They help improve water quality by removing excess nutrients and sediments before water enters rivers, lakes, or oceans.

Carbon Sequestration:

Wetlands store large amounts of carbon in their soils and vegetation. Subsidence makes this storage permanent.

Erosion Control:

Vegetation in wetlands helps stabilize shorelines and prevent erosion. The root systems of wetland plants bind soil together, reducing the impact of waves and currents.

Conserving wetland habitats is critical for maintaining these benefits and ensuring the health of both ecosystems and human communities. Wetland preservation and restoration efforts are important for sustaining biodiversity, ecosystem services, and the well-being of people around the world.

Topic: Water Quality Testing

Can anybody tell me what inorganic nutrients are?

Inorganic nutrients are chemical elements that are essential for the growth and development of living organisms. They are the building blocks of life.

Unlike organic nutrients, which are derived from living or once-living organisms, inorganic nutrients come from non-living sources such as rocks, minerals, water, and gases in the atmosphere.

Macronutrients: These are required by organisms in relatively large quantities.

Nitrogen (N), Phosphorus (P), Potassium (K), Calcium (Ca), Magnesium (Mg) & Sulfur (S)

Micronutrients: These are needed in smaller amounts but are equally essential.

Iron (Fe), Zinc (Zn), Copper (Cu), Manganese (Mn), Boron (B), Chlorine (Cl), Nickel (Ni)

Nitrogen and phosphorus - known as growth limiting nutrients - control algae & plant growth

What happens when there are too much nitrogen and phosphorus in the water?

When there is an excess of nitrogen and phosphorus in water, it can lead to a phenomenon known as nutrient pollution. This type of pollution can have detrimental effects on aquatic ecosystems, water quality, and overall environmental health.

Algal Blooms:

The rapid growth of algae, which are primary producers that use nutrients for photosynthesis.

Harmful Algal Blooms (HABs):

Some algal species, particularly certain types of cyanobacteria (blue-green algae), can produce toxins during blooms. These harmful algal blooms (HABs) can pose serious risks to aquatic life, animals and humans through the contamination of drinking water and recreational waters.

Oxygen Depletion:

The decomposition of algae by benthic organisms consumes dissolved oxygen in the water. This can lead to oxygen depletion, creating "dead zones" where oxygen levels are too low to support most aquatic life.

Fish Kills:

Fish and other aquatic organisms may die due to the lack of oxygen or exposure to algal toxins.

Changes in Water Chemistry:

Elevated nutrient levels can alter the chemical composition of water, leading to changes in pH, nutrient ratios, and the availability of other essential compounds and heavy meatals.

Loss of Biodiversity:

Changes in water quality and oxygen levels can adversely affect the diversity of aquatic plants and animals. Species adapted to lower nutrient conditions may decline, while species that thrive in nutrient-rich environments may dominate, leading to shifts in community composition.

Water quality monitoring and testing

Water quality monitoring is crucial for identifying potential contaminants, tracking changes over time, and making informed decisions about water management and protection.

Nitrogen is of particular importance because humans have doubled the amount of biological available nitrogen on planet earth, mostly by the use of artificial fertilizers, but also through the combustion of fossil fuels.

This has caused rainfall worldwide to have high levels of biological available nitrogen, impacting plant distributions and species diversity worldwide.

Can anyone tell me how increased nitrogen can change plant distributions?

Some plants use nitrogen better than other – out competing (overgrowing) other plants

Nitrogen – nitrate, ammonia, organic nitrogen and total nitrogen

Nitrogen is an essential element for living organisms. It is a key component of amino acids, which are the building blocks of proteins. Nitrogen is also present in nucleic acids (DNA and RNA), chlorophyll, and many other biological molecules.

Phosphorus – orthophosphate, organic phosphorus, total phosphorus

Phosphorus is a key component of DNA, RNA, and ATP (adenosine triphosphate), which are fundamental molecules for the storage and transfer of genetic information and energy within cells.

Like nitrate and ammonia, phosphate availability has greatly increased on the planet, mostly through the mining of ancient deposits.

In most lakes and ponds, phosphorus is the limiting nutrient, which means that any additional phosphorus added to them will cause algae blooms.

Chlorophyll *a* – measure of phytoplankton standing stock in the water column.

Total suspended sediments – Sand and silt - affect light penetration into water column.

Dissolved oxygen

Dissolved oxygen (DO) refers to the amount of molecular oxygen (O_2) that is dissolved in water.

If dissolved oxygen levels drop, some animals may move away, decline in health or die. However, most animals living in wetland environments have become adapted to low dissolved oxygen conditions naturally present in wetlands.

Salinity/conductivity

Salinity and conductivity are two related but distinct measures that are often used to characterize aquatic ecosystems.

Salinity refers to the concentration of dissolved salts in water, typically expressed as a percentage or part per thousand.

Conductivity is a measure of how well a solution conducts an electric current and is often used as an indirect measure of salinity.

pH

pH is a measure of the concentration of hydrogen ions in a solution. The more hydrogen ions, the lower the pH (more acidic), and the fewer hydrogen ions, the higher the pH (more alkaline).

pH may make certain minerals and heavy metals more or less water soluble.

Water temperature

A fundamental parameter that has mediating effects on most biological processes that impact water quality, such as phytoplankton growth, denitrification, ammonification, and decomposition.

Biological Oxygen Demand (BOD_5)

Biological Oxygen Demand (BOD_5) is a key indicator used to measure the amount of oxygen that microorganisms require to decompose organic matter in a water sample over a specific period, usually five days. BOD_5 is an important parameter in assessing the level of organic pollution in water bodies, particularly in terms of the amount of biodegradable organic material present.

Delgado students observing Jason Day take probe measurements on December 13, 2023

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ANALYTICAL RESULTS

Project: SANKOFA
Pace Project No.: 20296416

Sample: BRIDGE **Lab ID: 20296416001** Collected: 11/09/23 09:30 Received: 11/09/23 14:45 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
BR SM4500P E2011 OrthoP in WT	Analytical Method: SM 4500P-E 2011 Pace Analytical Services - Baton Rouge							
Orthophosphate as P	**1.6**	mg/L	0.25	5		11/13/23 12:05		H3
BR SM2540D TSS	Analytical Method: SM 2540D 2011 Pace Analytical Services - Baton Rouge							
Total Suspended Solids	**37.0**	mg/L	8.3	1		11/16/23 16:15		
BR 5210B 2016 BOD, 5 day	Analytical Method: SM 5210B-2016 Preparation Method: SM 5210B-2016 Pace Analytical Services - Baton Rouge							
BOD, 5 day	**5.7**	mg/L	1.7	1.5	11/10/23 14:00	11/15/23 09:40		
351.2 Total Kjeldahl Nitrogen	Analytical Method: EPA 351.2 Preparation Method: EPA 351.2 Pace Analytical Services - New Orleans							
Nitrogen, Kjeldahl, Total	**10.4**	mg/L	0.40	4	11/15/23 11:43	11/17/23 16:29	7727-37-9	D4
365.4 Total Phosphorus	Analytical Method: EPA 365.4 Preparation Method: EPA 365.4 Pace Analytical Services - New Orleans							
Phosphorus	**2.0**	mg/L	0.10	1	11/15/23 11:45	11/17/23 14:54	7723-14-0	
4500 Ammonia Water	Analytical Method: SM 4500-NH3 G Pace Analytical Services - New Orleans							
Nitrogen, Ammonia	**10.6**	mg/L	0.50	5		11/22/23 14:48	7664-41-7	D4
4500NO3-F, NO3-NO2	Analytical Method: SM 4500-NO3 F Pace Analytical Services - New Orleans							
Nitrogen, NO2 plus NO3	**0.091**	mg/L	0.050	1		11/21/23 15:20		

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ANALYTICAL RESULTS

Project: SANKOFA
Pace Project No.: 20296416

Sample: S1 | **Lab ID: 20296416002** | Collected: 11/09/23 10:50 | Received: 11/09/23 14:45 | Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
BR SM4500P E2011 OrthoP in WT	Analytical Method: SM 4500P-E 2011 Pace Analytical Services - Baton Rouge							
Orthophosphate as P	**0.81**	mg/L	0.25	5		11/13/23 12:07		H3
BR SM2540D TSS	Analytical Method: SM 2540D 2011 Pace Analytical Services - Baton Rouge							
Total Suspended Solids	**36.0**	mg/L	25.0	1		11/16/23 16:15		
BR 5210B 2016 BOD, 5 day	Analytical Method: SM 5210B-2016 Preparation Method: SM 5210B-2016 Pace Analytical Services - Baton Rouge							
BOD, 5 day	**4.3**	mg/L	1.7	1.5	11/10/23 14:00	11/15/23 09:50		
351.2 Total Kjeldahl Nitrogen	Analytical Method: EPA 351.2 Preparation Method: EPA 351.2 Pace Analytical Services - New Orleans							
Nitrogen, Kjeldahl, Total	**4.0**	mg/L	0.10	1	11/15/23 11:43	11/17/23 15:55	7727-37-9	
365.4 Total Phosphorus	Analytical Method: EPA 365.4 Preparation Method: EPA 365.4 Pace Analytical Services - New Orleans							
Phosphorus	**0.82**	mg/L	0.10	1	11/15/23 11:45	11/17/23 14:54	7723-14-0	
4500 Ammonia Water	Analytical Method: SM 4500-NH3 G Pace Analytical Services - New Orleans							
Nitrogen, Ammonia	**2.8**	mg/L	0.10	1		11/22/23 14:37	7664-41-7	
4500NO3-F, NO3-NO2	Analytical Method: SM 4500-NO3 F Pace Analytical Services - New Orleans							
Nitrogen, NO2 plus NO3	ND	mg/L	0.050	1		11/21/23 15:21		

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: SANKOFA
Pace Project No.: 20296416

Sample: S2 | **Lab ID: 20296416003** | Collected: 11/09/23 11:00 | Received: 11/09/23 14:45 | Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
BR SM4500P E2011 OrthoP in WT	Analytical Method: SM 4500P-E 2011 Pace Analytical Services - Baton Rouge							
Orthophosphate as P	**0.33**	mg/L	0.050	1		11/13/23 12:08		H3
BR SM2540D TSS	Analytical Method: SM 2540D 2011 Pace Analytical Services - Baton Rouge							
Total Suspended Solids	**24.5**	mg/L	12.5	1		11/16/23 16:15		
BR 5210B 2016 BOD, 5 day	Analytical Method: SM 5210B-2016 Preparation Method: SM 5210B-2016 Pace Analytical Services - Baton Rouge							
BOD, 5 day	**10.5**	mg/L	4.6	4	11/10/23 14:00	11/15/23 09:53		
351.2 Total Kjeldahl Nitrogen	Analytical Method: EPA 351.2 Preparation Method: EPA 351.2 Pace Analytical Services - New Orleans							
Nitrogen, Kjeldahl, Total	**3.5**	mg/L	0.10	1	11/15/23 11:43	11/17/23 15:57	7727-37-9	
365.4 Total Phosphorus	Analytical Method: EPA 365.4 Preparation Method: EPA 365.4 Pace Analytical Services - New Orleans							
Phosphorus	**0.66**	mg/L	0.10	1	11/15/23 11:45	11/17/23 14:55	7723-14-0	
4500 Ammonia Water	Analytical Method: SM 4500-NH3 G Pace Analytical Services - New Orleans							
Nitrogen, Ammonia	**0.46**	mg/L	0.10	1		11/22/23 14:38	7664-41-7	
4500NO3-F, NO3-NO2	Analytical Method: SM 4500-NO3 F Pace Analytical Services - New Orleans							
Nitrogen, NO2 plus NO3	ND	mg/L	0.050	1		11/21/23 15:23		

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ANALYTICAL RESULTS

Project: SANKOFA
Pace Project No.: 20296416

Sample: S3 **Lab ID: 20296416004** Collected: 11/09/23 11:12 Received: 11/09/23 14:45 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
BR SM4500P E2011 OrthoP in WT	Analytical Method: SM 4500P-E 2011 Pace Analytical Services - Baton Rouge							
Orthophosphate as P	ND	mg/L	0.050	1		11/13/23 12:08		H3
BR SM2540D TSS	Analytical Method: SM 2540D 2011 Pace Analytical Services - Baton Rouge							
Total Suspended Solids	**60.0**	mg/L	16.7	1		11/16/23 16:15		
BR 5210B 2016 BOD, 5 day	Analytical Method: SM 5210B-2016 Preparation Method: SM 5210B-2016 Pace Analytical Services - Baton Rouge							
BOD, 5 day	**5.5**	mg/L	1.7	1.5	11/10/23 14:00	11/15/23 10:04		
351.2 Total Kjeldahl Nitrogen	Analytical Method: EPA 351.2 Preparation Method: EPA 351.2 Pace Analytical Services - New Orleans							
Nitrogen, Kjeldahl, Total	**3.7**	mg/L	0.10	1	11/15/23 11:43	11/17/23 15:57	7727-37-9	
365.4 Total Phosphorus	Analytical Method: EPA 365.4 Preparation Method: EPA 365.4 Pace Analytical Services - New Orleans							
Phosphorus	**0.21**	mg/L	0.10	1	11/15/23 11:45	11/17/23 14:56	7723-14-0	
4500 Ammonia Water	Analytical Method: SM 4500-NH3 G Pace Analytical Services - New Orleans							
Nitrogen, Ammonia	**0.11**	mg/L	0.10	1		11/22/23 14:40	7664-41-7	
4500NO3-F, NO3-NO2	Analytical Method: SM 4500-NO3 F Pace Analytical Services - New Orleans							
Nitrogen, NO2 plus NO3	ND	mg/L	0.050	1		11/21/23 15:24		

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ANALYTICAL RESULTS

Project: SANKOFA
Pace Project No.: 20296416

Sample: S4 | **Lab ID: 20296416005** | Collected: 11/09/23 11:30 | Received: 11/09/23 14:45 | Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
BR SM4500P E2011 OrthoP in WT	Analytical Method: SM 4500P-E 2011 Pace Analytical Services - Baton Rouge							
Orthophosphate as P	ND	mg/L	0.050	1		11/13/23 12:10		H3
BR SM2540D TSS	Analytical Method: SM 2540D 2011 Pace Analytical Services - Baton Rouge							
Total Suspended Solids	**105**	mg/L	16.7	1		11/16/23 16:15		
BR 5210B 2016 BOD, 5 day	Analytical Method: SM 5210B-2016 Preparation Method: SM 5210B-2016 Pace Analytical Services - Baton Rouge							
BOD, 5 day	**5.6**	mg/L	1.7	1.5	11/10/23 14:00	11/15/23 10:11		
351.2 Total Kjeldahl Nitrogen	Analytical Method: EPA 351.2 Preparation Method: EPA 351.2 Pace Analytical Services - New Orleans							
Nitrogen, Kjeldahl, Total	**4.1**	mg/L	0.10	1	11/15/23 11:43	11/17/23 16:02	7727-37-9	
365.4 Total Phosphorus	Analytical Method: EPA 365.4 Preparation Method: EPA 365.4 Pace Analytical Services - New Orleans							
Phosphorus	**0.22**	mg/L	0.10	1	11/15/23 11:45	11/17/23 14:56	7723-14-0	
4500 Ammonia Water	Analytical Method: SM 4500-NH3 G Pace Analytical Services - New Orleans							
Nitrogen, Ammonia	**0.16**	mg/L	0.10	1		11/22/23 14:41	7664-41-7	
4500NO3-F, NO3-NO2	Analytical Method: SM 4500-NO3 F Pace Analytical Services - New Orleans							
Nitrogen, NO2 plus NO3	ND	mg/L	0.050	1		11/21/23 15:25		

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ANALYTICAL RESULTS

Project: SANKOFA
Pace Project No.: 20296416

Sample: S5 **Lab ID: 20296416006** Collected: 11/09/23 11:45 Received: 11/09/23 14:45 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
BR SM4500P E2011 OrthoP in WT	Analytical Method: SM 4500P-E 2011 Pace Analytical Services - Baton Rouge							
Orthophosphate as P	ND	mg/L	0.050	1		11/13/23 12:11		H3
BR SM2540D TSS	Analytical Method: SM 2540D 2011 Pace Analytical Services - Baton Rouge							
Total Suspended Solids	**288**	mg/L	50.0	1		11/16/23 16:15		
BR 5210B 2016 BOD, 5 day	Analytical Method: SM 5210B-2016 Preparation Method: SM 5210B-2016 Pace Analytical Services - Baton Rouge							
BOD, 5 day	**18.0**	mg/L	3.4	3	11/10/23 14:00	11/15/23 10:14		
351.2 Total Kjeldahl Nitrogen	Analytical Method: EPA 351.2 Preparation Method: EPA 351.2 Pace Analytical Services - New Orleans							
Nitrogen, Kjeldahl, Total	**6.3**	mg/L	0.10	1	11/15/23 11:43	11/17/23 16:02	7727-37-9	
365.4 Total Phosphorus	Analytical Method: EPA 365.4 Preparation Method: EPA 365.4 Pace Analytical Services - New Orleans							
Phosphorus	**0.78**	mg/L	0.10	1	11/15/23 11:45	11/17/23 14:58	7723-14-0	
4500 Ammonia Water	Analytical Method: SM 4500-NH3 G Pace Analytical Services - New Orleans							
Nitrogen, Ammonia	ND	mg/L	0.50	5		11/22/23 14:45	7664-41-7	D3
4500NO3-F, NO3-NO2	Analytical Method: SM 4500-NO3 F Pace Analytical Services - New Orleans							
Nitrogen, NO2 plus NO3	ND	mg/L	0.050	1		11/21/23 15:29		

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ANALYTICAL RESULTS

Project: SANKOFA
Pace Project No.: 20296416

Sample: TRIANGLE **Lab ID: 20296416007** Collected: 11/09/23 11:22 Received: 11/09/23 14:45 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
BR SM4500P E2011 OrthoP in WT	Analytical Method: SM 4500P-E 2011 Pace Analytical Services - Baton Rouge							
Orthophosphate as P	**0.38**	mg/L	0.050	1		11/13/23 12:09		H3
BR SM2540D TSS	Analytical Method: SM 2540D 2011 Pace Analytical Services - Baton Rouge							
Total Suspended Solids	**20.0**	mg/L	5.0	1		11/16/23 16:16		
BR 5210B 2016 BOD, 5 day	Analytical Method: SM 5210B-2016 Preparation Method: SM 5210B-2016 Pace Analytical Services - Baton Rouge							
BOD, 5 day	**2.8**	mg/L	1.7	1.5	11/10/23 14:00	11/15/23 10:08		
351.2 Total Kjeldahl Nitrogen	Analytical Method: EPA 351.2 Preparation Method: EPA 351.2 Pace Analytical Services - New Orleans							
Nitrogen, Kjeldahl, Total	**2.8**	mg/L	0.10	1	11/15/23 11:43	11/17/23 16:04	7727-37-9	
365.4 Total Phosphorus	Analytical Method: EPA 365.4 Preparation Method: EPA 365.4 Pace Analytical Services - New Orleans							
Phosphorus	**0.48**	mg/L	0.10	1	11/15/23 11:45	11/17/23 14:58	7723-14-0	
4500 Ammonia Water	Analytical Method: SM 4500-NH3 G Pace Analytical Services - New Orleans							
Nitrogen, Ammonia	**1.1**	mg/L	0.10	1		11/22/23 14:47	7664-41-7	
4500NO3-F, NO3-NO2	Analytical Method: SM 4500-NO3 F Pace Analytical Services - New Orleans							
Nitrogen, NO2 plus NO3	ND	mg/L	0.050	1		11/21/23 15:30		