Comments on the
Integrated Draft Feasibility Study & Environmental Impact Statement
Pearl River Basin, Mississippi Federal Flood Risk Management Project
Hinds & Rankin Counties, MS
June 13, 2018

Submitted by

National Wildlife Federation

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The National Wildlife Federation appreciates the opportunity to submit these comments on the Integrated Draft Feasibility Study & Environmental Impact Statement Pearl River Basin, Mississippi Federal Flood Risk Management Project Hinds & Rankin Counties, MS (June 13, 2018) (the "DEIS"). The National Wildlife Federation strongly opposes the preferred alternative in the DEIS and urge the Corps of Engineers to develop and select an alternative that will protect communities and the ecological health of the Pearl River.

The National Wildlife Federation (NWF) is the nation's largest conservation education and advocacy organization. NWF has almost six million members and supporters and conservation affiliate organizations in forty-nine states and territories. NWF has a long history of advocating for the protection, restoration, and ecologically sound management of the Mississippi River. NWF also has a long history of working to modernize federal water resources planning to protect the nation's rivers, wetlands, floodplains, and coasts and the fish and wildlife that depend on those vital resources.

General Comments

The Pearl River Project would cause massive and irreparable harm to the Pearl River ecosystem, expose people and wildlife to significant amounts of toxic exposure, reduce vital freshwater flows and water quality all the way to the Gulf of Mexico, encourage development of areas that will remain at high risk of flooding, and impose enormous financial costs on federal taxpayers and local communities. This Project must be rejected.

The National Environmental Policy Act (NEPA) provides an important framework for developing and selecting alternatives that would reduce these significant burdens. However, rather than taking advantage of NEPA to do this, the DEIS appears to have been formulated to justify selection of the dangerous and highly controversial One Lake plan. Among many other problems, the DEIS fails to evaluate a host of highly reasonable alternatives; fails to meaningfully evaluate the project's adverse impacts to fish and wildlife, the environment, and public health and safety; and is scientifically unsound.

The National Wildlife Federation urges the Corps of Engineers and the non-Federal sponsor to reject the TSP and abandon the current study process. A meaningful consideration of a flood damage reduction project for the Pearl River requires development of a new and fundamentally different environmental impact statement that fully considers all potential impacts; evaluates all reasonable alternatives; and complies with Federal environmental laws and Corps of Engineers' planning requirements, including meaningful public notice and comment. Critically, any such study should develop—and select—an alternative that will protect people, wildlife, and the environment by utilizing natural infrastructure and a combination of targeted non-structural measures.

Specific Comments

I. The Tentatively Selected Plan Must Be Rejected Because It Will Devastate the Environment and Harm Public Health and Safety

The National Wildlife Federation strongly opposes the Tentatively Selected Plan (TSP) because, among other things, it will cause irreparable harm to the environment, expose the public to high levels of toxins, reduce water quality, and induce development in areas at significant risk of flooding. As

discussed throughout these comments, the harm from the TSP, which "is the most environmental damaging plan"[1] evaluated be far greater than acknowledged in the DEIS.

Among other harm, the TSP will:

- Fundamentally and irreparable alter the Pearl River ecosystem. The TSP will construct a new low-head dam on the Pearl River and dredge 25 million cubic yards of sediment—enough to fill 7,500 Olympic size swimming pools. These combined actions will transform a 10 mile stretch of riverine ecosystem into a 1,900-acre impoundment. The dredged sediment will then be used to raise and build a number of large levees and bury floodplain habitat to create new land for development purposes.

- Destroy vital wildlife habitat, including wetlands, small streams, sloughs, and diverse instream habitats that also provide critical ecosystem services, including natural flood protection. The DEIS acknowledges that more than 2,500 acres of wildlife habitat, including at least 1,500 acres of vital bottomland hardwood wetlands, will be destroyed. An additional 1,900 acres of diverse in-stream riverine habitat and ecologically vital small streams will be destroyed and turned into an impoundment. Though not acknowledged by the DEIS even more habitat will be lost as the fundamental changes to the form and function of the Pearl River system play out over time, including reduction and elimination of natural floodplain inundation.

- Adversely affect hundreds of species of fish and wildlife, including numerous species listed under the Federal Endangered Species Act or otherwise federally designated as at-risk, due to the habitat losses and fundamental transformation of the Pearl River ecosystem. As the U.S. Department of the Interior has advised, "[w]ildlife resources within the Pearl River Basin are dependent upon the diverse floral composition of associated forested wetlands" and "a higher percentage" of vertebrate wildlife species in the Basin "use bottomland hardwoods as primary habitat (habitat a species depends upon for reproduction and/or feeding during all or a portion of the year) than any other habitat type."[2]

- Threaten the health and productivity of vital downstream habitats, including the Mississippi Sound, Lake Borgne, and the Gulf of Mexico, including by reducing freshwater flows below the new dam, particularly during traditional low flow periods. The Pearl River is a major source of freshwater to the Gulf of Mexico and such reductions in flow could alter water quality and coastal salinities, affect sediment transport, and increase saltwater intrusion upriver. This would threaten the health and productivity of many downstream habitats including more than 125,000 acres of existing—and mostly public—conservation lands such as Bogue Chitto National Wildlife Refuge, Pearl River Wildlife Management Area, and Hancock County Coastal Preserve. Altered flows could also affect the already struggling oyster sector that relies on a well-balanced mix of fresh and salt water to ensure oyster survival and harvest.

- Expose people and fish and wildlife to high levels of toxins. The TSP's extensive dredging will re-suspend contaminated sediments, and the TSP will impact at least three highly contaminated

[1] U.S. Department of the Interior, Fish and Wildlife Service letter to Michael E. Goff at page 6 (August 16, 2018) (providing official comments on the DEIS).
[2] U.S. Department of the Interior, Fish and Wildlife Service letter to Michael E. Goff at page 1 (August 16, 2018) (providing official comments on the DEIS).

sites—a former creosote wood treatment facility and two unpermitted landfills. At least five additional contaminated sites, including one identified for federal Superfund cleanup, could also be affected.

- Impair water quality. The Project's large-scale dredging operations, major construction, and impoundment of a once free-flowing stretch of river, and large-scale destruction of wetlands that help filter pollutants will all adversely affect water quality and could facilitate harmful algal blooms. Project-induced changes in flow will also make it harder for downstream industrial and municipal facilities to meet their environmental permit discharge limits without installing costly new water treatment technologies, threatening water quality all the way to the Gulf of Mexico. More than one hundred downstream industrial users and municipalities in Mississippi and eight in Louisiana—including the sewage treatment plants for Jackson, Bogalusa and Pearl River as well as Georgia-Pacific and International Paper—depend on a reliable flow of freshwater from the Pearl River to meet their environmental permit discharge limits. The Project-induced future development will also increase runoff and cause other adverse impacts that will affect water quality.

- Induce development in areas that will remain at high risk of flooding, putting more people, homes, businesses, and properties at risk. The DEIS acknowledges that additional future development is both a goal and likely outcome of the TSP. This new development will occur in areas that will continue to have a high risk of flooding, including potentially catastrophic flooding when the TSP and/or existing levees overtop or fail. Under the best possible scenario, the TSP would only provide protection for the 100 year flood event and larger flood events will happen.

Because the TSP will cause irreparable harm to the functions of the Pearl River and its floodplain, it is clearly at odds with longstanding federal policy directing the protection of the nation's rivers, floodplains, and wetlands, including the National Water Resources Planning Policy established by Congress in 2007:

> "It is the policy of the United States that all water resources projects" are to, among other things, "protect[] and restor[e] the functions of natural systems and mitigat[e] any unavoidable damage to natural systems."[3]

We also note that because the DEIS lacks so much fundamental information, including information on flood heights and levels and extent of inundation, it is not possible to assess whether the TSP will in fact provide the level of flood damage reduction that it claims.[4]

For these reasons and the many other reasons discussed throughout these comments, the TSP must be rejected. Any additional consideration of a flood damage reduction project for the Pearl River must be

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[3] 42 USC § 1962–3.

[4] The DEIS also fundamentally misconstrues the existing project authorization. The DEIS states that: "Section, 3104 of WRDA 2007 Pearl River Basin, Mississippi. Authorizing construction of the NED plan, locally preferred plan, or a combination thereof, if environmentally acceptable and technically feasible." DEIS at 96. However, section 3104 of WRDA 2007 is actually much more restrictive. Due to the changes in the Project, including its significantly increased cost, new authorization will be required should the Corps of Engineers recommend construction of the TSP.

based on development of a fundamentally new draft EIS that: fully considers all potential impacts; evaluates all reasonable alternatives; and complies with Federal environmental laws and Corps of Engineers' planning requirements, including a new public notice and comment period. If such a study is pursued, the National Wildlife Federation urges the development and selection of an alternative utilizes natural infrastructure and a combination of targeted non-structural measures to protect people, wildlife, and the environment.

II. The DEIS Does Not Comply with the National Environmental Policy Act

The National Environmental Policy Act (NEPA) requires that an environmental impact statement identify the full scope of direct, indirect, and cumulative impacts of a proposed action and determine whether there are less environmentally damaging ways to achieve the project purpose. As discussed throughout these comments, the DEIS fails to satisfy these fundamental requirements.

A. The DEIS Purpose and Need Statement Does Not Comply with NEPA

An appropriate statement of Purpose and Need is crucially important to the adequacy of the DEIS because the Purpose and Need statement "delimit[s] the universe of the action's reasonable alternatives."[5] This is because "[o]nly alternatives that accomplish the purposes of the proposed action are considered reasonable, and only reasonable alternatives require detailed study. . . ."[6]

As the Courts have long acknowledged:

> "One obvious way for an agency to slip past the strictures of NEPA is to contrive a purpose so slender as to define competing "reasonable alternatives" out of consideration (and even out of existence). . . . If the agency constricts the definition of the project's purpose and thereby excludes what truly are reasonable alternatives, the EIS cannot fulfill its role. Nor can the agency satisfy the Act. 42 U.S.C. § 4332(2)(E)."[7]

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[5] *Citizens Against Burlington v. Busey*, 938 F.2d 190, 195 (D.C. Cir. 1991). *See also Wyoming v. U.S. Dep't of Agric.*, 661 F.3d 1209, 1244 (10th Cir. 2011) ("how the agency defines the purpose of the proposed action sets the contours for its exploration of available alternatives."); *Sierra Club v. U.S. Dep't of Transp.*, 310 F.Supp.2d 1168, 1192 (D. Nev. 2004) (citing *City of Carmel-By-The-Sea v. U.S. Dep't of Transp.*, 123 F.3d 1142, 1155 (9th Cir. 1997)).
[6] Webster v. U.S. Department of Agriculture, 685 F.3d 411, 422 (4th Cir. 2012); Methow Valley Citizens Council v. Regional Forester, 833 F.2d 810, 815-16 (9th Cir. 1987).
[7] *Simmons v. United States Army Corps of Eng'rs*, 120 F.3d 664, 666 (7th Cir. 1997). *See also City of Bridgeton v. FAA*, 212 F.3d 448, 458 (8th Cir. 2000); *City of Carmel-by-the-Sea v. United States Dep't of Transp.*, 123 F.3d 1142, 1155 (9th Cir. 1997) ("an agency cannot define its objectives in unreasonably narrow terms"); *Citizens Against Burlington, Inc. v. Busey*, 938 F.2d 190, 195-96 (D.C. Cir. 1991), *cert. denied*, 502 U.S. 994 (1991) ("an agency may not define the objectives of its action in terms so unreasonably narrow that only one alternative from among the environmentally benign ones in the agency's power would accomplish the goals of the agency's action"); *City of New York v. United States Dep't of Transp.*, 715 F.2d 732, 743 (2d Cir. 1983), *cert. denied*, 456 U.S. 1005 (1984) ("an agency will not be permitted to narrow the objective of its action artificially and thereby circumvent the requirement that relevant alternatives be considered"); *Methow Valley Citizens Council v. Regional Forester*, 833 F.2d 810, 815-16 (9th Cir. 1987) (impact statements must consider all reasonable alternatives that accomplish project purpose, but need not consider alternatives not reasonably related to purpose).

Accordingly, the Courts have made it clear that an agency may not define a project so narrowly that it "forecloses a reasonable consideration of alternatives"[8] or makes the final EIS "a foreordained formality."[9]

A proper statement of Purpose and Need must also consider "the views of Congress, expressed, to the extent that an agency can determine them, in the agency's statutory authorization to act, **as well as in other Congressional directives**."[10] These other Congressional directives include many that require and/or promote the protection and restoration of the nation's waters and fish and wildlife resources, including:

(1) The National Water Resources Planning Policy established by Congress in 2007. This policy requires "all water resources projects" to protect and restore the functions of natural systems and to mitigate any unavoidable damage to natural systems. 42 U.S.C. § 1962-3.

(2) The National Environmental Policy Act enacted in 1970. NEPA directs the "Federal Government to use all practicable means" to, among other things: (i) "fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;" (ii) ensure "safe, healthful, productive" surroundings for all Americans; and (iii) "attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences." 42 U.S.C. § 4331(b). NEPA states explicitly that the policies, regulations and laws of the United States "**shall** be interpreted and administered in accordance with the policies set forth in this Act." 42 U.S.C. § 4332(1) (emphasis added). NEPA also explicitly states that "policies and goals set forth in this Act are supplementary to those set forth in existing authorizations of Federal agencies." 42 U.S.C. § 4335.

(3) The many statutory directives to protect the environment and fish and wildlife contained in the Clean Water Act, the Endangered Species Act, the Clean Air Act, the Corps' civil works mitigation requirements (33 U.S.C. § 2283(d)), and the Water Resources Development Act of 1990 that changed the Corps' fundamental mission to "include environmental protection as one of the primary missions of the Corps of Engineers in planning, designing, constructing, operating, and maintaining water resources projects." 33 U.S.C. § 2316.

(4) The Fish and Wildlife Coordination Act enacted in 1958. The Fish and Wildlife Coordination Act directs that "wildlife conservation shall receive equal consideration and be coordinated with

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[8] *Fuel Safe Washington v. Fed. Energy Regulatory Comm'n*, 389 F.3d 1313, 1324 (10th Cir. 2004) (quoting *Davis v. Mineta*, 302 F.3d 1104, 1119 (10th Cir. 2002); *Citizens' Comm. To Save Our Canyons v. U.S. Forest Serv.*, 297 F.3d 1012, 1030 (10th Cir. 2002); *Friends of Southeast's Future v. Morrison*, 153 F.3d 1059, 1066 (9th Cir. 1998) ("An agency may not define the objectives of its action in terms so unreasonably narrow that only one alternative from among the environmentally benign ones in the agency's power would accomplish the goals of the agency's action".); *Simmons v. United States Army Corps of Eng'rs*, 120 F.3d 664, 666 (7th Cir. 1997); *City of New York v. United States Dep't of Transp.*, 715 F.2d 732, 743 (2d Cir. 1983), *cert. denied*, 456 U.S. 1005 (1984) ((holding that "an agency may not narrow the objective of its action artificially and thereby circumvent the requirement that relevant alternatives be considered); *Citizens Against Burlington, Inc. v. Busey*, 938 F.2d 190, 196 (D.C. Cir. 1991), *cert. denied* 502 U.S. 994 (1991).

[9] *City of Bridgeton v. FAA*, 212 F.3d 448, 458 (8th Cir. 2000) (quoting *Citizens Against Burlington, Inc. v. Busey*, 938 F.2d 190, 196 (D.C. Cir. 1991), *cert. denied* 502 U.S. 994 (1991); citing *Simmons v. U.S. Army Corps of Eng'rs*, 120 F.3d 664, 666 (7th Cir. 1997)).

[10] *Citizens Against Burlington, Inc. v. Busey*, 938 F.2d 190, 196 (D.C. Cir. 1991) (emphasis added).

> other features of water-resource development," and that water resources development is to prevent loss and damage to fish and wildlife and improve the health of fish and wildlife resources. Fish and Wildlife Coordination Act, 16 U.S.C. §§ 661, 662. *See* Section IV of these comments for a more detailed discussion of the Fish and Wildlife Coordination Act and its applicability to the Project.

Corps regulations in place since 1980 also make it clear that environmental protection and enhancement of the environment must be considered during the planning, construction and operation of projects:

> "Laws, executive orders, and national policies promulgated in the past decade require that the quality of the environment be protected and, where possible, enhanced as the nation grows. . . . **Enhancement of the environment is an objective of Federal water resource programs to be considered in the planning, design, construction, and operation and maintenance of projects.** Opportunities for enhancement of the environment are sought through each of the above phases of project development. Specific considerations may include, but are not limited to, **actions to preserve or enhance critical habitat for fish and wildlife; maintain or enhance water quality; improve streamflow**; preservation and restoration of certain cultural resources, **and the preservation or creation of wetlands.**"

33 C.F.R. § 236.4 (emphasis added).

The DEIS utilizes the following statement of Purpose: "to provide a recommendation for federal participation in Pearl River Mississippi, flood risk management along the Pearl River in Hinds and Ranking Counties." DEIS at 5. The DEIS statement of Need only discusses flood risks.

This Purpose and Need statement violates NEPA because it is: (1) so narrowly drawn that it effectively limits the analysis of alternatives to only those that will result in a federal project focused solely on flood risk; and (2) fails to incorporate the critically important Congressional directives mandating protection and restoration of fish, wildlife, and the environment as key objectives of water resources planning.[11]

To correct these failings, the National Wildlife Federation recommends adoption of the following, legally appropriate, Purpose and Need statement that would help ensure consideration of important and fully reasonable alternatives:

> The purpose of the Project is to reduce flood damages in the Jackson Metropolitan Statistical Area while protecting and restoring the ecological health of the Pearl River and its floodplain.
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> The need for this Project includes, the need to:
> (1) Improve the degraded conditions of the Pearl River and its floodplain;
> (2) Protect and restore important and diverse in-stream habitats;
> (3) Restore as much of the natural functions of the Pearl River as possible;
> (4) Conserve and restore populations of fish and wildlife species, including federally listed and at-risk species;
> (5) Reduce the risks of exposure to contaminated materials and the resuspension of toxic sediments;
> (6) Reduce the risk of flood damages; and

[11] See Citizens Against Burlington, Inc. v. Busey, 938 F.2d 190, 196 (D.C. Cir. 1991).

(7) Ensure full compliance with Federal laws and policies.

B. The DEIS Alternatives Analysis Does Not Comply with NEPA

The DEIS fails to satisfy NEPA's critically important and longstanding requirements for conducting an adequate analysis of alternatives which is the "heart of the environmental impact statement."[12]

NEPA requires that each EIS "[r]igorously explore and objectively evaluate all reasonable alternatives."[13] This requires a "**thorough consideration of all appropriate methods of accomplishing the aim of the action**" and an "**intense consideration of other more ecologically sound courses of action**."[14] Importantly, "the discussion of alternatives must be undertaken in good faith; it is not to be employed to justify a decision already reached."[15]

While an EIS need not explore every conceivable alternative, it must rigorously explore all reasonable alternatives that are consistent with its basic policy objective and that are not remote or speculative. A viable but unexamined alternative renders an EIS inadequate.[16] An alternative may not be disregarded merely because it does not offer a complete solution to the problem.[17] An alternative also may not be disregarded because it would require additional Congressional authorization. To the contrary, the alternatives analysis must "[i]nclude reasonable alternatives not within the jurisdiction of the lead agency."[18]

In comparing and analyzing potential alternatives, the DEIS must examine, among other things, the direct, indirect, and cumulative environmental impacts of the different alternatives, the conservation potential of those alternatives, and the means to mitigate adverse environmental impacts. 40 C.F.R. § 1502.16. A robust analysis of project impacts is essential for determining whether less environmentally damaging alternatives are available.

These steps are critical for ensuring that that an EIS conducts an "informed and meaningful" consideration of the alternatives, as required by law:

> "NEPA's requirement that alternatives be studied, developed, and described both guides the substance of environmental decisionmaking and provides evidence that the mandated decisionmaking process has actually taken place. "Informed and meaningful consideration of

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[12] 40 C.F.R § 1502.14.
[13] 40 C.F.R. § 1502.14.
[14] Environmental Defense Fund, Inc. v. Corps of Engineers of U.S. Army, 492 F.2d 1123, 1135 (5th Cir. 1974) (emphasis added).
[15] Citizens Against Toxic Sprays, Inc. v. Bergland, 428 F.Supp. 908, 933 (D.Or. 1977).
[16] E.g. Muckleshoot Indian Tribe v. U.S. Forest Service, 177 F.3d 800, 810, 814 (9th Cir. 1999).
[17] Natural Resources Defense Council, Inc. v. Morton, 458 F.2d 827, 836 (D.C. Cir. 1972).
[18] 40 C.F.R. § 1502.14(c); *Natural Resources Defense Council v. Morton*, 458 F.2d 827, 834-36 (D.C. Cir. 1972) (alternative sources of energy had to be discussed, despite federal legislation indicating an urgent need for offshore leasing and mandating import quotas; Department of Interior had to consider reasonable alternatives to offshore oil lease which would reduce or eliminate the need for offshore exploration, such as increased nuclear energy development and changing natural gas pricing, even though that would require Congressional action); *Environmental Defense Fund v. Froehlke*, 473 F.2d 346 (8th Cir. 1974) (acquisition of land to mitigate loss of land from river channel project must be considered even though it would require legislative action).

> alternatives – including the no action alternative – is . . . an integral part of the statutory scheme.[19]

As discussed below, the DEIS alternatives analysis violates NEPA because it: (1) fails to evaluate highly reasonable alternatives; and (2) fails to provide an informed and meaningful consideration of the alternatives that it does evaluate, including by failing to meaningfully evaluate the alternatives' direct, indirect, and cumulative impacts.

The DEIS also fails to identify the environmentally preferable alternative. Any Record of Decision for the final EIS for the Project would be required to identify the "environmentally preferable" alternative and agencies are encouraged to identify the environmentally preferable alternative in the EIS.[20] The environmentally preferable alternative is:

> "the alternative that will promote the national environmental policy as expressed in NEPA's Section 101. Ordinarily, this means the alternative that causes the least damage to the biological and physical environment; it also means the alternative which best protects, preserves, and enhances historic, cultural, and natural resources."[21]

Identification of the environmentally preferable alternative is critical so that the public and decision makers can fully assess the appropriateness of the preferred alternative:

> "Through the identification of the environmentally preferable alternative, the decisionmaker is clearly faced with a choice between that alternative and others, and must consider whether the decision accords with the Congressionally declared policies of the [National Environmental Policy] Act."[22]

The DEIS, however, does not identify the environmentally preferable alternative, which based on the information provided in the DEIS would either be the No Action alternative or the Non-Structural alternative since neither would result in any of the extensive array of adverse impacts and neither would require compensatory mitigation. Instead, as noted by the Department of the Interior[23] and as clearly evident, the DEIS selects the most environmentally damaging alternative as the TSP.

1. The DEIS Does Not Evaluate Highly Reasonable Alternatives

The DEIS clearly violates NEPA because it fails to evaluate highly reasonable alternatives to determine whether there are less damaging ways to achieve the project purpose. A viable but unexamined alternative renders an EIS inadequate.[24] The DEIS also violates NEPA because it fails to look at an

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[19] *Bob Marshall Alliance v Hodel*, 852 F.2d 1223, 1228 (9th Cir. 1988) (internal citations omitted).
[20] 40 C.F.R. § 1505.2.
[21] CEQ Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations, 46 Fed. Reg. 18026 (March 23, 1981), as amended, Question 6.
[22] Id.
[23] U.S. Department of the Interior, Fish and Wildlife Service letter to Michael E. Goff at page 6 (August 16, 2018).
[24] E.g. Muckleshoot Indian Tribe v. U.S. Forest Service, 177 F.3d 800, 810, 814 (9th Cir. 1999).

appropriate range of alternatives.[25] The greater the impacts and scope of the proposed action, the greater the range of alternatives that must be considered.[26]

For example, the DEIS fails to consider the following alternatives:

(1) An alternative that utilizes restoration activities to reduce flood damages in the project area while also improving the ecological health and resiliency of the Pearl River, its floodplain, and the fish and wildlife species that rely on those resources. Flood damage reduction benefits can be achieved through, among other things, restoring the Pearl River floodplain wetlands, restoring wetlands along upstream tributaries, and restoring the in-stream functions of the Pearl River and its tributaries.[27]

(2) An alternative that utilizes a combination of restoration activities in conjunction with targeted buy-outs, targeted flood-proofing, and appropriate levee setbacks.

(3) An alternative that utilizes a combination of targeted buy-outs, targeted flood-proofing, and appropriate levee setbacks.

(4) An alternative that examines levee setbacks and floodplain restoration at highly constricted areas along the Pearl River, including the levee setbacks from RM 288 to RM 291 identified in the TSP and floodplain restoration between RM 284 and RM 290.

(5) An alternative that examines options to address any unaddressed root causes of the 1979 Flood as identified in the report by the Comptroller General of the United States, entitled *Improvements Being Made In Flood Fighting Capabilities in the Jackson, Mississippi, Area*, CED-80-36 (December 18, 1979).

(6) An alternative that examines options for changes to the operation of the Ross Barnett Reservoir to aid in flood damage reduction, both as a stand-alone alternative and in combination with other alternatives.

None of these were assessed in the DEIS.

The single nonstructural alternative carried through beyond the initial screening of alternatives did not examine combinations of different non-structural measures, and did not consider targeted nonstructural measures. Instead, it only considered buying out every single structure located in the 100 year

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[25] *E.g. Resources Ltd., Inc. v. Robertson*, 35 F.3d 1300, 1307 (9th Cir. 1993).

[26] *Alaska Wilderness Recreation and Tourism v. Morrison*, 67 F.3d 723, 729 (9th Cir. 1995); *see Sierra Club v. Espy*, 38 F.3d 792, 803 (5th Cir. 1994) (the range of alternatives that must be considered in an environmental assessment decreases as the environmental impact of the proposed action becomes less and less substantial).

[27] Natural infrastructure has a demonstrated track record of providing vital flood damage reduction benefits. For example, Wetlands prevented $625 million in flood damages in the 12 coastal states affected by Hurricane Sandy and reduced damages by 20% to 30% in the four states with the greatest wetland coverage. Narayan, S., Beck, M.B., Wilson, P., et al., The Value of Coastal Wetlands for Flood Damage Reduction in the Northeastern USA. Scientific Reports 7, Article number 9463 (2017), doi:10.1038/s41598-017-09269-z (available at https://www.nature.com/articles/s41598-017-09269-z). Additional examples of natural infrastructure and non-structural measure successes in reducing flood damages and improving ecosystem health are provided at Attachment A to these comments.

floodplain of the project area. Appendix A at 9-10. According to the DEIS, this would entail buying out 3,100 structures, including residential structures, commercial structures, government and public buildings, schools, and hospitals." E.g., DEIS at 101, 132, 145, Appendix A at 10.

Notably, this "all-or-nothing" alternative was in fact rejected during the preliminary screening phase, making its inclusion in the DEIS meaningless window dressing. DEIS, Appendix A at 10. Other single focused nonstructural measures—including smaller buyouts—were also rejected during the preliminary screening phase. The discussion of these other nonstructural alternatives is highly limited, collectively covering just 2 pages. DEIS, Appendix A at 10-12.

To comply with NEPA, the DEIS must rigorously explore and objectively evaluate a full range of alternatives, including the highly reasonable alternatives outlined above, that will improve ecological conditions while also reducing flood damages.

2. The Alternatives Analysis Appears Designed To Justify The Pre-Selected TSP

As noted above, "the discussion of alternatives must be undertaken in good faith; it is not to be employed to justify a decision already reached."[28] Regrettably, however, the alternatives analysis appears to have been developed to do just that.

Critically, the alternatives appear to have been developed in such a way that the TSP would be the only economically viable alternative. The non-TSP alternatives in the DEIS appear to include unnecessary elements that significantly increase their costs, while the costs of the TSP appears to be significantly understated.

Alternative A (Buy Out): Alternative A would buy-out every single structure located in the Project Area's 100 year floodplain, which according to the DEIS would require a buy-out of 3,100 structures that include "residential structures, commercial structures, government and public buildings, schools, and hospitals." DEIS at 113-114; E.g., DEIS at 101, 132, 145, Appendix A at 9-10.

The few paragraphs that describe the actions that would be carried out under Alternative A: (1) do not include any type of meaningful explanation as to why it would be necessary or appropriate to buy-out every single structure in the 100-year floodplain; (2) do not include any information on how the number of structures was calculated; and (3) do not provide any information on how the potential cost of buying out those structures was calculated. *See* DEIS at 113-114, Appendix A at (9-10).

Not surprisingly, this "all-or-nothing" buy-out alternative was rejected in the preliminary screening stage based solely on cost considerations, making its inclusion in the DEIS meaningless window dressing. *See, e.g.,* DEIS at ix ("Although logistics and costs render it an impractical alternative, the measure of relocation structures (buy-out) was carried forward in the final array of alternatives in order to comply with the USACE EP 1165-2-1 requirement that a standalone non-structural alternative be considered through the entire process."); DEIS at 113 ("reference to this alternative in future discussions will be limited."). Notably, the DEIS does recognize that the cost of acquiring the structures at highest risk—those impacted by the 2% exceedance flood (i.e., the 50 year flood) "would be low." DEIS, Appendix A at 11. Despite the significantly lower cost and high benefits, this alternative was also eliminated at the preliminary screening stage and was not carried forward into the DEIS. DEIS, Appendix A at 11.

[28] Citizens Against Toxic Sprays, Inc. v. Bergland, 428 F.Supp. 908, 933 (D.Or. 1977).

A meaningful analysis of a non-structural alternative would carefully assess a combination of non-structural measures that could be utilized to provide flood damage reduction benefits, including such things as a combination of targeted buyouts for repetitive loss properties in conjunction with targeted flood-proofing, appropriate levee setbacks, and natural infrastructure measures (floodplain, wetland, and stream restoration both along the Pearl River and in tributaries upstream).

Alternative B (Levee Plan): Alternative B also appears to include elements that were not, and likely cannot be, justified in order to support a pre-ordained decision to reject this alternative.

Alternative B includes construction of seven pumping stations that add $311.6 million to the initial costs of this Alternative—significantly more than the cost of the levees and almost half of the cost of the entire Alternative B. DEIS, Appendix C at 7 (the pumping plants are estimated to cost $181.99 million plus a risk contingency of $129.62 million; the levees alone are estimated to cost $135.36 million plus a risk contingency of $100.07 million)**.** Notably, the 2007 study on the Project did not include pumping plants in the levee plan, and "previous Corps studies found that pumping facilities (i.e., plants) were not economically justified, with costs exceeding benefits by at least an 8 to 1 margin for each of the pump areas (1994 USACE draft Feasibility Study)."[29]

The DEIS does not explain why the pumping facilities are now justified and provides only the following cursory and unsupported statements regarding the "need" for the pumping plants:

- "From updated interior analysis, it appears levees without pumps will put property in low areas behind levees at an unreasonable level of flood risk." DEIS, Appendix A at 34-35.

- "Also, pumps were not proposed in the 2007 draft report. When levees are placed across streams and drainage ways, the risk of flooding is created because closing the gates leaves no exit route for drainage behind the levees. Pumps are typically needed to insure that levee obstructions do not increase flooding. Pumps to move water over the levees would make the alternative more effectual by reducing the risk of flooding behind the levees from interior drainage; however, pumps can drive the costs up considerably. From updated interior analysis, it appears that levees without pumps will put property behind the levees at an unreasonable risk of flooding in low lying areas behind levees. Without pumps, flood events on the Pearl River are highly likely to result in ponding behind the levees." DEIS at 33.

- "Although pumps were not included in the preliminary draft plan of 2007, no interior analysis was performed to determine impacts of levees without pumps at these locations. Updated information and analysis of interior areas presented significant impacts and risk associated with levees without pumps." DEIS at 175.

The National Wildlife Federation was unable to locate any information in the DEIS or Appendices that identified the specific "updated interior" study, or explained or quantified the contents of that study. Without this information, it is impossible for the public or decision makers to determine whether or not the pumping plants are in fact a necessary component of Alternative B.

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[29] U.S. Department of the Interior, Fish and Wildlife Service letter to Michael E. Goff at page 11 (August 16, 2018) (providing official comments on the DEIS).

Alternative C (Channel Improvements Plan): While the other alternatives appear to include unnecessary components that significantly increase costs, Alternative C significantly understates the costs association with its implementation. For example:

- The DEIS vastly understates the costs of remediating the three contaminated sites that will be impacted by the TSP and does not discuss the potential clean-up costs that would be required if the TSP in fact impacts any of the other five highly contaminated sites in and near the Project area. The only potential clean-up costs identified in the TSP are $8 million (or $12.8 million with contingencies) for "landfill excavating/lining" associated with levee construction. DEIS, Appendix C at 13. Remediation of contaminated sites will be a critical prerequisite to project construction and will require much more work than "landfill excavating/lining."

  For comparison, a relatively straight forward clean-up of a 22 acre Southeastern Wood Treating Plant Superfund site, which essentially consists of one ditch located along Batchelor Creek in Canton, MS, is estimated to cost $18 million. The National Wildlife Federation understands that the costs of cleaning up the contaminated sites that will be affected by the TSP will be vastly higher – likely in the range of hundreds of millions of dollars – because the clean-ups will be more extensive and more complicated. For example, the highly contaminated Jackson Creosote Slough covers 141 acres of mostly wetlands and oxbow lakes. Remediation of this site will require an extensive and complicated clean-up effort that will involve excavation, construction of slurry walls, clay caps, liners, and groundwater extraction wells among other things. The costs of transporting contaminated soil by rail car for disposal can cost upwards of $500/ton.

- The DEIS does not include any costs associated with critical testing for contaminated sediments, the special dredging techniques and equipment required to safely remove contaminated sediments, or the costs for properly disposing of contaminated sediments. As noted above, the costs of transporting contaminated soil by rail car for disposal can cost upwards of $500/ton. Proper testing, dredging, and disposal of toxic sediments will add significant costs to the TSP.

- The DEIS vastly understates the costs of mitigation for the Project, including by understating the impacts of the TSP, failing to propose mitigation to address all fish and wildlife impacts as required by law, failing to account for the costs needed to ensure wetland hydrology as part of its mitigation plans, and failing to prepare and account for the full costs of implementing the specific mitigation plan that is required by law for this Project. The DEIS also fails to provide any justification or explanation for the mitigation costs it does include. Necessary mitigation is discussed in detail below.

C. The DEIS Impacts Analysis Does Not Comply With NEPA

In comparing and analyzing potential alternatives, the DEIS must examine the direct, indirect, and cumulative environmental impacts of the different alternatives, the conservation potential of those alternatives, and the means to mitigate adverse environmental impacts. 40 C.F.R. § 1502.16. A robust analysis of project impacts is essential for determining whether less environmentally damaging alternatives are available.

Direct impacts are caused by the action and occur at the same time and place as the action. Indirect impacts are also caused by the action, but are later in time or farther removed from the location of the action. 40 C.F.R. § 1508.8. Cumulative impacts are:

> "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time."

40 C.F.R. § 1508.7. A cumulative impact analysis ensures that the agency will not "treat the identified environmental concern in a vacuum."[30] All "reasonably foreseeable" direct, indirect and cumulative environmental impacts must be analyzed.[31] "If it is reasonably possible to analyze the environmental consequences in an EIS...the agency is required to perform that analysis."[32]

An EIS must utilize "quantified or detailed information" when analyzing impacts.[33] The DEIS may not rely "on conclusory statements unsupported by data, authorities, or explanatory information."[34] This is because:

> "A conclusory statement unsupported by empirical or experimental data, scientific authorities, or explanatory information of any kind not only fails to crystalize the issues, but affords no basis for a comparison of the problems involved with the proposed project and the difficulties involved in the alternatives."[35]

Accordingly, the DEIS must supply supporting data and authorities, and explain how and why it has drawn the conclusion it has reached. "General discussion of an environmental problem over a large area" also is not sufficient and cannot satisfy NEPA.[36]

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[30] *Grand Canyon Trust v. FAA*, 290 F.3d 339, 346 (D.C. Cir. 2002).
[31] 40 C.F.R. § 1508.8.
[32] *Kern v. U.S. Bureau of Land Mgmt.,* 284 F.3d 1062, 1072 (9thCir.2002).
[33] *Neighbors of Cuddy Mountain v. U. S. Forest Service*, 137 F.3d 1372, 1379 (9th Cir. 1998); *Ecology Center v. Castaneda*, 574 F.3d 652, 666 (9th Cir. 2009) (requiring "quantified or detailed data"); *Natural Resources Defense Council v. Callaway*, 524 F.2d 79, 87 (2d Cir. 1975).
[34] Id.
[35] *Seattle Audubon Society v. Moseley*, 798 F. Supp. 1473, 1479 (W.D. Wash. 1992), *aff'd* 998 F.2d (9th Cir. 1993); *see also, e.g.*, *Klamath-Siskiyou Wildlands Ctr. v. BLM*, 387 F.3d 989,995-996 (9th Cir. 2004) ("generalized or conclusory statements" in cumulative effects analyses do not satisfy NEPA); *Friends of the Earth v. Army Corps of Engineers*, 109 F. Supp. 2d 30, 38 (D.D.C. 2000) (ruling that the Corps must "provide further analysis" to satisfy NEPA because the Corps did not provide "the basis for any" of its claims that the project would have an insignificant impact or that fish and other organisms would simply move to other areas); *Sierra Club v. Norton*, 207 F. Supp. 2d 1310, 1335 (S.D. Ala. 2002) (stating "Defendant's argument in this case would turn NEPA on its head, making ignorance into a powerful factor in favor of immediate action where the agency lacks sufficient data to conclusively show not only that proposed action would harm an endangered species, but that the harm would prove to be 'significant'").
[36] South Fork Band Council v. U.S. Dept. of Interior, 588 F.3d 718 (9th Cir. 2009); Neighbors of Cuddy Mountain v. U.S. Forest Service, 137 F.3d 1372, 1379-80 (9th Cir. 1998).

An EIS also must be based on "high quality" science and information and the agency preparing the EIS must "insure professional integrity, including scientific integrity, of the discussions and analysis in environmental impact statements."[37] Importantly, if information that is essential for making a reasoned choice among alternatives is not available, the agency **must** obtain that information unless the costs of doing so would be "exorbitant."[38]

The Corps must also candidly disclose the risks of its proposed action and respond to adverse opinions held by respected scientists:[39]

> "'Where scientists disagree about possible adverse environmental effect, the EIS must inform decision-makers of the full range of responsible opinion on the environmental effects.' Where the agency fails to acknowledge the opinions held by well respected scientists concerning the hazards of the proposed action, the EIS is fatally deficient."[40]

It is not sufficient to include the statements of independent experts, including the Independent External Peer Review panel, in an Appendix or some other document. The expert comments must be included and appropriately responded to in the impacts section of the DEIS.[41]

As discussed below and throughout these comments, the DEIS violates these fundamental NEPA requirements.

1. The DEIS Lacks Scientific Integrity

The DEIS lacks scientific integrity. Among other problems the DEIS: fails to include and assess vital existing data and scientific analyses; fails to obtain information that is critical to making a reasoned choice among alternatives—including for areas where there are significant data gaps; draws contradictory conclusions; fails to justify its conclusions; and fails to provide data sources, survey and study methods and results, and needed citations to scientific literature. All scientific methods and data used for decision making should be explained and detailed; and the studies, models, and data used must be made available to the public and decision-makers so it can properly be vetted. Without this information, the public cannot know if data were properly applied and interpreted and cannot verify that acceptable and logical conclusions were reached.

The following are just some examples of these failings:

1. DEIS at 61, line 32 to DEIS at 63, line 16: To fill in the "sparse" water quality data for the Study Area, the non-Federal sponsor collected some additional water quality samples during two sampling periods in July 2014. Sampling one month of one year for water quality data is a highly improper sampling regime that, among other problems, cannot account for critically

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[37] 40 C.F.R. § 1502.24 ("Agencies shall insure professional integrity, including scientific integrity, of the discussions and analysis in environmental impact statements"); *Earth Island Inst. v. U.S. Forest Service*, 442 F.3d 1147, 1159-60 (9th Cir. 2006) (quoting 40 CFR §1502.24).
[38] 40 C.F.R. § 1502.22.
[39] *Seattle Audubon Soc'y v. Mosely*, 798 F.Supp. 1473, 1482 (W.D. Wash. 1992) (citing *Friends of the Earth v. Hall*, 693 F.Supp. 904, 934, 937 (W.D.Wash. 1988).
[40] *Friends of the Earth v. Hall*, 693 F. Supp. 904, 934 (W.D. Wash. 1988) (citations omitted).
[41] Id.

important seasonal and yearly variations. As noted at DEIS page 65, an appropriate assessment of water quality data can only be conducted if the data complies with the CALM requirements, which among other things requires collection of samples during multiple sampling periods over multi-year periods.

2. DEIS at 65, line 30 to DEIS at 66, line 1: States that the current water quality data do not meet the requirements needed for a "rigorous assessment of the water quality status of the Pearl River near Jackson" but nevertheless concludes that a review of the water quality data collected "shows that the river water quality typically meets the criteria for the parameters that are measured." This conclusion, however, is contradicted by the list of the Pearl River on the 2008 § 305(b) list for total nitrogen and total phosphorus and the development and then updating of TMDLs for this segment of the river. According to the DEIS at 65, the 2014 TMDL calls for a 70% reduction in total phosphorus and a 30% reduction in total nitrogen entering the river from all sources. In addition, the DEIS does not consider water quality downstream. The Louisiana 2016 list of impaired waters lists the Pearl River as impaired for sulfates for "sources outside of their jurisdiction" which most likely means Mississippi.

3. DEIS at 70, line 14: Acknowledges that only a "limited geomorphic assessment was conducted for the Project Area" despite the fundamental changes that the TSP will cause to the form and function of the Pearl River system. A comprehensive geomorphic assessment that also assess downstream changes caused by the Project is critical for under the full suite of impacts of the TSP. Moreover, this "limited" assessment is itself rife with problems, including those identified throughout these comments.

4. DEIS at 73, lines 10-18 ("Planform Geometry"): References historical photography from two periods without providing the time periods covered, or why that review justified a conclusion of low-to moderate channel migration during the 1990s. References a "cursory inspection of earlier aerial photography" without describing what that means or providing a justification for why such a cursory review could appropriately be used to draw any type of conclusion.

5. DEIS at 73, lines 19-24 ("Cross Sectional Area"): References cross section surveys at bridge crossings without providing the location of the survey, the time period, the data obtained, or any justification for the conclusion that "there does not appear to be any significant degradation or aggradation."

6. DEIS at 74, lines 9-19 ("Channel Erosion"): Provides an estimated erosion rate without providing the data sources used to reach this estimate, identifying what aerial photography was used and compared and for what years, and without providing how determinations made regarding sands and clays.

7. DEIS at 74, lines 20-29 ("Tributary Inputs of Sediment"): Discusses a "limited investigation of tributaries" without providing any information on the dates, locations, methods used, data obtained, or justification for the conclusions drawn.

8. DEIS at 74, line 30 to DEIS at 75 line 4 ("Watershed"): States that a detailed analysis of sediment delivery from the watershed was not conducted for the DEIS. Instead a general estimate of sediment delivery was made based on data from 1979 (or earlier) despite the fact that the 1979 data did not include any urban areas similar to the Study Area. Also reached a conclusion on an estimated sediment yield based on this data without providing a justification for the estimate or the underlying data used to justify the estimate. Sediment yields based on 40 year old data for areas with dissimilar land use cannot provide an accurate estimate of sediment yields for the TSP.

9. DEIS at 78, lines 19-20: References "the most recent surveys and studies" without providing any information on those surveys and studies, including the locations, dates, methods used, data obtained, or citations for those surveys and studies.

10. DEIS at 79, lines 4-10: States that the "quality of the fisheries habitats within the Pearl River through the Project Area has been significantly degraded due to siltation and other adverse impacts associated with past flood control projects completed within the area. As urban growth continues in the Study Area, the habitats of fish and other aquatic organisms may be further reduced, unless preservation measures are undertaken by local interests." This conclusion directly contradicts: (1) the conclusions at DEIS 73-74 the DEIS that there have not been any significant change due to sedimentation (including no changes to cross sections) and that there does not appear to be any excess sedimentation in the Pearl River; and (2) the conclusion at DEIS 78, lines 12-14 that "for the most part, the fishery resources within the watershed are considered to be of high quality and a testament to the overall health and water quality conditions with the river system."

11. DEIS at 82, lines 5-10: References the collection of bald eagle data without providing the times of year that the data was collected.

12. DEIS at 84, lines 31-36: References survey information on the Pearl Darter without providing citation to the surveys, the dates the survey was conducted, the areas covered by the survey, the methods used, or the data obtained.

13. DEIS at 85, lines 6-8: States that no federally listed plant species were observed during field studies without providing information on when, how, or where the field surveys were done and without providing any information on the data from those studies.

14. DEIS at 86, line 24: References a Cultural Resources Survey without providing a reference or citation to that survey.

15. DEIS at 170, lines 20-26: References rainfall in the basin, states that 33% is typically runoff, refers to a 1.1% rate of potential water losses downstream, and concludes that this loss could be less than 50% of this amount by the time it reaches Lake Borgne without providing any sources or citations for this data, or justification for these calculations and conclusions.

16. DEIS at 175, lines 25-31: References a "review" of tributaries and draws numerous conclusions regarding flood profiles without providing any information on the locations or conditions present during the "review", a citation for the review, the methods used to conduct the review, the data collected during the review, or the justifications for the conclusions drawn.

17. DEIS at 177, lines 15-24: References "a more detailed analysis" being carried out which is then referred to as "preliminary assessment" on channel stability for Alternative C without providing any information on the location of the assessment, the methodology used for the assessment, the data collected from the assessment, the model used in the assessment, or the justifications for the conclusion that potential sediment issues "do not appear to be unmanageable, and a sediment management plan can be developed that will be feasible from an engineering, economic, and environmental perspective."

18. DEIS at 177, lines 27-28 and 30-31: Concludes that cumulative impacts "to erosion and sedimentation can be confined in a small reach within the project limits" and that "[d]ownstream sedimentation and erosion are not seen as a long term concern when compare with other existing projects in the area" without providing any data, analysis, justification, or citation to studies to support these conclusions; without providing any information on the "small reach" in the project area; and without providing any information on the "other existing projects" referred to or the rates of sedimentation and erosion at those sites.

19. DEIS at 181, lines 21-23: Concludes that "[c]onversion of habitats and removal of vegetation across the watershed in general has not been significant and future conversion activity throughout the watershed is not anticipated" without providing any data, analysis, justification, or citation to studies to support these conclusions. This conclusion is also contradicted by findings in Appendix D at page 10 of the Wetlands Delineation and Determination Report: "Much of the proposed project area is influenced heavily by the adjoining urban development activities, as well as, previous flood control projects that have affected the historical flows within the drainage basin over time."

Additional significant problems with the impacts analysis—including critical analyses that are entirely absent from the DEIS—are discussed in the following sections of these comments.

2. The DEIS Does Not Establish Accurate Baseline Conditions

The DEIS violates NEPA because it fails to accurately establish and consider baseline conditions. It is well established that:

> "Without establishing the baseline conditions ... there is simply no way to determine what effect the [action] will have on the environment, and consequently, no way to comply with NEPA."[42]

[42] *Half Moon Bay Fisherman's Mktg. Ass'n. v. Carlucci,* 857 F.2d 505, 510 (9th Cir.1988). As a result, the entire DEIS is inadequate as a matter of law. *E.g.*, *Friends of Back Bay v. U.S. Army Corps of Engineers*, 681 F.3d 581, 588 (4th Cir. 2012) (an EIS fails to comply with NEPA if it relies on a "material misapprehension of the baseline conditions.")

Properly establishing baseline conditions requires accurate and comprehensive data on baseline conditions. Without baseline data, "an agency cannot carefully consider information about significant environment impacts. Thus, the agency fails to consider an important aspect of the problem, resulting in an arbitrary and capricious decision."[43] If information that is essential for making a reasoned choice among alternatives is not available, the Corps must obtain that information unless the costs of doing so would be "exorbitant."[44]

Properly establishing baseline conditions also requires a clear description of "how conditions have changed over time and how they are likely to change in the future without the proposed action" to determine whether additional stresses will push this system over the edge.[45] This is particularly important in situations, like those in the Pearl River, where the environment has already been greatly modified by human activities because it "is often the case that when a large proportion of a resource is lost, the system nears collapse as the surviving portion is pressed into service to perform more functions."[46]

The DEIS fails to meet these requirements because the DEIS:

(a) Lacks fundamental baseline data on water quality, contaminated sediments, sedimentation rates and patterns, and tributary conditions.

(b) Lacks fundamental baseline data on the Pearl Rivers' natural hydrograph and changes to that hydrograph over time.

(c) Lacks fundamental baseline data on elevations and levels of inundation of the Pearl River floodplain.

(d) Lacks fundamental baseline data on vitally important habitat types, including diverse in-stream river habitats and small streams.

(e) Lacks important baseline information on the ecological health of wetland and floodplain habitats.

(f) Lacks fundamental baseline data on losses of diverse river habitats and wetlands over time, including losses caused by construction and operation of the Ross Barnett Reservoir and other major projects affecting the Pearl River and its floodplain.

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[43] *N. Plains Res. Council, Inc. v. Surface Transp. Bd.*, 668 F.3d 1067, 1083, 1085 (9th Cir. 2011) (the EIS did "not provide baseline data for many of the species" of concern and thus "did not take a sufficiently 'hard look'" to fulfill its NEPA-imposed obligations at the impacts as to these species).

[44] 40 C.F.R. § 1502.22. *See also*, *Half Moon Bay Fisherman's Mktg. Ass'n.* 857 F.2d 505; N. Plains Res. Council, 668 F.3d 1067; *Gifford Pinchot Task Force v. Perez*, No. 03:13-CV-00810-HZ, 2014 WL 3019165, at *27-29 (D. Or. July 3, 2014), *appeal dismissed* (Dec. 23, 2014), *appeal dismissed* (Dec. 29, 2014); *Idaho Conservation League v. U.S. Forest Serv.,* No. 1: 11 –CV–00341 -EJL, 2012 WL 3758161, at *16 (D.Idaho Aug. 29, 2012) (analyzing an EA, ruling that the agency needed to conduct a baseline study and actual investigation of groundwater before reaching a conclusion regarding the impacts of a mining project on groundwater).

[45] Council on Environmental Quality, Considering Cumulative Effects Under the National Environmental Policy Act at 41 (January 1997).

[46] *Id*.

(g) Lacks fundamental baseline data on fish and wildlife species, including migratory species, and their critical habitat needs. The DEIS fails to identify the vast majority of the many hundreds of individual species that rely on the Pearl river and its floodplain, including particularly those species that rely on diverse in-stream river habitats, small streams in the river's floodplain, and floodplain wetlands. Critically, the DEIS also fails to provide information on the various habitats needed throughout the full life cycles of those species, including habitat and flows needed to support breeding (including access to the floodplain), rearing, feeding, and resting.

(h) Lacks fundamental baseline data on plant species, including wetland plant species.

(i) Lacks fundamental baseline data on flood heights and levels and extent of inundation.

This information is critical to understand the direct, indirect, and cumulative impacts of the Project, including biological (as opposed to just spatial) impacts of the Project. Without this information, it is also not possible to assess whether the TSP will in fact provide the level of flood damage reduction that it claims.

3. The DEIS Does Not Meaningfully Evaluate the Risks of Toxic Exposure

The DEIS does not evaluate the risk of exposing the public and fish and wildlife to toxic contaminants. The DEIS does provides no evaluation of contaminated sediments and no meaningful evaluation of the risk of exposure through the disturbance of HTRW sites.

The TSP would dredge 25 million cubic yards of sediment—enough to fill 7,500 Olympic size swimming pools—from a 10 mile stretch of the Pearl River. The dredged sediment will then be used to raise and build a number of large levees and bury floodplain habitat to create new land for development purposes. Despite this extensive sediment dredging and disposal, the DEIS: does not examine whether the sediments that will be dredged are contaminated; does not examine the potential impacts of re-suspending and disposing of contaminated sediments; and does not examine and adopt special dredging and disposal plans to minimize any such impacts. This is a major failing that puts the public and fish and wildlife at significant risk.

It is highly likely that there are contaminated sediments in the area to be dredged under the TSP for at least the following reasons:

(a) The DEIS acknowledges that sediments in the Pearl River consist primarily of fines (silts and clay), which are highly susceptible to binding and retaining toxic contaminants. Appendix C (Preliminary Sediment Analysis) at 13 (64.5% of streambank sediment samples are fines (silt and clay) and 35.5% are sand; and 64.4% of tested eroding streambanks are fines while 35.6% of such tested sites are sands).[47]

[47] The DEIS limits it review of sediments to analyzing a small handful of locations to assess sediment sources into the Pearl River. As part of this analysis, it looks at the composition of the sediments (i.e., whether the sediments consist of fines (silt and clay) or sand). This inappropriately limited review is rife with problems, including: only a few sediment samples were taken from an extremely limited area; samples were taken at only one depth in all but one location; outdated or irrelevant data was used to assess composition at some locations instead of direct measurements; graphs in the analysis are misleading; and the analysis draws several inaccurate conclusions.

(b) The DEIS acknowledges that toxics are present in sites located in or near the Project Area. Identified contaminants include: benzene, barium, cadmium, cobalt, creosote residuals, lead, lindane, manganese, mercury, nickel, raw sewage, sodium pentachlorophenate, pentachlorophenol (PCP), phenyl mercuric acetate, polynuclear aromatic hydrocarbons (PAHs), and zinc. DEIS, Appendix C (Environmental Evaluation of Hazardous, Radioactive, and Toxic Waste (HTRW) Sites); DEIS at 91 ("Creosote residuals were disposed or released to backwater sloughs of the Pearl River adjacent to the west side of the site. Creosote residuals continue to exist in sediments in the slough and potentially in groundwater beneath the former facility treatment area adjacent to the slough.").

(c) The Pearl River flows through highly urbanized areas that discharge runoff and pollutants into the Pearl River. The DEIS recognizes that "[r]unoff from urban areas can carry pollutants such as nutrients, sediment, and oil and grease to receiving waterbodies" and that other pollutants are present in the Pearl River. DEIS at 138; see, e.g., DEIS at 138-139 (Numerous facilities discharge toxics into the Project Area, including the Entergy Rex Brown Plant which discharges cooling water, storm water runoff, low volume wastewater, oil and grease, pH, TSS, temperature, total residual chlorine, chromium, and zinc into a tributary located within the area to be impounded.)

(d) The Pearl River flows through agricultural lands that discharge runoff carrying fertilizers and pesticides into the Pearl River. Extensive agricultural areas also exist within the Project Area. DEIS at 60 ("Approximately 553 acres or 18.9% of the land within the Project Area is currently in agricultural use" and an "additional 249 acres or 8.5% are classified as hay fields.").

According to the HTRW analysis, three highly contaminated sites in the Project Area will be directly affected by the project dredging and impoundment, resulting in resuspension of contaminated sediments and other toxic releases:

1. **The Gulf States Creosoting Company Site and the Creosote Slough:** This site is located directly in and along the edge of the proposed impoundment. The TSP would dredge this site resulting in the "introduction of large amounts of creosote impacted sediments to the Pearl River." DEIS, Appendix C (HTRW) at 15. The contaminated wetlands referred to as the Creosote Slough "will become a part of the bottom of the channel improvements" further increasing exposure to toxic sediments and other toxic releases. DEIS, Appendix C (HTRW) at 17. This site is contaminated with creosote chemical contaminants used in preserving wood, along with barium, cobalt, manganese, zinc, and polynuclear aromatic hydrocarbons (PAHs). DEIS, Appendix C (HTRW).

2. **The Gallatin Street Dump Site:** This site is located directly in the proposed impoundment. Half of this site would be dredged, with no plan for disposing of the sediments in a confined and safe disposal site, while the remaining portion would be directly adjacent to the new impoundment. The HTRW analysis acknowledges that the TSP would result in the "introduction of large

However, even this flawed and extremely limited testing shows that Project Area sediments include large areas of silts and clays which are more likely to be contaminated than sands. DEIS at 74; DEIS, Appendix C (Preliminary Sediment Analysis).

amounts of sediment to the Pearl River" from this site. DEIS, Appendix C (HTRW) at 14. This site is contaminated with cadmium, lead, and nickel, and its leachate visibly seeps through the soils and eroding bank into the Project site. The Gallatin Street Dump Site has also historically taken in hazardous waste including but not limited to hospital waste; municipal sewage sludge; raw sewage from septic tankers; dead animals; and contaminated produce, poultry, dairy products, and meat. DEIS, Appendix C (HTRW).

3. **The Lefleurs Landing Site (also known as the Jefferson Street Landfill):** This site is located directly along the edge of the proposed channel improvements, where materials from the landfill have eroded into the water. Confirmed contaminants at this site include benzene and polynuclear aromatic hydrocarbons (PAHs), and the evaluation mentions that soil and groundwater samples were tested for other contaminants but does not share the results of this testing. The TSP would disturb contaminated sediments in this area and result in other releases of toxic materials. DEIS, Appendix C (HTRW).

The HTRW recommends further study for each of these sites to determine the full extent of contamination and the likely impacts, and calls for remediation for each site. While the HTRW briefly lists remediation options and states that some form of mitigation/remediation will be carried out, neither the HTRW nor the DEIS include a plan for carrying out these additional studies or mitigation/remediation efforts. The DEIS also does not account for the highly significant costs of such study and remediation. The DEIS nevertheless concludes, without any supporting evidence, that the long-term environmental impact of the Project would be positive with respect to these sites.

The HTRW analysis also identifies additional potential sources of highly contaminated sediments and other toxic discharges, but the DEIS does not evaluate the impacts of these sites despite their proximity to the Project Area:

1. **The Rival Manufacturing Companies National Priorities List (NPL) Site:** This highly toxic site is excluded from the impacts assessment due to the distance from the project site and Environmental Protection Agency (EPA) remediation efforts. However, this site is located just 1,500 feet east of the project site, and the EPA's remediation of the site was not complete as of the time of the 1993 EPA report that the HTRW assessment references in making this conclusion. DEIS, Appendix C (HTRW) at 9. Moreover, this site is located within the Pearl River watershed, which the Preliminary Sediment Analysis identified as one of the major sources of sediment to the Project Area, making it a potentially significant source of contamination. DEIS, Appendix C (HTRW); DEIS, Appendix C (Preliminary Sediment Analysis) at 12.

2. **Sonford Products Lumber Mill Superfund Site:** This highly toxic site is also excluded from the impacts assessment due to the distance from the project site and EPA remediation efforts. However, the Sonford Superfund Site is only 0.5 miles east of the project site, and the EPA's remediation of the site was not complete as of the time the HTRW assessment was completed. Moreover, this site is located within the Pearl River watershed, which the Preliminary Sediment Analysis identified as one of the major sources of sediment to the Project Area, making it a potentially significant source of contamination. DEIS, Appendix C (HTRW); DEIS, Appendix C (Preliminary Sediment Analysis) at 12.

3. **Multiple automotive junkyards:** The HTRW evaluation identifies multiple automatic junkyards in the Project Area, with the largest junk yard site located directly along the eastern edge of the proposed channel improvements near RM 287, and three other junk yards located within a few thousand feet east of the Project between RM 290 and 288. DEIS, Appendix C (HTRW) at 22 Figure 1. Automotive junkyards historically "have been known to contribute hydrocarbons, metals, solvents, and other CoCs [Compounds of Concern] to the environment." DEIS, Appendix C (HTRW) at 10. However, the HTRW asserts that there is no readily available information about the presence or absence of such contaminants and recommends "investigation and characterization of these sites" before any construction is carried out. DEIS, Appendix C (HTRW) at 10.

The HTRW analysis makes it clear that "[c]onstruction activities have the potential to increase noise levels, **erosion and runoff of silt**, generation of **air borne dust**, and the **release of hazardous substances** from these HTRW sites." DEIS, Appendix C (HTRW) at 16 (emphasis added). The HTRW analysis also identifies the potential for dangerous public health impacts from the TSP dredging of the City of Jackson's secondary/back up drinking water source:

> "**The dredging of sediments and subsurface soils** in the Pearl River could potentially increase the turbidity of the surface **waters to levels unacceptable for human consumption**; therefore, the City of Jackson would need to evaluate temporary water supply alternatives during the duration of dredging and construction activities."

DEIS, Appendix C (HTRW) at 16 (emphasis added).

The high potential for resuspension of contaminated sediments and other toxic releases—and the implications of those releases for human health and healthy populations of fish and wildlife—must be examined in the DEIS. Critically, the DEIS must conduct a comprehensive assessment of the massive amounts of sediments to be dredged under the TSP, and develop detailed remediation, dredging, and disposal plans that will protect the public and wildlife from direct, indirect, and cumulative levels of toxic exposure. The DEIS should must also fully study the risk of contamination from each of the identified HTRW sites and develop and include detailed remediation plans for those sites. The costs of sediment testing, additional studies, remediation, special dredging techniques, and legally acceptable disposal methods must be fully accounted for as a Project cost.

4. The DEIS Does Not Meaningfully Evaluate the Impacts on Sediment Loading, Sediment Transport, Hydrology, and Hydraulics in the Pearl River

The extensive dredging, restriction of flow, and destruction of the floodplain are both intended to—and will—result in significant morphological changes to the Pearl River, the River's floodplain, small streams and sloughs, and tributary streams. Meaningfully assessing these changes and their biological implications requires extensive analysis and modeling of river hydrology, hydraulics, sediment loading, and sediment transport. These critical assessments, however, are not included in the DEIS rendering the DEIS woefully inadequate.

For example, understanding the sediment loading and transport processes, including the effect of the Project on those processes, is critical for determining whether the TSP impoundment will become a sediment trap; cause tributary head-cutting and erosion; or reduce the amount of sediments reaching,

nourishing, and building critically important coastal wetlands. These sediment processes are fundamentally affected by river hydrology, hydraulics, and morphology.

To meaningful assess sediment loading and transport properties, among other things the DEIS must examine particle size, settling velocity, specific gravity, and fraction distribution within each particle size—for both bed load and suspended load – in the Project Area and key tributaries. The DEIS would also need to analyze and account for annual and seasonal sediment volumes entering the Pearl River, particularly in the Project Area, and how those volumes are affected by the combined influences of channel conveyance, flood hydrographs (i.e., rising leg and falling leg), bed load, suspended sediment load, and sediment transportation.

Instead of conducting this vitally important assessment, the DEIS instead provides only an extremely limited Preliminary Sediment Analysis that is itself fundamentally flawed, as highlighted in Section II.C.1 of these comments. The DEIS repeatedly stresses the highly preliminary nature of this analysis, which does not provide sufficient information to evaluate the impacts of the TSP. For example:

- DEIS at 73: "A key component of sediment impact assessment is the identification and quantification of major sediment sources within the Project Area. For this preliminary assessment, the major sediment sources were identified but a detailed quantification of the sediment delivery from these sources was determined to be beyond the scope of the FS/EIS."
- DEIS, Appendix C (Preliminary Sediment Analysis) at 1: "This was a limited analysis that focused on the project area between the Ross Barnett Reservoir and continuing to slightly downstream of the proposed weir location. A thorough sediment impact assessment considering the entire stream system will be required during the preconstruction, engineering, and design phase."
- DEIS, Appendix C (Preliminary Sediment Analysis) at 2: "Although one sediment sample is insufficient to draw any definite conclusions about the transport of sand material through the reservoir, it does suggest this as a subject for further investigation."
- DEIS, Appendix C (Preliminary Sediment Analysis) at 6: "A more detailed analysis of all the [six selected USGS stream] gages may be required during the preconstruction, engineering, and design phase."
- DEIS, Appendix C (Preliminary Sediment Analysis) at 8: A "more detailed analysis is recommended in the feasibility study to document the longer term planform characteristics."
- DEIS, Appendix C (Preliminary Sediment Analysis) at 9: "Unfortunately, available survey within the study area is not sufficient to conduct this type of analysis [cross sectional geometry to assess historical channel response]. Acquiring additional survey of the study reach which can be compared with the 1991 survey is recommended. This survey comparison can provide important information, particularly between the Ross Barnett Reservoir dam and Hwy 80 where gage records documenting the channel stability in the post dam period are not available."
- DEIS, Appendix C (Preliminary Sediment Analysis) at 10: "A more detailed analysis of the [Ross Barnett] reservoir and downstream channel is needed to develop estimates of the size and quantity of sediment potentially passing through the reservoir."
- DEIS, Appendix C (Preliminary Sediment Analysis) at 10: "A more detailed analysis of the tributaries [that enter the Pearl River between the dam and proposed weir location] may be recommended during the preconstruction, engineering, and design phase."

- DEIS, Appendix C (Preliminary Sediment Analysis) at 11: "[M]ore detailed analysis and modeling may be required during the preconstruction, engineering, and design phase of the project for confirmation" that "the channel bed is not considered to be a significant source of sediment."
- DEIS, Appendix C (Preliminary Sediment Analysis) at 12: "It should be emphasized that this is a preliminary estimate [of sediment volume and type from the Pearl River watershed that would enter the project reach], and a more detailed analysis should be conducted during the preconstruction, engineering, and design phase."
- DEIS, Appendix C (Preliminary Sediment Analysis) at 13: The geomorphic assessment "should be considered preliminary in nature, and a more detailed investigation is recommended for the preconstruction, engineering, and design phase of this project. The geomorphic study should also address the channel system downstream of the study reach."
- DEIS, Appendix C (Preliminary Sediment Analysis) at 13: "A more detailed analysis of the reservoir and downstream channel is needed to develop estimates of the size and quantity of sediment that may be passing through the [Ross Barnett] reservoir."
- DEIS, Appendix C (Preliminary Sediment Analysis) at 14: "The results of this preliminary analysis would require additional information to develop sediment estimates" for sediment transport analysis.
- DEIS, Appendix C (Preliminary Sediment Analysis) at 17: "Development of a viable sediment management plan will require a more detailed sediment analysis during the preconstruction, engineering, and design phase." .

In addition, while the DEIS states that a sediment management plan would be required, it does not provide that sediment management plan, and it does not provide information on the sediment issues that need to be addressed in that plan or how those issues should be addressed. See DEIS at 177.

5. The DEIS Not Evaluate Impacts to the Pearl Rivers' Entire Hydroperiod

The DEIS does not discuss or assess the impacts of the TSP on the entire hydroperiod for the Pearl River. Maintaining or mimicking a natural hydrograph is critically important for ecosystem health and sustainability. Issues that must be addressed in a meaningful assessment of the River's hydroperiod include assessing and accounting for: appropriately timed low and high flows; appropriate depth, frequency and duration of overbank flooding; and maintaining connectivity to surrounding habitats.

The natural flood regime is extremely important for ecosystem health. For example, spring floods that overflow the Pearl River's banks are critical for nourishing bottomland hardwood and other wetlands, including the Bogue Chitto National Wildlife Refuge, the Pearl River Wildlife Management Area, and Honey Island Swamp in Louisiana. Indeed, part of the reason that the Pearl River Basin forests remain healthy and thriving, and the Basin's coastal wetlands continue to regenerate (unlike many other areas on the coast), is because the River experiences a somewhat natural flooding regime. This flood cycle results in the flooding of the higher elevation bottomland hardwood forests periodically and the lower elevation swamps and sloughs in most years. From 1995 to 2018, the Pearl River gauge at highway 59 (USGS 02492600) flooded its banks (over 16.5 feet) in fourteen of the 24 years and reached flood stage (14 feet) in all 24 years. Changes to this flood regime could result in major degradation and put the public at risk.

Lowering flood stages could also cause significant adverse impacts to the ecological health of the Pearl River and its floodplain, including damaging fisheries resources that rely on access to the floodplain,

degrading floodplain and other wetland habitats, causing head-cutting and incision in tributaries, reducing water quality, and elevating sediment influx including into the TSP impoundment.

Changes to the hydrograph that result in lower flows or more frequent low flows could also cause significant harm, including to downstream forested wetlands, Mississippi Sound, Lake Borgne, and the Gulf of Mexico. The Pearl River is a major source of freshwater to the Gulf of Mexico and reductions in flow could alter water quality and coastal salinities, affect sediment transport, and increase saltwater intrusion upriver. Altered flows could also affect the already struggling oyster sector that relies on a well-balanced mix of fresh and salt water to ensure oyster survival and harvest.

The Project's impact on the entire hydroperiod must be assessed in both the Project Area and downstream to the mouth of the Pearl River, including the potential for altering the River's flood regime and for reducing flows particularly during traditional low flow periods. The DEIS, however, provides only the most minimal discussion of maintaining historic low flows. *See, e.g.*, DEIS at 67-69, 171-172. High flows are viewed by the DEIS only as something to be stopped by the Project.

6. The DEIS Does Not Evaluate Impacts to Tributaries

The fundamental changes to the structure and functions of the Pearl River and it floodplain from the TSP could cause significant adverse impacts to the River's tributaries. These impacts must be evaluated to understand the full suite of direct, indirect, and cumulative impacts of the Project, including the impact to fish and wildlife.

The TSP will result in significant and irreparable changes to the Project Area, including the complete destruction of tributary streams. Changes to sediment loading and transport processes both alone and in combination with changes to flow and channel morphology could also cause significant adverse impacts to tributaries, including headcutting, incision, reduction in water quality, and degradation of habitat.

These impacts must be assessed in the DEIS, along with the implication of such impacts for fish, wildlife, wetlands, and other critical resources.

7. The DEIS Does Not Evaluate Impacts to Diverse Instream Habitats

Important fish and wildlife habitat includes diverse instream habitats such as braided channels, crossover habitat, sand bars, and backwater habitats in addition to riverine and floodplain wetlands. The DEIS fails to assess impacts to these diverse habitats, and fails to meaningfully asses the impact of transforming the Pearl River's diverse and complex riverine and floodplain habitat into a relatively stagnant impoundment.

The DEIS provides virtually no discussion of the impacts of the losses of these various types of habitats on fish and wildlife, and fails to account for the very significant differences between riverine and lacustrine habitat and the often very different fish and other aquatic resource assemblages that they support. As the Fish and Wildlife Service has noted,

> "Even though water flow will be maintained through the lake, it will not provide the habitat required for those species needing a riverine environment to survive, thus representing a net loss of approximately 250 aces of this habitat type."[48]

These failures preclude a meaningful assessment of fish and wildlife impacts, which requires an accurate understanding of the differences between habitat types and an accurate assessment of impacts to the full range of habitats.

8. The DEIS Does Not Meaningfully Evaluate Impacts to Wetlands

While the DEIS provides information on types and acreages of wetlands that will be directly impacted—i.e., destroyed—by the Project, the DEIS provides no information on indirect impacts to wetlands, and as discussed below fails to provide a meaningful analysis of cumulative impacts.

The Project will result in significant and fundamental changes to the Pearl River's ecosystem that will have far-reaching hydrological impacts. These hydrologic changes will affect the remaining Project Area wetlands, and will likely also affect highly valuable wetlands downstream. For example, as noted above, changes to the Pearl River's hydrograph could harm vast acreages of bottomland hardwood and other wetlands, including the Bogue Chitto National Wildlife Refuge, the Pearl River Wildlife Management Area, and Honey Island Swamp in Louisiana.

Assessing the impacts to wetlands requires a scientifically sound assessment of the impacts of the proposed Project on wetland hydrology which "is probably the single most important determinant of the establishment and maintenance of specific types of wetlands and wetland processes":

> "Hydrology affects the species composition and richness, primary productivity, organic accumulation, and nutrient cycling in wetlands. . . . Water depth flow patterns, and duration and frequency of flooding, which are the result of all the hydrologic inputs and outputs, influence the biochemistry of the soils and are major factors in the ultimate selection of the biota of wetlands. . . . Hydrologic conditions can directly modify or change chemical and physical properties such as nutrient availability, degree of substrate anoxia, soil salinity, sediment properties, and pH."[49]

Even "small changes in hydrology can result in significant biotic changes"[50] and produce ecosystem-wide changes:

> "**When hydrologic conditions in wetlands change even slightly, the biota may respond with massive changes in species composition and richness and in ecosystem productivity.**"[51]

As a result the impacts from even small changes in the duration and extent of inundation of wetlands in the Pearl River system must be evaluated, as such changes could create significant adverse impacts to the structure and function of those wetlands leading to adverse impacts to fisheries, wildlife habitat,

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[48] U.S. Department of the Interior, Fish and Wildlife Service letter to Michael E. Goff at page 9 (August 16, 2018) (providing official comments on the DEIS).
[49] William J. Mitsch and James G. Gosselink, *Wetlands* (2nd ed.) (1993) at 67-68.
[50] *Id*. at 68.
[51] *Id*. at 68 (emphasis added).

plant communities, water quality, water quantity, soil moisture recharge, nutrient cycling, and flood pulse conditions.

As with all impacts analyses, the wetland assessment must look at the direct, indirect, and cumulative impacts to wetlands.

9. The DEIS Does Not Meaningfully Evaluate Impacts to Water Quality

The DEIS does not meaningfully evaluate water quality impacts. As highlighted in Section II.C.1 of these comments, the water quality analysis suffers from a fundamental lack of scientific integrity.

Among many other problems, the water quality analysis: is based on a wholly inadequate data set; ignores the water quality impacts that will result from the significant hydrologic, morphologic and flow changes from the TSP; fails to meaningfully assess impacts from sedimentation; ignores the significant risk of toxic releases from the TSP; and fails to assess water quality impacts due to the significant loss of Project Area wetlands and small streams.

Inadequate Data Set: The entire water quality analysis is based on a highly inadequate data set. To fill in the acknowledged "sparse" water quality data for the Study Area, the non-Federal sponsor collected some additional water quality samples during two sampling periods in July 2014. Sampling one month of one year for water quality data is a highly improper sampling regime that, among other problems, cannot account for critically important seasonal and yearly variations. DEIS at 61-63. As note d at DEIS page 65, an appropriate assessment of water quality data can only be conducted if the data complies with the CALM requirements, which among other things requires collection of samples during multiple sampling periods over multi-year periods.

Indeed, the DEIS states that the current water quality data do not meet the requirements needed for a "rigorous assessment of the water quality status of the Pearl River near Jackson" but nevertheless concludes that a review of the water quality data collected "shows that the river water quality typically meets the criteria for the parameters that are measured." DEIS at 65-66. This conclusion, however, is contradicted by the list of the Pearl River on the 2008 § 305(b) list for total nitrogen and total phosphorus and the development and then updating of TMDLs for this segment of the river. According to the DEIS at 65, the 2014 TMDL calls for a 70% reduction in total phosphorus and a 30% reduction in total nitrogen entering the river from all sources. In addition, the DEIS does not consider water quality downstream. The Louisiana 2016 list of impaired waters lists the Pearl River as impaired for sulfates for "sources outside of their jurisdiction" which most likely means Mississippi.

Hydrologic, Morphologic, and Flow Changes: The newly created impoundment will receive significant runoff from urban and agricultural areas and impoundment of the current flow, along with other changes, could greatly reduce water quality. Channelization and excavation will also cause changes to water quality and clarity. These changes could also produce frequent algal blooms as the mitigating benefits of flowing water will be lost or severely diminished.

Sedimentation from Project construction and the potential for significantly increased sedimentation due to changes in sediment transport into and through the system will also reduce water quality in the impoundment and will also likely contaminate and pollute downstream waters and habitats as well. Sedimentation is the largest form of aquatic pollution, and smothers the benthos, or bottom habitat of aquatic systems. Likely changes in sediment particle sizes through deposition of fine particles will result

in homogenization of substrates and overall reduction of community diversity. Organisms that would be impacted include aquatic invertebrates (i.e., sponges, insects, and mussels), reptiles, such as map turtles, and benthic spawning and feeding fishes, such as Gulf Sturgeon.

Increased water surface area will affect water temperatures and evaporation rates, influencing water availability and quality downstream. Warmer water evaporates faster, something that was not considered in the formula quoted from an introductory hydrology textbook on page 169 of the DEIS.

These impacts have not been assessed in the DEIS.

Toxic Releases: As discussed above, the TSP is likely to result in resuspension of contaminated sediments and other toxic releases into the Pearl River, dramatically impacting water quality. These impacts have not been assessed in the DEIS.

Loss of Wetlands and Small Streams: Wetlands and small streams are highly effective filters that provide important water quality benefits. The significant wetland and stream losses from the TSP will have effects on water quality downstream. These impacts have not been assessed in the DEIS.

10. The DEIS Does Not Meaningfully Evaluate Impacts to Fish and Wildlife

The failings identified above, preclude an adequate evaluation of impacts to fish and wildlife, since the changes to habitat and flow are among the primary changes that would affect fish and wildlife. Other failings abound, including those outlined in this section. As importantly, the DEIS fundamentally ignores the biological and ecological ramifications of the major changes that this project will cause to the form and functioning of the Pearl River and its floodplain.

Almost 500 different species of fish and wildlife utilize the Pearl River Basin, including 116 species of freshwater fish.[52] These wildlife resources "are dependent upon the diverse floral composition of associated forested wetlands" and "a higher percentage" of vertebrate wildlife species in the Basin "use bottomland hardwoods as primary habitat (habitat a species depends upon for reproduction and/or feeding during all or a portion of the year) than any other habitat type."[53] Some of these species can only survive in a riverine environment, so will not survive in the TSP impoundment.[54]

The Mississippi State Wildlife Action Plan 2015-2025 identifies 73 "Species of Greatest Conservation Need" for the Upper and Lower Pearl River and bottomland hardwood forests (which includes the forests of the Pearl River).[55] These species include 22 birds, 17 fish, 12 mammals, 8 mussels, 5 amphibians, 5 amphibians, 5 reptiles, and 4 crustaceans. Key conservation actions to assist in the protection and restoration of these species include:

- "Encourage retention, preservation, and conservation of remaining natural habitat through purchase, easements or MOAs." Mississippi Wildlife Action Plan at 134, 260, 346, 504.

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[52] U.S. Department of the Interior, Fish and Wildlife Service letter to Michael E. Goff at page 1 (August 16, 2018) (providing official comments on the DEIS).
[53] Id.
[54] Id.
[55] *The Mississippi State Wildlife Action Plan 2015-2025 is accessible at https://www.mdwfp.com/media/251788/mississippi_swap_revised_16_september_2016__reduced_.pdf.*

- "Maintain/improve/restore hydrologic (depth, hydroperiod, flow) and geomorphic (channel sinuosity, floodplain, microtopography) integrity." Mississippi Wildlife Action Plan at 134, 260, 346, 504.

- "Monitor/limit commercial/residential/industrial point source erosion and sedimentation or pollution into streams/atmosphere." Mississippi Wildlife Action Plan at 134, 260, 346, 504.

Neither the identified Species of Greatest Conservation Need, nor the conservation actions identified as vital for protecting and restoring those species, are evaluated in the DEIS.

Neither the Biological Assessment nor the Habitat Evaluations Procedures (HEP) Report satisfy NEPAs requirements to meaningfully evaluate the impacts of the Project on fish and wildlife. The Biological Assessment looks only at species listed as threatened or endangered under the Federal Endangered Species Act and is itself flawed, and the HEP Report is both extremely limited and only designed to assess mitigation needs for a handful of species.

- **Biological Assessment:** The DEIS was prepared without the benefit of the Biological Assessment, which was not completed until after release of the DEIS for public comment. The Biological Assessment that was eventually released for public review is itself fundamentally flawed, and does not provide the meaningful assessment of impacts required under NEPA. As noted below, a Biological Opinion is undeniably required for this Project – a point that is recognized in the DEIS. DEIS at 85. The Biological Opinion should have been finalized before release of the DEIS, and avoiding impacts to listed species should be an integral driver in the development of alternatives and not a Project afterthought. Numerous problems with the Biological Assessment are identified in the DEIS comments submitted by the Center for Biological Diversity.

  One particularly notable failing is the DEIS's statement that the threatened Ringed Sawback Turtle is not known to occur in the Project Areas. DEIS at 81. This statement is incorrect and shows a lack of investigation into Project impacts. Researchers from Millsaps College (Jackson, MS) have documented healthy populations of this species within the Project area.[56] The species' life history also shows that it will be severely impacted by the TSP. This species is known to be a riverine species, dependent on riverine conditions for completion of life history processes. It is known to inhabit sand and gravel substrates, which are found in flowing water habitats. It is also known to feed on riverine organisms, such as lotic invertebrates including caddisflies and freshwater sponges.

  It is also important to recognize that the legal obligations under the Endangered Species Act and NEPA are entirely separate and apply fundamentally different standards. While incredibly important, a Biological Assessment (and full compliance with the ESA Section 7 prohibition against jeopardizing the continued existence of a species), does not satisfy NEPA's requirements

[56] This study is provided at Attachment B to these comments.

to analyze impacts that fall short of the threat of extinction.[57] "Clearly, there can be a significant impact on a species even if its existence is not jeopardized."[58]

- **HEP Report:** The HEP Report, which was prepared in 2014, is included in Appendix D but is only referred to in the DEIS in the discussion of mitigation acreage. The HEP Report also does not provide a meaningful assessment of impacts to fish and wildlife that utilize the Pearl River Basin or the Project Area. The HEP Report looks at only 16 species that appear to consist primarily of generalists, and the HEP Report include one species—the common carp—that is recognized by the state of Mississippi as an invasive species. None of the species looked at in the HEP Report are ranked for conservation priority in the Mississippi State Wildlife Action Plan for 2015-2025.[59]

  Despite the massive habitat damage that will be caused by the TSP, the HEP Report somehow concludes that the TSP will result in improved conditions (i.e. positive average annual habitat units) for 9 of the 16 species evaluated, including 5 of the 7 fish species evaluated. DEIS, Appendix D (HEP Report) at 22-23. At a minimum these conclusions demonstrate that the HEP analysis looks at far too few species and looks at the wrong species for a meaningful evaluation of mitigation needs for this Project. In addition, every HEP analysis is plagued by the fact that it only assesses average annual habitat units, which cannot account for the significance of adverse impacts related to habitat losses at critical stages in a species lifecycle. The U.S. Fish and Wildlife Service has also raised concerns with the HEP analysis.[60]

  Moreover, the use of HEP analyses violates the recommendations for appropriate wetland impact and mitigation analysis because HEP focuses on limited attributes of habitat, oversimplifies species needs, and assumes that artificial management of small areas can replace natural flooding of larger areas. HEP models also make many judgments about the needs of different species with little or no evidence. The change of focus of wetland mitigation away from these kinds of habitat models recognized their inadequacy and that the full complement of wetland and other aquatic functions required that mitigation reproduce the more natural conditions of the aquatic areas to be lost.

The DEIS does not include or consider the mandatory Fish and Wildlife Coordination Act Report, which had not been completed as of August 31, 2018. This Report and related Planning Aid Letters should have been developed early in the process to inform development and evaluation of alternatives in the

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[57] *See Greater Yellowstone Coalition v. Flowers*, 359 F.3d 1257, 1275-76 (10th Cir. 2004) (recognizing that FWS' conclusion that the action is not likely to cause jeopardy does not necessarily mean the impacts are insignificant); *Makua v. Rumsfeld*, 163 F. Supp.2d 1202, 1218 (D. Haw. 2001) ("A FONSI . . . must be based on a review of the potential for significant impact, including impact short of extinction. Clearly, there can be a significant impact on a species even if its existence is not jeopardized."); *National Wildlife Federation v. Babbitt*, 128 F. Supp.2d 1274, 1302 (E.D. Cal. 2000) (requiring EIS under NEPA even though mitigation plan satisfied ESA); *Portland Audubon Society v. Lujan*, 795 F. Supp. 1489, 1509 (D. Or. 1992) (rejecting agency's request for the court to "accept that its consultation with [FWS under the ESA] constitutes a substitute for compliance with NEPA.").

[58] *Makua v. Rumsfeld*, 163 F. Supp.2d 1202, 1218 (D. Haw. 2001) ("A FONSI . . . must be based on a review of the potential for significant impact, including impact short of extinction. Clearly, there can be a significant impact on a species even if its existence is not jeopardized.")

[59] The Mississippi State Wildlife Action Plan for 2015-2025 is available at https://www.mdwfp.com/media/251788/mississippi_swap_revised_16_september_2016__reduced_.pdf.

[60] U.S. Department of the Interior, Fish and Wildlife Service letter to Michael E. Goff at page 13-14 (August 16, 2018) (providing official comments on the DEIS).

DEIS. The after-the-fact Fish and Wildlife Coordination Act Report will not serve the purpose of the Fish and Wildlife Coordination Act, which is to ensure that fish and wildlife are given equal consideration in the planning, construction, and operation of federal water resources projects. 16 U.S.C. § 662.

The DEIS does not include a host of highly applicable research on fish and wildlife habitat needs and no effort was made to document species occurrences and population sizes in the Pearl River or its floodplain. Additional species-specific concerns are outlined below.

Notably, there is no scientific justification for the DEIS' conclusions regarding the impacts to fish and wildlife resources. Despite recognizing adverse impacts, the DEIS essentially concludes that there isn't really a problem because species that need the habitat that was destroyed will move to other areas, and species that can use the new impoundment will move in. *See* DEIS at 184-186.

(a) Fisheries

The DEIS violates NEPA because it fails to meaningfully evaluate impacts to the full range of fish species found in the Project area.

Among many other failings, the DEIS does not consider the life-cycle needs of an appropriate array of fish species. For example, the DEIS does not account for impacts to fish species that utilize the Pearl River's floodplain for spawning and rearing. This is a critical deficiency as floodplains provide vital fish and wildlife habitat as demonstrated by an extensive body of science (none of which is assessed in the DEIS).

The DEIS also fails to meaningfully consider the very different needs and Project impacts on species that require riverine habitat versus species that utilize pool or impoundment habitats. Inhabitants of rivers and streams are almost always dependent on flowing water for survival. Exceptions to this include generalist species, of which there are few. The disruption of flow through impounding the riverine habitat will have detrimental effects on a multitude of riverine organisms, ranging from the tiniest of insect larvae, to pearly mussels, to riverine turtles and fishes. As noted by the U.S. Fish and Wildlife Service:

> "Even though water flow will be maintained through the lake, it will not provide the habitat required for those species needing a riverine environment to survive, thus representing a net loss of approximately 250 aces of this habitat type."[61]

(b) Birds and Waterfowl

The Pearl River Basin and the Project Area provide extremely important habitat for migratory birds and waterfowl. However, the DEIS fails to meaningfully evaluate impacts to birds and waterfowl found in the Project area. This failure presents a fundamentally flawed image of the impacts of the TSP that renders the DEIS inadequate.

A number of species of particular concern that utilize that Project Area and the Pearl River Basin include: Prothonotary Warbler, Swainson's Warbler, Swallow-tailed Kite (Mississippi State Listed Endangered),

[61] U.S. Department of the Interior, Fish and Wildlife Service letter to Michael E. Goff at page 9 (August 16, 2018) (providing official comments on the DEIS).

Reddish Egret, Clapper Rail, and Wood Stork (Federal and Mississippi State Listed Endangered). The Project is also likely to impact Important Bird Areas (IBAs)[62]. For example, maps in the DEIS show that dredging is still planned on property in LeFleur's Bluff State Park, which is an important IBA area. Other IBAs that are directly imperiled by One Lake include Hancock County Marsh Coastal Preserve (MS), East Delta Plain (LA), and Pearl River (LA; nominated).

A meaningful assessment of impacts to migratory birds must account for direct, indirect, and cumulative impacts, including the cumulative impacts of climate change, which can significantly exacerbate the impacts on the many migratory species that utilize the Pearl River and its floodplain. Among many other things, migratory birds are affected by habitat losses, habitat shifts, changes in water regimes, losses and mismatches with food supply, changes in prey range, and increased storm frequency, which can all be greatly exacerbated by climate change, making a meaningful cumulative impacts analysis particularly critical.

Migratory birds, as with all migratory wildlife, are particularly vulnerable to the impacts of climate change, as recognized by the United Nations Environment Program and the Convention on the Conservation of Migratory Species of Wild Animals:

> "As a group, migratory wildlife appears to be particularly vulnerable to the impacts of Climate Change because it uses multiple habitats and sites and use a wide range of resources at different points of their migratory cycle. They are also subject to a wide range of physical conditions and often rely on predictable weather patterns, such as winds and ocean currents, which might change under the influence of Climate Change. Finally, they face a wide range of biological influences, such as predators, competitors and diseases that could be affected by Climate Change. While some of this is also true for more sedentary species, migrants have the potential to be affected by Climate Change not only on their breeding and non-breeding grounds but also while on migration."
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> "Apart from such direct impacts, factors that affect the migratory journey itself may affect other parts of a species' life cycle. Changes in the timing of migration may affect breeding or hibernation, for example if a species has to take longer than normal on migration, due to changes in conditions *en route*, then it may arrive late, obtain poorer quality breeding resources (such as territory) and be less productive as a result. If migration consumes more resources than normal, then individuals may have fewer resources to put into breeding . . . ."
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> * * *
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> "Key factors that are likely to affect all species, regardless of migratory tendency, are changes in prey distributions and changes or loss of habitat. Changes in prey may occur in terms of their distributions or in timing. The latter may occur though differential changes in developmental rates and can lead to a mismatch in timing between predators and prey ("phenological disjunction"). Changes in habitat quality (leading ultimately to habitat loss) may be important for migratory species that need a coherent

[62] An IBA is an area that has been identified using an internationally agreed to set of criteria as being globally important for the conservation of bird populations. National Audubon Society administers the program in the U.S.

> network of sites to facilitate their migratory journeys. Habitat quality is especially important on staging or stop-over sites, as individuals need to consume large amounts of resource rapidly to continue their onward journey. Such high quality sites may [be] crucial to allow migrants to cross large ecological barriers, such as oceans or deserts."[63]

As noted above, migratory birds are at particular risk from climate change since they are affected by changes in water regime, mismatches with food supply, habitat shifts, changes in prey range, increased storm frequency, and sea level rise—all of which are greatly exacerbated by climate change.[64]

(c) Amphibians and Reptiles

The DEIS violates NEPA because it fails to meaningfully evaluate impacts to amphibian and reptiles. This failure presents a fundamentally flawed image of the impacts of the TSP and renders the DEIS inadequate.

Despite the significant number of reptile and amphibian species in Mississippi, the DEIS analysis of impacts looks at only a single reptile—the Federally threatened ringed sawback turtle. Another reptile (the slider turtle) is included in the HEP mitigation analysis. Indeed, other than in connection with the ringed sawback turtle, the words amphibian and reptile appear only three times in the body of the DEIS. DEIS at 77-78 ("The river watershed also supports populations of many common reptile and amphibian species including alligator snapping turtles, box turtles, copperhead moccasins, cottonmouth moccasins, and other common species."); DEIS, Appendix E at 10 (stating that amphibians are a food source for the great blue heron, and are a food source for the great egret).

The Mississippi Department of Wildlife, Fisheries, and Parks has documented 146 species of reptiles and amphibians in Mississippi.[65] Many of these species rely on the habitat provided by bottomland hardwood wetlands and the Pearl River. The Mississippi State Wildlife Action Plan 2015-2025 identifies 10 species of reptiles and amphibians as Species of Greatest Conservation Need in the Pearl River and the state's bottomland hardwood forests.[66] One of the key conservation actions for these species is to: "Encourage retention, preservation, and conservation of remaining natural habitat through purchase, easements or MOAs."[67]

Evaluating the impacts of the Project on amphibians and reptiles is also particularly important because these species are facing unprecedented risks of extinction. In the United States, the IUCN Red List of Threatened Species lists 56 amphibian species and 37 reptile species as known to be critically

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[63] UNEP/CMS Secretariat, Bonn, Germany, *Migratory Species and Climate Change: Impacts of a Changing Environment on Wild Animals* (2006) at 40-41 (available at http://www.cms.int/publications/pdf/CMS_CimateChange.pdf).
[64] *Id*. at 42-43.
[65] This species list can be accessed at https://www.mdwfp.com/media/3283/mississippi_herpetology_checklist_013012.pdf (visited August 31, 2018).
[66] Mississippi State Wildlife Action Plan 2015-2025 at 25. The Action Plan is accessible at https://www.mdwfp.com/media/251788/mississippi_swap_revised_16_september_2016__reduced_.pdf (visited August 31, 2018).
[67] Id. at 134.

endangered, endangered, or vulnerable.[68] Worldwide, at least 1,950 species of amphibians are threatened with extinction of which 520 species are critically endangered, 783 are endangered, and 647 species are vulnerable. This represents 30 percent of all known amphibian species.[69] In 2004, scientists estimated that most of 1,300 other amphibian species are also threatened though sufficient data are currently lacking to be able to accurately assess the status of those species.[70] The IUCN Red List of Threatened Species also lists 879 species of reptiles as threatened with extinction worldwide, which represents 21 percent of all evaluated reptile species.[71]

A recent study demonstrates the increasingly dire conditions of amphibians worldwide:

> "Current extinction rates are most likely 136–2707 times greater than the background amphibian extinction rate. These are staggering rates of extinction that are difficult to explain via natural processes. No previous extinction event approaches the rate since 1980 (Benton and King, 1989).
>
> Despite the catastrophic rates at which amphibians are currently going extinct, these are dwarfed by expectations for the next 50 yr (Fig. 1). If the figure provided by Stuart et al. (2004) is true (but see Pimenta et al., 2005; Stuart et al., 2005), one-third of the extant amphibians are in danger of extinction. This portends an extinction rate of 25,000–45,000 times the expected background rate. Episodes of this stature are unprecedented. Four previous mass extinctions could be tied to catastrophic events such as super volcanoes and extraterrestrial impacts that occur every 10 million to 100 million years (Wilson, 1992). The other mass extinction seems to be tied to continental drift of Pangea into polar regions leading to mass glaciation, reduced sea levels, and lower global temperatures (Wilson, 1992). The current event far exceeds these earlier extinction rates suggesting a global stressor(s), with possible human ties."[72]

Amphibians thrive in cool wetland environments, and are found in all types of wetlands except more saline coastal environments. Small, isolated wetlands play especially important roles in amphibian productivity.[73] Amphibian populations thrive when there are a variety of small ecosystems within a regional landscape in which a "dynamic equilibrium" of different populations becomes established.[74]

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[68] IUCN Red List version 2013:2, Table 5: Threatened species in each country (totals by taxonomic group), available at http://cmsdocs.s3.amazonaws.com/summarystats/2013_2_RL_Stats_Table5.pdf (visited on November 24, 2013.)

[69] IUCN Red List version 2013:2, Table 3a: Status category summary by major taxonomic group (animals), available at http://cmsdocs.s3.amazonaws.com/summarystats/2013_2_RL_Stats_Table3a.pdf (visited on November 24, 2013).

[70] Science Daily, Amphibians In Dramatic Decline; Study Finds Nearly One-Third Of Species Threatened With Extinction (October 15, 2004), available at http://www.sciencedaily.com/releases/2004/10/041015103700.html (visited on November 24, 2013).

[71] IUCN Red List version 2013:2, Table 3a: Status category summary by major taxonomic group (animals), available at http://cmsdocs.s3.amazonaws.com/summarystats/2013_2_RL_Stats_Table3a.pdf (visited on November 24, 2013).

[72] McCallum, M. L. (2007). "Amphibian Decline or Extinction? Current Declines Dwarf Background Extinction Rate. *Journal of Herpetology* 41 (3): 483–491. doi:10.1670/0022-1511(2007)41[483:ADOECD]2.0.CO;2.

[73] Gibbons, J. Whitfield, Christopher Winne, et. al. 2006. Remarkable Amphibian Biomass and Abundance in an Isolated Wetland: Implications for Wetland Conservation. Conservation Biology Volume 20, No. 5, 1457–1465.

[74] Mann, W., P. Dorn, and R. Brandl. 1991. Local distribution of amphibians: The importance of habitat fragmentation. Global Ecology and Biogeography Letters 1:36-41.

However, if the environment becomes overly fragmented, the dynamic equilibrium is disturbed because patterns of emigration and immigration may be disrupted.

Amphibians spend part of their life cycles in an aquatic environment and part in a terrestrial environment (typically returning to water to breed). For example, some salamanders undergo larval development within an aquatic environment, and then live along wet streamsides following metamorphosis into adult stages. Those that do not breed in water still need moist environments to prevent extreme dehydration.[75] The tadpoles of most frog species develop in ponds, lakes, wet prairies, and other still bodies of water, while others are known to breed in a wide variety of wetland habitats. As adults, toads, frogs and some salamanders can travel relatively great distances from water sources, but they return to water to reproduce.

Recent studies also point to the role of global climate change in promoting potentially catastrophic impacts to amphibian populations. For example:

- Global climate change will result in changes to weather and rainfall patterns that can have significant adverse effects on amphibians. Drought can lead to localized extirpation. Cold can induce winterkill in torpid amphibians. It is possible that the additional stress of climate change, on top of the stresses already created by severe loss of habitat and habitat fragmentation may jeopardize many amphibian species.[76]

- Recent studies suggest that climate change may be causing global mass extinctions of amphibian populations. Particularly alarming is the fact that many of these disappearances are occurring in relatively pristine area such as wilderness areas and national parks.[77] One recent study suggests that climate change has allowed the spread of a disease known as chytridiomycosis which has led to extinctions and declines in amphibians. Climate change has allowed this disease to spread by tempering the climate extremes that previously kept the disease in check.[78] About two-thirds of the 110 known harlequin frog species are believed to have vanished during the 1980s and 1990s because of the chytrid fungus *Batrachochytrium dendrobatidis.* Other studies indicate that amphibians may be particularly sensitive to changes in temperature, humidity, and

[75] Semlitsch, R. D. 1987. Relationship of pond drying to the reproductive success of the salamander Ambystoma talpoideum. Copeia 1987:61-69; Pechmann, J. H. K., D. E. Scott, J. W. Gibbons, and R. D. Semlitsch. 1989. Influence of wetland hydroperiod on diversity and abundance of metamorphosing juvenile amphibians. Wetlands Ecology and Management 1:3-11.

[76] Sjogren, P. 1993a. Metapopulation dynamics and extinction in pristine habitats: A demographic explanation. Abstracts, Second World Congress of Herpetology, Adelaide, Australia, p. 244; Sjogren, P. 1993b. Applying metapopulation theory to amphibian conservation. Abstracts, Second World Congress of Herpetology, Adelaide, Australia, p. 244-245.

[77] Pounds, J. A., and M. L. Crump. 1994. Amphibian declines and climate disturbance: The case of the golden toad and the harlequin frog. Conservation Biology 8:72-85; Lips, K. R. 1998. Decline of a Tropical Montane Amphibian Fauna. Conservation Biology 12:106-117; Lips, K., F.Brem, R. Brenes, J.D. Reeve, R.A. Alford, J. Voyles, C. Carey, L. Livo, A. P. Pessier, and J.P. Collins 2006. Emerging infectious disease and the loss of biodiversity. Proceedings of the National Academy of Sciences 103:3165-3170.

[78] Pounds, J.A., M.P.L. Fogden, J.H. Campbell. 2006. Biological response to climate change on a tropical mountain. Nature 398, 611-615.

air and water quality because they have permeable skins, biphasic life cycles, and unshelled eggs.[79]

- Climate change may also affect amphibian breeding patterns.[80] Amphibians spend a significant part of the year protecting themselves from cold or shielding themselves from heat. They receive cues to emerge from their shelters and to migrate to ponds or streams to breed from subtle increases in temperature or moisture. As the earth warms, one potential effect on amphibians is a trend towards early breeding, which makes them more vulnerable to snowmelt-induced floods and freezes common in early springs. Some studies already indicate a trend towards earlier breeding in certain amphibian species.[81]

- Increases in UV-B radiation in the northern hemisphere due to ozone depletion is also having an adverse impact on amphibians.[82] One study suggests that ultraviolet-B (UV-B) radiation adversely affects the hatching success of amphibian larvae.[83] High levels of UV-B also induced higher rates of developmental abnormalities and increased mortality in certain species (*Rana clamitans* and *R. sylvatica*) than others that were shielded from UV-B.[84] UV-B also can have detrimental effects on embryo growth.

(d) Mammals

The DEIS violates NEPA because it fails to meaningfully evaluate impacts to mammals. Many mammal species are found in the Pearl River Basin and the Project Area, including many that utilize riparian areas.

The DEIS, however, limits its "assessment" of impacts to mammal species to: inadequately analyzing impacts to the Federally threatened Northern Long-eared bat; mentioning that Louisiana black bears have not been seen in the Project Area; and including the grey squirrel and swamp rabbit in the HEP analysis. This does not satisfy NEPAs requirement to take a "hard look" at the impacts of this Project on mammals.

11. Impacts to Plants Are Not Meaningfully Evaluated

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[79] Carey, C., and M. A. Alexander. 2003. Climate change and amphibian declines: is there a link? Diversity and Distributions 9:111-121.
[80] Carey, C., and M. A. Alexander. 2003. Climate change and amphibian declines: is there a link? Diversity and Distributions 9:111-121.
[81] Beebee, T. J. C. 1995. Amphibian Breeding and Climate. Nature 374:219-220; Blaustein, A. R., L. K. Belden, D. H. Olson, D. M. Green, T. L. Root, and J. M. Kiesecker. 2001. Amphibian breeding and climate change. Conservation Biology 15:1804-1809; Gibbs, J. P., and A. R. Breisch. 2001. Climate warming and calling phenology of frogs near Ithaca, New York, 1900-1999. Conservation Biology 15:1175-1178.
[82] Blumthaler, M., and W. Ambach. 1990. Indication of increasing solar ultraviolet-B radiation flux in alpine regions. Science 248:206-208; Kerr, J. B., and C. T. McElroy. 1993. Evidence for large upward trends of ultraviolet-B radiation linked to ozone depletion. Science 262:1032-1034.
[83] Blaustein, A. R., P. D. Hoffman, D. G. Hokit, J. M. Kiesecker, S. C. Walls, and J. B. Hays. 1994a. UV repair and resistance to solar UV-B in amphibian eggs: A link to population declines? *Proceedings of the National Academy of Science* 91:1791-1795.
[84] Grant, K. P., and L. E. Licht. 1993. Effects of ultraviolet radiation on life history parameters of frogs from Ontario, Canada. Abstracts, Second World Congress of Herpetology, Adelaide, Australia, p. 101.

The DEIS violates NEPA because it fails to evaluate impacts to the wide-range of plant species that would be affected by the Project, including wetland plant species. While the DEIS breaks down direct wetland impacts by acres of main plant type (i.e., forested wetlands, cypress and tupelo gum slough wetlands, scrub shrub wetlands, cypress slough wetlands, emergent wetlands bottomland hardwood wetlands), it does not provide any other information on plant species that will be affected by the Project and does not provide information on the current ecological health of any plant species or main plant types.

Direct impacts to plant species and health will be significant. Indirect and cumulative impacts will also be significant, including through both large and small changes to hydrology. As noted above, even "small changes in hydrology can result in significant biotic changes"[85] and produce ecosystem-wide changes:

> "**When hydrologic conditions in wetlands change even slightly, the biota may respond with massive changes in species composition and richness and in ecosystem productivity.**"[86]

The impacts of the proposed alternatives on plant species, including wetland plant species must be analyzed. This is also important for understanding adverse impacts to fish and wildlife species.

12. Cumulative Impacts Are Not Meaningfully Evaluated

The DEIS violates NEPA because it fails to meaningfully evaluate cumulative impacts. This failure renders the DEIS grossly inadequate.

The cumulative impacts analysis is a critical component of NEPA review. It ensures that the reviewing agency will not "treat the identified environmental concern in a vacuum."[87] Cumulative impacts are defined as:

> "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time."[88]

A meaningful assessment of cumulative impacts must identify:

> "(1) the area in which effects of the proposed project will be felt; (2) the impacts that are expected in that area from the proposed project; (3) other actions – past, present, and proposed, and reasonably foreseeable – that have had or are expected to have impacts in the same area; (4) the impacts or expected impacts from these other actions; and (5) the overall impact that can be expected if the individual impacts are allowed to accumulate."[89]

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[85] *Id*. at 68.
[86] *Id*. at 68 (emphasis added).
[87] *Grand Canyon Trust v. FAA*, 290 F.3d 339, 346 (D.C. Cir. 2002).
[88] 40 C.F.R. § 1508.7.
[89] *TOMAC, Taxpayers Of Michigan Against Casinos v. Norton*, 435 F.3d 852 (D.C. Cir. 2006) (quoting Grand Canyon Trust, 290 F.3d at 345); *Fritiofson v. Alexander*, 772 F.2d 1225, 1245 (5th Cir. 1985) (holding this level of detail necessary even at the less detailed review stage of an Environmental Assessment).

In conducting the cumulative impacts assessment, it is not enough to simply catalog past actions. The DEIS instead must determine the specific impacts of those actions on the system. The DEIS must also assess whether the past degradation of the system combined with the proposed alternative will significantly affect the ecological health and functioning of the Pearl River ecosystem. Indeed, this is the primary goal of the cumulative impacts analysis:

> "The analyst's primary goal is to determine the magnitude and significance of the environmental consequences of the proposed action in the context of the cumulative effects of other past, present, and future actions. Much of the environment has been greatly modified by human activities, and most resources, ecosystems, and human communities are in the process of change as a result of cumulative effects. **The analyst must determine the realistic potential for the resource to sustain itself in the future and whether the proposed action will affect this potential; therefore, the baseline condition of the resource of concern should include a description of how conditions have changed over time and how they are likely to change in the future without the proposed action.** The potential for a resource, ecosystem, and human community to sustain its structure and function depends on its resistance to stress and its ability to recover (i.e., its resilience). Determining whether the condition of the resource is within the range of natural variability or is vulnerable to rapid degradation is frequently problematic. Ideally, the analyst can identify a threshold beyond which change in the resource condition is detrimental. More often, the analyst must review the history of that resource and evaluate whether past degradation may place it near such a threshold. For example, the loss of 50% of historical wetlands within a watershed may indicate that further losses would significantly affect the capacity of the watershed to withstand floods. **It is often the case that when a large proportion of a resource is lost, the system nears collapse as the surviving portion is pressed into service to perform more functions.**"[90]

The DEIS completely fails to satisfy this primary goal of a cumulative impacts analysis.

There are numerous, significant problems with the DEIS cumulative impacts assessment. These problems start with the fundamental problems regarding a lack of scientific integrity and lack of meaningful evaluation of the direct and indirect impacts of the TSP and other alternatives. If the direct and indirect impacts are not fully assessed—as they are not in the DEIS—it is not possible to fully evaluate cumulative impacts.

Examples of other significant problems with the cumulative impacts assessment include, but are not limited to, the following:

1. The DEIS draws conclusions regarding impacts and cumulative impacts that are patently false and directly contradicted even by the inadequate assessments contained in the DEIS. Notably, for example, the DEIS states that: "Structural measures such as levees, channel excavation, and construction of an in-channel weir (Alternative C) would not have significant direct or indirect impacts on the existing conditions of the Pearl River" and Alternative C "will not result in adverse cumulative effects to existing conditions of the Pearl River." DEIS at 133-134.

[90] Council on Environmental Quality, *Considering Cumulative Effects Under the National Environmental Policy Act* (January 1997) at 41 (emphasis added).

2. The DEIS does not consider the cumulative nature of the various impacts that are identified. For example, the DEIS does not assess the cumulative impacts to water quality that would be created by the TSP-induced significant wetland losses, significant loss of small streams, creation of an artificial and artificially controlled impoundment, impacts to sites containing toxic contaminants, and tremendous dredging and construction from the TSP. Instead, each of these items are looked at and considered separately (and inadequately).

3. The cumulative impacts analysis does not consider the magnifying and additive adverse effects of climate change on the resources affected by the Project. Despite clear evidence of the impacts of climate change, the DEIS does not evaluate whether the impacts of climate change could exacerbate the adverse impacts of the Project or whether the Project would make the Pearl River system and the species that rely on it less resilient to climate change.

   Climate change impacts must be taken into account as they are clearly occurring now and have already caused significant harm. In *Massachusetts. v. Environmental Protection Agency*,[91] the Supreme Court acknowledged the reality of global climate change, the "enormity of the potential consequences associated with manmade climate change," and the fact that climate change impacts have already occurred:

   > "The harms associated with climate change are serious and well recognized. Indeed, [the National Research Council report relied on as objective and independent by the Environmental Protection Agency] identifies a number of environmental changes that **have already inflicted significant harms**, including 'the global retreat of mountain glaciers, reduction in snow-cover extent, the earlier spring melting of ice on rivers and lakes, [and] the accelerated rate of rise of sea levels during the 20th century relative to the past few thousand years ....'"[92]

   Federal agencies have concluded that climate change impacts are happening now and that those impacts are significant. For example, the Park Service has concluded that: "The current science confirms the planet is warming and the effects are here and now."[93] The Park Service also acknowledges that climate change is already affecting the Nation's ocean and coastal parks:

   > "Climate change and variability **are affecting** the National Park Service's 84 ocean and coastal parks and over 12,000 miles of shoreline. More parks in the coastal zone will be vulnerable as sea levels rise. Additional coastal change effects include lowering water levels in the Great Lakes, changing storm patterns, increasing ocean acidity and melting permafrost. These processes and other coastal hazards are threatening parks' resources, infrastructure, and public recreational opportunities."[94]

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[91] The Supreme Court held that EPA has the authority to regulate greenhouse gas emissions from new motor vehicles if EPA forms a "judgment" that such emissions contribute to climate change.
[92] Massachusetts. v. Environmental Protection Agency, 549 U.S. 497, 525, 591 (2007) (emphasis added) (*quoting* National Research Council Report, Climate Change Science: An Analysis of Some Key Questions (2001) at 16).
[93] National Park Service, Climate Change Response Strategy (September 2010) at 1.
[94] National Park Service, Climate Change Response Program, Coastal Adaptation Brief (emphasis added), available at http://www.nps.gov/climatechange/docs/CoastalAdaptationBrief.pdf.

The U.S. Fish and Wildlife Service has similarly concluded that climate change is happening now and causing significant impacts:

> "The Earth's climate is changing at an accelerating rate that has the potential to cause abrupt changes in ecosystems and increase the risk of species extinction. Climate change transcends the Service and the National Wildlife Refuge System and poses one of the largest conservation threats of the 21st century.
>
> Climate change has very likely increased the size and number of wildfires, insect outbreaks, pathogens, disease outbreaks and tree mortality in the interior West, the Southwest and Alaska. In the aquatic environment, evidence is growing that higher water temperatures resulting from climate change are negatively impacting cold- and coolwater-adapted populations across the country. Rising sea levels have begun to affect fish and wildlife habitats, including those used by shorebirds and sea turtles that nest on coastal national wildlife refuges. Ocean acidification and coral bleaching represent major threats to marine life in more than 50 million acres of refuge waters and beyond. We acknowledge climate change is a crosscutting theme as we continue to work with the conservation community to develop and implement conservation strategies. We also recognize that a changing climate interacts with other ongoing environmental threats and stressors such as destructive fires, water shortages, invasive species and disease transmission."[95]

The U.S. Environmental Protection Agency has issued a formal finding that climate change poses serious adverse impacts to "both the public health and the public welfare of current and future generations."[96] This endangerment finding defines "current generations" as "a near-term time frame of approximately the next 10 to 20 years" and "future generations" as "a longer-term time frame extending beyond that.[97] The endangerment finding further states:

> "The Administrator reached her determination by considering both **observed** and projected effects of greenhouse gases in the atmosphere, their effect on climate, and the public health and welfare risks and impacts associated with such climate change.
>
> * * *
>
> Overall, the evidence on risk of adverse impacts for coastal areas provides clear support for a finding that greenhouse gas air pollution endangers the welfare of **current** and future generations. The most serious potential adverse effects are the increased risk of storm surge and flooding in coastal areas from sea level rise and more intense storms. Observed sea level rise is already increasing the risk of storm surge and flooding in some coastal areas. The conclusion in the assessment literature that there is the potential for hurricanes to become more intense (and even some evidence that Atlantic hurricanes have already become more intense) reinforces the judgment that coastal communities

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[95] U.S. Fish and Wildlife Service, *Conserving the Future: Wildlife Refuges and the Next Generation,* October 2011 at 36-37.

[96] 74 Fed. Reg. 66495-66546 (Dec. 15, 2009) (finding that "six greenhouse gases taken in combination endanger both the public health and the public welfare of current and future generations.")

[97] *Id*. (emphasis added).

> are now endangered by human-induced climate change, and may face substantially greater risk in the future."
>
> ***
>
> Over the 21st century, changes in climate will cause some species to shift north and to higher elevations and fundamentally rearrange U.S. ecosystems. Differential capacities for range shifts and constraints from development, habitat fragmentation, invasive species, and broken ecological connections will likely alter ecosystem structure, function, and services, leading to predominantly negative consequences for biodiversity and the provision of ecosystem goods and services."[98]

Despite the significant impacts of climate change, the only reference to climate change in the DEIS is the statement that "changes to the climate were considered" but because of a lack of consensus on the impacts of climate change on extreme storms, "flood events of large magnitude, such as the annual 0.2% exceedance event, were used for analysis but no quantitative adjustments to the flood magnitudes were made." DEIS at 109.

4. The cumulative impacts analysis does not include any discussion of the impacts of agriculture, including related land clearing, pesticide use, and fertilizer use on the wetlands and water quality in the Pearl River.

5. The cumulative impacts analysis does not include any discussion of the habitat changes, including wetland losses, or alterations to the natural river hydrograph created by construction and operation of the Ross Barnett Reservoir.

6. The cumulative impacts analysis does not address the cumulative impacts to downstream flows and habitats. The DEIS also does not discuss the direct or indirect impacts of flow changes. The Project has the potential to significantly affect vital downstream habitats through Project-induced changes to flow across the full hydroperiod and these impacts, including cumulative impacts, must be assessed.

7. The cumulative impacts analysis does not meaningfully assess the cumulative impacts of toxic exposure. As discussed above toxic exposure via resuspension of contaminated sediments and other discharges from the HTRW sites are likely to be highly significant. Instead, the DEIS improperly contends that future HTRW site remediation that is unstudied, unplanned, and not accounted for as a cost of the project, will translate into cumulative adverse impacts that are only "moderate in intensity and short-term in duration." DEIS at 223.

8. The cumulative impacts analysis does not address the impacts of past and ongoing development in the Project Area (other than through discussion of some specific water treatment facilities). It is of course beyond dispute that there has been a significant amount of development in and around the Jackson area (and beyond) that has adversely affected the Project Area. *See* DEIS at 88 (the Project area "has been subjected to a significant amount of associated development activities over time"); DEIS at 89 (discussing development impacts on air quality); DEIS at 90-92

[98] 74 Fed. Reg. at 66497-66498.

(discussing implications of HTRW sites, which are the direct result of development and economic activities); Appendix D at page 10 of the Wetlands Delineation and Determination Report ("Much of the proposed project area is influenced heavily by the adjoining urban development activities, as well as, previous flood control projects that have affected the historical flows within the drainage basin over time.").

9. The cumulative impact analysis does not assess the impacts of foreseeable future development, including Project-induced future development even though it repeatedly states that such impacts can be anticipated. *E.g.*, DEIS at 164 ("the determination of any future development activities associated with the project implementation would not be feasible as a part of this assessment process."); DEIS at 181 ("The potential for further cumulative impacts associated with the increased development activities as a result of the enhanced flood protection cannot be determined at this time but can be anticipated."); DEIS at 186 ("The potential for further cumulative impacts associated with any increased development activities as a result of the enhanced flood protection afforded by Alternative C cannot be determined at this time."); DEIS at 206 ("The potential for indirect, adverse impacts associated with the added level of flood protection within the area and the potential future development also exist" but no assessment of such impacts are provided.); DEIS at 209 ("in addition, potential indirect, adverse impacts associated with future development activities associated with the improved flood protection could be anticipated" but no assessment of such impacts is provided).

   This failure is notable since the DEIS repeatedly acknowledges that future development is reasonably foreseeable due to the TSP—and indeed that promoting future development is both a stated purpose of the TSP and a fully recognized outcome of the TSP. DEIS at xi ("The TSP will also enhance community development through the newly accessible riverfront created by the channel improvement within the confines of the existing levee structure, reconnecting the community with the river through expanded riverfront access and recreational opportunities."); DEIS at 146 ("The channel improvements will provide significant flood risk management and will allow for riverfront access and development, along with recreational opportunities. The new activities made possible by this amenity will stimulate community development, population, and housing for the project life and beyond."); DEIS at 147 ("Beneficial, long-term, cumulative impacts will continue with respect to employment, business activities, and industry activities over the life of the project for not only the local project area, but for the region."); DEIS at 149 ("Long term improvement to public services would be expected due to enhancement of measures that reduce flood risk."); DEIS at 151 ("Growth opportunities for new, improved lands through flood risk management and the waterbody amenity would provide numerous growth opportunities for the community."); DEIS at 153 ("This alternative should result in increases in long-term tax revenue and property values due to enhanced flood risk management plus new development and growth in the Study Area."); DEIS at 154 ("The new activities made possible by the water amenity will result in long-term, beneficial, direct and indirect impacts expected to stimulate community development and improve community cohesion for the area.")

   The DEIS also acknowledges that there will be increased urbanization both inside and upstream of the project Area under future without-project conditions. *E.g.*, DEIS at 22 and 69 ("Watershed hydrology and hydraulics would remain unchanged when compared to existing conditions except for an increase in runoff due to development within the watershed. Increased urbanization, both inside and upstream of the Project Area, will have impacts to operations including in increased in runoff and potential increase in localized flooding."); DEIS at 61 ("Given

the past and present growth trends in the Jackson Metropolitan Area, further urbanization is projected to claim in excess of 5% of the undeveloped areas during the project life. Without constraints on development, more significant encroachment into the floodplain can be anticipated, especially along the eastern side of the Pearl River floodplain in Rankin County."). The DEIS does not provide any information to suggest that at least this amount of development also would not occur under the TSP, particularly since it is designed and predicted to promote increased development in and near the project area.

10. The DEIS attempts to minimize the cumulative impacts it does identify by stating without any supporting data or analysis that the cumulative impacts in the Project Area are much less significant when considered in the context of the entire watershed. *See* DEIS at 164 ("The cumulative impacts for soils within the project area would be considered as moderate and long-term. However, cumulative impacts within the Pearl River Watershed are considered to be minor in intensity and long-term in duration."); DEIS at 181 ("The conversion of existing vegetation resources associated with the Alternative C implementation associated with other existing and proposed projects should lead to adverse cumulative impacts within the Project Area, specifically that are considered to be major in intensity and long-term in duration. Conversion of habitats and removal of vegetation across the watershed in general has not been significant and future conversion activity throughout the watershed is not anticipated. Therefore, cumulative impacts associated with the proposed alternative relative to the Pearl River Watershed would be considered as moderate in intensity and long-term in duration."); DEIS at 186 ("Additionally, the conversion of the existing wildlife habits within the Project Area associated with the implementation of Alternative C will result in cumulative, adverse impacts that would be moderate in intensity and long-term in duration specifically within the Project Area. . . . Cumulative adverse impacts relative to the Pearl River Watershed in general will be minor and long-term in duration given the amount of available habitats that are present within the watershed."). As noted above, this contention is completely unsupported by any analysis or data in the DEIS. We also note that the DEIS has, for reasons not provided, excluded consideration of cumulative impacts outside of the study area. DEIS at 132 ("The geographic area for this [cumulative impacts] assessment encompasses the study area").

11. The DEIS also appears to attempt to support the TSP through misapplication of the cumulative impact analysis to the assessment of the "future without project conditions." See DEIS at 92 ("the cumulative impacts are the incremental direct and indirect impacts of not implementing a flood risk management system on both natural and human resources.") This is not a proper analysis since cumulative impacts are "the impact on the environment which results from the **incremental impact of the action** when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions." 40 C.F.R. § 1508.7. If there is no action there are no cumulative impacts for the purposes of an impacts analysis under NEPA.

The cumulative impacts analysis must include a comprehensive, factually accurate, and realistic assessment of the magnitude and significance of the environmental consequences of the Project in the context of the cumulative effects of other past, present, and future actions. This assessment should determine how the TSP will affect the ability of the Pearl River ecosystem to sustain itself in the future.

13. The DEIS Does Not Meaningfully Evaluate the Risk of Disproportionate Impacts to Low Income and Minority Communities

Executive Order 12898 requires that each Federal agency achieve environmental justice by identifying and addressing disproportionately high adverse human health or environmental effects of federal activities on minority and low-income populations.

The failings in the DEIS preclude compliance with this Executive Order. Notably, the DEIS fails to meaningfully assess a host of critical impacts, including impacts due to toxic exposure to people and wildlife, impacts to water quality, and impacts resulting from residual flood risks that could create significant disproportionate impacts on minority or low-income populations.

Moreover, the environmental justice impacts analysis that was conducted looked only at direct impacts. It did not address indirect and cumulative impacts that could be quite significant. See DEIS at 159 (discussing direct impacts, but not indirect or cumulative impacts. "Direct impacts such as air, noise, and other health risks were analyzed. Due to setback of residential areas from the proposed project construction areas, health risks associated with air quality, noise, or other health risks would not impact the areas as described within the project area.")

14. The DEIS Does Not Evaluate Impacts to Ecosystem Services

The DEIS fails to provide any assessment of the ecosystem services that will be lost as a result of the TSP or the other alternatives. Ecosystem services valuations are well recognized as providing important information for decision makers. Understanding the impacts to these services is critical for assessing the full extent of Project impacts.

The importance of ecosystem services valuation is made clear in the 2013 *Principles and Requirements for Federal Investments in Water Resources* and *Interagency Guidelines* (collectively, the PR&G). The PR&G focus extensively on the importance of evaluating the value of ecosystem services lost and gained during project planning. While the National Wildlife Federation recognizes that the Corps is not yet utilizing the PR&G, the DEIS should nevertheless evaluate the impacts on ecosystem services.

The National Wildlife Federation urges the non-Federal sponsor to contract with an organization expert in conducting ecosystem services valuations to properly account for the ecosystem services that will be lost to the project.

15. The DEIS Does Not Meaningfully Evaluate Mitigation

The DEIS violates NEPA because it fails to meaningfully evaluate mitigation. As discussed in Section III of these comments, the DEIS also fails to comply with federal mitigation requirements.

At the most fundamental level, the DEIS has not properly assessed mitigation because it has not meaningfully evaluated the adverse impacts of the Project. The DEIS also violates longstanding NEPA requirements by failing to discuss mitigation measures with "sufficient detail to ensure that environmental consequences have been fairly evaluated"; failing to discuss the effectiveness of the proposed mitigation; and failing to demonstrate that the proposed mitigation will be ecologically

successful.[99] As discussed above, the HEP Analysis used to assess mitigation for this Project is also fundamentally flawed.

The DEIS also violates NEPA, and the Water Resources Development Act because it does not consider mitigation for all resource types affected. The Water Resources Development Acts require the Corps to mitigate all losses to fish and wildlife created by a project unless the Secretary determines that the adverse impacts to fish and wildlife would be "negligible." 33 U.S.C. § 2283(d)(1).

NEPA requires that the DEIS discuss mitigation measures with "sufficient detail to ensure that environmental consequences have been fairly evaluated."[100] A "perfunctory description" of the mitigating measures is not sufficient.[101] NEPA also requires an evaluation of the effectiveness of the proposed mitigation:

> "An essential component of a reasonably complete mitigation discussion is an assessment of whether the proposed mitigation measures can be effective. The Supreme Court has required a mitigation discussion precisely for the purpose of evaluating whether anticipated environmental impacts can be avoided. A mitigation discussion without at least *some* evaluation of effectiveness is useless in making that determination."[102]

A bald assertion that mitigation will be successful is not sufficient. The effectiveness must instead be supported by "substantial evidence in the record."[103] The DEIS utterly fails to meet this requirement, including by incorrectly assuming that lacustrine habitat and riverine habitat provide equivalent habitat for fish and wildlife. As the U.S Fish and Wildlife Service has concluded, however, this conclusion is incorrect:

> "Even though water flow will be maintained through the lake, it will not provide the habitat required for those species needing a riverine environment to survive, thus representing a net loss of approximately 250 aces of this habitat type."[104]

The mitigation proposed in the DEIS consists of restoring agricultural lands to bottomland hardwood wetlands. Such mitigation, however, is typically not successful in part due to the extreme difficulty in restoring appropriate hydrology to such mitigation sites. The proposed mitigation does not address the need for restoring appropriate hydrology and it does not commit to restoring only those lands where appropriate hydrology exists—such as natural overbank flooding. The bottomland hardwood forest that will be destroyed evolved because it was flooded periodically when the Pearl River overflowed its bank. Moreover, even if a perfect hydrologic regime was restored to the agricultural lands (which is extremely unlikely), it would take decades for restored forest to function like the mature forest that was destroyed. The temporal losses off habitat have not been accounted for in the proposed mitigation.

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[99] Robertson v. Methow Valley Citizens Council, 490 U.S. 332, 352 (1989).
[100] Id.
[101] Neighbors of Cuddy Mountain v. U.S. Forest Service, 137 F.3d 1372, 1380 (9th Cir.1998).
[102] *South Fork Band Council v. Dept. of Interior*, 588 F.3d 718, 727 (9th Cir. 2009) (internal citations omitted).
[103] Wyoming Outdoor Council v. U.S. Army Corps of Eng'rs, 351 F. Supp. 2d 1232, 1252 (D. Wyo. 2005).
[104]U.S. Department of the Interior, Fish and Wildlife Service letter to Michael E. Goff at page 9 (August 16, 2018) (providing official comments on the DEIS).

III. The DEIS Does Not Comply With Mandatory Federal Mitigation Requirements

All losses to fish and wildlife created by a federal water resources project must be mitigated unless the Secretary of the Army determines that the adverse impacts to fish and wildlife would be "negligible." 33 U.S.C. § 2283(d)(1). To ensure that this happens, the Corps of Engineers – and in this case, the non-Federal sponsor—is prohibited from selecting a "project alternative in any report" unless that report includes a "specific plan to mitigate fish and wildlife losses." *Id*. Accordingly, the DEIS must include a specific mitigation plan.

Corps mitigation plans must ensure that "impacts to bottomland hardwood forests are mitigated in-kind and harm to other habitat types are mitigated to not less than in-kind conditions, to the extent possible." 33 U.S.C. § 2283(d)(1). Mitigation plans "shall include, at a minimum:"

1. The type, amount, and characteristics of the habitat being restored, a description of the physical actions to be taken to carry out the restoration, and the functions and values that will be achieved;
2. The ecological success criteria, based on replacement of lost functions and values, that will be evaluated and used to determine mitigation success;
3. A description of the lands and interest in lands to be acquired for mitigation, and the basis for determining that those lands will be available;
4. A mitigation monitoring plan that includes the cost and duration of monitoring, and identifies the entities responsible for monitoring if it is practicable to do so (if the responsible entity is not identified in the monitoring plan it must be identified in the project partnership agreement that is required for all Corps projects). Corps mitigation must be monitored until the monitoring demonstrates that the ecological success criteria established in the mitigation plan have been met; and
5. A contingency plan for taking corrective action in cases where monitoring shows that mitigation is not achieving ecological success as defined in the plan. 33 U.S.C. § 2283(d).

Corps mitigation plans must also comply with the "the mitigation standards and policies established pursuant to the regulatory programs" administered by the Corps. 33 U.S.C. § 2283(d).

Corps mitigation must be monitored until the monitoring demonstrates that the ecological success criteria established in the mitigation plan have been met. The Corps is also required to consult yearly on each project with the appropriate Federal agencies and the states on the status of the mitigation efforts. The consultation must address the status of ecological success on the date of the consultation, the likelihood that the ecological success criteria will be met, the projected timeline for achieving that success, and any recommendations for improving the likelihood of success. 33 U.S.C. § 2283(d).

In addition, mitigation lands for Corps civil works projects must be purchased before any construction begins. 33 U.S.C. § 2283(a). Any physical construction required for purposes of mitigation should also be undertaken prior to project construction but must, at the latest, be undertaken "concurrently with the physical construction of such project." *Id*.

The DEIS fails to comply with these important mitigation requirements for at least the following reasons.

(1) The DEIS does not propose mitigation for all fish and wildlife impact that are more than negligible, as required by law.

(2) The DEIS does not propose mitigation to address the temporal loss of resources. This is extremely important as it can take decades for a bottomland hardwood forest to reach maturity and during this period of growth even successfully regenerating bottomland hardwood forest areas will not mitigate for the losses of mature bottomland hardwood wetland forests.

(3) The DEIS does not propose mitigation for the impacts to riverine habitat. Hundreds of acres of large river and small stream riverine habitat will be lost as a direct result of the TSP and these impacts must be mitigated to not less than in-kind conditions. Indeed, it is unclear whether such riverine mitigation would be possible.

(4) The DEIS does not propose any actions to ensure wetland hydrology on lands targeted for bottomland hardwood wetland mitigation, which could prevent this wetland habitat from being mitigated in-kind.

(5) The DEIS does not provide a description of the lands and interest in lands to be acquired for mitigation, and the basis for determining that those lands will be available.

(6) The DEIS cannot determine the actual amount of mitigation needed because it has not meaningfully assessed the full extent of the harm to fish and wildlife as a result of the direct, indirect, and cumulative impacts of the Project.

(7) The DEIS does not provide a specific plan to mitigate the adverse impacts of the Project that satisfies the requirements discussed above, including the requirement for identifying specific actions, ecological success criteria, monitoring actions to ensure ecological success, or a contingency plan.

IV. The Endangered Species Act Requires Formal Consultation and a Biological Opinion

As discussed above, even the flawed Biological Assessment demonstrates that formal consultation must be initiated under the Endangered Species Act and a Biological Opinion must be prepared for the Project. The DEIS states that the Biological Opinion is being prepared. The Biological Opinion should have been completed prior to finalization of the DEIS to help guide development of the plan, and it should have been released to the public with the DEIS.

V. The Project is Prohibited Under Clean Water Act Section 404

As an initial matter we note that the DEIS fails to include the required Clean Water Act § 404(b)(1) analysis. It is nevertheless clear, however, that the TSP is prohibited under Section 404 of the Clean Water Act due to the magnitude and severity of the environmental harm that would be caused, the ability to avoid those impacts through the use of less damaging alternatives—including the alternatives recommended for review in Section II.B.1 of these comments—and the failure to require adequate compensatory mitigation.

This Project must comply with the requirements of Clean Water Act Section 404 and the Section 404(b)(1) Guidelines.[105] Critically, the 404(b)(1) Guidelines **prohibit** the Corps from proceeding with the Project (or approving a permit for this Project) if:

(a) The project "will cause or contribute to significant degradation of the waters of the United States;"[106] or
(b) A less damaging practicable alternative is available;[107] or
(c) The project fails to adequately minimize and compensate for wetland and other aquatic resource losses;[108] or
(d) The project evaluation fails to establish that the project will not have unacceptable adverse environmental impacts.[109]

The TSP is prohibited under each of these mandates.

Under the 404(b)(1) Guidelines, effects that contribute to significant degradation include:

- Significantly adverse effects of the discharge of pollutants on human health or welfare, including but not limited to effects on . . . fish, shellfish, wildlife, and special aquatic sites;
- Significantly adverse effects of the discharge of pollutants on life stages of aquatic life and other wildlife dependent on aquatic ecosystems;
- Significantly adverse effects of the discharge of pollutants on aquatic ecosystem diversity, productivity, and stability. Such effects may include, but are not limited to, loss of fish and wildlife habitat or loss of the capacity of a wetland to assimilate nutrients, purify water, or reduce wave energy; or
- Significantly adverse effects of discharge of pollutants on recreational, aesthetic, and economic values.[110]

As discussed above, the adverse impacts of the Project are so dire that they unquestionably would cause or contribute to significant degradation of the nation's waters. The TSP would cause significant and severe impacts to virtually every factor identified above and would cause unacceptable adverse impacts to fish and wildlife habitat and special aquatic sites, including wetlands. These impacts cannot be adequately mitigated—and adequate mitigation has certainly not been proposed. Critically, less damaging, practicable alternatives are also clearly available.

[105] 33 U.S.C. § 1323; 33 C.F.R. § 336.1(a).
[106] 40 C.F.R. § 231.10(c).
[107] 40 C.F.R. § 230.10(a).
[108] *See* 40 C.F.R. 230.10(a)–(d).
[109] 40 C.F.R. § 230.1(c).
[110] 40 C.F.R. § 230.10(c).

VI. Additional Consultations Should Be Carried Out

The non-Federal sponsor must consult with the Park Service on the Project because the Pearl River is listed in the Nationwide Rivers Inventory (NRI).[111] More than 150 miles of the Pearl River—extending from RM 161, above the city of Columbia, to RM 312, one mile south of Jackson—has been listed since 1982 due to the Outstanding Resource Values of Scenery, Recreation, Fish and Wildlife. The listing also notes that: "Numerous endangered, threatened and rare species; excellent example of large Gulf Coastal Plain river with extensive swamplands; upper reach very scenic."

River segments listed in the NRI are potential candidates for inclusion in the National Wild and Scenic River System because they are believed to possess one or more "outstandingly remarkable" natural or cultural values judged to be at least regionally significant. Under the Section 5(d)(1) of the Wild and Scenic Rivers Act and related guidance, all federal agencies must seek to avoid or mitigate actions that would adversely affect NRI river segments and the National Park Service has established consultation requirements to help ensure that this happens.[112]

Given the significant implications for public safety and the stated goal and anticipated outcome of increasing development in areas at high risk of flooding, the non-Federal sponsor should also formally consult with the Federal Emergency Management Agency and the Mississippi Emergency Management Agency. This consultation should focus on ensuring that any project recommendation will in fact minimize—instead of create—flood risks for the community.

VII. Independent External Peer Review is Required

The DEIS must be reviewed under the Independent External Peer Review (IEPR) process established by the Water Resources Development Act of 2007. 33 USC § 2343. The DEIS clearly triggers mandatory IEPR under this provision as it evaluates a highly controversial civil works project that will cost well over $200 million. 33 USC § 2343(a). The IEPR must finalized within 60 days of the close of the public comment period on the DEIS. Id. Ideally, at least a draft IEPR would have been provided with the DEIS to assist the public in identifying areas where the DEIS could be improved, but such a draft has not been released.

The public already should have received information on the timing of the IEPR, the entity that has the contract for the IEPR review, and the names and qualifications of the IEPR panel members. 33 USC § 2343(c). However, despite a formal written request for this information, it has not been provided.

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[111] Information on the Nationwide Rivers Inventory can be accessed at https://www.nps.gov/subjects/rivers/nationwide-rivers-inventory.htm.
[112] Information on the Nationwide Rivers Inventory consultation process can be accessed at https://www.nps.gov/subjects/rivers/consultation-instructions.htm.

Conclusion

The National Wildlife Federation strongly opposes the preferred alternative in the DEIS and urge the Corps of Engineers to develop and select an alternative that will protect communities and the ecological health of the Middle Mississippi River. The National Wildlife Federation urges the Corps to initiate a National Academy of Sciences study on the effect of river training structures on flood heights to inform development of this alternative, and urge the Corps to fully address the many legal, scientific, and factual deficiencies discussed throughout these comments

Respectfully submitted,

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Attachments A and B

Attachment A

National Wildlife Federation Comments
Integrated Draft Feasibility Study & Environmental Impact Statement
Pearl River Basin, Mississippi Federal Flood Risk Management Project
Hinds & Rankin Counties, MS
June 13, 2018

NATURAL INFRASTRUCTURE SUCCESS STORIES

The projects highlighted below utilized natural infrastructure solutions—including ecosystem restoration, levee setbacks, and voluntary relocations—to protect communities and the environment.

Notably, wetlands prevented $625 million in flood damages in the 12 coastal states affected by Hurricane Sandy and reduced damages by 20% to 30% in the four states with the greatest wetland coverage. During Hurricane Katrina, coastal wetlands reduced storm surge in some New Orleans neighborhoods by two to three feet, and levees with wetland buffers had a much greater chance of withstanding Katrina's fury than those levees without wetland buffers.

California – Coyote Creek. The Santa Clara Valley Water District sought approval for levee setbacks and bypass channels after major flooding in 1983. The project was completed in 1995, and is credited for reducing flooding in 1997. According to the Santa Clara Valley Water District, flood waters would have been 40% faster and water volume would have been 57% higher without these improvements.

California – Napa River. The Napa River has flooded at least 30 times in the last 150 years, with residents sustaining more than $540 million in flood damages in the past 40 years alone. After twice rejecting old-style Corps' plans for levees-only flood protection in 1998 a broad coalition worked to develop a "living river" plan that is reconnecting portions of the Napa River to its floodplain. This new plan replaces the Corps' proposed floodwalls and levees with terraced marshes, wider wetland barriers, and restored riparian zones. About 500 acres of previously drained farmland were returned to marshland. Though they were only partially completed, those natural flood control solutions are credited for lowering flood levels by about 2 to 3 feet during the 2006 New Year's Day flood.

Florida – Upper St. John's River. Florida has a long history of flooding caused by hurricanes, tropical storms, and heavy rainfall. By the 1970s, the St. John's River had lost more than 62 percent of its historic 400,000 acres of floodplain wetlands, aggravating extensive flooding in the region. In 1986, Congress authorized a combined structural and restoration project to reduce flood damages along the river. The backbone of this project is restoration of 200,000 acres of floodplain which will hold more than 500,000 acre-feet of water – enough to cover 86 square miles with 10 feet of water – and will accommodate surface water runoff from a more than 2,000 square mile area. The Corps predicts that this $200 million project will reduce flood damages by $215 million during a 100-year flood event, and provide average annual benefits of $14 million.

Illinois – Cache River. Channelized, dredged, diverted, and leveed since the early 1900s, the Cache River today has lost 91% of its historic wetlands, leaving just 472,800 acres of its once 5 million-acre floodplain. Friends of the Cache, local landowners, The Nature Conservancy, and a variety of government agencies formed a partnership in 1995 that has resulted in the restoration of 9,000 acres of wetlands, reducing erosion and sedimentation, improving water quality, decreasing flooding, and allowing wildlife to flourish. The success of this project has inspired efforts to restore small creeks in the watershed to their original channels.

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Illinois – Grafton. After the historic 1993 floods, and extreme flooding almost biannually for more than 150 years, the town of Grafton moved 70 homes and 18 commercial properties out of the floodplain to higher ground. The restored floodplain provides more room for the Mississippi and Illinois Rivers to spread out, reducing flood levels and damages, and providing recreational opportunities during dry periods. The 1995 Mississippi River flood left Grafton relatively unscathed.

Iowa – Iowa River. After the historic 1993 floods, communities in east-central Iowa looked to change how the land along the Iowa River was being used and purchased 12,000 acres in easements along the 45-mile river corridor for flood control purposes. Over the past decade, local communities are estimated to have saved $7.6 million in flood damages.

Iowa – Louisa Levee District 8. In 1993, when an oxbow levee breached for the 17th time, farmers in the Louisa Levee District volunteered for a federal buyout program. More than 2,500 acres of cropland in the old levee district was converted into the Horseshoe Bend Wildlife Refuge, a combination of grassland, meadows, and wetlands, which provides natural flood protection and serves as a stopover for migrating waterfowl. Residents report that this project helped to reduce flooding in 1995. Relocating the farmers out of the floodplain kept their agricultural land safe from future flooding at a cost that was about 50 percent less than the estimated cost of repairing flood damages from the 1993 flood. The project also put a permanent end to repeated levee repairs and expensive damage payments.

North Dakota and Minnesota – Red River. The communities of Grand Forks, North Dakota and East Grand Forks, Minnesota have suffered through at least 12 major floods since 1871. Following severe flooding in the spring of 1997, the communities worked with the Corps to develop a flood protection strategy featuring a space to give the river room to expand. This project involved setting back levees and acquiring flood-prone property to create a 2,200-acre greenway along the Red River between the two cities. This greenway has produced considerable flood insurance savings and provides open space for year-round recreation.

Massachusetts – Charles River. Extensive suburban growth paved over much of the Charles River watershed in eastern Massachusetts, triggering flooding from stormwater runoff in Boston and other downstream communities. In 1972, the Corps abandoned a planned $100 million levee and dam flood project along the Charles River after the agency determined that upstream wetlands were preventing some $17 million worth of flood damages annually. The Corps instead developed a nonstructural plan at a fraction of the cost, the $10 million Charles River Natural Valley Storage Project. This project, which included the purchase of 8,500 acres of wetlands with a storage capacity of 50,000 acre feet of water, helped reduce major floods in 1979, 1982, 1987, and 2006. In 1987, the storage area prevented an estimated $3.2 million in damages. In 2006, the storage area reduced flooding to a 2 year event while nearby rivers were suffering 40 and 100-year flood levels. The storage area has the added benefit of providing important recreational opportunities for the Boston Metropolitan area.

Missouri – Missouri River. Severe flooding throughout the 1990s led local citizens to seek natural alternatives to structural flood control measures. Through a combination of fee title acquisition and easement acquisition, 19,000 acres on a 49 mile stretch between Boonville and Jefferson City, Missouri were purchased and set aside as flood overflow areas, including nearly 6,000 acres that were previously enclosed by levees. According to the Natural Resource Conservation Service, the Corps estimated that such reconnections of the river with its floodplain reduced flood levels in 1998 by about four feet.

New York – Staten Island. Restoration of wetlands and lands adjacent to 19 stream corridors in Staten Island successfully eliminated regular flooding from southeastern Staten Island, while saving the City $300 million in costs of constructing storm water sewers.

Oklahoma – Mingo Creek. Once known as the flood capitol of the world, the city of Tulsa suffered the worst flood in its history in 1984. Five of the 14 deaths and $125 million of the $180 million in flood damage occurred along Mingo Creek. Rejecting the Corps' plan to build 5 structural detention sites, a team of civil engineers, urban planners, and landscape architects devised an alternative that included restoring open space where floodwater can safely overflow, creating permanent lakes, and relocating buildings from the Mingo Creek floodplain. Local property owners and businesses have not suffered major property losses due to flooding since the project was completed, and Tulsa's residents have received up to a 35% discount on their flood insurance rates. Tulsa's repetitive loss properties also declined from 93 in 1984 to just 5 in 1995.

Vermont – Otter Creek. A vast network of floodplains and wetlands, including those protected by 23 conservation easements protecting 2,148 acres of wetland along Otter Creek, saved Middlebury $1.8 million in flood damages during Tropical Storm Irene, and between $126,000 and $450,000 during each of 10 other flood events. Just 30 miles upstream, in an area without such floodplain and wetland protections, Tropical Storm Irene caused extensive flooding to the city of Rutland.

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Attachment B

National Wildlife Federation Comments
Integrated Draft Feasibility Study & Environmental Impact Statement
Pearl River Basin, Mississippi Federal Flood Risk Management Project
Hinds & Rankin Counties, MS
June 13, 2018

Diamonds in the Rough: Status of Two Imperiled *Graptemys* Species (*Graptemys oculifera* and *G. pearlensis*) in the Pearl River of Jackson, MS

Year 1


G. oculifera female, Stretch 2


G. pearlensis female, Stretch 1

Prepared for:
the Mississippi Department of Wildlife, Fisheries, and Parks
and the U.S. Fish and Wildlife Service

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13 November 2017

ABSTRACT

Two *Graptemys* species (Map Turtles and Sawbacks) are endemic to the Pearl River system of Mississippi and Louisiana: *Graptemys oculifera* (Ringed Sawback) and *Graptemys pearlensis* (Pearl Map Turtle). *Graptemys oculifera* was designated as federally threatened in 1986, while *G. pearlensis* was recently petitioned in 2011 to be listed under the Endangered Species Act. Relatively little is known about either species in the Pearl River system surrounding Jackson, Mississippi, even though Jackson is the most populated city along the river's entire length. We surveyed for both *Graptemys* species and other river turtle species during June and July 2017 using spotting scopes and binoculars. Surveys occurred along five equidistant stretches (5.3 rkm; S1-S5) from south of the Ross Barnett Reservoir (east of Westbrook Road) to south of Interstate 20 (near Savanna Street Exit). We documented *G. oculifera* in all surveyed reaches of the Pearl, and all stretches had reproducing populations as evidenced by the presence of juveniles. Densities of *G. oculifera* were higher (30 – 44/rkm) in stretches upstream of Lefleur's Bluff State Park (S1, S2) and downstream of Interstate 20 (S5) compared to middle stretches (10 – 14/rkm). This is likely associated with human modifications to the middle stretches of river including altered riverine hydrology and a lack of riparian forest that borders the river. Even though densities of *G. oculifera* were lower in these stretches, we found reproducing populations in degraded habitat and sometimes moderate densities where pockets of suitable habitat occur. We found *Graptemys pearlensis* in all river stretches surveyed, but densities were lower than *G. oculifera* in all surveys (0.7 – 3.2/rkm). Stretches 2 – 4 are inclusive of a portion of the Pearl River that is proposed to be impounded for flood control and economic development via the One Lake Project. This project would certainly alter existing riverine hydrology to favor turtles that prefer non-flowing, lake settings at the expense of turtles like *G. oculifera* and *G. pearlensis* that are riverine specialists. We estimate that along the ~15.9 km that would be impounded, this would impact 1033 to 1895 *G. oculifera* and ~65 to 150 *G. pearlensis.*

INTRODUCTION

Two endemic *Graptemys* species occur sympatrically in the Pearl River system of central Mississippi: *G. oculifera* (Ringed Sawback; Baur 1890) and *G. pearlensis* (Pearl Map Turtle; Ennen et al. 2010). Much research has been conducted on *G. oculifera* including population densities (Jones and Hartfield 1995, Dickerson and Reine 1996, Lindeman 1998, Shively 1999), population structure (Jones and Hartfield 1995), reproductive ecology (Jones 2006), and population genetics (Gaillard et al. 2015). Most of this information was collected because the species was listed as federally threatened in 1986 (USFWS 1986) and subsequently, the *G. oculifera* recovery plan outlined many studies to be undertaken (Stewart 1988). However, there is very little data available for *G. pearlensis*, with most being coincidental to *G. oculifera* visual population density surveys (Dickerson and Reine, 1996; Lindeman, 1998; Shively, 1999). Almost all of the data reported occurred prior to its recognition as a separate *Graptemys* taxon (Ennen et al., 2010), and only recently has long-term and short-term population status data become available (Selman and Jones 2017). Selman and Jones (2017) and all previous data point to *G. pearlensis* being rarer and in steeper decline relative to *G. oculifera*. In turn, *G. pearlensis* was recently petitioned by the Center for Biological Diversity to be considered a candidate for federal protection status (vis-à-vis *G. gibbonsi*; U.S. Fish and Wildlife Service 2011).

The objective of this study was to determine if both species occurred in 5 river stretches of the Pearl River that flow through the Jackson Metropolitan area (Hinds/Rankin counties). We also wanted to determine the abundance of each species via basking density surveys. Because data has only been collected for *Graptemys oculifera* north Lakeland Drive (see Jones and Hartfield 1995), our data for downstream sites are novel and will be informative for state and federal entities tasked with managing both species in this urban river stretch. Furthermore, this stretch is also inclusive of a segment of the Pearl River that would be impacted by the proposed

One Lake Project. Therefore, our data may also serve as pre-construction data for post-construction comparisons.

MATERIALS AND METHODS

Study Site.—Five equidistant and consecutive river segments (5.3 rkm each; total 26.5 rkm) of the Pearl River were selected to survey for river turtles in Jackson, Mississippi (Hinds and Rankin counties; Fig. 1). Two of these stretches (S1, S2) occur upstream of a lowhead dam on the Pearl River that pools water for intake by the J.H. Fewell Water Treatment Plant. Three survey stretches occur downstream of the lowhead dam (S3-S5). S1 and S5 are similar because they have alternating sandbar and cutbank sections with high levels of submergent and emergent deadwood. They also have an intact riparian forest buffer (i.e., forest up to the river's edge) and the primary trees species include Water Oak (*Quercus nigra*), Bald Cypress (*Taxodium distichum*), Overcup Oak (*Quercus lyrata*), and Black Willow (*Salix nigra*). Stretch 2 is a relatively straight portion of the Pearl River with fewer sandbar and cutbank sections, but similar to S1 and S5, S2 maintains moderate-high amounts of deadwood and a mostly intact riparian forest buffer. Lakeland Drive also crosses the Pearl River in S2. Stretch 3 and 4 encompass a highly modified stretch of the Pearl River, with human modifications including channelization, mowing, and desnagging of riverine deadwood. The river lacks a riparian forest buffer along most of S3 and S4, and instead, it is bordered by a grassy/shrubby margin. In stream differences include few deadwood snags and a shallow bottom with few deep sections. Also, Interstate 59, Old Brandon Road, and a railroad crossing occur within S3, while Interstate 20, U.S. Highway 80, and another railroad crossing occur along S4. Three of these river stretches occur within the

planned zone of the One Lake Project (S2-4), while two stretches (S1, S5) occur upstream and downstream of the proposed impacted segment.

Methods.—All river survey stretches were floated by boat during the months of June and July 2017. We completed 4 replicate surveys for S1 and 3 replicate surveys for S2-5 (total of ~84.8 rkm surveyed); for the latter, flooding during June prevented us completing a fourth round a surveys for S2-5. When sandbars were present, we moored the boat on the upstream end of the sandbar and viewed/counted basking turtles via spotting scope while we walked down the sandbar (similar to Selman and Qualls 2009); turtles were typically counted on emergent deadwood snags, but we also observed them on river banks and other manmade structures present in the river (e.g., rock rip rap). In the absence of sandbars, visual surveys consisted of floating downstream in an outboard motorboat with two observers that were equipped with binoculars; each observer counted opposite banks of the river and another person served as data recorder. A Nikon Coolpix p900 digital camera with 83× optical zoom was also used to take photographs of large basking aggregations of turtles that were difficult to identify from a distance with binoculars. All surveys were completed between the mid-morning to mid-afternoon hours (~0900 – 1530 hrs), when environmental conditions are conducive for basking. We avoided days when mostly cloudy conditions or precipitation occurred to minimize differences of environmental conditions during our observations.

We used a one-factor ANOVA to determine if *G. oculifera* densities were equal across the five stretches surveyed. If differences were observed, we used a Tukey-Kramer post hoc analysis to determine differences among sites. Because *G. pearlensis* data were non-normally distributed, we used a nonparametric Wilcoxon Rank Sums test to determine if densities were equal among the sites.

RESULTS

***Graptemys oculifera* Status**.—The mean number of *G. oculifera* observed per survey for all stretches surveyed was 158.4 turtles (99.1 ♂, 43.4 ♀, 9.9 Juveniles) with densities averaging 29.8 per rkm. Adults of both sexes and juveniles were observed within all stretches surveyed. However, there was considerable variability in densities among the stretches (Table 1). *Graptemys oculifera* densities were statistically different among the 5 stretches surveyed ($F_{4,16}$ = 7.78, p =0.0031). Results from the Tukey-Kramer post hoc analysis indicated that S1 (44.0/rkm) and S5 (41.8/rkm) had higher densities than S3 (10.0/rkm) and S4 (14.8/rkm), but S1 and S5 densities were not higher than those observed in S2 (33.5/rkm); S2 did not have higher densities than S3 and S4 (Table 1). *Graptemys oculifera* were observed in higher densities than *G. pearlensis* during all surveys at all sites (Fig. 2). For all surveys combined, *G. oculifera* was observed at 23× higher densities in comparison to *G. pearlensis*. Within site comparisons of *G. oculifera* and *G. pearlensis* ranged from a low of 13× higher in S5 to a high of 48× higher in S2.

***Graptemys pearlensis* Status**.—The mean number of *G. pearlensis* observed for all stretches surveyed was 7.1 turtles (4.7 ♂, 1.4 ♀, 0.6 Juveniles) per survey with densities averaging 1.3/rkm. Adults of both sexes were observed in all stretches, but juveniles were not observed in S3. Contrary to *G. oculifera*, *Graptemys pearlensis* densities were low in all river stretches surveyed (range: 0.25 – 3.2/rkm; Table 1), but densities were statistically different across sites (χ^2= 12.1, df = 4, p = 0.016). S5 had higher densities than S1-S4.

Other Turtle Species Observed and Miscellaneous Observations.—Along with *G. oculifera* and *G. pearlensis*, we also observed *Pseudemys concinna* (River Cooter; 93 observed, 1.1/rkm), *Sternotherus carinatus* (Razorback Musk Turtle; 35, 0.41/rkm), *Trachemys scripta* (Red-eared Slider; 41, 0.48/rkm), *Apalone mutica* (Smooth Softshell; 7, 0.08/rkm), *Apalone*

spinifera (Spiny Softshell; 1, 0.01/rkm), and *Graptemys pseudogeographica* (False Map Turtle; 16, 0.19/rkm).

For *G. pseudogeographica*, 16 individuals were observed in S2 (11 individuals), S3 (1), S4 (1), and S5 (3) including both mature males and females. No juveniles were observed, but hatchling and juvenile age classes of turtles can be relatively difficult to detect. Photographs were taken of individuals, and there seems to be subspecific variability with some individuals expressing *kohnii* subspecies characters (Fig. 3A, 3B) and other expressing *pseudogeographica* subspecies characters (Fig. 3C). *Graptemys pseudogeographica* was observed basking with other native turtle species including *P. concinna*, *G. oculifera*, and *G. pearlensis*; in one observation, all three *Graptemys* species were observed basking in the same tree crown (Fig. 3D). Thus, it seems likely that this species is established (likely via the pet trade and introductions) and occurs primarily downstream of Lakeland Drive.

While conducting surveys, we made many observations of *G. oculifera* basking on "non-traditional", manmade basking platforms. This includes individuals basking on rock rip rap (Fig. 4A), concrete culverts (Fig. 4B), exposed pipes (Fig. 4C), and discarded metal (Fig. 4D). Many of these "non-traditional" basking platforms were located in S3 and S4 (discussed below). We also observed *G. oculifera* basking on a log under Lakeland Drive even though the log was fully shaded by the bridge (Fig. 4E).

Within S3 and S4, the Pearl River has been highly modified throughout much of this 10.6 rkm stretch by channelization (i.e., straightening), desnagging, and removal of riparian trees/vegetation. Because of these actions, there are few deadwood basking structures for turtles in this stretch compared to S1, S2, and S5, and this likely contributes to turtles basking on manmade structures as mentioned above. Along with fewer deadwood basking structures, the

river channel has also filled substantially by sand/sediment, and this has left long river sections with a shallow river bottom and few deep refuges preferred by *Graptemys* species. Nonetheless, both *Graptemys* species persist in this setting – albeit at lower densities. Juveniles are also present in these stretches, an indication of a breeding population. Within S3/S4, there were short river sections where moderate to high amounts of deadwood and an intact riparian zone could be found (e.g., at the end of S3 [near E. Silas Brown Road/Old Brandon Road], in the middle of S4 [east of East McDowell Road and downstream of I-20]). In these stretches, densities of *G. oculifera* were concentrated around areas that maintained a riparian forest buffer even though few individuals occurred upstream and downstream of these locations.

DISCUSSION

***G. oculifera* Status**.—The Pearl River around Jackson has been historically altered by humans in many ways, particularly to limit flooding in the city of Jackson via channelization, desnagging, and riparian zone clearing (especially in S3 and S4). Many riverine modifications were made before and following the historic Easter Flood of 1979, and all of these modifications were implemented in an attempt to move river water faster through a segment of the Pearl River that was historically sinuous. It has also been hydrologically altered since 1963 via the Ross Barnett Reservoir that controls river flows via a dam and spillway system (~17.4 km upstream of lowhead dam in Jackson). Last, along with these modifications, this entire stretch of the Pearl River has also been historically subjected to degraded water quality via industrial, municipal, and residential sources (McCoy and Vogt 1979). However, water quality throughout this section of the Pearl River has improved following infrastructure enhancements (Mississippi Department of

Environmental Quality 1998), but litter is still present in copious amounts (WS and HS, personal observation).

Therefore, our observations that *G. oculifera* persists throughout this section of river – sometimes in relatively high densities – is surprising, encouraging, and indicative of the recovery potential of the species. Even in the most degraded habitat of S3 and S4, *G. oculifera* were still present and reproducing, and they were observed in moderately high densities where a riparian buffer was present (e.g., near Silas Brown Street). Thus, it is not surprising that densities in S1 and S5 were highest given their "more natural" river setting with sandbars, cutbanks, intact riparian buffer, and copious amounts of riverine deadwood for basking. Stretch 1 has also been the focus of long-term study by R.L. Jones (site name Lakeland), and this population of *G. oculifera* is one of the most stable populations of the 5 populations surveyed since the 1980s (Selman and Jones 2017).

Mean densities of *G. oculifera* in S1 (44.0/rkm), S2 (33.5/rkm), and S5 (41.8/rkm) exceeded the densities observed by prior researchers throughout the Pearl River system except at two study sites: Ratliff Ferry and Columbia (see Selman and Jones 2017). However, even though mean densities of *G. oculifera* in S3 (10.0/rkm) and S4 (14.8/rkm) are 2-3× less than the other river stretches we surveyed, these densities are not insignificant. Densities in S3 and S4 are similar to densities observed by Shively (1999) in the Bogue Chitto River (4 – 17/rkm), and they exceed or are similar to densities in the lower Pearl River (0 – 15.7/rkm; Dickerson and Reine 1996).

***G. pearlensis* Status**.—*Graptemys pearlensis* densities were lower during all surveys and in all stretches in comparison to *G. oculifera*. Most studies to date have found similar observations for the species comparison (see summary table Selman and Jones 2017). Our observed densities

fall within most previously reported basking densities for *G. pearlensis* (range: 0 – 7 per rkm), with only a few sites having densities exceeding our observations (range: 10 – 15/rkm; Pearl River at Columbia, Selman and Jones 2017; portions of the Bogue Chitto River, Shively 1999). Based on *G. pearlensis* capture data for the Lakeland population (i.e., S1, north of Lakeland Drive), this population has undergone a significant population decline since the 1980s (Selman and Jones 2017). For example, in the 1980s and 1990s, 20-40 individuals were regularly captured per trapping effort, while by 2013, only a single individual was captured with similar effort (Selman and Jones 2017). It is unknown why the population has declined in this stretch, but water quality and riverine regulation at the reservoir have likely impacted prey item presence and availability (Selman and Jones 2017). Ultimately, the chances of localized extirpations is higher in species with small populations like *G. pearlensis* (in comparison to *G. oculifera*) due to environmental and demographic stochastic events.

Implications of the One Lake Project on Riverine Turtles.—Proposed riverine impoundment projects on this section of the Pearl River, particularly the One Lake project, have the potential to impact populations of both *G. oculifera* and *G. pearlensis* along with other riverine turtle species we observed. The One Lake project currently proposes to impound ~15.9 rkm of the Pearl River, and that river stretch encompasses surveyed stretches S2 – S4.

Based on our surveys, the minimum number of *G. oculifera* impacted along this stretch (S2 – S4) of river would be 379 individuals (Max and Mean Counts: S2 – 211 [$\bar{x}$ = 177.5]; S3 – 58 [$\bar{x}$ = 53]; S4 – 110 [$\bar{x}$ = 78.4]). However, when factoring in basking frequency information for a similar species from the Pascagoula River (*G. flavimaculata*; Selman and Qualls 2011), it is likely that we only observed 20 – 30% of the population basking during our surveys (i.e., during the summer, thermoregulatory needs are much less for individuals, and therefore, fewer

individuals in the population are observed basking at any particular time compared to spring or fall). Therefore, if we only observed 20 – 30% of the population, the population in this stretch impacted would likely approach 1033 to 1895 *G. oculifera* individuals. This is inclusive of males and females that represent a viable and reproducing population given the presence of juveniles along all stretches.

In contrast to *G. oculifera*, a much smaller minimum number of *G. pearlensis* would be impacted along this stretch of river (S2 – S4): 15 individuals (Max and Mean Counts: S2 – 4 [$\bar{x}$ = 3.7]; S3 – 3 [$\bar{x}$ = 1.3]; S4 – 8 [$\bar{x}$ = 4.8]). However, factoring in basking frequency information for a similar species from the Pascagoula River system (*G. gibbonsi*; Selman and Lindeman 2015), it is likely that we only observed 10 – 15% of the population basking during our surveys for similar reasons as cited above for *G. oculifera*. Therefore, given that we only observed 10 – 15% of the population, the population in this stretch impacted would be ~65 to 150 *G. pearlensis* individuals.

If the One Lake project is implemented, it will dramatically alter the hydrology of this stretch of the Pearl River. It will convert from a lotic, river setting (i.e., moderate to high flow) to a more lentic, lake setting (i.e., low to no flow setting; for review see Bunn and Arthington 2002). Furthermore, it seems likely that if the One Lake Project was implemented, the conditions that result would benefit common, generalist species that thrive in low flow settings (e.g., Red-eared Slider, Common Musk Turtle, Common Snapping Turtle, Spiny Softshell) at the expense of threatened riverine specialist species (e.g., Ringed Sawback, Pearl Map Turtle, Razorbacked Musk Turtle, Alligator Snapping Turtle, Smooth Softshell). Indeed, reservoirs are a leading contributor to species endangerment in the southeastern United States (Czech et al. 2000), and a project such as this could lead to localized extirpations of flow-dependent species.

The data contained herein provide baseline basking densities for comparison if the project occurs in order to test this likely scenario. We intend to collect additional data during the summer 2018 using similar methods along the same stretches outlined.

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Stretch	Mean (SD) *G.o.* ♂	Mean (SD) *G.o.* ♀	Mean (SD) *G.o.* Juv	Mean (SD) *G.o.* Total	Mean *G.o.*/rkm	Mean (SD) *G.p.* ♂	Mean (SD) *G.p.* ♀	Mean (SD) *G.p.* Juv	Mean (SD) *G.p.* Total	Mean *G.p.*/rkm
1	137.5 (63.7)	72.8 (26.0)	15.5 (6.2)	234.3 (86.8)	44.0 [a] (16.3)	5.5 (3.1)	1.0 (0.82)	1.5 (1.3)	8 (2.2)	1.5 [a] (0.4)
2	109.3 (11.0)	40.7 (13.3)	23 (10.8)	178.0 (31.2)	33.5 [ab] (5.9)	2.3 (1.5)	1.3 (1.2)	0	3.7 (0.6)	0.7 [a] (0.1)
3	28.3 (2.5)	21.7 (8.4)	2.0 (1.2)	53.0 (9.5)	10.0 [b] (1.8)	1.0 (1.0)	0.3 (0.56)	0	1.3 (1.5)	0.25 [a] (0.28)
4	47 (19.7)	21.7 (3.8)	3.7 (2.5)	79 (27.2)	14.8 [b] (5.1)	2.3 (2.5)	2.3 (1.2)	0.3 (0.6)	5.0 (3.6)	0.9 [a] (0.7)
5	160.7 (54.6)	50.7 (28.0)	3.3 (1.2)	222.3 (50.6)	41.8 [a] (9.5)	12.0 (6.1)	2.3 (0.58)	1 (n/a)	17.0 (7.0)	3.2 [b] (1.3)
Total	**99.1 (63.0)**	**43.4 (26.6)**	**9.9 (9.8)**	**158.4 (89.5)**	**29.8 (16.8)**	**4.7 (4.9)**	**1.4 (1.1)**	**0.6 (0.9)**	**7.1 (6.3)**	**1.3 (1.2)**

Table 1. Mean counts and densities of *Graptemys* species within the Pearl River near Jackson, MS. Different superscript letters are indicative of significantly different densities among river stretches. *G.o.* = *G. oculifera*, *G.p.* = *G. pearlensis*, SD = Standard Deviation, rkm = river km.

Figure 1. River turtle survey segments along the Pearl River near Jackson, Mississippi (Hinds and Rankin counties). Numbered markers note the beginning of each of the 5.3 river km stretches surveyed.

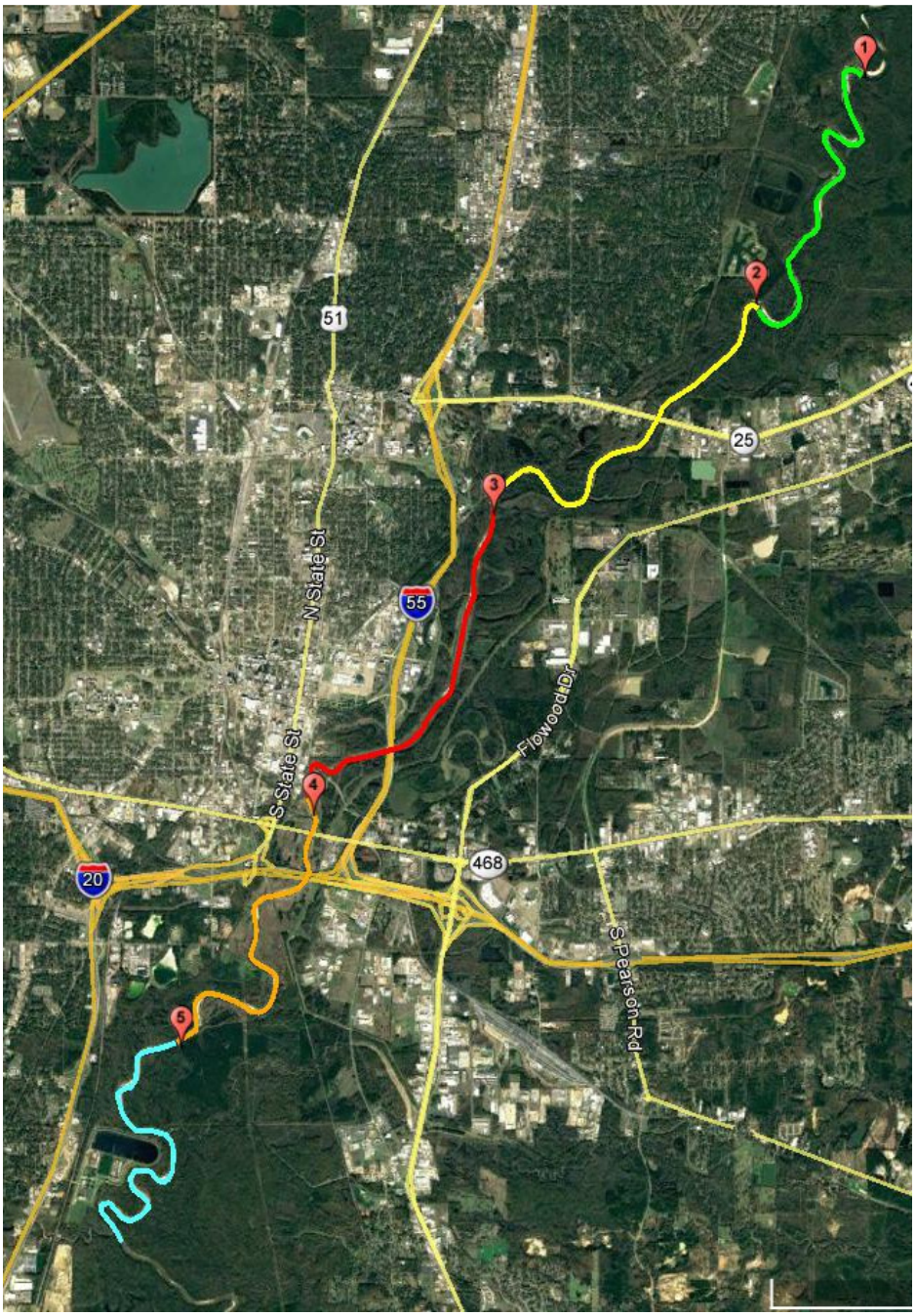

Figure 2. Variability in *Graptemys* densities among five stretches surveyed of the Pearl River. *Graptemys oculifera* is in blue and *G. pearlensis* is in red.

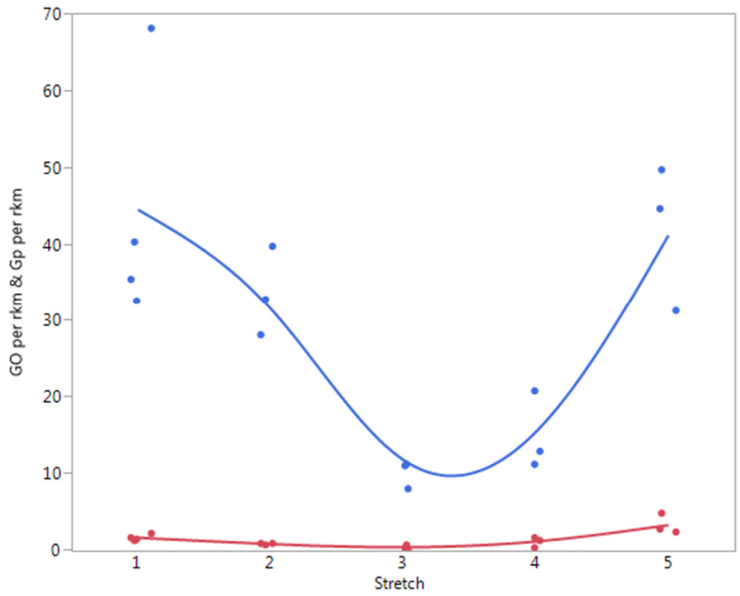

Figure 3. Observations of *G. pseudogeographica* in the Pearl River including *kohnii* subspecies forms (A, B) and *pseudogeographica* subspecies forms (C). *Graptemys pseudogeographica* was also observed basking with other native *Graptemys* (D). The white iris is characteristic for the species and can be seen here in all photographs.

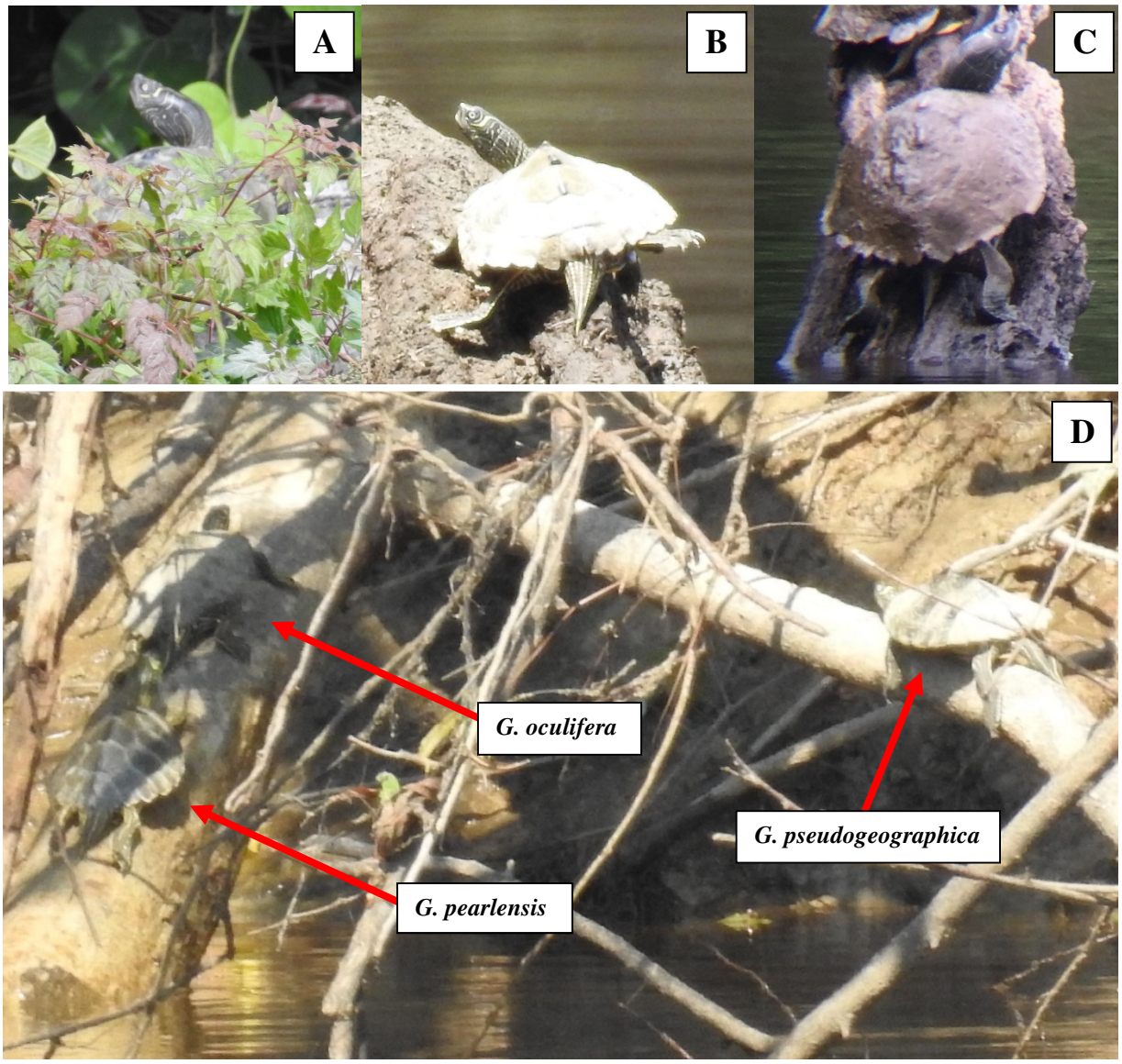

Figure 4. Observations of *G. oculifera* basking on manmade structures in the Pearl River near Jackson, Mississippi. This includes rock rip rap (A), discarded concrete culverts (B), exposed pipes (C), and discarded metal (Fig. D). We also commonly made observations of turtles basking under bridge overpasses like Lakeland Drive (E).