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## DECLARATION OF DR. IVOR VAN HEERDEN

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1. My name is Ivor van Heerden. I am more than eighteen (18) years old and am competent to make this declaration.
2. I am an expert in the fields of wetlands and wetland hydrology, sedimentation, and eutrophication. I hold a doctorate degree in Marine Sciences from Louisiana State University (LSU), a master's degree in Marine Sciences from LSU, and bachelor's degrees in Geology and Botany from the University of Natal in South Africa. My c.v. is attached to this declaration.
3. This Declaration contains my expert opinions, which I hold to a reasonable degree of scientific certainty. My opinions are based upon sufficient facts or data, consisting specifically of a review of the Coastal Protection and Restoration Authority's (CPRA's) Joint Permit Application dated April 4, 2022, including attachments, and the U.S. Army Corps of Engineers April 25, 2022, Public Notice for the Proposed Ecological Swamp Enhancement Project (East Grand Lake), MVN-2016-01163-CM, and the relevant scientific literature. These are facts and data typically and reasonably relied upon by experts in the fields of environmental and civil engineering. Also, I have developed my opinions using reliable principles and methods which I have applied in a scientific and reliable manner to the facts of this subject matter.
4. I previously reviewed an earlier, 2018, version of the East Grand Lake project and produced an expert report on the project on April 2, 2018. That report and associated documents are attached.

5. After reviewing the 2022 Joint Permit Application and Public Notice for the East Grand Lake project, I submit the following opinions:

SUMMARY OF OPINIONS

- a. The East Grand Lake Project will have a negative impact on both the environment and the floodwater-carrying-capacity of the Atchafalaya Basin.
- b. The 2022 version of the East Grand Lake Project will not perform as described but rather will introduce sediment into wetlands areas already suffering from excessive sedimentation, to the detriment of the Basin’s aquatic ecosystems and the flood absorbing public health function of the Basin.
- c. The 2022 version of the East Grand Lake Project will introduce nutrient-laden river water into the wetlands, causing eutrophication and hypoxia.
- d. The 2022 version of the East Grand Lake Project is fundamentally similar to the 2018 version, and thus my conclusions pertaining to the 2018 version remain applicable. The documentary support of this 2022 version, however, is almost non-existent; there is no adequate explanation of the purported wetlands creation.

DETAILED OPINIONS

I. Review of the 2022 Joint Permit Application (JPA) dated 04/04/2022, CUP Permit Number P20220132.

The applicant’s project description on Page 2 and the need for the project statement on page 4 of the JPA do not correspond with the “Character of the work statements” as articulated in the Public Notices (PN) of March 19, 2018, and April 25, 2022. One important fact as pointed out in the PN’s as compared to the 2022 JPA is the following statement from the PN’s: “The applicant has requested Department of the Army authorization to clear, grade, excavate, and place fill to improve the north to south hydrologic flow in Bayou Sorrel during moderate river stages for improved circulation and ecological function throughout the back swamp of the East Grand Lake Area of the Atchafalaya Basin.”

There is a huge fallacy with this project work aspect in that any attempt to improve the south ward directed hydraulic flow down Bayou Sorrel means dramatically increasing the sediment load down this bayou directed at the GIWW (Gulf Intracoastal Waterway) and thus the section of the GIWW just downstream of the Bayou Sorrel lock that has to be dredged regularly. June 2021 the Waterways Journal reported “And while mariners can look forward to Bayou Sorrel reopening sometime soon, barring further rain, they will have to keep watch for the dustpan dredge Jadwin, which the New Orleans Engineer District has announced will begin dredging below the lock beginning June 8 and continuing for about a month.”

<https://www.waterwaysjournal.net/2021/06/08/corps-set-to-dredge-bayou-sorrel-as-water-levels-slowly-return-to-normal/>. The US Army Corps of Engineers (USACE) states that “Dredges serve to clear sediment in rivers which falls out where the current slows. Locations with slower current are typically channel crossings and harbor entrances. The unique features of a dustpan dredge help it to clear a path, making channels passable.”

Dustpan dredges have a dustpan-shaped appendage which lowers to a specific depth on the river bottom. Water jets agitate the sediment, and the dustpan vacuums up the agitated material and pumps it through the dredge and pipeline, where it is typically placed in swift water and resuspended as it continues its journey down river. The material can also be placed in a deep location if the current is not strong enough to wash it down river

(<https://www.mvk.usace.army.mil/Media/News-Stories/Article/2602135/usace-vicksburg-district-dredge-jadwin-embarks-for-2021-season-of-dredging/>). Dredging this section of the GIWW is a regular activity of the USACE. The sediment comes from the Atchafalaya River via Bayou Sorrel and is deposited just downstream of the Bayou Sorrel lock in the GIWW. The USACE either disposes of the dredge material in high spoil piles or using the dustpan dredge moves it further downstream or into shallow water bodies in the Basin adding to the siltation and loss of aquatic environments and/or wetlands in these areas.

Review of a portion of the project area, depicted below in Figure 1, reveals that if you examine the width of the GIWW Channel, as it known, between where Bayou Sorrel and Grande River meet adjacent to the artificial Guide levee and the actual GIWW south (Section 1) and downstream of the Bayou Sorrel Locks (Section 2), the latter is more than twice the width. So going from a confined narrow channel to a much wider channel means that the flow will lose inertia (it slows down) and rapid sedimentation will take place. As stated above sediment falls out when the current slows. The USACE has thus created a ‘sediment trap’ immediately downstream of Bayou Sorrel that has to be dredged regularly at tax payers’ expense. Any project that enhances flows down Bayou Sorrel will exacerbate this problem.

The sediment load that will settle out along the Elements (as further described below) will cause the nature of the vegetation to change from a primarily cypress-tupelo wetlands to a hardwood area that stays above water-level most or all of the year.

As greater amounts of sediment are introduced within the Basin, settling out and elevating ground levels throughout the area, the Basin's floodwater-carrying-capacity shrinks. This will adversely affect downstream communities that rely on the Basin to absorb annual floodwaters.

The April 2022 JPA mentions in the project description that one of the goals is to “Reduce stagnation in a portion of the Atchafalaya Basin by increasing north to south flow through the swamp”. As is so typical with these sorts of JPA and PN documents no data is presented to justify this statement. Van Heerden (2019) published a report after extensive study titled TURBIDITY, NITROGEN, AND DISSOLVED OXYGEN ABNORMALITIES IN THE ATCHAFALAYA BASIN 2016-2019 – A WORKING PAPER. One goal of this research was to better understand the causes of eutrophication and hypoxia in the Basin. This study included data from federal and state government sources. My main conclusion was that eutrophication and hypoxic events in the Atchafalaya Basin principally owe their origin to very nutrient rich (industrial fertilizer) Atchafalaya River floodwater entering the wetlands, aided in a large part by manmade canals, channels and cuts. Here microorganisms have a ‘Thanksgiving feast’ and the nutrients with the resultant reduction (consumption) of oxygen leading to eutrophication and at times hypoxia. This process is akin to the dead zones that characterize Louisiana, Mississippi and Alabama coastal waters once the Bonnet Carre' Spillway opens, as well as the infamous Gulf of Mexico dead zone. The introduction of riverine floodwater will simply introduce nutrients (fertilizers, farm runoff, and so on) that in turn triggers eutrophication and subsequent de-oxygenation of the water, destroying animal life.

This eutrophication triggering that drives the unnatural responses in the Basin reveals that future proposed management should not involve “so-called flushing projects” such as the East Grand Lake project. Rather this points to the need to think outside the box and recognize that this Basin, although in three separate parts due to levees, could well be managed as one unit – the original Atchafalaya Basin. Management such as the proposed EGL project are not the solution to dealing with eutrophication and hypoxia; instead it will exacerbate these negative impacts. <https://static1.squarespace.com/static/5afdef23a2772c8ce5112639/t/5fc7f644d347a13f0f808317/1606940255697/Turbidity+paper+2016+to+2019+finalv2.pdf>.

## II. Comparison of Joint public Notice (PN) 2018 and Public Notice (PN) 2022.

On the surface the PN (2022) has one less element but still claims the same area of benefit of 5560 acres; something is not right. Figure 2 is sheet 6 of the 2018 PN and reveals a claimed



Figure 1. Google Earth Image showing the very distinct difference in the widths of channels as marked.

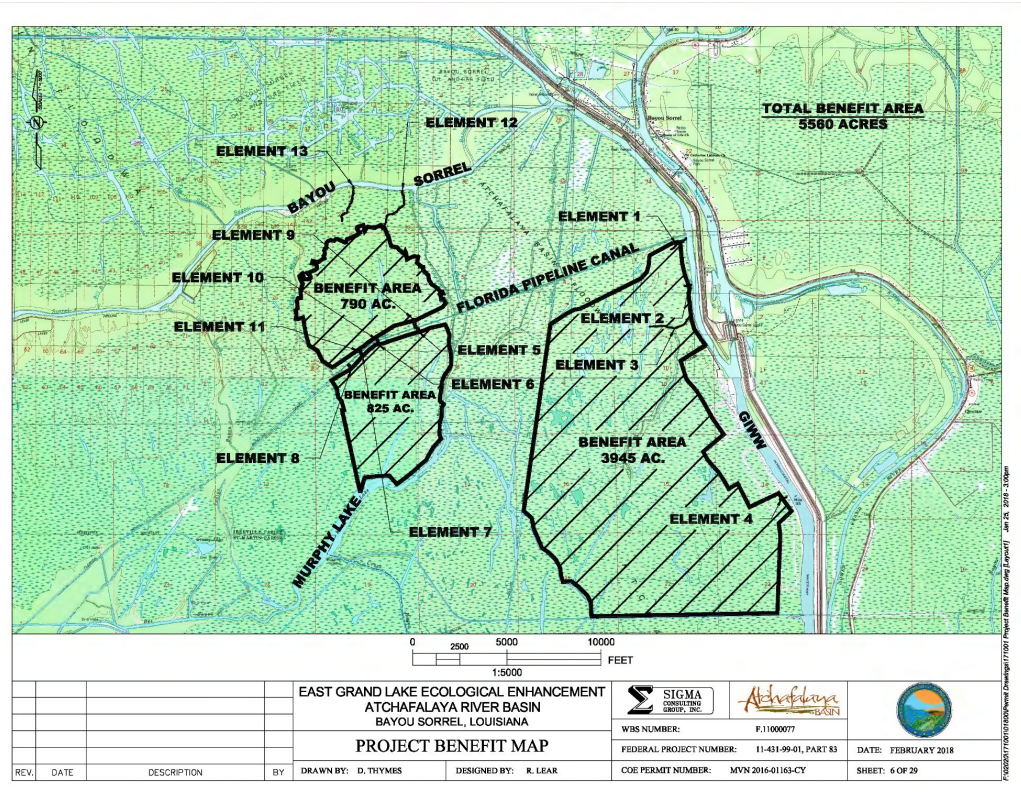


Figure 2. Sheet 6 of 2018 JPA.

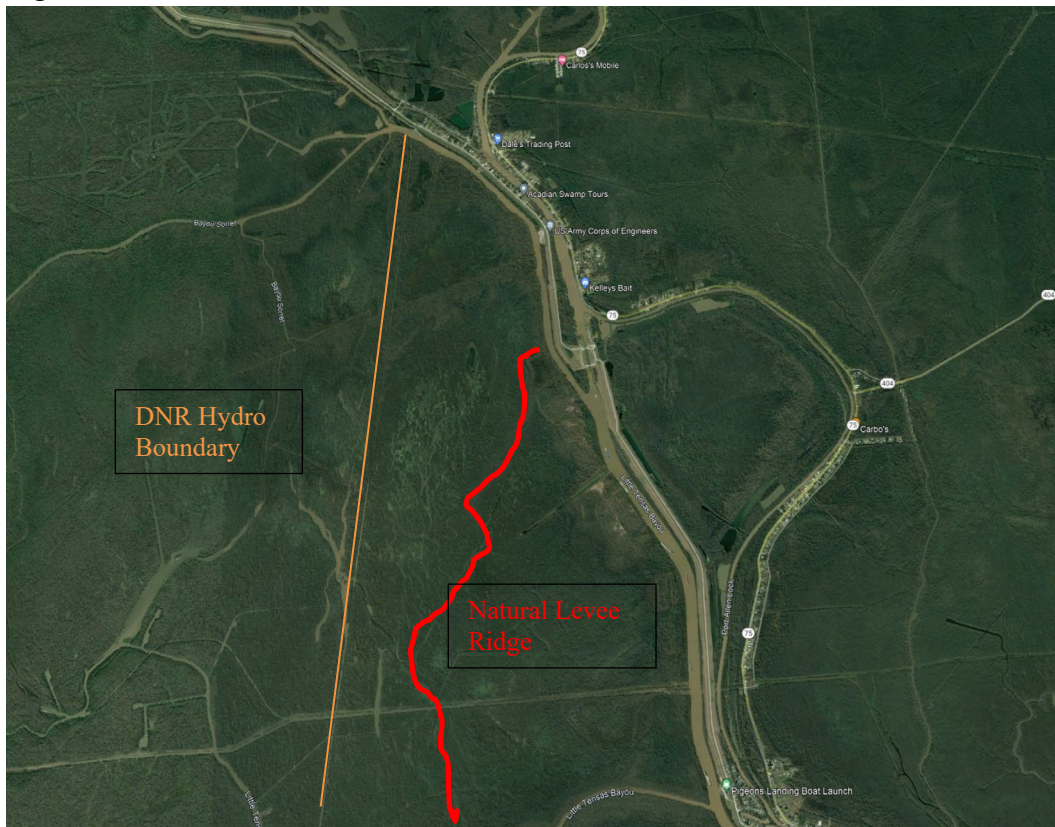


Figure 3. Google Earth Image of area displayed in Figure 2 with annotations.

substantial benefit area in the Vicinity of Element 4, which is missing from the 2022 PN. So, it would seem that the 2022 PN is claiming benefits well beyond the scope of the project given one less element. Missing from the 2022 PN is an image similar to Figure 2. Based on this analysis, it seems that the Corps or permittee has mistakenly inflated the benefit area since the project is “smaller” than the prior project and yet, proposes benefits outside the immediately adjacent area. (See Fig 2 Sheet 6 of 2018 JPN compared to claimed “benefit area” in 2022 JPN).

However, there is another error in this inflated benefit claim. As revealed in Figure 3 the area of benefit claimed for the Elements 1 through 4 in the 2018 PN do not fully consider the topography of the Basin and ignores the elevation difference (of mere centimeters) as well as flora. There is a very distinct and prominent former Bayou course running from Element 3 in a southerly direction all the way to beyond the project boundary (Red Trace on Figure 3). This natural levee would be a very effective hydrologic block to any flows that might make it down Elements 1, 2, and 3 into the Basin interior. Thus, the true area of so-called ‘benefit’ would be substantially less, by about 50% (Review figures 2 and 3 above). In this light all the claimed areas of benefit for this project need to be very carefully and scientifically assessed. Because the applicant has failed to provide modeled hydrologic data indicating that this ridge (former levee, or boundary identified above) would not impede the flow, the applicant has vastly overstated the benefit this project would produce. Indeed, more likely is that this levee would further “collect” additional sedimentation, causing the loss of high quality cypress wetlands and the formation of less ecologically desirable bottomland. This process has been described by van Heerden, 2019. Thus, the application is unreliable for the Corps review and should not be granted.

#### a. Review of Individual Elements.

The very first thing that stands out is that in the 2018 PN the side slopes of all excavated channels are 1 in 2 or 26.5 Degrees. This amount of created change in angle provides for a relatively stable slope. However, the side slopes for the 2022 PN excavated channels is 2 in 1 or a very steep 63.5 degrees. The angle of repose of soil is 36 degrees so anything steeper than that is inviting erosion, so in my opinion these channels, if excavated as proposed in the 2022 PN, will erode very quickly moving lots of coarse sandy sediments down into the swamp. Again, the applicant states that the project area will benefit long term by this flushing, and yet, this creation of steep side slopes will force greater erosion, and likely channelize and create further sedimentation in the very area the applicant articulates will receive the most benefit.

- 2018 Element 1 vs 2022 Element 1.

The very first thing that stands out is that since 2018 the ground elevations have dramatically risen by up to 5 feet, reflecting sedimentation in the area especially during the major flood years of recent such as 2018 and 2019. Along the Florida Gas Canal, the ground level has aggraded by at least 5 feet. Along the proposed cut of Element 1 the ground level has aggraded by 1 to 2 feet

over the same 4-year period. Ample evidence that this Basin is filling rapidly with sediment to the detriment of the aquatic ecosystems and the flood absorbing public health function of the Basin. Two feet in 4 years is an annual aggradation rate of 6 inches a year! This process reflects significant over topping of these high levees during floods negating any claims of a need to increase flushing.

The 2022 PN Sheet states that the 920 CY of excavated material will be spread up to 8 inches thick on the intended “benefit area”. The document very clearly states in more than one location that the material will be excavated. How are you going to spread the bucket excavated material over the area to a thickness of 8 inches without destroying the existing trees, which as pointed out in Sheet 2, are to remain? The applicant offers no support (i.e., scientific data or evidence) for its assertion that by spreading the excavated material 8 inches thick through the area, that the cypress forest would “benefit” and has not provided any evidence or scientific studies to suggest that such excavated material could be spread without further destruction of the existing wetlands adjacent to the project elements. In other words, once the dredge begins, the “benefit area” adjacent to the elements which all agree are protected wetlands would be negatively impacted by the excavation machines and workers in order to build the additional 8 inches of “new land.”

- 2018 Element 2 vs 2022 Element 2.

The very first thing that stands out is that since 2018 the ground elevations have dramatically risen by up to 4 feet, reflecting sedimentation in the area especially during the major flood years of recent such as 2018 and 2019. Along the proposed cut of Element 2, the ground level has aggraded by up to 4 feet in locations over the same 4-year period. Ample evidence exists that this Basin is filling rapidly with sediment to the detriment of the aquatic ecosystems and the flood absorbing public health function of the Basin. Four feet in 4 years is an annual aggradation rate of 12 inches a year, again indicating a major loss in the highest ecological value of cypress wetlands and accretion of bottomland that even the Corps and state agencies routinely require mitigation for when other projects shift one type of wetland to a “lesser quality” wetland.

The 2022 PN Sheet shows that the 224 CY of excavated material will be spread over an area of about 3,000 square feet, so to a thickness of 2 feet. The document very clearly states in more than one location that the material will be excavated. How are you going to spread the bucket excavated material over the designated disposal area to a thickness of 24 inches without destroying the existing trees, which as pointed out in Sheet 2, are to remain? Again, the applicant has simply failed to demonstrate how mitigation is not required for a project of this scope because the proposed project on its face admits that sedimentation and land accretion will occur on existing swampland.



- 2018 Element 3 vs 2022 Element 3

The 2022 PN Sheet shows that the 516 CY of excavated material will be spread over an area of about 6,875 square feet, so to a thickness of 2 feet. The document very clearly states in more than one location that the material will be excavated. How are you going to spread the bucket excavated material over the designated disposal area to a thickness of 24 inches without destroying the existing trees, which as pointed out in Sheet 2, are to remain?

- 2018 Elements 5 and 9 vs 2022 Elements 4 and 5.

These two sites reveal minor sedimentation, so the ground elevation has kept pace with relative sea level rise, so suspended sedimentation and thus flushing are naturally accruing here. After the project construction the canal would be closed to 0.0 ft NAVD 88. This will severely curtail access of indigenous crawfishermen to some of their traditional fishing areas.

There is a major discrepancy in the volumes of material to be excavated between the two PN's. Element 5 (2018 PN) has a dredging volume of 1030 CY as against the same site Element 4 (PN 2022) of 2138 CY, more than twice the volume while the latter is 20 feet shorter. Why? Element 9 of the 2018 PN has a dredge volume of 2410 CY and is 235 feet longer than the 2022 PN's Element 5 and is basically in the same location. The latter claimed volume to be excavated is 2381 CY. One of these dredge material volumes is incorrect, a confusing situation and fundamental flaw in the project application.

This same problem is present with other claims of volumes to be dredged when comparing the 2018 PN to the 2022 PN. These discrepancies make it difficult for the public to ascertain just what the impacts of all these proposed excavations should be. In general, the 2022 PN has smaller areas to be excavated but larger disposal volumes. For example, Element 8 of 2018 PN is about 5 times the area of Element 10 of the 2022 PN but only 200 more CY of excavated material. Again, this further supports the claim that the Corps cannot grant this permit with such major discrepancies apparent from the application.

- 2018 Element 12 vs 2022 Element 11.

Element 12 of 2018 PN is the same project location as Element 11 of the 2022 PN. The difference is that the 2018 Element is proposed at a bottom width of 25 feet with slopes of 1 in 2. The 2022 PN Element 11 has a proposed top width of 20 feet but very steep and easily eroded side slopes of 2 in 1. So, after a few flood events the latter top width would most likely erode to a 1 in 2 slope, with a lot of sediment thus moving down the channel into the interior swamps downstream. However, the claimed volume to be excavated in 2018 was 7600 CY while the claimed volume for the 2022 footprint is basically half, namely 3381 CY. Something does not make sense. But the most ecologically damaging aspect of this project is that spoil is to be placed, based on Sheet 12 of 15, up to 8 feet high. All the way down the depth of this channel the ground elevation is 8 to 10 feet NAVD 88, so the spoil piles that will result will be a wall, on

both sides of the channel will be around 16 feet NAVD 88. Note how the spoil disposal area as marked on Sheet 12 narrows from Bayou Sorrel as one moves down channel. So, in some places the spoil will be higher than 16 ft NAVD 88? In essence this project will result in a North to South flow barrier extending 2000 feet into the interior swamp that will totally inhibit east to west (and vice versa) flows and lead to levee flood water overtopping to be directed straight into the swamps with its high suspended loads. **This makes no ecological sense and is fundamentally at odds with the proposed benefit for this project since the creation of this channel will ensure high volumes of sediment, nutrient rich water, further hypoxia-creation at the end zone, and increase in erosion for these banks.**

The above arguments also hold true for 2018 Element 13 versus 2022 Element 12. But there is a very real and egregious error in the depiction of Element 12 in the 2022 JPA. It is claimed that 4359 CY of material will be spread 8 inches on either side of the channel to a maximum width of 30 feet based on the data presented in Sheet 13 of 15. But note that on Sheet 5 of the 2018 PN it is clearly articulated that the dredge spoil will be 6 feet in height (thickness), not 8 inches. Additionally, for the 2022 project, the footprint is not much different than that proposed in 2018, but at 9350 CY of dredge spoil, is almost twice than the 4359 CY claimed in 2022. How?

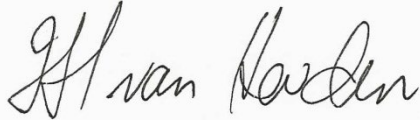
This permit has so many errors in it that are confusing, make no sense and give the public false impressions of the impacts of the ecologically unsound proposal, that it should be withdrawn immediately.

Lastly, all my previous reports that have discussed the real failings and ecological costs of the project, along with the very real public health impacts of hastening the infilling of the Atchafalaya Basin, are still as valid today as when they were made. I incorporate by reference my prior comments on the 2018 joint permit application as well as the following written studies as attached in the appendix.

#### CONCLUSION:

In my expert opinion, the 2022 Public Notice describes a series of poorly planned cuts that will allow fast-moving, nutrient and sediment-carrying river water to flow freely into low lying healthy Cypress–Tupelo swampland, depositing their suspended sediment loads in these stillwater interior areas, and causing eutrophication and basin infilling with a host of subsequent cascading adverse effects. These include impacts to the Basin’s ecological value, impacts to the Basin’s food chain, and its flood protection role that is so important to millions of residents of coastal Louisiana. This is especially true as Global Warming-induced very high rainfall events will increase. This project will reduce the Basin’s ability to absorb and hold floodwaters, as the ground level rises, and kill or alter the natural vegetation of the wetlands in the area. Moreover, the Public Notice documents are incomplete, riddled with errors or inconsistencies, and fail to provide the public (including other governing agencies) with the requisite information needed to

provide informed, meaningful comment. As such, based on the applicant's own failure to provide adequate and accurate information, this permit should be denied or the permit application withdrawn.



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Ivor van Heerden, Ph.D.

2<sup>nd</sup> September 2022

## Appendix

Van Heerden, I. LL, 1983. Deltaic sedimentation in eastern Atchafalaya Bay, Louisiana. Special Grant Publication. Baton Rouge, LA.: Center for Wetland Resources, Louisiana State University.

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Van Heerden, I.L. and M. Bryan, 2006. The Storm – What Went Wrong and Why during Hurricane Katrina – the Inside Story from One Louisiana Scientist Publ. Penguin/Viking, New York, New York, 308pp.