



STATE OF MISSISSIPPI

Phil Bryant
Governor

MISSISSIPPI DEPARTMENT OF MARINE RESOURCES

Jamie M. Miller, Executive Director

August 14, 2015

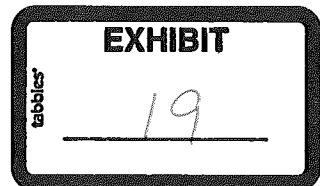
Honorable Louis Guirola, Jr., Chief Judge
United States District Court
Southern District of Mississippi
2012 15th Street, Suite 814
Gulfport, MS 39501

Dear: Judge Guirola:

wetland
The Mississippi Department of Marine Resources (MDMR) is appreciative of the opportunity to obtain the 320-acre parcel (Parcel 01210020.000) of Mississippi Phosphates property located in the ~~eastern~~ boundary of the Grand Bay National Estuarine Research Reserve (GBNERR) and overlapping the MDMR Coastal Preserves boundary. Grand Bay National Estuarine Research Reserve is part of the National Estuarine Research Reserve System, and is a state-federal partnership in estuarine research and education between MDMR and the National Oceanic and Atmospheric Administration (NOAA). The MDMR Coastal Preserves Program was developed in 1992 by authority of the Mississippi Wetlands Protection Act.

The mission of the Reserve is to practice and promote informed stewardship of the GBNERR and Mississippi coastal resources through innovative research, stewardship, education and training. This mission reflects a vision of valuing and conserving the broader Gulf of Mexico and being part of a regional effort to focus increased attention on the economic and environmental value of "America's Sea." The MDMR Coastal Preserves Program, acquires, protects and manages coastal wetlands habitats along the Mississippi Gulf Coast in order to ensure the ecological health of Mississippi's coastal wetland ecosystems.

The ecosystem this parcel supports is a valuable nursery site for commercially and recreationally important fish and shellfish species and provides important habitat for nesting and foraging

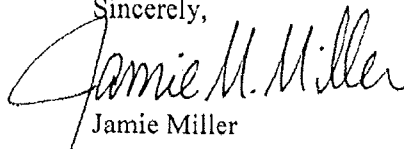


marsh birds and other wildlife. Additionally, these habitats provide an array of valuable ecosystem services, including attenuation of storm surge, nutrient transformation, sediment retention, carbon transfer and water filtration, as well as the ineffable contribution to societal stability and human well-being. The parcel consists of approximately 100 acres of open water, 60 acres of maritime forest and 160 acres of emergent tidal marsh. There are human impacts in the form of utility lines and limited ditching that can be restored. This area of the reserve has been the site of Mississippi Phosphates' environmental violations, including phosphate spills and phosphate leaching. A large spill in 2005 resulted in an expansive fish kill, and the oyster reefs in Bangs Lake have yet to recover. In addition, phosphate levels in Bangs Lake have been higher than baseline since 2012. The role of phosphate leachate on estuarine environments is currently the subject of numerous research efforts, and this parcel plays a critical role in these research studies.

The transfer of this property to MDMR would ensure long-term conservation of these habitats, furthering the mission of the department, and contribute to the purpose for which the Grand Bay NERR and the Coastal Preserves Program was established.

Please see supporting documentation for additional information. If you should have any question please do not hesitate to contact Kelly Lucas, PhD., Chief Scientific Officer for Mississippi Department of Marine Resources at 228-523-4171 or Kelly.Lucas@dmr.ms.gov.

Sincerely,



Jamie Miller
Executive Director

encl (7)

cc: Kelly Lucas, PhD.

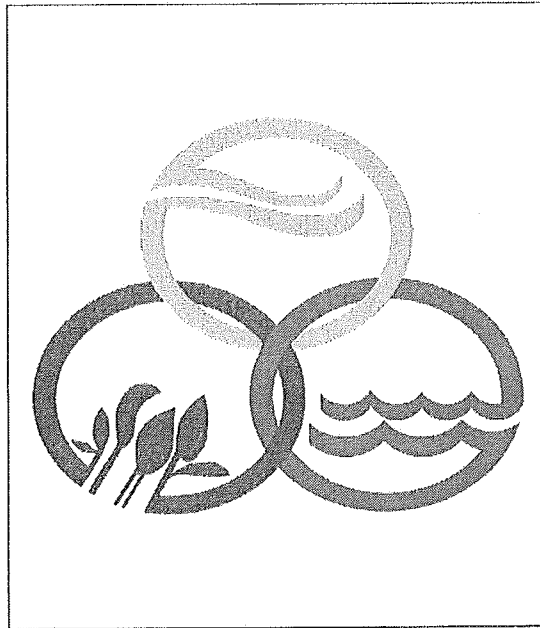
Ayesha Gray, PhD.

Jeremy F. Korezenik

Gaines Cleveland

Ray Carter

Bayou Casotte Fish Kill Investigation and Assessment



Report Date: April 7, 2014

MISSISSIPPI DEPARTMENT OF ENVIRONMENTAL QUALITY
OFFICE OF POLLUTION CONTROL
P.O. Box 2261
Jackson, Mississippi 39225

Introduction:

On August 19, 2013, the Mississippi Department of Environmental Quality (MDEQ) responded to reports of a fish kill due to an emergency bypass from Mississippi Phosphates Corporation (MPC) into Bayou Casotte, Jackson County. The bypass consisted of untreated wastewater, characterized by low pH and high ammonia-nitrogen and phosphorous. MDEQ was notified the morning of August 18, 2013, that the bypass had begun and was likewise notified on the morning of August 19, 2013, that it had ended. MPC has estimated 38 million gallons of wastewater were released during this event.

MDEQ investigators Emily Cotton and Brian Bosch began surveying the condition of the bayou collecting data at six locations on Bayou Casotte. In addition, estimates of fish killed were also made at two locations on the bayou. The investigation began on August 19, 2013, and continued for 8 days concluding on August 27, 2013. The locations of all monitoring sites are shown in Figure 1, along with a detailed digitization of the shoreline of Bayou Casotte, and a depiction of the segments that were used by MDEQ and the Mississippi Department of Marine Resources (MDMR) to determine the estimated total number fishes killed as a result of the emergency bypass. All monitoring data are outlined within this report in sequential order along with any observations made at the time of sampling. All samples and measurements were taken at approximately 0.5 feet representing the surface layer of the water and all analysis results are provided in Tables 14 and 15. All samples were collected, shipped and analyzed according to MDEQ Standard Operating procedures. All results were verified and validated by Field Services Division Laboratory Quality Assurance Manager. In addition to the above mentioned information, historical information on the Section 303(d) impaired waters listing and Total Maximum Load (TMDL) development of Bayou Casotte is included along with an assessment of the data collected during this investigation. For reference purposes, all pictures taken during the course of the investigation have been compiled, captioned, and included as Appendix A of this report.

Day 1 of Investigation

At the time of the initial investigation on August 19, 2013, the weather conditions were hot and humid with scattered clouds and an in-coming tide. MDEQ launched at CC's Bait shop and travelled as far up the bayou possible by boat where dead and struggling fish (small fish < 6 inches, pictures 1-3) were observed all the way upstream to the Bayou Parkway Bridge (site #1, GPS N30.36432, W088.51027). In situ water quality measurements and water samples for nutrients and metals were collected. This location represents the northernmost monitoring location in the study area.

Table 1: Field Measurements August 19, 2013, Site #1.

Bayou Parkway Bridge (site #1, GPS N30.36432, W088.51027) on 081913 at 1348	
Water Temperature °C	28.58
pH units	5.76
Dissolved Oxygen mg/L	5.84
Dissolved Oxygen % saturation	75.3
Specific Conductance µS/cm	1365
Salinity ppt	0.72

Moving downstream, MDEQ collected data at the Concrete Ditch/Break location (site #2, GPS N30.36039, W088.50463) of MS Phosphates, Inc. This is the location where the spill entered into Bayou Casotte (pictures 4-5). In situ water quality measurements and water samples for nutrients and metals were collected.

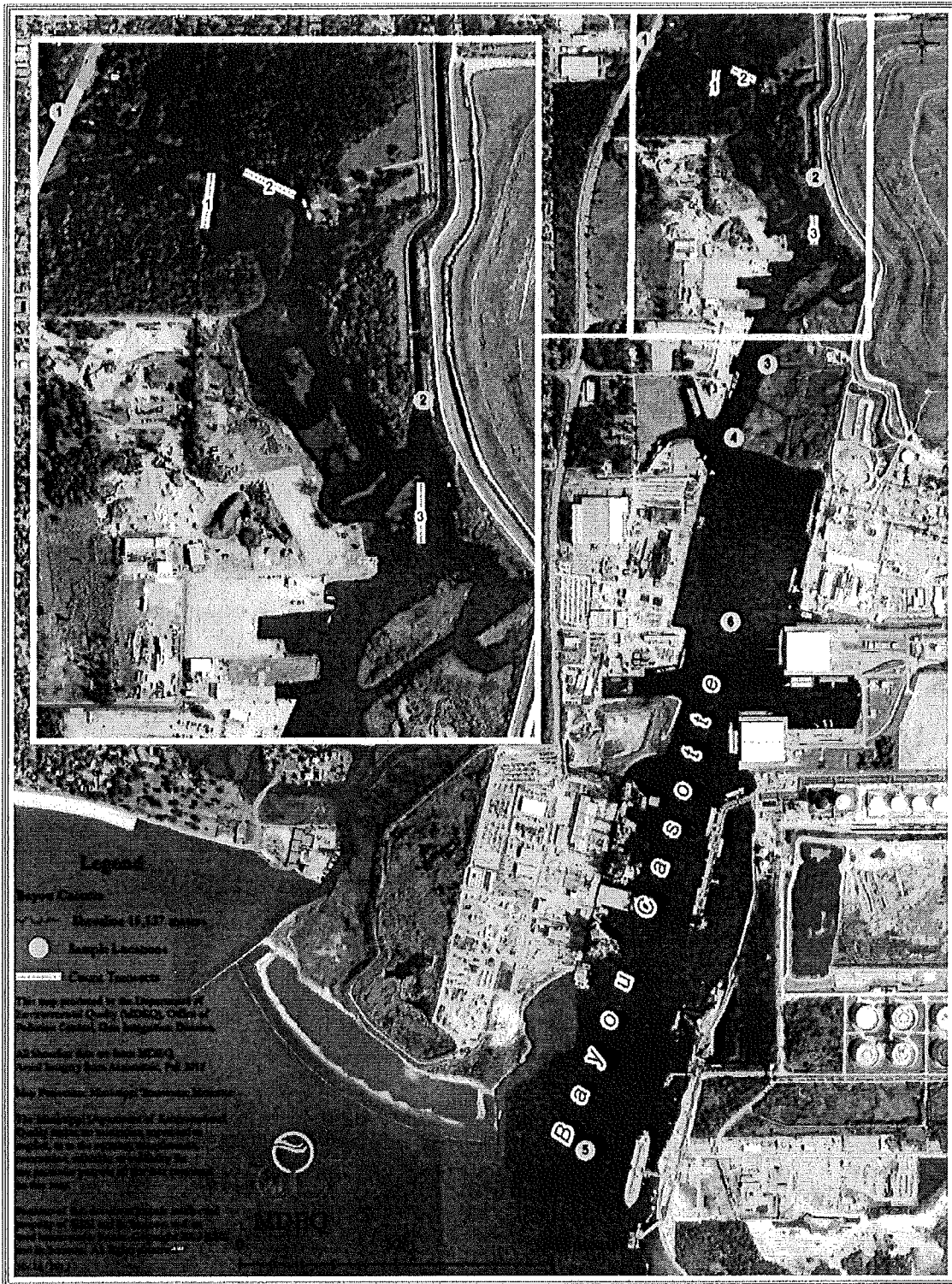


Figure 1: Map of Bayou Casotte with sampling locations and fish count segments

Table 2: Field Measurements August 19, 2013, Site #2

Concrete Ditch/Break (site #2, GPS N30.36039, W088.50463) on 081913 at 1410	
Water Temperature °C	28.09
pH units	5.99
Dissolved Oxygen mg/L	4.15
Dissolved Oxygen % saturation	52.9
Specific Conductance µS/cm	1375
Salinity ppt	0.64

Heavy machinery was observed at this location (picture 4) still moving earth to repair a breach in the dike. Liquid was still running downhill and entering into Bayou Casotte (pictures 6-11) when MDEQ arrived on site at 1410 on August 19, 2013.

In situ water quality measurements and water samples for nutrients and metals were collected at MS Phosphates, Inc. outfall (site#3, GPS N30.35507, W088.50622, picture 12). Dead fish were observed at the mouth of outfall channel (picture 13).

Table 3: Field Measurements, August 19, 2013, Site #3

MS Phosphates, Inc. outfall (site#3, GPS N30.35507, W088.50622) on 081913 at 1427	
Water Temperature °C	30.91
pH units	2.72
Dissolved Oxygen mg/L	5.20
Dissolved Oxygen % saturation	71.2
Specific Conductance µS/cm	7184
Salinity ppt	3.86

Further downstream, at Channel Marker 12, near the boat ramp (site#4, GPS N30.35.245, W088.80735, pictures 17-18), MS Phosphates, Inc. employees were seen collecting dead fish (picture 14-16) in this area. In situ water quality measurements and water samples for nutrients and metals were collected.

Table 4: Field Measurements August 19, 2013, Site #4

Channel Marker 12, near the boat ramp (site#4, GPS N30.353245, W088.80735) on 081913 at 1435	
Water Temperature °C	31.35
pH units	2.67
Dissolved Oxygen mg/L	5.63
Dissolved Oxygen % saturation	77.9
Specific Conductance µS/cm	7904
Salinity ppt	4.42

Case 1:15-cr-00058-LG-RHW Document 9 Filed 08/19/15 Page 8 of 45

Downstream from the boat ramp, in-situ water quality measurements were taken mid-channel near VT Halter Dock (GPS N30.34776, W088.50745). In Figure 1, this location is marked as Site 6 on the map.

Table 5: Field Measurements August 19, 2013, near VT Halter Dock

Mid-channel near VT Halter Dock (GPS N30.34776, W088.50745) on 081913 at 1445	
Water Temperature °C	30.24
pH units	2.79
Dissolved Oxygen mg/L	5.53
Dissolved Oxygen % saturation	79.1
Specific Conductance µS/cm	22235
Salinity ppt	13.37

The downstream most monitoring location was at the mouth of the channel of Bayou Casotte (site#5, GPS N30.33274, W088.51231, picture 21). In situ water quality measurements and water samples for nutrients and metals were collected.

Table 6: Field Measurements August 19, 2013, Site #5

Mouth of Channel of Bayou Casotte (site#5, GPS N30.33274, W088.51231) on 081913 at 1454	
Water Temperature °C	29.45
pH units	5.70
Dissolved Oxygen mg/L	6.15
Dissolved Oxygen % saturation	90.0
Specific Conductance µS/cm	31424
Salinity ppt	19.52

Along the entire observed reach from the Bayou Casotte Parkway Bridge to the mouth of the channel of Bayou Casotte, dead fish were observed. Species noted were: sheephead, hardhead catfish, gar (pictures 19-20, 26), needlefish, ground mullet, pinfish, spot, atlantic croaker, blue crab, hogchoker, redfish, and black drum.

MDEQ issued a fishing and water contact closure August 19, 2013, for Bayou Casotte and the adjacent waters of the Mississippi Sound within 1,000 feet of the mouth of the bayou. MDEQ advised the public "to avoid these waters and while seafood is not considered to be contaminated; fishermen are advised not to consume any seafood collected from these waters until further notice."

Day 2 of Investigation

August 20, 2013: Investigators Emily Cotton and Brian Bosch (MDEQ) and Jedidiah Bullard (MDMR).

Investigators returned to the same locations monitored on Day 1 of the investigation and continued water quality monitoring and sample collections. Estimated counts of dead fish were conducted as well (pictures 22-23). The results of in situ water quality monitoring for all sites are presented in Table 7 below. Water samples were also collected and analyzed (nutrients metals and orthophosphates).

Table 7: Field Measurements August 20, 2013

Parameters	Bayou Parkway Bridge Site #1 Sample Time 0940	Concrete Ditch/Break Site #2 Sample Time 1038	MS Phosphates, Inc. outfall Site#3 Sample Time 1102	Channel Marker 12, near the boat ramp Site#4 Sample Time 1110	Mid-channel near VT Halter Dock* Sample Time 1115	Mouth of Channel Bayou Casotte Site#5 Sample Time 1122
Water Temperature °C	27.20	28.86	30.19	29.95	29.82	29.67
pH units	5.12	4.94	4.84	5.03	4.82	6.28
Dissolved Oxygen mg/L	5.07	4.64	4.97	5.37	5.94	6.75
Dissolved Oxygen % saturation	65.4	61.8	72.1	76.4	85.5	98.8
Specific Conductance μ S/cm	7877	24624	26272	22458	27470	33678
Salinity ppt	4.46	16.25	16.04	13.52	16.87	21.11

*In situ readings only

At site#2, Concrete Ditch/Break, liquid was seen flowing downhill into bayou (pictures 24-25). The sampling team also observed what looked to be a burn line on overhanging shrubs and trees (pictures 27-28).

Determination of Numbers of Fishes Dead

Three separate stream segments were counted for numbers of dead fish and then added for a total estimated count length (267.96m). Figure 1 depicts the extent of the segments used to determine the total estimated count.

- Count#1- start GPS N30.36348, W088.5079 end GPS N30.36274, W088.50802= 84.86m
- Count#2- start GPS N30.36350, W088.50745 end GPS N30.36317, W088.50661= 89.30m
- Count#3- start GPS N30.35929, W088.50469 and GPS N3035847, W088.50478=93.80m

The total perimeter of the affected waterbody of Bayou Casotte as shown in Figure 1, from the Bayou Casotte Parkway Bridge to the mouth of Bayou Casotte is 15,537m.

Table 8: Total count by species observed by MDEQ/MDMR:

Species	Number of dead
Stripped Mullet $\geq 12''$	5044
Stripped Mullet $\leq 6''$	32760
Needlefish	347
Flounder	116
Blue crab	928
Fiddler crab	116
Spot	2899
Atlantic croaker	928
Mosquito fish	347
Pinfish	638
Menhaden	347
Silverside	232
Gizzard shad 6-8''	58
Bluegill	58
Hogchoker	58
Shiner	58
Oysterfish	58
Redfish	58
Ladyfish	58
Hardhead catfish	58
Grass shrimp	58

*Two gar were seen dead in Bayou Casotte, but were not within the estimated count segments (pictures 19-20, 26). Total count=45226 fishes killed.

As noted above, MS Phosphates, Inc. deployed a crew boat to collect dead fish from Bayou Casotte. Email dated 8/21/13 from Alan Dees to Samuel Cunningham and Richard Johnson, with the totals of fish collected for two days by crew boat on 8/19/13-8/20/13:

Table 9: Total Count by Species Observed by MS Phosphates, Inc.

Species	Number Collected
Popeye mullet 10-15''	1430
Pinfish	565
Sheephead 12-18''	37
Redfish	53
Catfish 10-18''	75
Spot	25
Altantic croaker 4-6''	235
Black drum	1
Trout	15
Flounder 15''	11
Blue crab	68
Eels	2

Total dead collected=2517. Grand total=45226+2517=47743.

Day 3 of Investigation

August 21, 2013: Investigators Emily Cotton and Brian Bosch (MDEQ).

Weather conditions were overcast, hot and humid with calm winds. The results from in situ water quality measurements for all sites are provided in Table 10 below. Water samples were also collected and analyzed (nutrients and metals).

Table 10: Field Measurements August 21, 2013

Parameters	Bayou Parkway Bridge Site #1 Sample Time 1119	Concrete Ditch/Break Site #2 Sample Time 1143	MS Phosphates, Inc. outfall Site#3 Sampled 1155	Channel Marker 12, near the boat ramp Site#4 Sample Time 1202	*Mid-channel near VT Halter Dock Site #6 Sample Time 1208	Mouth of channel Bayou Casotte Site#5 Sample Time 1215
Water Temperature °C	28.54	29.35	29.44	29.42	29.38	29.27
pH units	5.60	5.70	6.13	6.60	6.47	7.94
Dissolved Oxygen mg/L	3.70	4.84	7.14	9.99	10.20	11.03
Dissolved Oxygen % saturation	49.3	67.7	103.6	144.6	146.7	158.3
Specific Conductance µS/cm	15897	22054	30812	31523	30445	30356
Salinity ppt	9.37	15.46	19.04	19.56	18.87	18.82

*In situ readings only

Day 4 of Investigation

August 22, 2013: Investigators Emily Cotton and Brian Bosch (MDEQ).

Weather conditions were scattered clouds, hot and humid with winds out of the east ~5-10mph at high tide. Results from in situ water quality measurements for all sites are provided in Table 11 below. Water samples were also collected and analyzed (nutrients and metals).

Table 11: Field Measurements August 22, 2013

Parameters	Bayou Parkway Bridge Site #1 Sample Time 0948	Concrete Ditch/Break Site #2 Sample Time 1000	MS Phosphates, Inc. outfall Site#3 Sample Time 1008	Channel Marker 12, near the boat ramp Site#4 Sample Time 1016	*Mid-channel near VT Halter Dock Site #6 Sample Time 1023	Mouth of channel Bayou Casotte Site#5 Sample Time 1028
Water Temperature °C	28.84	29.72	30.25	29.93	30.14	29.36
pH units	5.90	5.98	6.37	6.48	6.69	7.35
Dissolved Oxygen mg/L	3.05	6.21	9.93	8.99	11.93	8.74
Dissolved Oxygen % saturation	47.3	88.8	144.9	130.9	172.9	127.2
Specific Conductance µS/cm	22464	29302	30307	31440	30216	32809
Salinity ppt	13.42	18.02	19.47	19.86	18.70	21.80

*In situ readings only

Day 5 of Investigation

August 23, 2013: Investigators Barbara Viskup (MDEQ) and Jedidiah Bullard (MDMR).

Weather conditions were heavily overcast, light chop at high tide. Results from in situ water quality measurements are provided in Table 12 below. Water samples were also collected and analyzed (nutrients and metals).

Table 12: Field Measurements August 23, 2013

Parameters	Bayou Parkway Bridge Site #1 Sample Time 1003	Concrete Ditch/Break Site #2 Sample Time 0952	MS Phosphates, Inc. outfall Site#3 Sample Time 0945	*Channel Marker 12, near the boat ramp Site#4 Sample Time 0940	Mid-channel near VT Halter Dock Sample Time 0935	Mouth of Channel Bayou Casotte Site#5 Sample Time 0924
Water Temperature °C	29.32	29.65	29.46	29.17	29.21	28.84
pH units	6.26	6.43	6.84	7.39	7.81	7.74
Dissolved Oxygen mg/L	3.79	5.96	7.84	7.97	7.49	6.75
Dissolved Oxygen % saturation	54.4	86.6	114.3	115.9	109.5	96.8
Specific Conductance µS/cm	27741	30552	32530	33112	33114	30204
Salinity ppt	16.96	19.42	20.36	20.70	20.74	18.70

*In situ readings only

During sampling activities, Investigators observed work being done on the dike at site#2 Concrete Ditch and liquid still flowing (leaking) at the mouth of ditch. Also, MDEQ lifted water contact closure for Bayou Casotte on Day 5 of the investigation, August 23, 2013.

Day 8 of Investigation

August 27, 2013: Investigators Emily Cotton and Barbara Viskup (MDEQ).

Weather conditions were scattered clouds, hot and humid, at high tide. Winds were out of the east to northeast ~5-10mph. The results for in situ water quality measurements for all sites are provided in Table 13 below. Water samples were also collected and analyzed (nutrients and metals).

Table 13: Field Measurements August 27, 2013

Parameters	Bayou Parkway Bridge Site #1 Sample Time 1017	Concrete Ditch/Break site #2 Sample Time 1037	MS Phosphates, Inc. outfall Site#3 Sample Time 1046	Channel Marker 12, near the boat ramp Site#4 Sample Time 1052	*Mid-channel near VT Halter Dock Sample Time 1057	Mouth of Channel Bayou Casotte Site#5 Sample Time 1103
Water Temperature °C	27.13	29.28	29.15	29.13	28.74	27.96
pH units	7.16	6.84	7.75	7.94	8.07	8.06
Dissolved Oxygen mg/L	4.34	8.67	8.48	9.52	8.76	6.92
Dissolved Oxygen % saturation	56.9	124.8	124.4	140.8	126.3	98.0

Case 1:15-cr-00058-LG-RHW Document 9 Filed 08/19/15 Page 13 of 45

Specific Conductance $\mu\text{S}/\text{cm}$	15967	29888	35385	34667	35036	32639
Salinity ppt	9.09	18.48	22.35	21.79	22.62	20.36

*In situ readings only

Validated results from the analyses of the water samples collected during the investigation show elevated levels of heavy metals, Nitrogen, Phosphates and Phosphorus from August 19, 2013 until August 23, 2013. During the time, Bayou Casotte was closed to fishing and water contact activities. The analytical results from the entire investigation are provided in Tables 14 and 15 below.

Table 14: Laboratory Analysis Results for Metals

LOCATION	DATE TIME	Depth (ft)	Total Arsenic (ug/L)	Total Cadmium (ug/L)	Total Chromium (ug/L)	Total Copper (ug/L)	Total Lead (ug/L)	Total Nickel (ug/L)	Total Selenium (ug/L)	Total Thallium (ug/L)	Total Zinc (ug/L)
SITE 1	08/19/2013 13:48	0.5	7.88	3.87	12.4	7.70	2.16	9.14	0.55	<MQL	86.1
SITE 1	08/20/2013 09:40	0.5	10.2	6.35	15.1	12.8	2.03	12.2	0.52	<MQL	104
SITE 1	08/21/2013 11:19	0.5	9.46	5.02	5.83	11.6	1.04	10.5	0.92	<MQL	87.9
SITE 1	08/22/2013 09:48	0.5	6.53	2.42	1.26	5.43	0.59	6.58	0.78	<MQL	55.0
SITE 1	08/23/2013 10:03	0.5	5.46	1.26	1.13	3.31	0.71	4.74	0.89	<MQL	35.0
SITE 1	08/27/2013 10:17	0.5	1.74	<MQL	<MQL	2.58	0.62	1.65	0.63	1.33	42.6
SITE 2	08/19/2013 14:10	0.5	1.85	<MQL	1.33	3.09	1.46	2.17	<MQL	<MQL	25.9
SITE 2	08/20/2013 10:38	0.5	12.3	8.12	14.4	36.1	1.18	14.9	0.94	<MQL	113
SITE 2	08/21/2013 11:43	0.5	9.15	4.48	4.21	12.6	1.02	10.6	0.76	<MQL	79.6
SITE 2	08/22/2013 10:00	0.5	5.36	1.73	1.87	3.65	1.37	8.47	0.67	<MQL	47.9
SITE 2	08/23/2013 09:52	0.5	5.16	1.16	1.75	3.60	0.76	4.89	1.17	<MQL	27.1
SITE 2	08/27/2013 10:37	0.5	3.14	0.60	2.11	2.97	1.32	2.99	1.06	0.57	18.3
SITE 3	08/19/2013 14:27	0.5	34.8	35.4	90.3	37.6	2.54	58.5	1.56	<MQL	503
SITE 3	08/20/2013 11:02	0.5	15.5	11.4	19.2	43.5	1.44	22.3	1.18	<MQL	159
SITE 3	08/21/2013 11:55	0.5	6.85	2.81	3.05	9.23	0.63	7.39	0.86	<MQL	41.7
SITE 3	08/22/2013 10:08	0.5	5.82	1.89	2.90	6.20	0.70	6.07	0.86	<MQL	32.6
SITE 3	08/23/2013 09:45	0.5	4.58	1.01	2.44	3.77	0.55	4.34	1.12	<MQL	18.2
SITE 3	08/27/2013 10:46	0.5	2.76	<MQL	1.31	1.83	<MQL	2.22	1.34	<MQL	<MQL

Table 15: Laboratory Analysis Results for Metals (continued)

LOCATION	DATE TIME	Depth (ft)	Total Arsenic (ug/L)	Total Cadmium (ug/L)	Total Chromium (ug/L)	Total Copper (ug/L)	Total Lead (ug/L)	Total Nickel (ug/L)	Total Selenium (ug/L)	Total Thallium (ug/L)	Total Zinc (ug/L)
SITE 4	08/19/2013 14:35	0.5	33.9	34.5	84.8	44.6	2.58	50.4	1.21	<MQL	431
SITE 4	08/20/2013 11:10	0.5	12.5	8.22	14.7	52.0	1.91	14.9	0.99	<MQL	131
SITE 4	08/21/2013 12:02	0.5	6.55	2.43	2.36	9.39	0.57	5.80	0.99	<MQL	38.7
SITE 4	08/22/2013 10:16	0.5	5.45	1.70	1.27	5.56	<MQL	4.56	1.00	<MQL	28.7
OFF VT HALTER DOCK	08/23/2013 09:35	0.5	2.88	<MQL	0.68	1.63	<MQL	1.10	1.43	<MQL	<MQL
SITE 4	08/27/2013 10:52	0.5	2.87	<MQL	0.95	1.67	<MQL	1.92	1.11	<MQL	<MQL
SITE 5	08/19/2013 14:54	0.5	7.82	4.34	10.5	14.3	0.93	8.26	0.72	<MQL	60.8
SITE 5	08/20/2013 11:22	0.5	6.42	2.56	4.60	10.0	0.85	5.26	1.38	<MQL	37.8
SITE 5	08/21/2013 12:15	0.5	3.69	<MQL	0.70	1.83	<MQL	1.43	0.83	<MQL	<MQL
SITE 5	08/22/2013 10:28	0.5	3.83	0.78	0.88	3.34	<MQL	2.17	0.97	<MQL	13.9
SITE 5	08/23/2013 09:24	0.5	2.58	<MQL	0.65	1.14	<MQL	1.88	1.58	<MQL	<MQL
SITE 5	08/27/2013 11:03	0.5	2.44	<MQL	<MQL	0.84	<MQL	0.68	1.22	<MQL	<MQL

*Sample collected mid-channel Near VT Halter Dock

Table 15: Laboratory Analysis Results for Nutrients

LOCATION	DATE TIME	Depth (ft)	Ammonia (mg/L)	Nitrogen, Total Kjeldahl (mg/L)	Nitrogen, Total Nitrite-Nitrate (mg/L)	Phosphate, Ortho	Phosphorus, Total (mg/L)
SITE 1	08/19/2013 13:48	0.5	1.79	2.62	0.06	NULL	31.4
SITE 1	08/20/2013 09:40	0.5	3.16	3.45	0.10	37.1	48.2
SITE 1	08/21/2013 11:19	0.5	2.36	4.47	0.06	39.1	41.6
SITE 1	08/22/2013 09:48	0.5	1.74	2.56	0.05	22.7	25.5
SITE 1	08/23/2013 10:03	0.5	1.50	2.21	0.11	NULL	20.0
SITE 1	08/27/2013 10:17	0.5	0.28	1.17	0.14	NULL	1.62
SITE 2	08/19/2013 14:10	0.5	0.45	1.26	0.05	NULL	4.98
SITE 2	08/20/2013 10:38	0.5	3.71	4.47	0.12	59.6	59.2
SITE 2	08/21/2013 11:43	0.5	2.54	4.39	0.16	27.1	40.4
SITE 2	08/22/2013 10:00	0.5	2.32	3.61	0.11	25.5	31.3
SITE 2	08/23/2013 09:52	0.5	1.58	2.35	0.10	NULL	17.9
SITE 2	08/27/2013 10:37	0.5	0.79	1.80	0.04	NULL	11.4
SITE 3	08/19/2013 14:27	0.5	12.9	15.7	0.17	NULL	249
SITE 3	08/20/2013 11:02	0.5	5.13	7.02	0.28	58.4	71.0
SITE 3	08/21/2013 11:55	0.5	1.83	2.69	0.23	18.9	23.6
SITE 3	08/22/2013 10:08	0.5	1.51	2.35	0.25	16.1	21.4
SITE 3	08/23/2013 09:45	0.5	1.24	2.18	0.21	NULL	13.0
SITE 3	08/27/2013 10:46	0.5	0.62	1.13	0.26	NULL	3.19
SITE 4	08/19/2013 14:35	0.5	12.7	16.3	0.09	NULL	238
SITE 4	08/20/2013 11:10	0.5	3.59	4.20	0.12	56.4	53.7
SITE 4	08/21/2013 12:02	0.5	1.40	2.05	0.09	16.7	20.7
SITE 4	08/22/2013 10:16	0.5	1.07	1.99	0.05	15.5	16.4
OFF VT HALTER DOCK	08/23/2013 09:35	0.5	0.07	0.80	0.03	NULL	2.30
SITE 4	08/27/2013 10:52	0.5	0.24	1.09	0.04	NULL	4.89
SITE 5	08/19/2013 14:54	0.5	1.99	2.27	0.06	NULL	27.2
SITE 5	08/20/2013 11:22	0.5	1.06	1.38	0.14	16.1	16.0
SITE 5	08/21/2013 12:15	0.5	<MQL	0.59	<MQL	3.11	3.06
SITE 5	08/22/2013 10:28	0.5	0.28	0.95	0.03	5.66	6.31
SITE 5	08/23/2013 09:24	0.5	<MQL	0.68	<MQL	NULL	0.94
SITE 5	08/27/2013 11:03	0.5	<MQL	0.59	0.03	NULL	0.33

Water Quality Assessment

History: §303(d) and Total Maximum Daily Load (TMDL) Development

Bayou Casotte (MS109E04M) was originally included in the 1998 Section 303(d) list of impaired waters by MDEQ as an evaluated listing. As part of the 1998 water quality assessment process, an evaluated assessment was made when there were little to no actual water quality data, but there was some information to indicate the water may not support aquatic life use. Bayou Casotte was listed for the following causes of impairment: priority organics, nonpriority organics, metals, unionized ammonia, other inorganics, and total toxics. In 2001, the nonpriority organics and other inorganics causes were delisted on the basis that recent water quality monitoring data indicated the water was not impaired for those pollutants. The following year (2002), a TMDL was developed for phenols resulting in the removal of that pollutant cause from the Section 303(d) List. Also in 2002, pollutant cause for metals was delisted on the basis that monitoring data indicated metals were not causing impairment. In 2007, EPA completed TMDLs for total toxics and unionized ammonia resulting in the delisting of those causes as well. Currently, there are two segments of Bayou Casotte on the Section 303(d) List, 200313 and 200312. Both are listed for the pollutant cause organic enrichment /low Dissolved Oxygen. Segment 200313 was first listed in 2006, and segment 200312 was listed in 2010.

Assessment of Investigation Data

Analysis and assessment of surface water quality in Mississippi is routinely carried out by MDEQ through comparison of surface water monitoring data and information to chemical, physical, and bacteriological water quality criteria established for Mississippi waters. In cases where there are not adopted pollutant criteria (i.e. nutrients), data are compared to §305(b) pollutant screening levels and/or a selected reference site location in an adjacent unaffected water body for determination of water quality impact.

Mississippi's water quality standards (WQS) document, *State of Mississippi Water Quality Criteria for Intrastate, Interstate and Coastal Waters* (MDEQ 2007), specify the appropriate levels for which various water quality parameters or indicators support a water body's designated uses. Surface waters in Mississippi are classified based on existing use of the water body, along with any expected future uses. Bayou Casotte is classified by the state of Mississippi as a Fish and Wildlife stream with an aquatic life designated use.

For determination of water quality impact from this fish kill event, water quality data collected and/or measured at the fish kill site in Bayou Casotte were evaluated by comparing the data to state numeric water quality criteria where applicable as specified in the State WQS. Parameters collected during the fish kill having numeric criteria include pH, temperature, dissolved oxygen and certain metals. In addition to the analysis for water quality criteria attainment, data collected on Bayou Casotte during the fish kill event were also compared to water quality data collected/measured in an adjacent bayou located in the Grand Bay National Estuarine Research Reserve (NERR) established by the National Oceanic and Atmospheric Administration (NOAA). This site, Bayou Cumbest, station ID - GNBBCWQ, was chosen for comparison as it is located only five miles east of Bayou Casotte, is tidally connected to the Mississippi Sound like Bayou Casotte and was unaffected by the fish kill. The Bayou Cumbest monitoring site is a real time, long term monitoring station where data are collected for temperature,

salinity, specific conductance, dissolved oxygen, pH, turbidity, meteorological data, and includes a tide gage. In addition to the real time data collection, monthly water samples are also taken and analyzed for nutrient concentrations (total phosphorus, ortho phosphorus, ammonia, nitrates and nitrites) and chlorophyll-a.

Analyses of the data are presented separately for three groups of parameters: in-situ field measurements, nutrients and metals. Box and Whisker plots are presented for field measurements of temperature, dissolved oxygen, salinity, and pH in Figures 2 – 5. Box and whisker plots are also provided for nutrient parameters collected at both Bayou Casotte and Bayou Cumbest such as ammonia (Figure 6) and total ortho phosphorus (Figure 7). The Bayou Cumbest reference site is designated as REF and the six sampling sites in Bayou Casotte for the fish kill investigation are shown as Sites 1 – 6, with Site 6 being the VT Halter Dock site. For the reference site on Bayou Cumbest, only in-situ data observed for the same week of the fish kill in Bayou Casotte are used for comparison purposes. For the nutrient analyses, only data collected in the summer of 2011 and 2012 in Bayou Cumbest are presented for comparison with the fish kill data in order to minimize seasonal variation.

Assessment of In-Situ measurement results

Presented below are the results of the analysis for in-situ measurements (temperature, dissolved oxygen, salinity and pH) collected during the study period. For comparison purposes, temperature data were assessed against the state water quality criterion for temperature in state waters and compared against observed temperature values measured at the reference station on Bayou Cumbest. The larger distribution range in temperature readings at the reference site compared to Bayou Casotte can be attributed to the differences in data collection techniques. The stationary automated site on Bayou Cumbest collects real time data with readings being taken at 15 minute intervals continuously throughout the day. The temperature data collected at the study sites represents a one-time daily measurement collected by MDEQ personnel during their investigation. For temperature, no violations of the WQS (32.2°C) were observed at any of the sites. In addition, temperature ranges noted at all Bayou Casotte sites were within the range noted at the REF site.

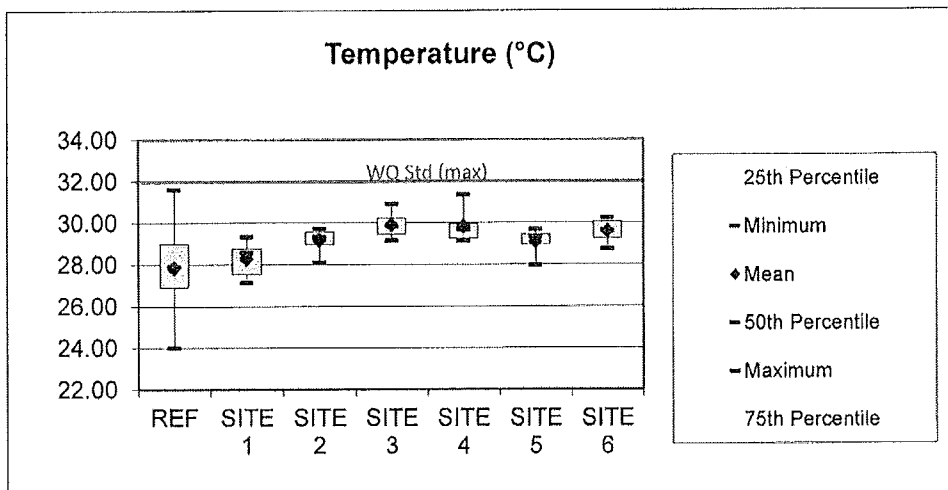


Figure 2: Temperature Plot of Bayou Cumbest (REF) and Bayou Casotte Sites (August 19-27)

According to water quality standards, dissolved oxygen values in state waters, should maintain a daily average of 5.0 mg/L and an instantaneous minimum of 4.0 mg/L. Violations of the dissolved oxygen instantaneous minimum value of 4.0 mg/L were observed at the REF site and Site 1 only. Low dissolved oxygen values are generally considered natural for waters like Bayou Casotte and Bayou Cumbest due to shallow depths, warm temperature and poor flushing in the upper reaches of these coastal bayous. Again, it should be noted that the data collected from the REF site on Bayou Cumbest represent the diurnal variations in dissolved oxygen where the measurements on Bayou Casotte only represent the one time, often mid-morning sampling that was conducted by MDEQ field staff.

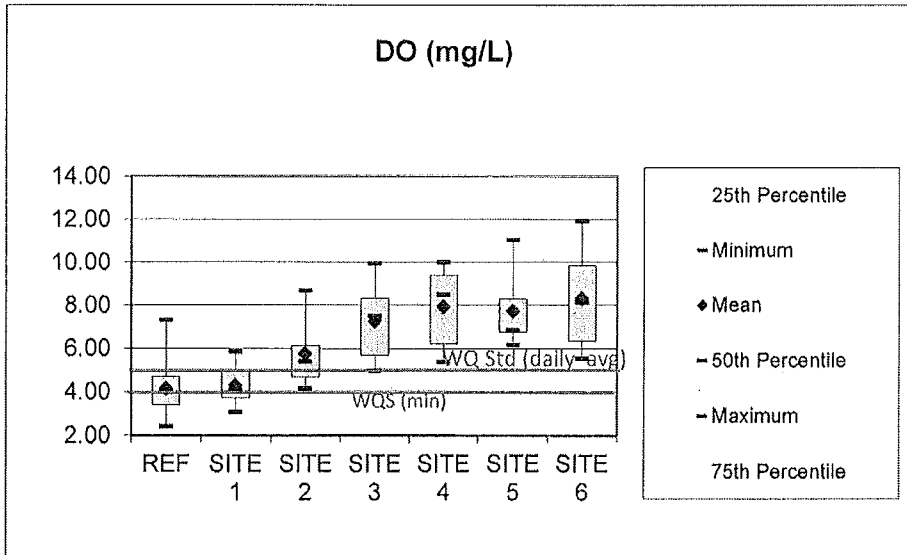


Figure 3: Dissolved Oxygen data for Bayou Cumbest (REF) and Bayou Casotte Sites (August 19-27)

Mississippi does not have water quality criteria or threshold screening levels for salinity as salt or brackish water is a natural component of estuarine systems. Data are presented here to show that both systems show similar salinity patterns typical of brackish waters.

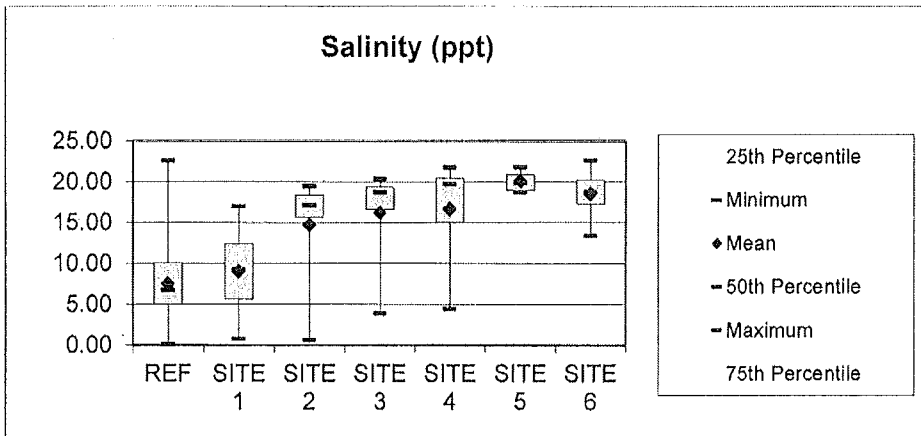


Figure 4: Plot of Salinity data for Bayou Cumbest (REF) and Bayou Casotte Sites (August 19-27)

Naturally-occurring low pH values are common in brackish waters especially those draining marshes with adjacent freshwater blackwater streams prevalent in the Mississippi coastal zone. According to water quality standards, pH for waters should be 6-9 SU with nothing causing the value to vary more than 1.0 SU within the range. Violations of water quality criterion for pH were noted at all sites including the REF site. However, the extreme deviation from background (REF and Site 1) levels for Sites 3, 4 and 6 in Bayou Casotte in the early days of the fish kill event reflect very low pH levels that are indicative of high acidity consistent with past and present emergency bypass characteristics experienced at this location.

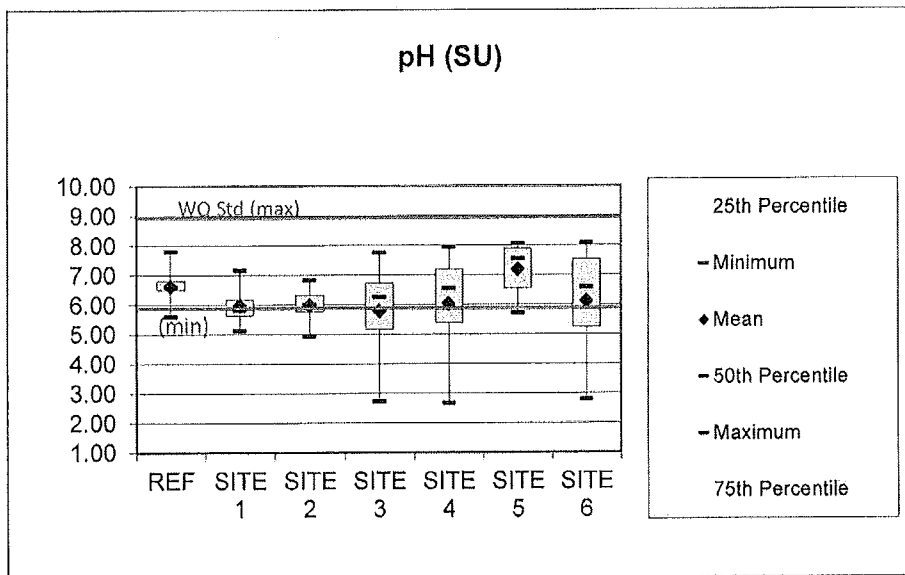


Figure 5: Plot of pH data for Bayou Cumbest (REF) and Bayou Casotte Sites (August 19-27)

Assessment of Nutrient Sample Results

Although MDEQ is working to develop numeric nutrient criteria for waters, no criteria for nutrient concentrations have been officially adopted into state water quality standards. For the purposes of the analyses presented below, in the absence of numeric nutrient criteria, comparisons to the reference site on Bayou Cumbest are used to make determinations.

Even without numeric nutrient criteria, USEPA does have numeric criteria for toxic pollutants. Ammonia in high concentrations can be toxic to aquatic species. The concentration at which ammonia becomes toxic is a standard calculation dependent upon site specific pH, temperature, and salinity values observed at the time of sampling. As shown above, temperature and salinity values observed at Bayou Casotte during the spill are within ranges observed at the reference site while the values for pH were much lower in Bayou Casotte. Ammonia values at all Bayou Casotte sites greatly exceeded those present at the reference site for the entire time of the fish kill investigation. Ammonia values in Bayou Casotte generally ranged from ten to fifty times the levels measured at the Bayou Cumbest reference site. Based on acute toxicity calculations modified on a site-specific basis in regards to pH, temperature and salinity, ammonia levels

measured during the fish kill event exceeded USEPA saltwater acute criteria at Site 3 and Site 4 on August 19, the first day of the investigation.

Table 16: Ammonia values observed at Bayou Cumbest (REF) and Bayou Casotte

Ammonia as N (mg/L)	REF	SITE 1	SITE 2	SITE 3	SITE 4	SITE 5
25th Percentile	0.02	1.56	0.99	1.31	0.45	0.67
Minimum	0.01	0.28	0.45	0.62	0.07	0.28
Mean	0.05	1.81	1.90	3.87	3.18	1.11
50th Percentile	0.04	1.77	1.95	1.67	1.24	1.06
Maximum	0.18	3.16	3.71	12.90	12.70	1.99
75th Percentile	0.08	2.22	2.49	4.31	3.04	1.53

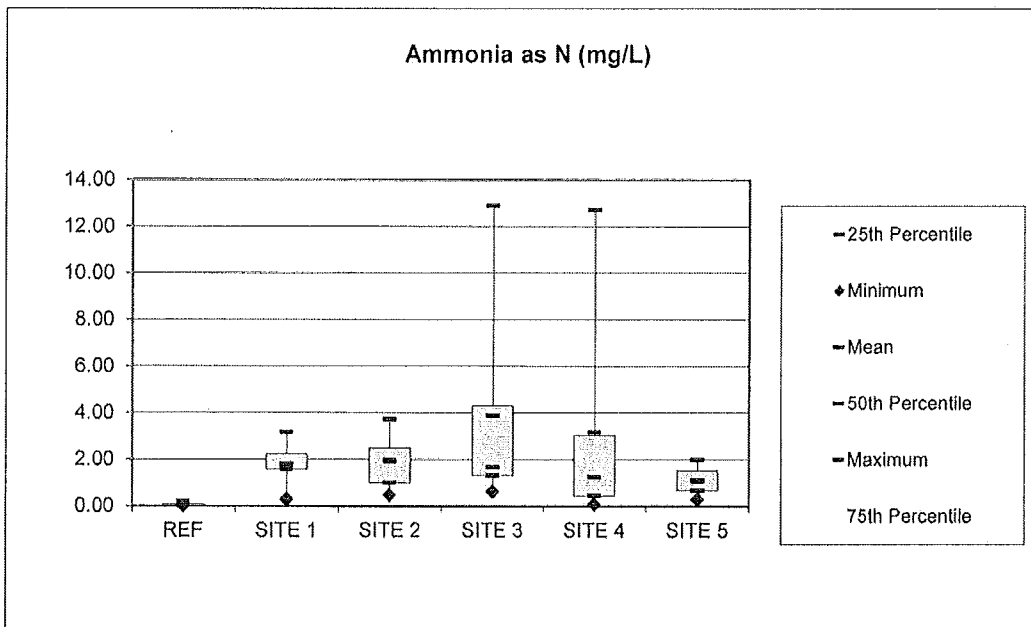


Figure 6: Plot of Ammonia Data for Bayou Cumbest (REF) and Bayou Casotte Sites (August 19-27)

Phosphorus in aquatic systems occurs as organic phosphate and inorganic phosphate. A portion of the total phosphorus concentration in surface waters, inorganic phosphate or orthophosphate, is available to plants to support their growth. Increases in phosphorus concentrations in ambient waters, especially increases in orthophosphate concentrations, can cause undesirable events such as accelerated plant growth, algae blooms, low dissolved oxygen and death of certain fish, invertebrates and other aquatic animals. As with other nutrient parameters, Mississippi does not have numeric criteria for total phosphorus or ortho phosphorus. Because orthophosphate is the bioavailable form of phosphorus for plants, these data were used for comparison purposes with levels observed in Bayou Cumbest. Based on comparison to the Bayou Cumbest REF site, all Bayou Casotte sites demonstrated major elevations of ortho phosphorus levels on all measurement dates during the August 19-27 event. Mean elevations alone at each Bayou Casotte site ranged from a minimum of 16.1 mg/L at Site 5 to a maximum of 59.6

mg/L at Site 2, approximately 75 and 60 times, respectively, over REF ortho phosphorus values which ranged from a minimum value of 0.01 mg/L to a maximum of 0.22 mg/L.

Table 16: Ortho Phosphorus values observed at Bayou Cumbest (REF) and Bayou Casotte

Total Ortho Phosphorus (mg/L)	REF	SITE 1	SITE 2	SITE 3	SITE 4	SITE 5
25th Percentile	0.01	29.90	26.30	17.50	16.10	4.39
Minimum	0.01	22.70	25.50	16.10	15.50	3.11
Mean	0.05	32.97	37.40	31.13	29.53	8.29
50th Percentile	0.01	37.10	27.10	18.90	16.70	5.66
Maximum	0.22	39.10	59.60	58.40	56.40	16.10
75th Percentile	0.06	38.10	43.35	38.65	36.55	10.88

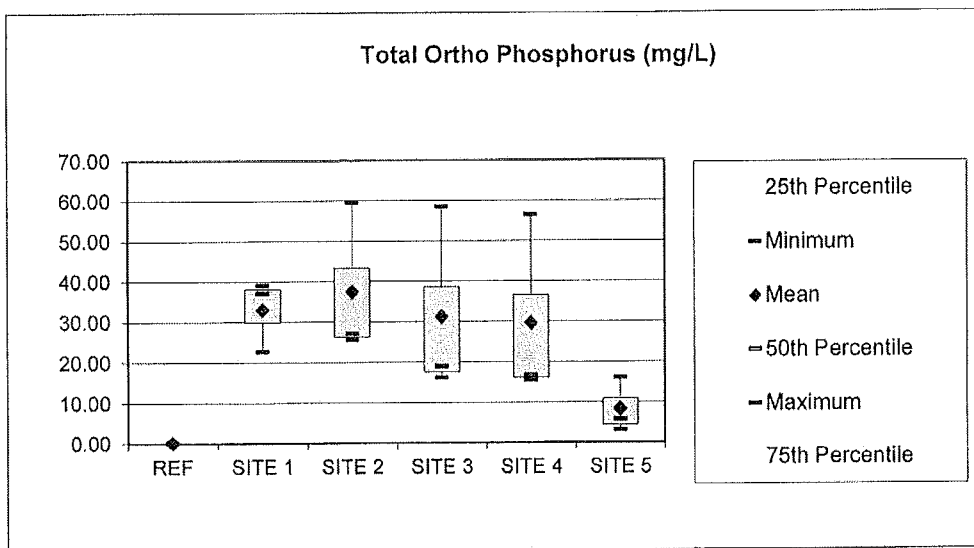


Figure 7: Plot of Ortho Phosphorus results for Bayou Cumbest (REF) and Bayou Casotte Sites (August 19-27)

Assessment of Metals Analyses Results

The state of Mississippi WQS includes national numeric acute and chronic criteria for certain toxic pollutants including various metals for both saltwater and freshwater water bodies. Water column sampling and analysis for metals for this fish kill investigation did not utilize "clean" techniques that are required to derive accurate results but an evaluation of the potential violation of metals criteria can be accomplished from this investigation. Metals sampled and analyzed during the investigation for which saltwater criteria have been established include arsenic, cadmium, copper, lead, nickel, selenium and zinc. Results of comparison of these data to the appropriate toxic substances criteria are presented in Table 18. Based on these calculations, violation of saltwater acute and/or chronic criteria occurred at all sites for total copper, total lead and/or total zinc during the period of August 19-23, 2013.

Table 18: Metal Toxicant/Criteria Analysis Results - Bayou Casotte Sites (August 19-27)

Site ID	Toxicant	Saltwater <u>Acute</u> Criterion (ug/L)*	Maximum Sample Result ug/L)	Number of Potential Violations	Saltwater <u>Chronic</u> Criterion (ug/L)*	Maximum Sample Result - 4 day Avg (ug/L)	Number of Potential Violations
1	Arsenic	69	10.2	0	36	8.52	0
1	Cadmium	41.1	6.35	0	9.4	4.42	0
1	Copper	5	12.8	4	3.2	9.38	2
1	Lead	235	2.16	0	9.1	1.45	0
1	Nickel	75.2	12.2	0	8.3	9.61	2
1	Selenium	314.5	0.92	0	77	0.78	0
1	Zinc	92	104	1	82.2	83.3	1
2	Arsenic	69	12.3	0	36	8	0
2	Cadmium	41.1	8.12	0	9.4	3.87	0
2	Copper	5	36.1	2	3.2	14	2
2	Lead	235	1.46	0	9.1	1.26	0
2	Nickel	75.2	14.9	0	8.3	9.72	2
2	Selenium	314.5	1.17	0	77	0.89	0
2	Zinc	92	113	1	82.2	67	0
3	Arsenic	69	34.8	0	36	15.7	0
3	Cadmium	41.1	35.4	0	9.4	12.9	1
3	Copper	5	43.5	4	3.2	24.1	2
3	Lead	235	2.54	0	9.1	1.33	0
3	Nickel	75.2	58.5	0	8.3	23.6	2
3	Selenium	314.5	1.56	0	77	1.11	0
3	Zinc	92	503	2	82.2	59.7	0
4	Arsenic	69	14.6	0	36	14.6	0
4	Cadmium	41.1	34.5	0	9.4	11.7	1
4	Copper	5	84.8	4	3.2	27.9	2
4	Lead	235	2.58	0	9.1	1.67	0
4	Nickel	75.2	50.4	0	8.3	18.9	1
4	Selenium	314.5	1.43	0	77	1.11	0
4	Zinc	92	431	2	82.2	157.4	1
5	Arsenic	69	7.82	0	36	5.44	0
5	Cadmium	41.1	4.34	0	9.4	2.56	0
5	Copper	5	14.3	2	3.2	7.37	2
5	Lead	235	0.93	0	9.1	0.89	0
5	Nickel	75.2	8.26	0	8.3	4.28	0
5	Selenium	314.5	1.58	0	77	1.19	0
5	Zinc	92	60.8	0	82.2	37.5	0

* Aquatic life criteria for metals was calculated by converting total dissolved acute and chronic criteria as stated in the State of Mississippi Water Quality Standards (MDEQ 2007), to total recoverable acute criteria presented here using conversion factors published in the 1997 §305(b) guidance document (EPA 1997).