BEFORE THE COUNCIL FOR THE CITY OF NEW ORLEANS

APPLICATION OF ENTERGY NEW ORLEANS, INC. FOR APPROVAL TO CONSTRUCT NEW ORLEANS POWER STATION AND REQUEST FOR COST RECOVERY AND TIMELY RELIEF	**)**	**DOCKET NO. UD-16-02**

PRE-FILED DIRECT TESTIMONY

OF

DR. ALEXANDER S. KOLKER

ON BEHALF OF

ALLIANCE FOR AFFORDABLE ENERGY,

DEEP SOUTH CENTER FOR ENVIRONMENTAL JUSTICE,

AND SIERRA CLUB

JANUARY 6, 2017

PRE-FILED DIRECT TESTIMONY OF

DR. ALEXANDER S. KOLKER

Q1. Please state your name, position, and business address.

A. My name is Dr. Alexander S. Kolker. My business address is Louisiana Universities Marine Consortium, DeFelice Marine Center, 8124 Highway 56, Chauvin, Louisiana 70344. I also teach in the Department of Earth and Environmental Sciences at Tulane University. For the record, the information I present is my own professional opinion, and not that of the institutions where I work.

Q2. Please describe your professional experience and education.

A. In 2005, I received a Ph.D. from the Stony Brook University (part of the State University of New York System) in Marine and Atmospheric Science. In 2007, I worked as a post-doctoral research scholar in the Department of Earth and Environmental Science at Tulane University and worked as a research professor in that department in 2007 and 2008.

Since 2008, I have worked as a coastal geologist at the Louisiana Universities Marine Consortium, and I continue to teach and advise graduate students in the Department of Earth and Environmental Sciences at Tulane University.

For my research, I study the geology and oceanography of coastal systems, and how people and climate impact these systems. In recent years, much of my research has focused on subsidence, sediment transport pathways, and groundwater discharge impact on the Mississippi River Delta and the Louisiana coastal zone.

A more detailed presentation of my education and professional experience is provided in my *curriculum vitae*, which is attached to this testimony. *See* Ex. AK-1.

Q3. Do you see any potential vulnerabilities caused by the proposed New Orleans Power Station ("NOPS") facility?

A. Yes, I think there are several areas of concern that include:

- The history of subsidence in the region directly surrounding the proposed NOPS facility, which has increased the vulnerability of the area to floods from hurricanes and heavy rain events. These legacy vulnerabilities will likely become increasingly important as climate changes and sea levels rise in the future.
- The potential for the proposed NOPS to further contribute to subsidence at the NOPS site, in the surrounding community, and potentially in New Orleans' recently upgraded storm risk reduction system.
- The design of the NOPS plant is quite close to sea level, and will become even closer to sea level (and potentially below sea level) over the coming decades, increasing the vulnerability of this facility to flooding.

Q4. Can you please define subsidence and its importance to the proposed NOPS plant?

A. Subsidence is the downward movement of the ground surface, or another stratigraphic horizon, with respect to the earth surface. As lands subside, they become closer to sea level, and can even fall below sea level. This increases their risk of flooding, should protective structures such as levees break, and it allows water to pool, thereby increasing the risk of flooding from rainfall events. Subsidence can also cause buildings, walls, and other structures to crack, crumble, and otherwise degrade, which is damaging to those buildings.

Q5. What causes subsidence?

A. Subsidence can be caused by a wide variety of processes. It can be caused by the compaction and dewatering of near-surface sediments; the decay of peat layers and other organic

deposits; the withdrawal of subsurface fluids; the loading of heavy material such as sediment, ice, and water on the continental crust; geological faults; and the movement of continental plates. Some of these processes greatly impact levees in Louisiana, while other processes have less of an impact. For example, the compaction of near-surface sediments, the decay of peat layers, and the withdrawal of subsurface fluids are among the largest contributors to subsidence here in Louisiana. Loadings are important, particularly in areas such as the Birdsfoot Delta near the river's mouth, where the modern (i.e. Holocene) sediment accumulation has been the greatest. There is currently some interest among the scientific community about the potential for faults in the Mississippi River Delta to be a driver of subsidence, though faults have yet to be fully researched. The movement of tectonic plates is not likely to be a major cause of subsidence in Louisiana.

Q6. Is there a difference between subsidence and differential consolidation?

A. As I mentioned above, subsidence is the downward movement of the ground surface (or another stratigraphic horizon) relative to the surface of the earth, and it can be caused by a number of factors including the consolidation and compaction of near-surface sediments. Differential consolidation occurs when nearby sediments compact at different rates. As an example of differential compaction, imagine a person who set out two patches of fill on which he wants to build a house. In this case, the left patch is made up sand and the right patch is made of clay. The sand and the clay would consolidate and compact at different rates, and this difference is often termed, "differential consolidation." Over time, differential consolidation can cause a house or building to shift and crack. Overall, differential consolidation should be thought of as one mode of subsidence, and not distinct from it.

Q7. What is the evidence of subsidence in the vicinity of the proposed NOPS facility?

A. Several independent studies conducted over a period of nearly a decade point to high levels of subsidence near Michoud and the proposed NOPS facility.

In 2016, authors from NASA; Louisiana State University ("LSU"); and the University of California, Los Angeles, used an Interferrometric Synthetic Aperture Radar ("InSAR") to determine subsidence rates across much of the New Orleans metropolitan region. InSAR works something like a speed radar gun, except pointed at the planet rather than a car. This system emits and receives radar waves, and, based on the phase shift of the return signal for images collected over a period of time, one can determine how fast the earth's surface is moving. This study, by Jones et al. (2016), determined subsidence rates for much of the greater New Orleans area for the period June 18, 2009 to July 2, 2012. These authors found that subsidence rates for the Michoud region of eastern New Orleans range from about 25–35 millimeters per year ("mm/yr"), with some nearby areas subsiding at rates as high as over 35 mm/yr and other nearby areas subsiding at lower rates of about 10–20 mm/yr. Just as a contrast, parts of uptown New Orleans subsided at a rate of about 3–6 mm/yr. Jones et al. (2016) linked the subsidence near Michoud to groundwater withdrawal.[1] Ex. AK-2.

In 2006, a team led by Timothy Dixon, then at the University of Miami, published a paper that used a similar approach to that of Jones et al. (2016). They used InSAR sensors mounted on satellites to determine patterns of subsidence around New Orleans. The results of Dixon et al. show subsidence rates of about 7–8 mm/yr in the area by Michoud and the proposed NOPS facility. *See* Ex. AK-3.

[1] I reviewed a pre-publication draft of this manuscript.

An examination of road and ground survey data by Kurt Shinkle of the National Geodetic Survey and Roy Dokka of LSU in 2004 indicated that subsidence rates in the area near the Michoud facility were about 20 mm/yr, about a factor of four higher than other sites along a transect that ran from Biloxi, Mississippi, to Kenner, Louisiana. *See* Ex. AK-4.

Finally, a 2009 report by Lawrence Prakken of the U.S. Geological Survey indicates a strong potentiometric cone of depression in the water table, centered around the Michoud facility, which they linked to local water withdrawal. *See* Ex. AK-5.[2] .

Q8. Is there evidence from other systems in other places that could be informative to the discussion here?

A. Yes. Studies from Houston show a strong relationship between water withdrawal and subsidence. In the mid-20th century, the Houston and Galveston areas had extensive subsidence that was linked to groundwater withdrawal. As groundwater withdrawal has been controlled, subsidence rates have decreased. Venice, Italy, had problems with subsidence too that they linked to the withdrawal of groundwater. In Venice, this problem stopped when they stopped the withdrawal of groundwater. Tokyo had similar problems, which were linked to groundwater withdrawal, and which slowed substantially when groundwater withdrawal stopped.[3]

[2] See Exhibit AK-9 for a list of references for the figures I cite here and elsewhere in this testimony.

[3] These papers are listed as Holzer and Galloway (2005), Kolker et al. (2011), Kaneko and Toyota, and Lewis and Schrefler (1978) in the list of references in Exhibit AK-9.

Q9. The CK report relied upon by Entergy suggested that there was no subsidence in the Michoud area. Can you comment on the evidence they presented to make this conclusion?

A. The evidence that they report appears to consist only of a few ground-level photographs of buildings. This is a flawed approach for several reasons.

- First, in order to know that an area is changing, one needs data from at least two points in time. By looking at a photograph from only one point in time, it is simply impossible to definitively tell whether an area is or is not changing.
- Second, the dataset they present is highly limited with just a few photographs of areas of a few buildings. One would feel much more comfortable looking at a dataset that covered several square miles, as the Jones, Dixon, Shinkle and Dokka, and Prakken reports do.
- While I do recognize that photographs, in some instances can be informative, the photographs presented in the CK report are taken from too far a distance from the buildings in question for any observer to carefully make any analyses.

The data presented by the CK report are woefully insufficient to judge subsidence risks, particularly given the critical nature of the proposed NOPS facility.

Q10. The CK report suggests that the major cause of subsidence in this region is isostatic sag? In your view, is this accurate?

A. While isostatic adjustments play a role in subsidence in coastal Louisiana, they are not the biggest driver of subsidence. One need only look at how New Orleans flooded in the wake of Hurricane Katrina to understand that this view is flawed. With Katrina, the deepest flood depths were in the parts of the city that had been swamplands, places like Lakeview and Gentilly. As

these swamps were drained, the ground subsided, often by ten feet over the course of a century. Along the Mississippi River the ground was comprised of heavier, more firm sediments that subsided less. As a result, many parts of uptown New Orleans did not flood.[4]

Q11. The CK report indicates that subsidence at Michoud is largely controlled by "natural, global and regional mechanisms, and any marginal increase in subsidence caused by groundwater extraction . . . ." Do you agree with this assessment?

A. I disagree. Across the region, humans exert a large influence on subsidence. As such, it's not surprising that humans could play a role in subsidence near the NOPS plant. There are several studies, including Jones et al. (2016), Dixon et al. (2006), and Prakken (2008) that all indicate a human impact on ground water management and subsidence.

Q12. Can you comment on vulnerability of this structure to flooding?

A. The area containing and surrounding the proposed NOPS, like almost all of south Louisiana, is vulnerable to flooding. This area faces at least two imminent flood risks: storm surge from hurricanes and rainfall from intense thunderstorms.

Data from Louisiana's 2012 Coastal Master Plan show some of the potential vulnerabilities of the area around the NOPS plant to storm surge. Under the plan's "less optimistic" scenario, it indicated that the region around the NOPS is likely to remain dry in the event of a 1% (100-year) storm over the next fifty years, both with and without the improvements called for in the Master Plan. Likewise, the area would likely remain dry from a 0.2% (500-year) event over the next fifty years. However, according to the 2012 Master Plan,

[4] The view that isostatic adjustments controlled subsidence in the Mississippi River Delta has had some adherents. A 2012 paper by Yu, Tornqvist, and Hu, all of Tulane University, set out to explicitly quantify the contribution of isostatic loadings to subsidence in the delta. They concluded that isostatic loading led to about 0.15 +/- 0.07 mm/yr of subsidence.

the area is likely to see flood depths of 10-15 feet at some point over the next fifty years from a 0.2% (500-year) event. *See* Ex. AK-6.

These numbers should be put in their proper context. First, one should keep in mind that a 100-year flood is not a flood that only occurs once in a hundred years, but a flood that has a 1% chance of happening in any given year. Since each year is effectively considered independently, a storm that has 1% chance of happening in any given year has a greater than 1% chance of happening in two years, and an even greater chance of occurring in three years. Over time, the chance that a 1% event will occur increases. Table 1 shows the chance of flooding, assuming that the surrounding landscape and storm climate stay constant.

(Source: https://www.weather.gov/epz/wxcalc_floodperiod).

% Chance of occurrence in a given year	Return Period (Years)	Plant Life Expectancy (Years)	% Chance of occurrence over plant lifetime
1	100	15	14
1	100	30	26
1	100	50	40
1	100	75	53
0.2	100	15	3
0.2	500	30	6
0.2	500	50	10
0.2	500	75	14

Table 1

In Louisiana, these probabilities could change over time. The chance of flooding could be reduced if restoration and protection measures are implemented by building levees and restoring wetlands. Likewise, these numbers can be made worse if the flood risk increases, either through subsidence, an increase in storm frequency or intensity, or if global sea levels rise.

Unfortunately, for much of Louisiana, flood risks are likely to increase in the years ahead as global warming intensifies. Louisiana's recently released 2017 draft coastal Master Plan will use subsidence and sea level rise rates that are higher than those of the 2012 Master Plan, as global experts now predict faster rates of climate change. In Louisiana's 2017 plan the, "low," (rate of sea level rise) scenario is on par with the 2012, "less optimistic," scenario. The "high" scenario is substantially higher than anything used in the 2012 plan, particularly for the later years of the plan.

Hurricane-driven storm surge is not the only flood risk that New Orleans faces. It also faces risks from rainwater, and heavy downpours can occur during and outside of hurricanes. For example, a "10-year" rainfall event (considered 8.5 inches of rainfall in a 24-hour period, with a maximum rate of 3.43 inches per hour) could lead to about one foot of flooding in areas near the proposed NOPS plant. As we know from events in Baton Rouge this summer, rainfall events substantially greater than this are possible. What's more, research from the international climate science community (IPCC, 2013) indicates that these events are likely to be more frequent and more intense as climate changes.

Q13. How will climate change and sea level rise impact the vulnerability of this structure to flooding?

A. Climate change and subsidence will substantially increase the vulnerability of this area to flooding. Using numbers from the Dixon and Jones papers, and Louisiana's 2017 Master Plan, we can find the range of relative sea level rise scenarios for the area around the proposed NOPS facility. The Dixon numbers on subsidence (7-8 mm/yr), will lead to 350 – 400 mm (13.78 inches to 15.75 inches) over a period of 50 years. The Jones subsidence numbers (20–34.9 mm/yr) lead to a total subsidence of 1000–1750 mm (39.4–68.5 inches) over a period of fifty

years. The 2017 Louisiana Coastal Master Plan will use three different global sea-level rise scenarios that range from 1.41 to 2.72 feet over fifty years. *See* Ex. AK- 7. If we combined these numbers, we suggest a total can bracket the total relative water level change as ranging from 2.56 to 8.42 feet over a period of fifty years. It is important to keep in mind that these water level changes are "still water" level changes—the amount of water level change that will occur on a calm day. Water level changes caused by the surge of a hurricane will be greater. Fifty years from now, under the "medium scenario" of sea level rise and subsidence, the area around this facility could see flood depths of 1-6 feet during a 100-year event if there is no additional strengthening to the current levees **(See Ex. AK-8)**. Thus the projections from this updated Master Plan are potentially less optimistic than the 2012 "less optimistic" scenario. A, 500-year event, would lead to even higher water levels. While a 500-year (0.2%) event may seem unlikely, as I mentioned above, such an event has about a 1 in 10 chance of happening over a fifty-year period. (Please note that the draft Master Plan has just been released, and not all graphics associated with that plan are available. I expect that more comprehensive graphics and data will be released in the coming months.)

Q14. What is your recommendation to the Council to proceed?

A. My recommendation is that the Council should proceed with substantial caution. My view is that the Council would benefit from hiring an independent engineering or scientific firm to investigate whether the NOPS plant will cause subsidence to the facility itself, the surrounding community, or nearby flood protection structures. That study would probably look at geotechnical data, geotechnical models, seismic surveys, soil borings, well logs, and storm surge models and climate projections. This report should also examine the optimal elevation for the plant, not only today, but for its entire lifespan. It is hard to imagine a way in which one could

safely proceed in the absence of a more detailed study of the risks to the environment caused by this plant, and the risks that a changing environment pose to this plant and the residents of New Orleans who depend on it.

Q15. Does this complete your testimony?

A. Yes.

AFFIDAVIT

STATE OF LOUISIANA

PARISH OF ORLEANS

NOW BEFORE ME, the undersigned authority, personally came and appeared, **Dr. Alexander S Kolker**, who after being duly sworn by me, did depose and say:

That the above and foregoing is his sworn testimony in this proceeding and he knows the contents thereof, that the same are true as stated, except as to any matters and things, if any, stated on information and belief, and that as to those matters and things, he verily believes them to be true.

Dr. Alexander S. Kolker

SWORN TO AND SUBSCRIBED BEFORE ME

THIS 5th DAY OF JANUARY, 2016

NOTARY PUBLIC

My commission expires: Upon death

Exhibit AK-1

Curriculum Vitae of Dr. Alexander Kolker

ALEXANDER S. KOLKER
Assistant Professor
Louisiana Universities Marine Consortium
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EDUCATION

State University of New York, Stony Brook University **2005**
Ph.D. in Marine and Atmospheric Science

State University of New York, Stony Brook University **2000**
Master of Arts in Biological Sciences: Ecology and Evolution

University of California, Santa Cruz **1995**
Bachelors of Arts in Biology

EMPLOYMENT HISTORY

Associate Professor **2015-Present**
Louisiana Universities Marine Consortium

- Led multi-institutional team to examine Mississippi River/Gulf of Mexico Interactions
- Examined geological underpinnings of coastal restoration strategies in Louisiana
- Lead PI in a multi-disciplinary project to examine groundwater dynamics in Louisiana
- Supervised graduate students and technicians
- Academic member of Louisiana's Coastal Master Plan Framework Development Team
- Contributed to plans to manage river diversions in Louisiana.

Assistant Professor **2008- 2015**
Louisiana Universities Marine Consortium, Cocodrie, Louisiana

- Established a cutting-edge coastal geosceince laboratory
- Raised over $1.8 million for research, education and facilities
- Examined the fate and transport of sediments in the coastal zone
- Co-discovered mechanisms for the delivery of massive quantities of groundwater from the Mississippi River to the coastal zone
- Studied the impacts of climate change to coastal systems
- Mentored graduate students from multiple Louisiana institutions
- Changing Course International Design Competition, Team Studio Mizi-Ziibi.

Adjunct Professor **2008- Present**
Tulane University, New Orleans, Louisiana

- Mentored Ph.D., M.S., and undergraduate student research projects
- Led classes, seminars and independent studies related to coastal oceanography
- Organized and led field trips to the Louisiana coastal zone
- Guided sedimentary geology laboratory

Research Assistant Professor
Tulane University, New Orleans, Louisiana **2007 - 2008**

- Developed innovative investigations of sediment dynamics coastal systems
- Experimentally studied the effects of sea level rise on coastal biogeochemistry
- Developed radioisotope geochronologies of sedimentary processes
- Advised Master's level student

Post-Doctoral Scholar **2007**
Tulane University, New Orleans, Louisiana
- Investigated subsidence, compaction, and sediment deposition in the Mississippi Delta
- Developed 2-dimensional images of marine sediments
- Determined rates of sedimentary processes using the radioisotopes ^{210}Pb and ^{137}Cs

Post-Doctoral Scholar **2006**
Stony Brook University, Stony Brook, New York and Gateway National Park, Brooklyn, NY
- Studied the biogeochemistry of Long Island and New York City salt marshes
- Developed research strategy to monitor salt marsh restoration efforts
- Investigated effects of climatic oscillations on global sea level variability

Scientist in Residence **2004-2005**
Stony Brook University, Stony Brook, New York and Gateway National Park, Brooklyn, NY
- Investigated causes of marsh loss and recovery in Jamaica Bay, New York
- Advised the National Park Service on matters of salt marsh loss
- Studied sedimentary geology of the Bohia Sea, China using ^{210}Pb and ^{137}Cs

Sea Grant Scholar **2002-2004**
Stony Brook University, Stony Brook, New York
- Research assistant on NOAA-Sea Grant funded project titled, "The Response of Long
- Island Salt Marshes to Environmental Change."
- Led field sampling efforts to collect sediment cores and surficial sediment samples
- Analyzed samples for radioisotopes, benthic foraminifera, and sedimentary geology

Research Assistant **1999-2000**
Goddard Institute for Space Studies/Columbia University, New York, New York
- Investigated climate change impacts to New York City Metropolitan Area
- Co-discovered rapid marsh loss in Jamaica Bay, New York

Physical Science Technician **1997-1998**
National Institutes of Health, Bethesda, Maryland
- Analyzed environmental and nuclear medicine samples for radioisotopes
- Maintained and operated radioisotope counting facility

Biologist/AmeriCorps Volunteer **1996-1997**
Big Cypress National Preserve, Ochopee, Florida
- Studied population dynamics of Swallow-tailed Kites using radiotelemetry
- Mapped wetland vegetation using Geographic Information Systems
- Conducted hydrological surveys by land and helicopter

PUBLICATIONS

*Peer Reviewed Scholarly Articles * Indicates Student*

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Kolker, A.S., Ameen, A*., Allison, M.A., Miner, M.D., Ramatchandirane, C., Weathers, H.D., Yuill, B., (2015). Deltaic evolution in the West Bay Mississippi River Diversion over seasonal to centennial time scales. Presented to the Biennial Coastal and Estuarine Research Federation conference, Portland, OR.

Keogh, M*., **Kolker, A.**, Renfro, A., Impacts of a Mississippi River diversion on accretion rates within an emergency marsh, southern Louisiana. Presented to the Biennial Coastal and Estuarine Research Federation conference, Portland, OR.

Kolker, A.S., Breaux, A.,* Telfeyan, K.,* Kim, J., Johannesoon, J.H., Cable, J.E. (2014). Deltaic Submarine Groundwater Discharge: An issue of global importance? H23D-0913. Presented to the Annual Conference of the American Geophysical Union, San Francisco, CA.

Breaux, A.,* **Kolker, A.S.,** Telfeyan, K.,* Kim, J., Johannesoon, J.H., Cable, J.E. (2014). Semi-permeable paleochannels as conduits for submarine groundwater discharge to the coast in Barataria Bay, Louisiana. H23D-0908, Presented to Annual Conference of the American Geophysical Union. San Francisco, CA.

Kolker, A.S., Breaux, A.,* Cable, J.E., Coleman, D.,* Kim, J.,* Johannesson, K.H., Schnedier, A.,* Telfeyan, K.,* (2014). The dynamics of subterranean flow in the Mississippi River Delta. Presented to State of the Coast Conference, New Orleans, LA.

Kolker, A.S. (2013). How understanding climate variability can inform our knowledge of coastal subsidence. Presented to First International Workshop on Coastal Subsidence, New Orleans, LA.

Chambers, C.R.,* **Kolker, A.S.,** Roberts, B.J., (2014). Spatial and season variability of sediment respiration and nutrient fluxes in a developing subdelta: The Wax Lake Delta and Atchafalaya River Delta Estuary. Presented to State of the Coast Conference, New Orleans, LA.

Ameen, A.,* **Kolker, A.S.,** & Taylor, C.M. (2014). Plants matter: Vegetation Dynamics and Ecogeomorphology in the West Bay Diversion, State of the Coast Conference, New Orleans, LA.

Kolker, A.S., Breaux, A.,* Coleman, D.,* Inniss, L.V. Telfeyan, K.,* Kim, J.,* Schneider, A.,* Allison, M.A., Cable, J.E., Johannesson, K.H. (2013). Underground and previously undiscovered rivers in the Mississippi Delta. H34A-04. Presented to Annual Conference of the American Geophysical Union. San Francisco, CA.

Breaux, A.,* Schneider, A.,* **Kolker, A.S.,** Telfeyan, K.,* Kim, J.,* Johannesson, K.H., Cable, J.E., Coleman, D.,* (2013). Buried Distributaries as a Conduit for Groundwater Flow in Barataria Bay, Louisiana. Abstract H4F-1300. Presented to Annual Conference of the

American Geophysical Union, San Francisco, CA.

Telfeyan, K.,* Breaux, A.,* Kim, J.,* **Kolker, A**., Johannesson, K.H., Cable, J.E., (2013). Biogeochemistry of submarine groundwater discharge to the Gulf of Mexico. Abstract ID CA H41F-1306. Presented the Annual Conference of the American Geophysical Union, San Francisco, CA.

Kolker, A.S., Ameen, A.D., Boxer, G., Li, C., Piley, C., Ramatchandirane, C.G., Walker, N.D., (2013). Dynamics of a large shelf-discharging river in flood: Implications for Coastal Sedimentology and Deltaic Restoration. Presented to Gulf Coast Association of Geological Societies Meeting, New Orleans LA.

Liu, Z., Zucheng, W., Wu, W., **Kolker, A.S.** (2013). Distribution and sources of polycyclic aromatic hydrocarbons in coastal sediments in the northern Gulf of Mexico. Delivered to American Chemical Society Meeting, New Orleans, LA.

Ramatchandirane, C. G.,* **Kolker, A. S**, Argow, B. A., Donnelly, J.P., Fagherazzi, S.; Giosan, L., Priestas, A. M. (2013). Chenier plan reactivation in southwest Louisiana leads to recent marsh development via fluvial and coastal processes. Abstract ID: 10673. Presented to Association for the Sciences of Limnology and Oceanography Aquatic Sciences Meeting, New Orleans, LA.

Kolker, A. S.; Cable, J. E.; Johannesson, K. H.; Allison, M. A. (2013). Subsurface hydrological and geochemical fluxes in the Mississippi River Delta. Abstract ID: 10942. Presented to Association for the Sciences of Limnology and Oceanography Aquatic Sciences Meeting, New Orleans, LA.

Ameen, A.*, **Kolker, A. S.,** Taylor, C. M.; (2013). Ecogeomorphology of developing wetlands near a Mississippi River sediment diversion. Abstract ID: 11639. Presented to Association for the Sciences of Limnology and Oceanography Aquatic Sciences Meeting, New Orleans, LA.

Chambers, C. R.,* Kolker, A. S., Roberts, B. J. (2013). Sediment dynamics and biogeochemical cycling in a developing deltaic system: Understanding land building and habitat quality in a river diversion. Abstract ID: 11888. Presented to Association for the Sciences of Limnology and Oceanography Aquatic Sciences Meeting, New Orleans, LA.

Dincer, Z.,* Sericano, J.L., Marcantonio, F., Wade, T., Bianchi, T., **Kolker, A.S.** (2013). Tracking oil from Deepwater Horizon oil spill in Barataria Bay sediments. Abstract ID: 162-16 Presented to Geological Society of America Annual Meeting, Charlotte, NC.

Kolker, A.S., Esposito, C.R.*, Georgiou, I., Miner, M.D., Weathers, H.D. (2012). Sediment dynamics and hydrodynamics in developing crevasse splays in the lowermost Mississippi River: Implications for Delta Restoration. Abstract ID 66-8. Presented to Geological Society of America Annual Meeting, Charlotte, NC.

Kolker, A.S., Li, C., Allison, M.A., Ameen, A.D.*, Dash, P, Ramatchandirane, C.*, Sinclair, G., Smith, D.*, Ullah, M.*, Williams, K.*, (2011). Activation of the Inner Continental Shelf Following the Great Mississippi/Atchafalaya River Flood of 2011. Presentation B24D-10. Fall Conference, American Geophysical Union, San Francisco, CA.

Ullah, M.*, **Kolker, A.,** Li, C., (2011). The importance of large scale flood over the regular sedimentation in delta development: A case study involving Wax lake delta. Presentation, B24D-07. Fall Conference, American Geophysical Union, San Francisco, CA.

Mohajerin, T.J.*, Johannesson, K.H, **Kolker, A.,** Burdige, D.J., Chevis, D.J.*, (2011). Rare earth element analysis indicates micropollutants in an urban estuary. Presentation H34C. Fall Conference, American Geophysical Union, San Francisco, CA.

Georgiou, I.*, Esposito, C.R., **Kolker, A.** (2011). Differential sedimentation in a Mississippi River crevasse splay. Presented at the 2011 Coastal and Estuarine Research Federation Conference, Daytona Beach, FL.

Ameen, S.*, Dosemegan, S., Griffith, A., Harada, C., **Kolker, A.,** Warren, J., (2011). Monitoring post-oil spill recovery of coastal wetlands using non-invasive techniques. Presented at the 2011 Coastal and Estuarine Research Federation Conference, Daytona Beach, FL.

Kolker, A.S, Hameed, S., Allison, M.A., (2011). A new subsidence curve for Mississippi River Delta tide gauges and its implications for coastal restoration. Presented at the 2011 Coastal and Estuarine Research Federation Conference, Daytona Beach, FL.

Ramatchandire, C.G.*, Kolker, A.S., Argow, B.A. Donnelly, J.P., Giosan, L. (2011). Chenier Plain coastal wetland development in southwest Louisiana: possible link to downdrift sedimentation from increased Atchafalaya River flow and storm deposits. Presented at the 2011 Coastal and Estuarine Research Federation Conference, Daytona Beach, FL.

Kolker, A.S., Ameen, A.D.,* Bianchi, T.S. Cook, R.L., Green, N.,* Kolic, P.,* Zhang, Y.* (2010). Ecosystem resilience following a massive oiling event. Abstract EP24A-08, Fall Meeting, AGU, San Francisco, CA.

Esposito, C.R.*, Georgiou, I.Y., **Kolker, A.S.** (2010). Patterns of sediment transport and deposition during a flood event in a river dominated wetland. Abstract EP53C-0636, Fall Meeting, AGU, San Francisco, CA.

Ramatchandirane, C.G.*, **Kolker, A.S.,** Argow, B., Ameen, A.D., Williams, K., Donnelly, J.P., Giosan, L. (2010). Does reactivation of Louisiana's Chenier Plain lead to the development of interior coastal wetlands? Assessing the relative roles of storm impacts and riverine deposits. Abstract EP53C-0636, Fall Meeting, AGU San Francisco, CA.

Williams, E.K.*, Rosenheim, B.E., **Kolker, A.S.** (2010). Constraining organic carbon sequestration in coastal wetlands in response to sea-level rise using samples along a

salinity gradient in southeast Louisiana. Abstract B13A-0447. Fall Meeting, AGU, San Francisco, CA.

Roe, K.M.,* Rosenheim, B.E., Roberts, B.J., Kolker, A.S., Allison, M.A (2010). A characterization of the lability of particulate organic matter in the lower Mississippi-Atchafalaya River System: An application of a programmed temperature pyrolysis/combustion system. Abstract OS33G-05 Fall Meeting, AGU, San Francisco, CA.

Esposito, C.R.,* Georgiou, I.Y., **Kolker, A.S.**, (2010). Delta evolution during a single flood event in a river dominated wetland. Paper Number 72-12. Geological Society of America, Annual Meeting, Denver, CO.

Kolker, A.S., Cruz, V.J., Pavolini, V.,* Allison, M.A., Donnelly, J.P., Giosan, L. (2010). Contrasting Sedimentary Environments in Low Energy Coastal Systems. Presented to American Association of Petroleum Geologists Conference, New Orleans, LA.

Kolker, A.S. Kirwan, M.K., Goodbred, S.L., and Cochran, J.K. (2009). Global Climate Changes Recorded in Coastal Wetland Sediments: Empirical Observation Linked to Theoretical Predictions. Invited by Matt Kirwan, to be Presented at Coastal and Estuarine Research Federation Conference, Portland, OR. ***INVITED.***

Kolker, A.S. Douglas, J.,* Rosenheim, B.E. (2009). Disturbance and Recovery in the Anthropocence: Examining Sedimentation and Coastal Progradation om Lana'I, Hawai'i. Title, Eos Trans. AGU, 90(52), Fall Meet. Suppl., Abstract EP43E-0687. American Geophysical Union, San Francisco, CA.

Douglas, J.L.*, **Kolker, A.S.,** Gasparini, N.M., Butcher, K.A., Rosenheim, B.E., (2009). Timing and forensics of an immense and rapid sedimentary progradation of the NE Lana'I (Hawaiian Islands) Coastline. Paper 247- 18. Geological Society of America Annual Meeting, October 18-21. Portland, OR.

Roe, K.M.,* Rosenheim, B.E., **Kolker, A.S.,** Allison, M.A., Nittrouer, J.A., Duncan, D.D., Nyman, J.A., Butcher, K.A., Adamic, J.F. (2009). The effect of flood events on the partitioning of labile and refractory carbon in the Missouri-Mississippi River system. Eos Trans. AGU, 90(52), Fall Meet. Suppl., Abstract B33C-0401. American Geophysical Union, San Francisco, CA.

Kolker, A.S. (2008). Wetland Processes in a Changing Environment. 9th Annual Technology-Transfer Workshop "Estuarine Design and Research Needs: Navigation Channels, Estuarine Vegetation, Placement of Dredged Sediments, and Long-term Estuary Evolution. Invited by Julie Rosati, US Army Corps of Engineers, Sarasota, FL. ***INVITED.***

Kolker. A.S. (2008). Sediment Dynamics on Quiescent Coastlines. 9th Annual Technology-Transfer Workshop, "Estuarine Design and Research Needs: Navigation Channels,

Estuarine Vegetation, Placement of Dredged Sediments, and Long-term Estuary Evolution. Invited by Julie Rosati, US Army Corps of Engineers. Sarastoa, FL. ***INVITED.***

Kolker, A.S., Allison, M.A., Butcher, K.A., Fulweiler, R.W., Green, S., Nittrouer, J., Nyman, J.A., Rosenheim, R. (2008). The Mississippi River Flood of 2008: Sediment Dynamics and Implications for Coastal Restoration. Geological Society of America Meeting, Houston, TX.

Kolker, A.S., Allison, M.A. (2008). Bathymetric and sedimentological changes in space and time: Towards a subsidence map of an interdistributary basin in the Mississippi Delta. AGU/ASLO Ocean Sciences Meeting. Orlando, FL.

Kolker, A.S., Hameed, S., Goodbred, S.L., and Cochran, J.K (2006). "Relative Sea-level Variability in the Western Atlantic Basin: Causes and Consequences." *Eos Trans. AGU, 87*(52), Fall Meet. Suppl. H31I-06. American Geophysical Union, San Francisco, CA.

Kolker, A.S., Goodbred, S.L., Hameed, S., and J.K. Cochran (2006). Does the Physical Setting Control a Salt Marshes Response to Climate Change? Implications for Predictive Modeling. Society of Wetlands Scientist Annual Meeting. Queensland, Australia. Invited by Carol Auer, NOAA. ***INVITED.***

Kolker, A.S. Goodbred, S.L., Hameed, S. and Cochran. J.K. (2005). A Close Coupling Between Salt Marsh Accretion Rates and Sea-Level Change Determined Through High Resolution Lead-210 Geochronologies: Evidence from Long Island, USA and Implications for Coastal Zone Change. *Eos Trans. AGU, 86*(52), Fall Meet. Suppl., Abstract H23J-03. American Geophysical Union, San Francisco, CA.

Kolker, A.S., Goodbred, S.L., Cochran, J.K. and Mushacke, F.M. (2005). Are Rates of Accretion and Marsh Loss Decoupled? Evidence from Long Island, USA. Contribution to the 18th Biennial Conference of the Estuarine Research Federation: Special Session-05. Organized by Carol Auer, NOAA, Norfolk, VA.

Kolker, A.S., Goodbred, S.L., Cochran, J.K., Beck, A., and Kroboth, T. (2004). Deciphering the Role of Climate and Sea-Level Changes on Observed Decadal-Scale Variability in Salt-Marsh Sedimentation. *Eos Trans. AGU, 85*(47), Fall Meet. Suppl., Abstract H51A-1106. American Geophysical Union, San Francisco, CA.

Kolker, A.S., Goodbred, S.L., and Cochran, J.K. (2004). Using Radioisotopes in Environmental Research. Presented to Chinese Geological Survey, Tianjin Institute of Mineral Resources. ***INVITED.***

Kolker, A.S., Goodbred, S.L., and Cochran, J.K. (2004). Urbanization in New York Wetlands: Local Problems, Global Implications. Presented to: Symposium on Coastal Geo-Environment and Urban Development. Tianjin, China. ***INVITED***.

Kolker, A.S., Goodbred, S.L., Cochran, J.K., A. Beck, and Kroboth, T. (2004). The Importance of the Physical Setting in Determining the Interaction Between Salt Marsh Accretion Rates and Climate Variability. American Geophysical Union Chapman Conference on Salt Marsh Geomorphology: Physical and Ecological Effects on Landform. Halifax, NS.

Kolker, A.S., Goodbred, S.L., Cochran, J.K., Browne, J., Kroboth, T., Pagano, M., and Beck, A. (2003). The Role of Local Dynamics in Determining Salt Marsh Response to Sea Level Rise. Proceedings of the 17th Biennial Conference of the Estuarine Research Federation.

Regional Conference Presentations and Proceedings

Kolker, A.S. (2013). Understanding dynamically-driven sea level change and its implications for long-term coastal evolution. Delivered to New Orleans Geological Society, April 1, 2013.

Kolker, A.S., Allison, M.A., Hameed, S. (2012). A new subsidence curve for northern Gulf of Mexico Tide Gauges and its Implications for Coastal Restoration, Presented to State of the Coast Conference, New Orleans, LA.

Kolker, A.S. (2012). Sediment Dynamics and Geomorphic Evolution of the West Bay Mississippi River Diversion. Presented to the workshop: Sediment Diversion: Land Building for a sustainable ecosystem restoration in coastal Louisiana, sponsored by American Society of Civil Engineers, COPRI, Baton Rouge, LA.

Williams, K.A.*, **Kolker, A.S**., Miner, M.D. (2012). The response of salt marshes in the relict St. Bernard delta lobe to tropical cyclone activity. Presented to Geological Society of America South-Central Meeting. Paper No. 1302, New Orleans, LA.

Kolker, A.S. Allison, M.A., Butcher, K.A.*, Nittrouer, J.,* Nyman, J.A., Rosenheim, R. (2008). The Lower Mississippi River Flood of 2008 Sediment Dynamics and Implications for Coastal Restoration. Presented to Dynamics of the 2008 Lower Mississippi River Flood Conference. Tulane University, New Orleans, LA.

Kolker, A.S. Allison, M.A., Butcher, K.A., Nittrouer, J.,* Nyman, J.A.*, Rosenheim, R. (2008). The Lower Mississippi River Flood of 2008 Sediment Dynamics and Implications for Coastal Restoration. Presented to Baton Rouge Geological Society Land Loss Symposium, Baton Rouge, Louisiana.

Kolker, A.S. Allison, M.A., Butcher, K.A.*, Nittrouer, J.*, Nyman, J.A., Rosenheim, R. (2008). The Lower Mississippi River Flood of 2008 Sediment Dynamics and Implications for Coastal Restoration. Presented to Society of Wetland Scientists South East and South Central Chapter Meeting, Tuscaloosa, Alabama.

Kolker, A.S., Goodbred, S.L., Hameed, S. and Cochran. J.K. and Aller, R.C. (2006). Understanding Global Environmental Trends in Local Wetland Settings. Proceedings of the 12th Conference on the Geology of Long Island and Metropolitan New York.

Kolker, A.S., Goodbred, S.L., Cochran, J.K., Aller, R.C., and Mushacke, F.M. (2005). Marsh Loss on Long Island: Does Biogeochemistry Trump Climate Change? Proceedings of the

11th Conference on the Geology of Long Island and Metropolitan New York, Stony Brook, NY.

Kolker, A.S., Goodbred, S.L., Beck, A., Kroboth, T., Cochran, J.K. (2004). Are Marsh Loss and Accretion Rates Decoupled? Proceedings: Jamaica Bay's Disappearing Marshes Scientific Symposium, Brooklyn, NY.

Kolker, A.S., Goodbred, S.L., Cochran, J.K., Browne, J., Kroboth, T., Pagano, M., and Beck, A. (2003). Do Local Dynamics Determine Salt Marsh Response to Sea Level Rise? Proceedings of the 10th Conference on the Geology of Long Island and Metropolitan New York. Stony Brook, NY.

Kolker, A.S., Goodbred, S.L., Cochran, J.K., Browne, J., Kroboth, T., Pagano, M., and Beck, A. (2003). Do Local Dynamics Determine Salt Marsh Response to Sea Level Rise? Presented to New York State Wetlands Forum. Saratoga Springs, NY.

Kolker, A.S., Goodbred, S.L., and Cochran, J.K., (2003). Are Sedimentation Patterns in Nissequogue River Salt Marshes Forced by Local or Regional Factors? Presented to: Conference on Wetland Loss in Long Island Sound Salt Marshes. Stony Brook, NY.

Kolker, A.S., Kroboth, T.K., Goodbred, S.L., and Cochran, J.K. (2002). Are Accurate Sea Level Curves Constructible: Evidence from Micropaleontology and Geochemistry. Proceedings of the 9th Conference on the Geology of Long Island and Metropolitan New York. Stony Brook, NY.

Kolker, A.S., Hartig, E.K., Mushacke, F.M., Fallon, D., and Gornitz, V. (2001). Erosion in Jamaica Bay: Causes, Questions and Sea Level Rise. Proceedings of the 8th Conference on the Geology of Long Island and Metropolitan New York. Stony Brook, NY

Public Outreach and Environmental Education

Kolker, A.S. (2014). A Scientific Safari of Louisiana's Coastal Wetlands. Presented to Rotary Club of New Orleans, New Orleans, LA.

Kolker, A.S., (2014). Pathways of Water and Sediment Transport in the Mississippi River Delta. Delivered to Brown Environmental Leadership Laboratory, Cocodrie, LA.

Kolker, A.S., (2013). Pathways of Water and Sediment Transport in the Mississippi River Delta. Delivered to Brown Environmental Leadership Laboratory, Cocodrie, LA.

Kolker, A.S., (2012). Recent Geological Changes in the Mississippi River Delta. Delivered to the Barataria/Terrebonne National Estuary Program, Thibodaux LA.

Kolker, A.S. (2012). New Perspectives on Land loss and Land Gain in Coastal Louisiana. Presented to Houma Library, Houma, LA

Kolker, A.S. (2010). Natural Analogs for Coastal Restoration. Presented to Jewish Community

Center, New Orleans, LA.

Kolker, A.S., Barker, A. Butcher, K.A., Cruz, V. and Treusch, N. (2009). Sediment dynamics at two Mississippi River diversion. Presented to the Geological Aspects of Flood Control Conference. Southeast Flood Protection Authority, West, Metaire, LA.

Kolker, A.S. (2007). A Role for Science in the Coastal Environment. Presented to Young Leadership Council, New Orleans, LA.

Kolker, A.S. (2006). Salt Marsh Loss in Jamaica Bay and its Relationship to Vertical Accretion, Human Impacts and Sediment Chemistry. Presentation to Jamaica Bay Watershed Protection Plan Advisory Committee, City of New York, NY.

Kolker, A.S. (2005). The Current and Future Status of Long Island Salt Marshes. Presented to Ward Melville Heritage Organization, Stony Brook, NY.

Kolker, A.S., Goodbred, S.L., Cochran, J.K. Browne, J. Pagano, M., Beck. A. (2003). Recent Trends in Salt Marshes along the South Shore of Long Island. Presented to Department of Conservation and Waterways, Town of Hempstead, NY.

Kolker, A.S., Goodbred, S.L., Cochran, J.K., Browne, J., Kroboth, T., Pagano, M., Beck, A. (2003). The Oceanography of Long Island Salt Marshes: Are All Marshes Created Equal? Presented to Long Island Marine Association, Nassau, NY.

Invited Talks: Academic Colloquia.

Kolker, A.S. (2015). Atmospheric, marine, and subsurface controls on water and sediment transport pathways in North America's largest delta. To be delivered to the Department of Geological Sciences, University of Florida. Gainesville, FL.

Kolker, A.S. (2015). Anthropogenic controls on fluid and particle transport in the Mississippi River Delta. To be delivered to the Department of Marine Science, University of Southern Mississippi. Stennis, MS.

Kolker, A.S. (2014). Stochastic and Sustained Forcing of Coastal Sedimentary Processes. Delivered to Department of Marine Science, University of North Carolina, Chapel Hill. Chapel Hill, NC.

Kolker, A.S. (2014). New Perspectives on the Hydrology and Ecogeomorphology of the Mississippi River Delta. Delivered to School of Biological Sciences, Louisiana Technical University, Ruston, LA.

Kolker, A.S. (2013). Understanding dynamically-driven sea level change and its implications for long-term coastal evolution. Delivered to New Orleans Geological Society. New Orleans, LA.

Kolker, A.S., (2013). Pathways of water and sediment transport in the Mississippi River Delta. Delivered to US Army Corps of Engineers, Engineer Research and Development Center, Vicksburg, MS.

Kolker, A.S. (2013). Pathways of Water and Sediment Transport in the Mississippi River Delta. Presented to Geology Department, Rice University, Houston, TX.

Kolker, A.S. (2012). New Insights into the Geology of The Mississippi River Delta. Presented to Department of Earth and Environmental Sciences, Tulane University, New Orleans, LA.

Kolker, A.S. (2012). Recent Geological Change in the Northern Gulf of Mexico. Presented to Department of Marine Science, Texas A&M University, Galveston, TX.

Kolker, A.S. (2011). The interplay between climate variability and human activities in the coastal zone. Delivered to the Department of Earth Sciences, Boston University, Boston, MA.

Kolker, A.S. (2011). Oceanographic, sedimentary, and biogeochemical controls on coastal shorelines. Delivered to the Department of Geology and Geophysics, Louisiana State University, Baton Rouge, LA.

Kolker, A.S., (2011). Climate Change and Sedimentary Dynamics Along The Land/Sea Interface. Delivered to Department of Marine Sciences, University of Southern Mississippi, Stennis, MS.

Kolker, A.S. (2009). Sea-level dynamics and the ups and downs of marsh accretion. Delivered to the National Wetlands Research Center, Lafayette, LA.

Kolker, A.S. (2008). Climatic, Sedimentary and Geochemical Controls on the Land/Sea Interface. Presented to the School of the Coast and the Environment, Louisiana State University. Baton Rouge, LA.

Kolker, A. S. (2007). Coastal Wetland Processes: The Role of Sea Level Rise and Human Impacts Presented to US Army Corps of Engineers: Engineering Research and Development Center. Vicksburg, MS.

Kolker, A.S. (2008). New Perspectives in Sea Level Rise. Presented to Department of Earth and Environmental Sciences, Tulane University, New Orleans, LA.

Kolker, A.S. (2006). Islands, Cities and Changing Seas An Analysis of the Causes and Consequences of coastal change in muddy environments. Presented to Department of Earth and Environmental Sciences, Vanderbilt University, Nashville, TN

Kolker, A.S. (2006). The Influence of Climate Variability and Human Activities on Salt Marshes in Varied Physiographic Settings. Presented to Geophysical Fluid Dynamics Institute. Florida State University, Tallahassee, FL.

Kolker, A.S. (2005). Storms, Sediments and Sea Level. Presented to Queens College, Department of Earth and Environmental Sciences, Queens, NY.

FUNDING AWARDS

Environmental Defense Fund

Kolker, A.S., (2016) Sedimentary Properties of the Fort St. Philip Crevasse After the 2016. $19,975. Monthly Support 0.25.

Mississippi River Delta Campaign

Kolker, A.S., Early stage development of a lucustrine delta: The Davis Pond Receiving Basin 6/1/2015-5/31/2016. $19,035. Monthly Support: 0.25.

NOAA RESTORE Act Science Program

Kolker, A.S., Renfro, A., Roberts, B.J., RESTORE SCIENCE: The Central Role of the Mississippi River and its Delta in the Oceanography, Ecology and Economy of the Gulf of Mexico Large Marine Ecosystem. $268,756. 9/1/2015-8/31/2017. Monthly Support 1.0/1.0

The Water Institute of the Gulf

Kolker, A.S., Stratigraphic Development of Crevasse Splay Islands in West Bay. $49,880. 12/1/2013-9/11/2014. Monthly Support 1.0.

Changing Course Competition

Hoal, J. Studio Misi-Ziibi Total Funds $400,000, Amount to ASK $15,000 (final contract pending). 9/1/2014-3/1/2015. Monthly Support $1.0.

National Science Foundation – Hydrological Sciences/Chemical Oceanography

Kolker, A.S. Johannesson, K.M. and Cable, J.E. Collaborative Research: Are Buried Paleochannels Effective Reactors for Water and Solute Transport in a Deltaic Subterranean Estuary? Total grant support, $734,210, Amount to ASK $282,638. 3/1/2012-2/28/2015. Monthly Support 1.0/1.0/1.0.

National Science Foundation – Ocean Sciences

Roberts, B.J, Rabalais, N.N. –Research Experience for Undergraduates Interdisciplinary Research Experiences in Changing Coastal Environments. Award Amount $225,591. Amount to ASK $3,800. (Kolker is listed as Senior Personnel on this project, and receives no monthly support.)

Mississippi River Delta Campaign

Kolker, A.S., Development of Deltaic Islands in the West Bay Receiving Basin. 5/1/2014-12/31/2014, $14,886, Monthly Support 0.25.

Lake Pontchartrain Basin Foundation

Kolker, A.S.. Beryllium-7 Analysis from Mardi Gras Pass High Water 2014. $16,500, 3/1/2014-12/1/2014, Monthly Support 0.0.

National Science Foundation – Marine Geology and Geophysics

Kolker, A.S., Li, C. Sinclair, G.A. Collaborative Research: Rapid: Activation of the Inner Continental Shelf in Response to the Great Mississippi/Atchafalaya River Flood of

2011. Total Funds $49,991, Amount to ASK $34,992, 7/15/2011-7/14/2013, Monthly Support 0.0.

Louisiana Sea Grant

Kolker, A.S., Roberts, B.J**.** Sediment Dynamics and Biogeochemical Cycling in a Developing Deltaic System: Understanding Land Building and Habitat Quality in a River Diversion. Award Amount: $179,963, Amount to ASK: $89,896, Monthly Support 1.0/1.0, 2/1/2012 -1/31/2014.

Louisiana Sea Grant/Louisiana Office of Coastal Protection

Kolker, A.S. Coastal Science Assistantship: Wetland formation from downdrift sediment transport in Louisiana's Chenier Plain. $75,000, 6/1/2011-5/31/2014, Monthly Support 0.0/0.0/0.0.

National Science Foundation – Field Stations and Marine Laboratories

Kolker, A.S., Roberts, B.J., Rabalais, N.N., Sammarco, P.W. Sinclair, G.A. FSML: Acquisition of environmental chambers to examine the impacts of climate change and anthropogenic disturbance on coastal ecosystems. $131,076, 9/1/2010- 8/31/2013, Monthly Support 0.0.

National Wildlife Federation

Kolker, A.S. Sediment Dynamics and Ecogeomorphic Processe in the West Bay Mississippi River Diversion. $10,000, 6/1/2012-12/31/2012, Monthly Support: 0.0.

Louisiana Sea Grant

Kolker, A.S., Georgiou, I. Sediment and Water Dynamics in River-Dominated Coastal Wetlands During the Mississippi River Flood of 2011. $10,000, 6/1/2011-12/31/2011, Monthly Support 0.0.

National Science Foundation - Ecosystems

Roberts, B.J., **Kolker, A.S.**, Rabalais, N.N. Rosenheim, B.E. Collaborative Research: RAPID: The 2011 Atchafalaya River Flood and a possible altered system state for the Atchafalaya River Delta Estuary. $92,595, Amount to ASK $2,000, 8/1/2011-1/31/2014, Monthly Support 0.0.

National Audubon Society

Kolker, A.S., Georgiou, I. Hydrodynamics in the Mississippi River Diversion. Total Amount $19,999. Amount to ASK: 14,999, Monthly Support 0.25, 7/1/2011-12/31/2011.

National Wildlife Federation

Kolker, A.S. Development of a Grain Size Map for the West Bay Mississippi River Diversion Receiving Basin. $10,000, 7/15/2011- 12/31/2011, Monthly Support 0.25.

Louisiana Board of Regents – Traditional and Undergraduate Enhancement Program

Kolker, A.S. Roberts, B.J. Rabalais, N.N., Sinclair, G.A. Enhancing LUMCON's Ability to Measure Rates of Environmental Change Using Naturally Occurring and

Anthropogenic Radionuclides. $67,047, 7/1/2010-6/30/2012,Monthly Support 0.0, Funds used entirely for LUMCON equipment purchase.

Greater New Orleans Foundation

Kolker, A.S. An examination of *Spartina alterniflora* regrowth in wetlands in Barataria Bay following a massive oiling event. $35,721, 1/1/2011- 8/31/2011, Monthly support 0.25.

Long-Term Estuary Assessment Group (US Geological Survey/Tulane University)

Kolker, A.S., "Establishing a coastal wetland river observatory." $23,985, 10/15/2009-8/31/2012, Monthly support 0.0.

Long-Term Estuary Assessment Group (US Geological Survey/Tulane University)

Kolker, A.S., "Establishing a coastal wetland river observatory." $15,497, 10/15/2009-6/30/2011, Monthly support 0.0.

Coastal Restoration and Enhancement Through Science and Technology Program

Kolker, A.S., Donnelly, J.P. and Giosan, L. "The Changing History and Impacts of Hurricanes along Louisiana's Coast and Their Implications to Coastal Restoration and Revitalization. $148,004, Amount to ASK $74,450, 9/1/2008-8/31/2010. Monthly Support: 0.5.

Coalition to Restore Coastal Louisiana

Kolker, A.S. Assessment of Physical Processes in the Fifi Island Mangrove Restoration Site. $18,250. Monthly Support 0.5.

Louisiana Coastal Area Science and Technology Program (US Army Corps of Engineers/Eyak Technologies)

Kolker, A.S. "Analysis of Sediment Cores from the West Bay Diversion Receiving Area" $25,000, 9/1/2009 – 10/1/2010, Monthly Support 1.0.

University of New Orleans/US Geological Survey

Kolker, A.S. (Subcontract from The University of New Orleans) Understanding sediment accretion and wetlands in the Chandeleur Islands, LA. $24,500, 9/2009 – 9/2010, Monthly support 0.0.

National Science Foundation – Geomorphology and Land Use Dynamics

Kolker, A.S., Rosenheim, B.E. Fate and Transport of Carbon and Sediments During a Mississippi River High Water Event, $24,094, 10/2008-9/2009, Monthly Support: 0.0.

U. S. Army Corps of Engineers: Engineering Research and Development Center

Kolker, A.S. "Hydrodynamics, Geomorphology and Sedimentology of Coastal Wetlands: Interactions with Estuarine and Inlet Dynamics" *$15,000.* 2008.

Tulane University, Research Enhancement Fund

Gasparini, N, Rosenheim, B.R. and **Kolker, A.S.** "Quantifying the role of climate and land-use change on ridge-to reef erosion and deposition processes in the Hawaiian Islands." *$44,410.* 2007-2008.

University of Virginia/US Geological Survey

Kolker, A.S. Determining sediment accretion rates in wetlands from Chesapeake Bay. *$10,000.* 2007-2008.

National Science Foundation – Margins Program

Acceptance to the Theoretical and Experimental Institute: Teleconnections between source and sink in sediment dispersal systems. 2005.

National Science Foundation/National Center for Earth Surface Dynamics.

Travel Grant to attend the AGU Chapman Conference on Salt Marsh. Geomorphology, $500.

National Park Service

Grant in aid of Research. Grant for Ph.D. thesis research on salt marsh biogeochemistry in Jamaica Bay. 2004-2005, $5,000.

ADDITIONAL AWARDS

Southeast Louisiana Flood Protection Authority, West. **2009**

Certificate of Thanks- Presentation of talk, “Sediment Dynamics at Two Mississippi River Diversion.

National Park Service **2004**

Certificate of Appreciation, Volunteer-in-Parks Program.

Long Island Marine Association **2003**

Certificate of Appreciation for "The Time and Effort Exhibited in Presenting an Interesting and Educational Program."

TEACHING EXPERIENCE

Course Leader **2014**

Tulane University.
Co-leader of course, “Saving Coastal Louisiana.

Course Leader **2014**

Louisiana Universities Marine Consortium
Lead Course, “Coastal Field Geology.”

Course Co-Instructor **2014**

Louisiana Universities Marine Consortium
Delivered Lectures in, “Changing Coastal Oceans.”

Invited Lecture **2014**

Louisiana State University
Guest Lecture, "*Coastal Wetlands of the Atlantic and Gulf Coasts*," Delivered to Geological Oceanography Course

Invited Lecture: **2014**
University of New Orleans.
Guest Lecture, "*The Mississippi River Delta: Formation, Degradation and Restoration*," Delivered to Department of Earth and Environmental Science.

Course Leader **2013**
Tulane University
Lead course, "Wetlands."

Course Co-Instructor **2013**
Louisiana Universities Marine Consortium
Delivered Lectures in, "Changing Coastal Oceans."

Course Leader
Tulane University **2013**
Lead course, "Coastal Geoscience."

Course Leader
Tulane University **2012**
Lead course, "Coastal Geoscience."

Course Co-Instructor **2012**
Louisiana Universities Marine Consortium
Delivered Lectures in, "Changing Coastal Oceans."

Course Leader
Tulane University **2011**
Lead course, "Coastal Geoscience in the 21st Century."

Course Co-Instructor **2011**
Louisiana Universities Marine Consortium
Delivered Lectures in, "Changing Coastal Oceans."

Course Leader
Tulane University **2010**
• Co-leader for seminar course, "Coastal Wetlands in Dynamics Environments."

Invited Lecturer **2011**
University of New Orleans, New Orleans, LA
• Guest lecture in Introductory Biology on Louisiana Wetlands.

Invited Lecturer **2008, 2009, 2010**

Tulane University, New Orleans, LA
• Guest lecture in Geology 311- Oceanography
• Prepared and delivered lecture on coastal wetlands of the Atlantic and Gulf Coasts.

Course Co-Instructor **2009**
Louisiana Universities Marine Consortium
Delivered Lectures in, “Changing Coastal Oceans.”

Invited Lecturer **2004, 2005**
Stony Brook University, Stony Brook, New York
Guest lecture in Environmental Studies 311- *The Global Environment*
Prepared and delivered lecture, "Understanding Salt Marsh Loss on Long Island Using Remote Sensing and GIS."

Invited Lecturer **2004**
Stony Brook University, Stony Brook, New York
Invited lecture in Environmental Studies 101- *Prospects for Planet Earth*; Delivered lecture, "Current Trends in Long Island Salt Marshes."

Invited Lecturer **2003**
Stony Brook University, Stony Brook, New York
Taught lectures on sediment diagenesis to graduate students for their core-curriculum class Marine Sciences 506- *Chemical Oceanography.*

Theses Supervised
Primary Advisor: Active Students
- Alex Ameen. Ph.D. student in Department of Ecology and Evolutionary Biology, Tulane University. Expected Graduation Date: May 2016. .
- Margaret Keogh, Ph.D. student in the Department of Earth and Environmental Sciences, Tulane University. Expected Graduation Date: May 2018.
- Celeste Woock. M.S. student in the Department of Earth and Environmental Sciences, University of New Orleans. Expected Graduation Date, May 2017.

Primary Advisor: Graduated Students
- Alexander Breaux, M.S. student in the Department of Earth and Environmental Sciences, Tulane University. Graduation Date: May 2015.
- Annelise Muscietta, M.S. student the in Department of Earth and Environmental Sciences, Tulane University. Graduation Date: May 2015.
- Ciara Chambers, M.S. student in the Department of Earth and Environmental Sciences, Tulane University. Graduation Date, May 2014.
- Cyndhia Ramatchandirane. M.S. student the Department of Earth and Environmental Sciences. Expected Graduation Date, December 2013.
- Kelly Williams. M.S. student in Department Earth and Environmental Science at Tulane University. Graduation Date, June 2012.
- Kristen Butcher. M.S. student in Department Earth and Environmental Science at Tulane University. Graduation Date, May 2010.

Committee Member: Active Students

- Katherine Telfeyan. Ph.D. student in Department of Earth and Environmental Science, Tulane University. Expected Gradation Date, May 2016.

Committee Member: Graduated Student

- Elizabeth Williams. Ph.D. student in Department Earth and Environmental Science, Tulane University. Graduation Date, December 2014.
- Jade Haug. Ph.D. student in Department Earth and Environmental Science, Tulane University. Expected Graduation Date, December 2014.
- Matthew Pendergraft, M.S. student in Department of Earth and Environmental Sciences, Tulane University. Graduation Date, May 2013
- Kimberly Roe. M.S. student in Department Earth and Environmental Science, Tulane University. Graduation Date, May 2011.
- Christopher Esposito. M.S. student in Department of Earth and Environmental Science, University of New Orleans. Graduation Date, May 2011.
- Lauren Land. M.S. student in Department of Oceanography and Coastal Sciences, Louisiana State University. Graduation Date, December 2010.

Mentor

- Shaily Rahman, Ph.D. student in School of Marine and Atmospheric Sciences, Stony Brook University. Expected Graduation Date, May 2015.
- Carol Wilson, Ph.D. student in Department of Earth Sciences, Boston University. Graduation Date, May 2012.
- Joanna Carey, Ph.D. student in Department of Earth Sciences, Boston University. Graduation Date, February 2013.
- T. Jade Haug, Ph.D. student in Department of Earth and Environmental Sciences, Tulane University, Graduation Date December 2014.
- Zeynep Dincer, M.S. student in College of Geosciences, Texas A&M University. Graduation Date May, 2013.
- Kristian Gustavson, M.S. student in Scripps Institute of Oceanography. Graduation Date, May 2011.
- Paulina Kolic. Ph.D. student in Department of Chemistry, Louisiana State University.
- Loice Ojwang, Ph.D. student in Department of Chemistry, Louisiana State University,
- Caroline Schneider, Ph.D. student in Department of Chemistry, Louisiana State University
- Padmanava Dash, Ph.D. student in Department of Oceanography and Coastal Science. Louisiana State University, Graduation Date, December 2012.
- Mohammad Ullah, Student in Department of Earth and Environmental Sciences, Tulane University. Transferred.

Undergraduate Students.

- Annie Schnider, B.S. in Marine Science, University of South Carolina. Graduation Date, May 2014. (LUMCON REU student).
- Ashley Barker, B.S. in Engineering, Louisiana State University, Graduation

Date, May 2013. (LUMCON Intern).

- Wesley Bluvstein, B.S. In Environmental Sciences, Tulane University, Graduation Date, May 2013 (Undergraduate Mentee).
- Georgia Boxer. B.S. in Biology, Tulane University. Graduation Date, May 2012 (Undergraduate Mentee).
- Dan Coleman. Undeclared Major. Tulane University. Expected Graduation Date, May 2015 (LUMCON REU student and Undergraduate Mentee).
- Jenny Douglas, B.S. in Geology, Tulane University. Graduation Date, May 2010 (Undergraduate Mentee).
- Emily Hladkey, B.S. in Marine Science, Eckerd College. (LUMCON REU 2012).
- Lindsey Keifer. B.S. in Architecture, Tulane University. Graduation Date, May 2012 (Undergradaute Mentee).
- Tamara Kroboth, B.S. in Biology. Stony Brook University. Graduation Date May 2004 (Undergraduate Mentee).
- Marlee Labroo. Underclared Major. Tulane University. Expected Graduation Date, May 2015 (Undergraduate Mentee).
- Cyndhia Ramatchandirane, B.S. in Geosciences, Wellesley College. Graduation Date, May, 2011 (LUMCON Intern, Also Tulane/LUMCON graduate student).
- Dakota Smith. B.S. in Meteorology. Penn State University. Expected Graduation Date, May, 2014 (LUMCON REU).
- Maribeth Smith 2013-2014. B.S. in Biology, Nicholls State University.
- Nicholas Treush, Bachelors in Biology, Northwestern State University (LUMCON Intern).

SCHOLARLY REVIEWS

- *Geochemica et cosmochemica acta*
- *Geology*
- *Nature Geoscience*
- *Marine Environmental Research*
- *Quaternary Science Reviews*
- *Estuarine, Coastal and Shelf Science*
- *Journal of Geophysical Research - Oceans*
- *Journal of Geophysical Research - Earth Surface*
- *Journal of Hydrology*
- *Estuaries and Coasts*
- *Sedimentary Geology*
- *Ocean Science*
- *Marine Geology*
- *Geomorphology*
- *Journal of Coastal Research*
- *Bioscience*
- *San Francisco Bay and Estuary Science*
- *Water*
- *Wetlands Ecology and Management*

- International Reviews: Intergovernmental Panel on Climate Change, Working Group 2, Chapter 5, Coastal Systems and Low-Lying Areas.
- NOAA, Coastal Ocean Program
- National Institute for Climate Change Research Coastal Center
- US Geological Survey
- National Science Foundation- Physical Oceanography, Hydrological Sciences, Geomorphology and Land Use Dynamics

Key Oceanographic and Field Experience.

- Project leader investigating sedimentology of the Davis Pond Diversion receiving basin (*R/V Steve Joltki, Spring, Fall 2015*).
- Project co-leader investigating vegetation, sedimentology and stratigraphic development of the West Bay Mississippi River Diversion (*R/V Safe Boat, R/V Blue Runner, R/V Shelley Meaux R/V Itaska*; 2013-2014).
- Led multiple field campaigns to study subsurface hydrological fluxes from the Mississippi River to surrounding wetlands. Key study locations: Barataria Bay, Lac Des Allemandes, Bayou Bienvenue (*R/V Safe Boat, R/V Blue Runner;* 2012 – 2015).
- Cruise leader- geochemistry of the Mississippi River plume *(R/V Gadwall*; 2014)
- Explored the development of mouth bar islands in the West Bay Mississippi River Diversion in multiple field campaigns (*R/V Safe Boat;* 2011-2013).
- Collected water samples to analyze for rare earth elements in Terrebonne Bay (*R/V Safe Boat;* 2013 - 2014).
- Sediment coring team leader: CARTHE cruise to outer continental shelf and continental slope (*R/V Pelican; 2012*).
- Team leader of study of the impacts of the great 2011 Mississippi/Atchafalaya River flood on sediment dynamics in continental shelves fronting the Atchafalaya and Mississippi Rivers (*R/V Acadiana, R/V Calliou Boca;* 2011).
- Examined impacts of BP/Deepwater Horizon oil spill on the ecology, geology and biogeochemistry of Louisiana's wetlands and coastal bays (*R/V Fearman, R/V Safe Boat*; 2012-2013).
- Quantified hydrodynamics of the Mississippi River using acoustical and optical tools (2008-2010, *R/V Itaska*).
- Researched the influence of storms and river inputs on wetland development in Louisiana's Chenier Plain (*R/V Safe Boat* 2008-2011).
- Examined mouth bar dynamics in the Birdsfoot region of the Mississippi River Delta. Key study locations include Cubit's Gap, Pass-a-Loutre, West Bay (*R/V Safe Boat, R/V Mudlump* 2008-2011).
- Collected sediment cores to examine the history of storm deposits in the Chandeleur Islands, Louisiana (*R/V Mudlump, R/V Ratcrud3*)
- Examined sedimentation patterns in Lana'i Hawai'i. (2007-2009).
- Investigated subsidence and sediment deposition in Barataria Bay, Mississippi Delta, geophysical tools and sediment cores by vibra-core (2008-2011 *R/V Itaska, R/V Greenhead*).
- Led research cruises to determine causes of sediment anoxia in the Forge River, New York (2006).

- Dissertation Research. Collected cores, surface samples, porewater, and vegetation in Long Island salt marshes (1999-2005).
- Canadian Arctic Shelf Exchanges Study. 6 week cruise off the Mackenzie River Shelf to investigate carbon fluxes using ^{234}Th (*CGS Pierre Radisson*, 2002).
- Mapped Long Island's south shore using high resolution multibeam bathymetry (R/V Seawolf, 2002).
- Radiotelemetry of Swallow-tailed Kites in Everglades ecosystem (1996).
- Radiotelemetry of Golden Eagles in Altamont Pass (1995).
- Vegetation and disturbed site mapping in the Everglades Ecosystem and Big Cypress National Preserve, Florida (1996-1997).

Panels and Advisory Boards

- Framework Development Team, Louisiana's Master Plan for a Sustainable Coast, 2014-2017.
- Shell Wetland Chemistry Endowed Chair Search Committee, Louisiana State University 2014-2016.
- Diversions Operations Working Group, Run by Environmental Defense Fund and Mississippi River Delta Coalition
- Program Committte, State of the Coast Conference, 2015-2016.
- Student Engagement Committee, State of the Coast Conference, 2015-2016.
- Review Panel, Nicholls State University Marine Biology Program, 2014.
- Program Committee: State of the Coast Conference, 2013-2014.
- Gulf Coast Science Consortium (2011).
- Elkhorn Slough National Estuarine Research Reserve: Technical Advisory Panel (2011).
- United States Climate Change Science Program. Examined the response of US coastal marshes to accelerated sea level rise (2005- 2009).
- Greater New Orleans Foundation, Environmental Fund (2008-2009).

Conferences and Workshops Organized

- 2016 -2017 Workshops on Mississippi River/Gulf of Mexico Interactions; coordinated with National Oceanographic and Atmospheric Administration, Tulane University, LUMCON, National Wildlife Federation and Environmental Defense Fund.
- 2015 Coastal and Estuarine Research Federation Conference of session, "Delta Dynamics in the Anthropocene with Paola Passalacqua (University of Texas, Austin) and Leanna Heffner (Louisiana State University).
- 2014 American Geophysical Union Conference. Co-chair of session, "Linking surface and subsurface exchange on continental margins," with Jaye Cable (University of North Carolina, Chapel Hill), Scott White (University of South Carolina) and Vincent Post (Flinders University).
- 2013 Coastal and Estuarine Research Federation Conference. Co-chair of session, "Geological and Biogeochemical Processes in the Sediments and Soils of Coastal Wetlands," with Zhanfei Liu (University of Texas, Austin – Port Aransas).
- 2011 Coastal and Estuarine Research Federation. Co-chair of session, "Morphological Feedbacks in Changing Coastal Environments," with Zoe Hughes and Carol Wilson (Boston University)

- 2008 Conference on the Mississippi River, 2008 high water event, at Tulane University.
- 2007 Coastal and Estuarine Research Foundation, Co-chair of session, "Evaluating Climate Records to Understand the Causes and Consequences of Climate Change in Coastal Systems," with Candace Oviatt (University of Rhode Island).

Professional Affiliations

- Coastal and Estuarine Research Foundation
- American Geophysical Union

Selected Media Contacts

- The Lens, "New research: Ancient bayous pull water from the Mississippi, creating 'missing river,'" September 5, 2013.
- The Lens, "Science to be key factor in lawsuit against oil and gas companies for coastal loss," July 23, 2013.
- Houma Today, "Locals interested in suit against oil companies," July 24, 2013.
- The News Hour, "In Louisiana, Rising Seas Threaten Native American Lands," June 1 2012.
- Science Magazine, "Rebuilding Wetlands by Managing the Muddy Mississippi," February 3, 2012.
- Houma Today, "News that isn't quite so bad." December 3, 2011.
- Houma Today, "Restoration could benefit from slow sinking," November 30, 2011.
- Louisiana Public Broadcasting, "Turning the Tide," September 2011. (The producer of the documentary, Christina Melton, won a Suncoast Emmy for this work.)
- Associated Press, "New land in eroding LA wetlands: Cause for hope," August 31, 2011.
- New Orleans Times Picayune, "Mississippi River flooding gives birth to tiny island in West Bay," Front Page.
- Financial Times, "After the Oil." April 15, 2011.
- New York Times, "Gulf Coast Towns Brace as Huge Oil Slick Nears." May 2, 2010. Page A1.
- Bloomberg New – Businessweek, "Gulf Faces 'Difficult Reality' of Storm-Whipped Oil," May 21, 2010.
- Associated Press, "Gulf's coastal wetlands surviving despite oil," June 29, 2010.
- Sky News Television, August 5, 2010.
- Reuters Television Interview, May 25, 2010.

Exhibit AK-2

Maps of subsidence in East New Orleans and Michoud from Jones *et al.* (2016)

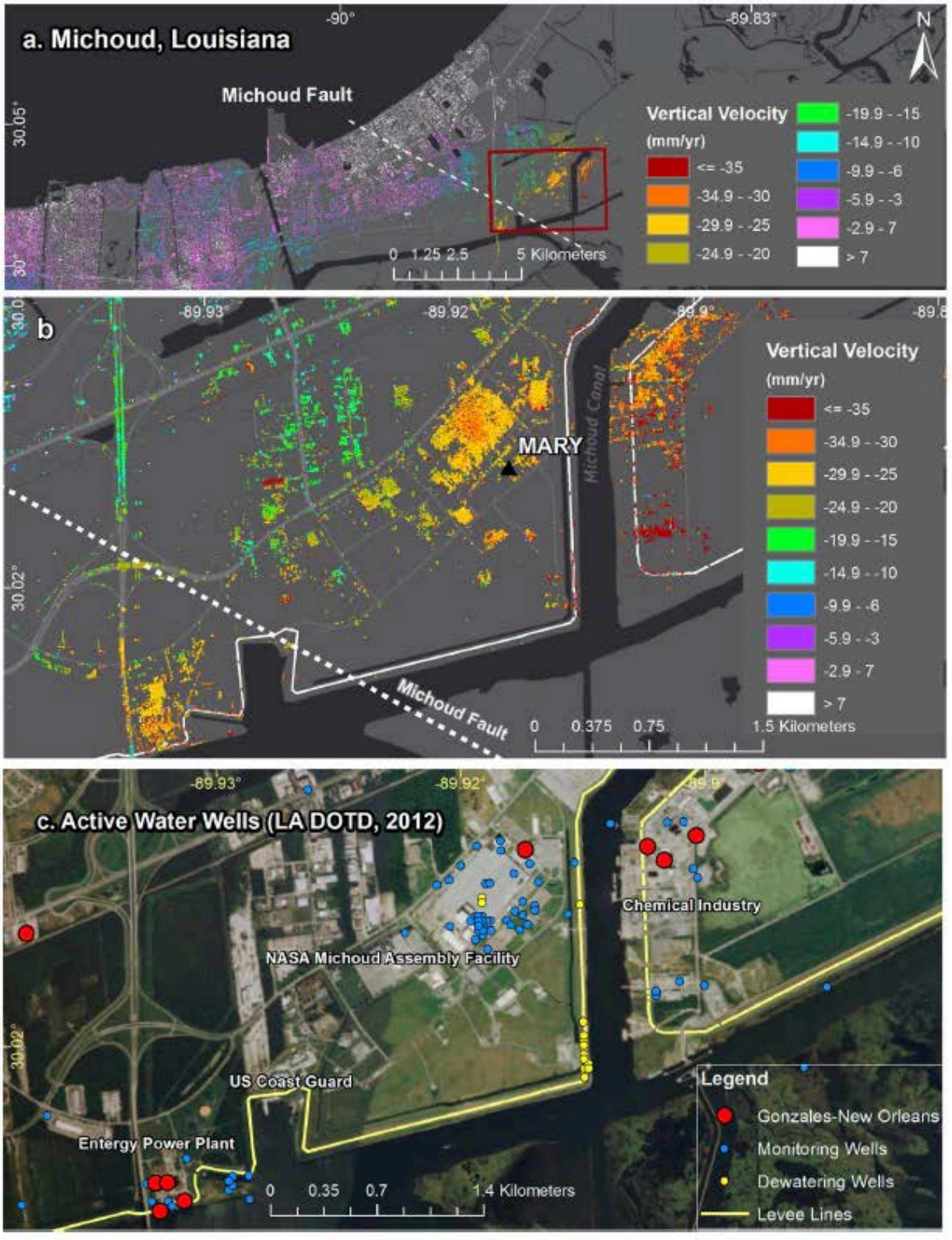


Figure 4. Subsidence in East New Orleans and Michoud. (a) Overview of the general area, including Michoud, East New Orleans, and districts of the city proper bordering Lake Pontchartrain. The location of the Michoud Fault, identified by *Dokka* [2011], is indicated. No distinct change in subsidence is seen along the fault. (b) The outlined area is shown: Subsidence in Michoud near the Gulf Intercoastal Waterway, from the New Orleans power plant (lower left) to the industrial complex immediately east of Michoud Canal. The MARY GPS site is indicated. (c) Active water wells as reported in 2012 (http://www.sonris.com/), and the locations of the Entergy New Orleans power plant, NASA Michoud Assembly Facility, and other local industry. Wells are indicated by type and by aquifer for the withdrawal wells connected to the Gonzales-New Orleans Aquifer. Subsidence increases near the cluster of withdrawal wells at the power plant and increases again at industrial sites to the east, particularly near Michoud Canal. Service Layer Credits: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, HERE, DeLorme, MapmyIndia, ©OpenStreetMap contributors, and the GIS user community.

Exhibit AK-3

Maps of subsidence in New Orleans area from Dixon *et al.* (2006)

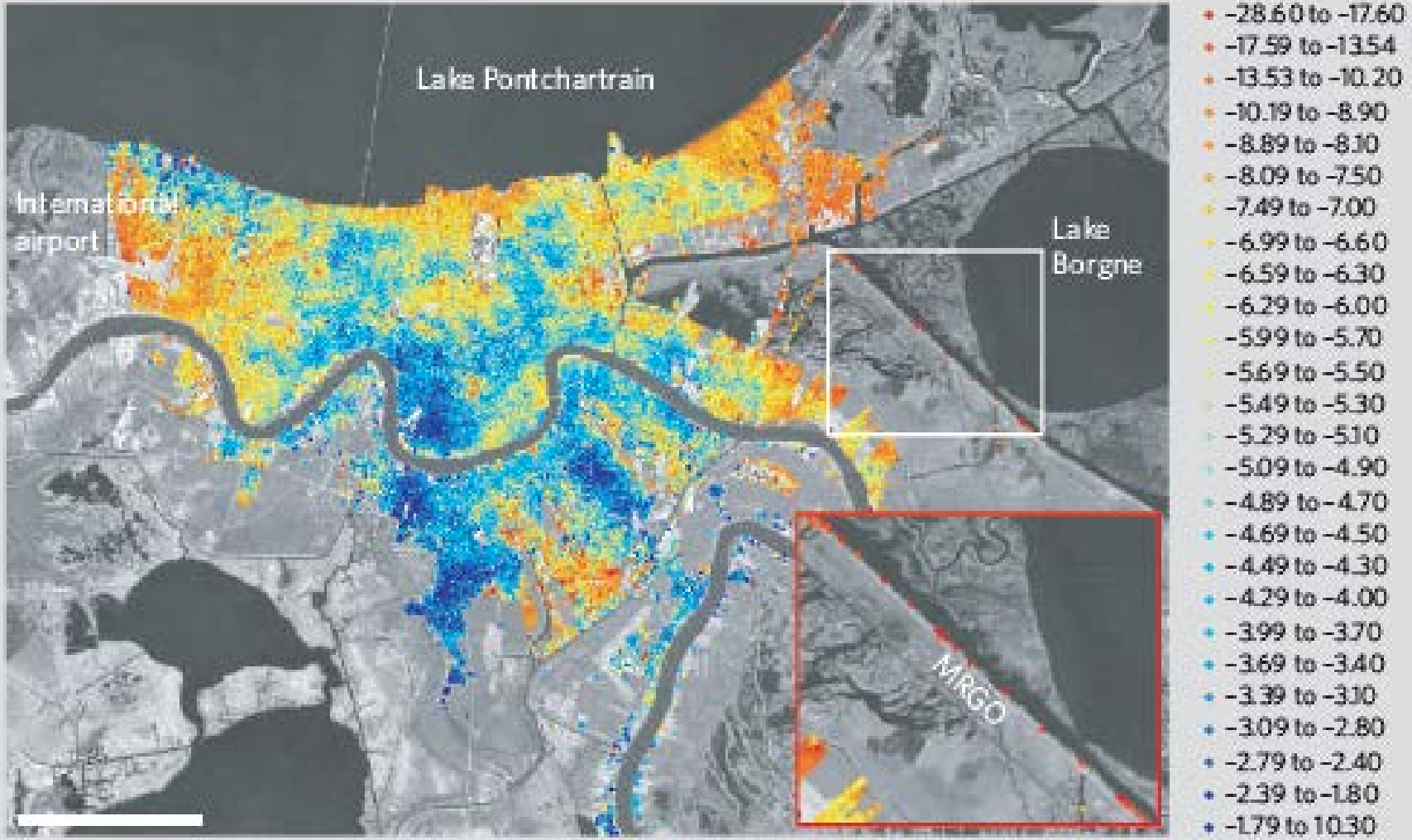

Lake Pontchartrain
International airport
Lake Borgne
MRGO
-28.60 to -17.60
-17.59 to -13.54
-13.53 to -10.20
-10.19 to -8.90
-8.89 to -8.10
-8.09 to -7.50
-7.49 to -7.00
-6.99 to -6.60
-6.59 to -6.30
-6.29 to -6.00
-5.99 to -5.70
-5.69 to -5.50
-5.49 to -5.30
-5.29 to -5.10
-5.09 to -4.90
-4.89 to -4.70
-4.69 to -4.50
-4.49 to -4.30
-4.29 to -4.00
-3.99 to -3.70
-3.69 to -3.40
-3.39 to -3.10
-3.09 to -2.80
-2.79 to -2.40
-2.39 to -1.80
-1.79 to 10.30

Exhibit AK-4

Graph of Subsidence Rates from Shinkle and Dokka (2004)

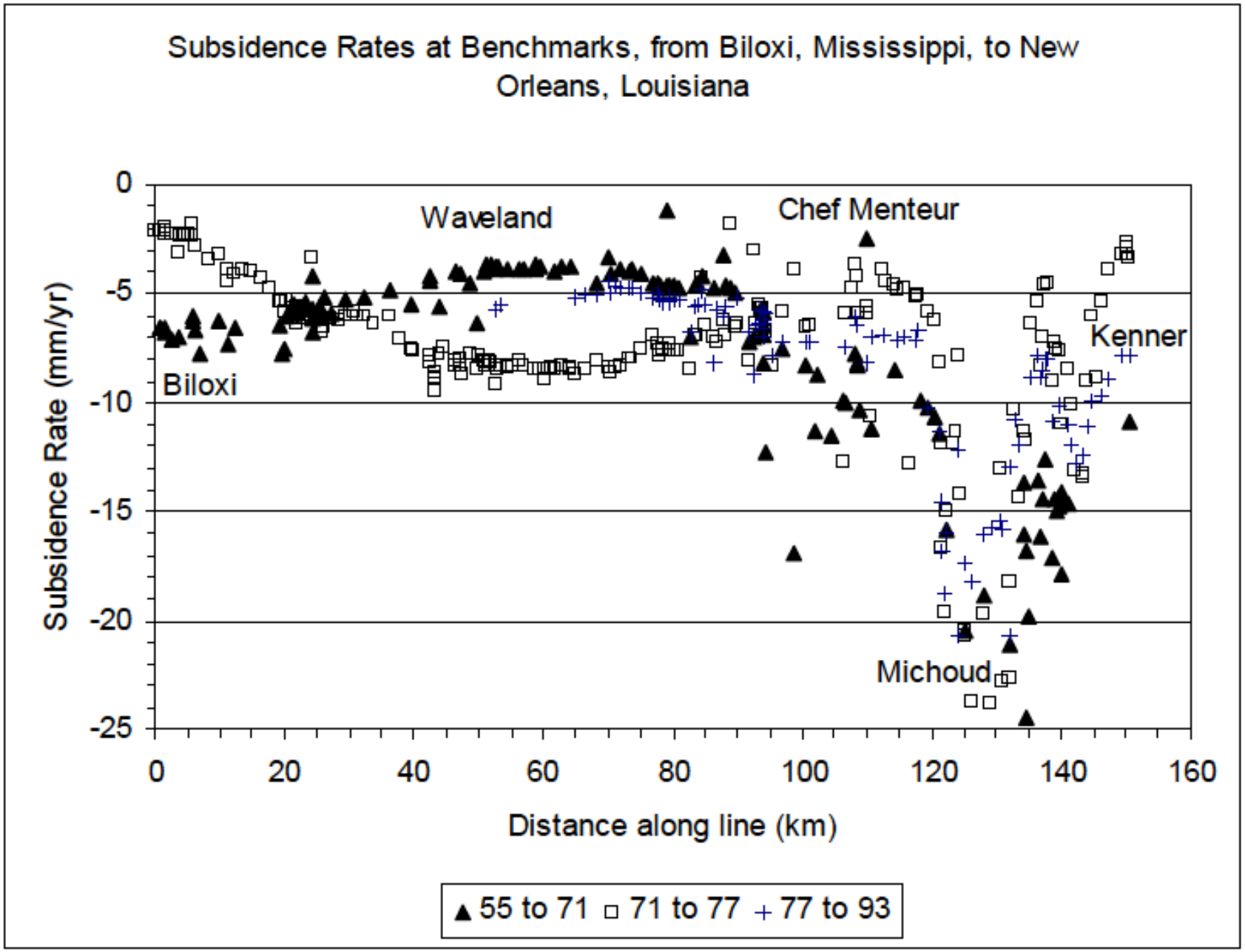
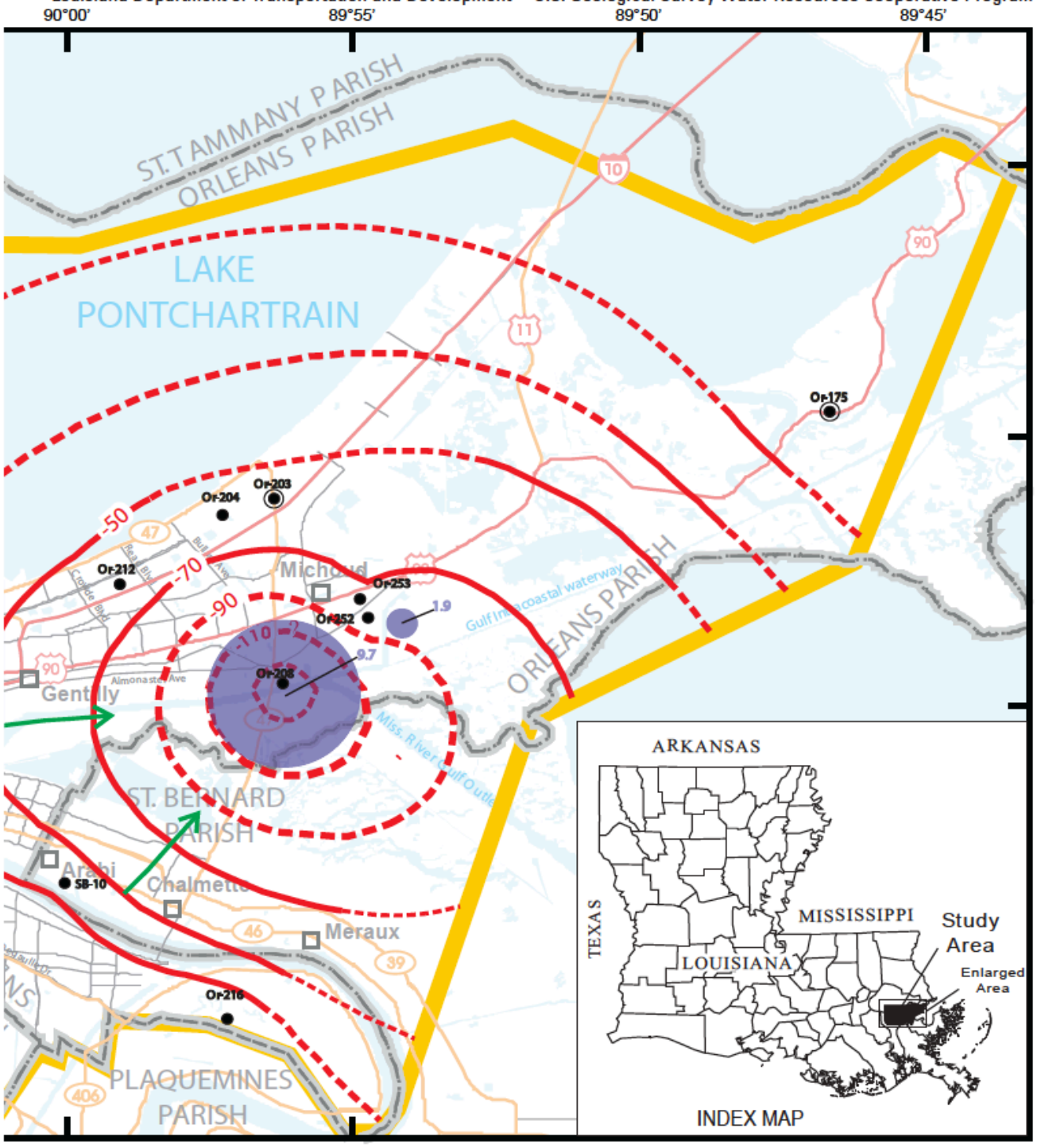

Subsidence Rates at Benchmarks, from Biloxi, Mississippi, to New Orleans, Louisiana
Waveland
Chef Menteur
Kenner
Biloxi
Michoud
Subsidence Rate (mm/yr)
0
-5
-10
-15
-20
-25
0
20
40
60
80
100
120
140
160
Distance along line (km)
55 to 71
71 to 77
77 to 93

Exhibit AK-5

Potentiometric Map of New Orleans East from Prakken (2009)

Louisiana Department of Transportation and Development—U.S. Geological Survey Water Resources Cooperative Program



Explanation

BOUNDARY OF STUDY AREA

-70 — POTENTIOMETRIC CONTOUR--Shows altitude at which water level would have stood in tightly cased wells. Dashed where approximately located. Contour interval, in feet, varies. Datum is National Geodetic Vertical Datum of 1929

FLOW ARROWS --Shows general direction of ground-water movement

Or-216 — CONTROL POINT AND WELL NUMBER

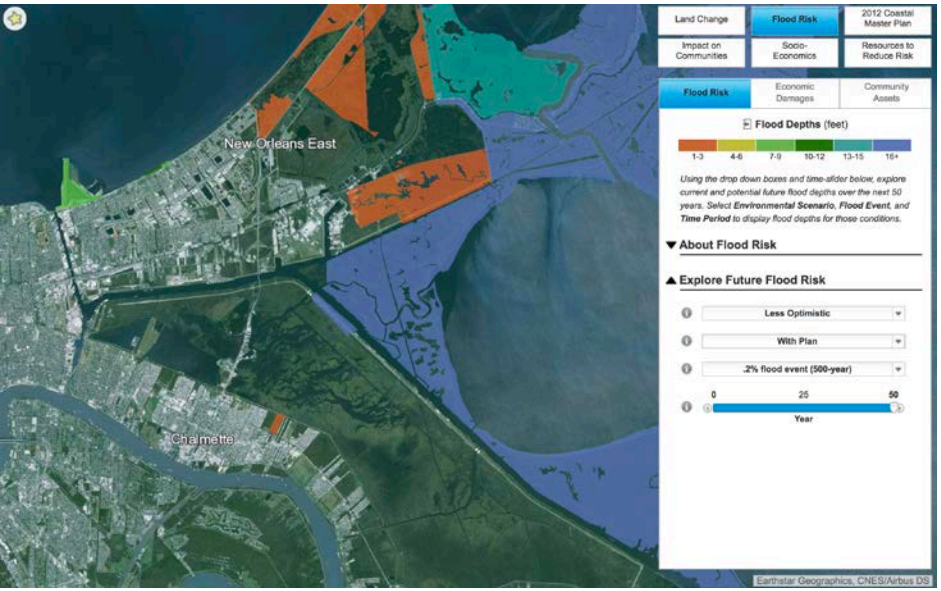
Or-175 — CONTROL POINT AND WELL NUMBER FOR WHICH HYDROGRAPH IS SHOWN (see fig. 12)

1.9 — WATER WITHDRAWAL CENTER--Average withdrawal rate in million gallons per day (Mgal/d) for 2007

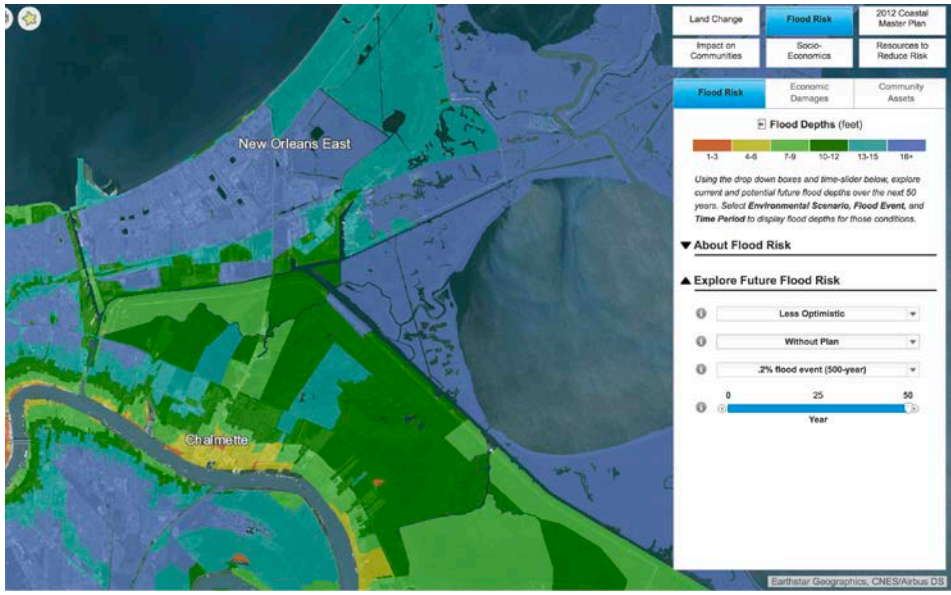
Exhibit AK-6

2012 Master Plan Analyses of 0.2% (500-year) Storm at Year 50 (2062)

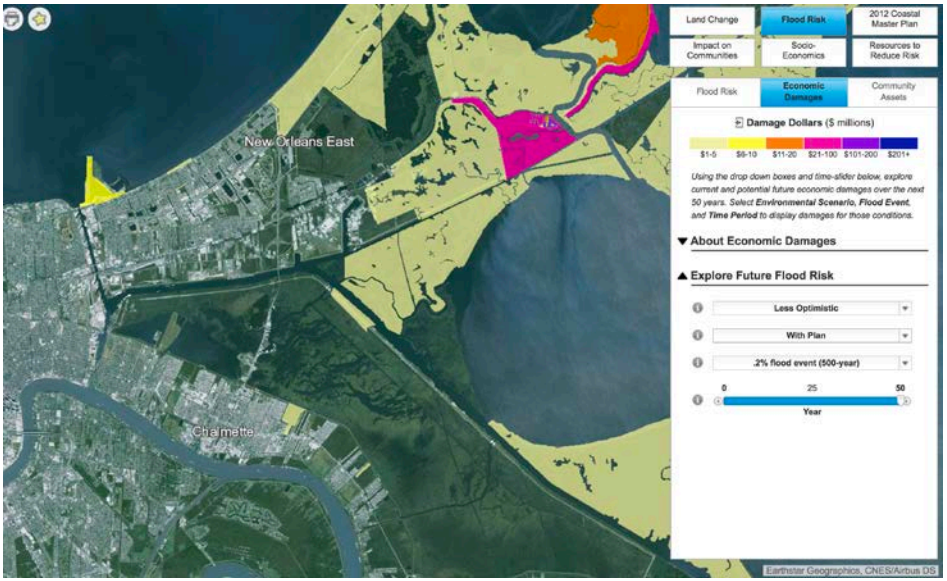
Flood Depths With MP Protection



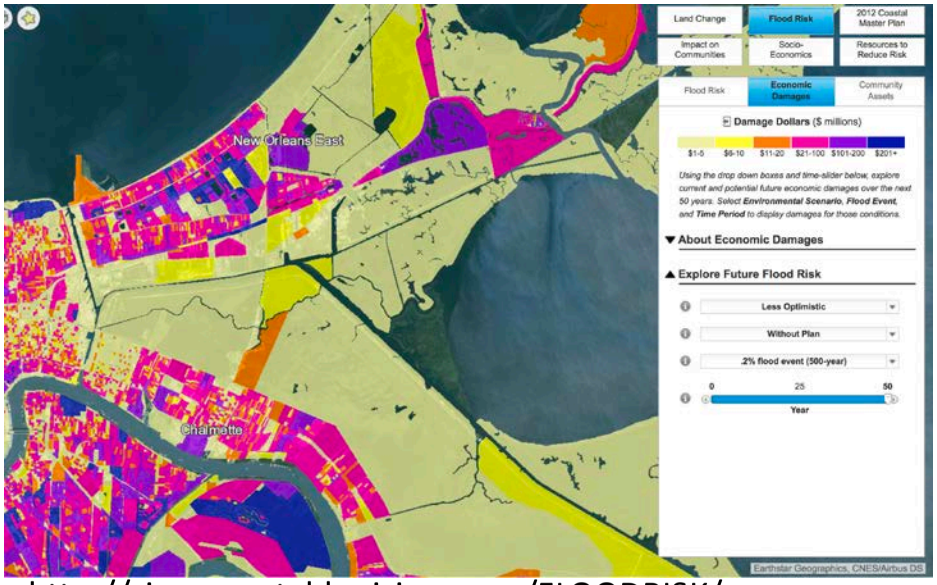
Flood Depths Without MP Protection



Expected Annual Damages with MP Protection



Expected Annual Damages w/o MP Protection



http://cims.coastal.louisiana.gov/FLOODRISK/

Exhibit AK-7

Environmental Scenarios in the 2017 Master Plan

ENVIRONMENTAL SCENARIOS

SCENARIO	PRECIP	ET	SEA LEVEL RISE	SUBSIDENCE	STORM FREQUENCY	AVG. STORM INTENSITY
2017 COASTAL MASTER PLAN						
LOW	>HISTORICAL	<HISTORICAL	1.41'	20% OF RANGE	-28%	+10.0%
MEDIUM	>HISTORICAL	HISTORICAL	2.07'	20% OF RANGE	-14%	+12.5%
HIGH	HISTORICAL	HISTORICAL	2.72'	50% OF RANGE	0%	+15.0%
COMPARED TO 2012 COASTAL MASTER PLAN						
MODERATE	>HISTORICAL	HISTORICAL	0.89'	20% OF RANGE	0%	+10.0%
LESS OPTIMISTIC	HISTORICAL	>HISTORICAL	1.48'	50% OF RANGE	+2.5%	+20.0%

(FEET/50 YEARS)

Exhibit AK-8

Excerpts from New Orleans and Orleans Parish Plans for Potential Floods and Land Loss

Flood Depths from a “10 Year” rainfall event, as described in the New Orleans Urban Water Plan

Engineers modeled the performance of existing and proposed systems during a theoretical 10-year storm (8.5 inches of rainfall over 24 hours, with a peak intensity of 3.43 inches/hour). The design storm was developed as an average of actual 10-year storms recorded in metro New Orleans over the past fifty years, and anticipates a 5% increase in rainfall intensity by 2025 as a result of climate change. The model takes into account rainfall distribution over time, and the effect that existing groundwater levels have on storage capacity.

PARISH FACT SHEET

ORLEANS PARISH

Orleans Parish is located south of Lake Pontchartrain and is the smallest parish by land area in Louisiana, but one of the largest in total population. The city of New Orleans and the parish of Orleans operate as a unified city-parish government. New Orleans has one of the largest and busiest ports in the world and the greater New Orleans area is a center of maritime industry and accounts for a significant portion of the nation's oil refining and petrochemical production. New Orleans also serves as a white-collar corporate base for onshore and offshore petroleum and natural gas production, in addition to being a city with several universities and other arts and cultural centers.

POPULATION

389,617

POPULATION CHANGE

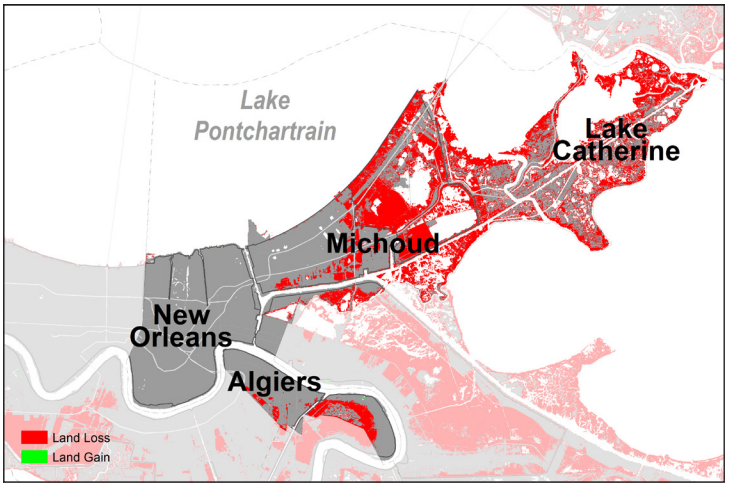
ECONOMIC DRIVERS

TRANSPORTATION & NAVIGATION
TOURISM
BUSINESS
OIL & GAS

Information from: 1) U.S. Census Quick Facts (2015 Estimate) 2) U.S. Census (2000-2010); and 3) City of New Orleans Economic Development.

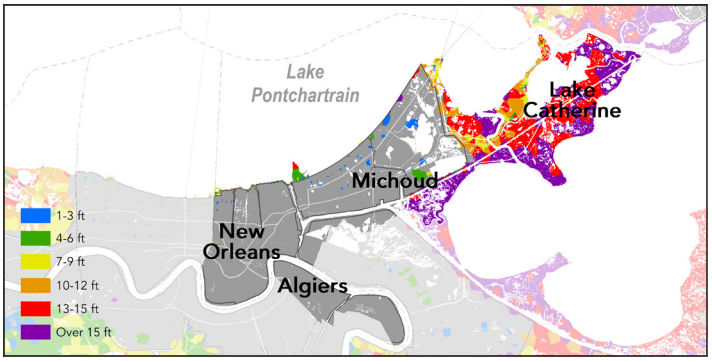
FUTURE WITHOUT ACTION LAND LOSS AND FLOOD RISK

YEAR 50, MEDIUM ENVIRONMENTAL SCENARIO

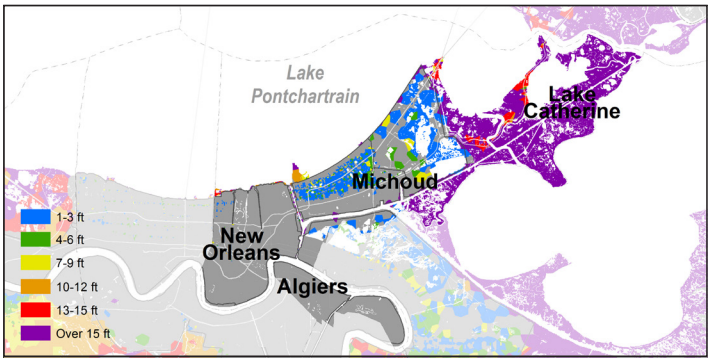


Land change (loss or gain) for year 50 under the medium environmental scenario with no future protection or restoration actions taken.

Orleans Parish faces significantly increased wetland loss over the next 50 years under the medium environmental scenario. With no further coastal protection or restoration actions, the parish could lose an additional 51 square miles, or 32% of the parish land primarily in the New Orleans East area. Additionally, with no further action, areas outside of the hurricane protection system face severe future storm surge based flood risk. Over the next 50 years (under the medium environmental scenario), 100-year flood depths increase to over 15 feet outside the levee system. Additionally, areas of New Orleans East may experience 1-6 feet future flood depths.



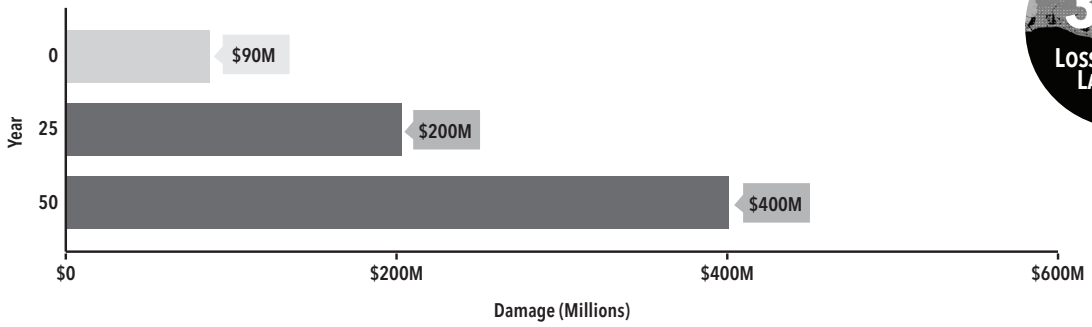
Flood depths from a 100-year storm event for initial conditions (year 0).

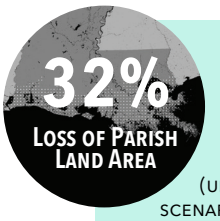


Flood depths from a 100-year storm event for year 50 under the medium environmental scenario with no future protection or restoration actions taken.

CURRENT & FUTURE ECONOMIC DAMAGE

FROM STORM SURGE-BASED FLOODING





ORLEANS PARISH MAY LOSE 32% OF THE PARISH LAND AREA OVER THE NEXT 50 YEARS (UNDER THE MEDIUM SCENARIO). FOR MORE INFORMATION ON LAND CHANGE, FLOOD RISK, AND RESOURCES TO REDUCE RISK, PLEASE VISIT:

CIMS.COASTAL.LA.GOV/MASTERPLAN

Parish's expected annual damage (EAD) from a 100-year storm event under the medium environmental scenario with no future protection or restoration actions taken. EAD is the average amount of damage projected to occur from storm surge flood events for a community, expressed as dollars of damage per year. While every community will not flood every year, these statistical averages show the expected flood risk and the damage that would be associated with that risk.

WHAT'S IN THE 2017 DRAFT COASTAL MASTER PLAN FOR ORLEANS PARISH?

PROJECT TYPES

Barrier Island Restoration*	Ridge Restoration	4 Marsh Creation	Sediment Diversion	1 Shoreline Protection	Hydrologic Restoration	2 Nonstructural Protection	2 Structural Protection

2017 MASTER PLAN PROJECTS

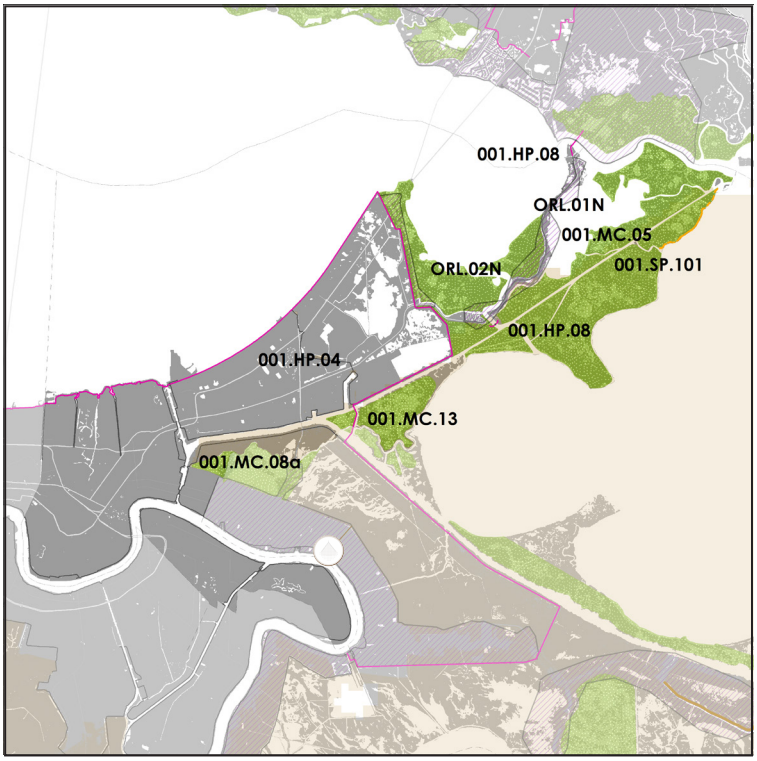
Risk Reduction Projects: Year 1-30
+ **001.HP.08:** Lake Pontchartrain Barrier
+ **ORL.01N:** Rigolets Nonstructural Risk Reduction
+ **ORL.02N:** Lake Catherine Nonstructural Risk Reduction

Risk Reduction Projects: Year 31-50
+ **001.HP.04:** Greater New Orleans High Level

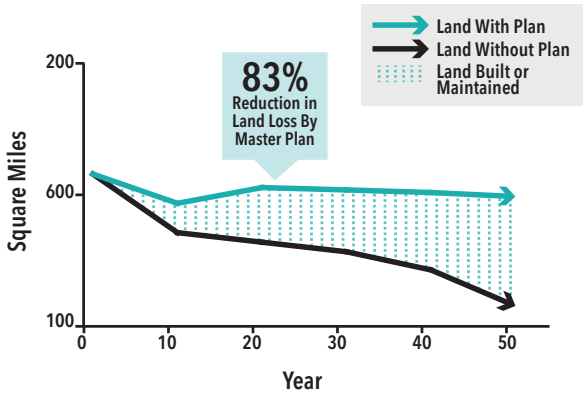
Restoration Projects: Year 1-10
+ **001.MC.05:** New Orleans East Landbridge Restoration*
+ **001.MC.13:** Golden Triangle Marsh Creation
+ **001.SP.101:** Unknown Pass to Rigolets Shoreline Protection

Restoration Projects: Year 11-30
+ **001.MC.05:** New Orleans East Landbridge Restoration*
+ **001.MC.08a:** Central Wetlands Marsh Creation - Comp A

Note: Projects with a (*) designate the implementation of a portion of a larger marsh creation project. In addition, Orleans Parish may also receive some benefits from sediment diversion projects in adjacent parishes.

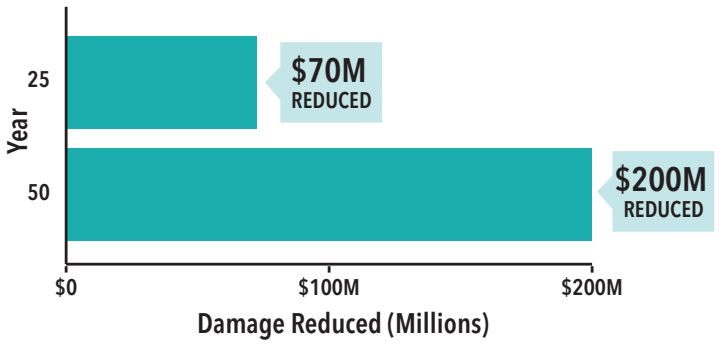


FUTURE LAND CHANGE



Land area (square miles) over time in Parish with and without the 2017 Coastal Master Plan projects under the medium environmental scenario.

REDUCTION IN ANNUAL ECONOMIC DAMAGE



Reduction in Parish's expected annual damage (EAD) over time with the implementation of the 2017 Coastal Master Plan projects under the medium environmental scenario.

For more information about the 2017 Coastal Master Plan and protection and restoration projects in your parish, please visit:
COASTAL.LA.GOV/2017

Exhibit AK-9

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References Cited in Testimony

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