

**SCOPE OF WORK**

**DESIGN OF  
DISSOLVED OXYGEN IMPROVEMENT SYSTEMS  
IN SAVANNAH HARBOR**

**SAVANNAH HARBOR ECOSYSTEM RESTORATION STUDY  
AND  
SAVANNAH HARBOR EXPANSION PROJECT**

**CHATHAM COUNTY, GEORGIA**

**1.0 INTRODUCTION.**

The Savannah Harbor Ecosystem Restoration Study is examining ways to improve dissolved oxygen levels in the harbor. Hydrodynamic and water quality models have been separately developed which are acceptable to EPA, USFWS, GADNR-EPD and SC DHEC to identify dissolved oxygen levels throughout Savannah Harbor. Work has been completed that identified a dissolved oxygen injection system as being the most cost effective method to improve dissolved oxygen levels in the harbor. Designs of such a system are now needed. This work effort will use the enhanced version of these models to size and locate the system components and ensure the dissolved oxygen effectively mixes throughout the portions of the harbor that have the critical dissolved oxygen problems.

The Savannah Harbor Expansion Project is also examining ways to mitigate for potential adverse effects on dissolved oxygen levels from proposed harbor deepening alternatives. The SH Expansion Project intends to use a dissolved oxygen injection system for that mitigation. Designs for a dissolved oxygen injection system to meet those mitigation requirements are now needed. This work effort will also use the enhanced version of these models to size and locate the system components and ensure the dissolved oxygen effectively mixes throughout the portions of the harbor that have the critical dissolved oxygen problems.

**2.0 BACKGROUND.**

Portions of Savannah Harbor do not meet Georgia's water quality standards for dissolved oxygen (D.O.) during the summer months. The harbor is on Georgia's Section 303(d) list for waters that do not comply with water quality standards for dissolved oxygen. EPA Region 4 released a Draft TMDL for Dissolved Oxygen for the harbor in August 2004 to address the recurring low D.O. levels. EPA is working with the states of Georgia and South Carolina to promulgate a new D.O. standard to apply in Savannah Harbor.

The Savannah District of the US Army Corps of Engineers has partnered with the City of Savannah in a study to investigate ways to improve D.O. levels in the harbor. That study is called the Savannah Harbor Ecosystem Restoration Study. The study is intended to identify the causes of the recurring low D.O. levels and recommend the most cost-effective way of improving D.O. levels. The report prepared at the conclusion of that study would provide the basis for both the Corps and a non-Federal sponsor to decide whether to proceed to implement a D.O. improvement measure.

The Savannah District has also partnered with the Georgia Ports Authority to evaluate the feasibility of deepening the Savannah Harbor Navigation Project. That effort is called the Savannah Harbor Expansion Project. That project is intended to identify whether deepening the harbor from its presently authorized 42-foot depth up to a depth of 48-feet is warranted and environmentally acceptable, and identify the most appropriate depth within that range. The report prepared at the conclusion of that evaluation would result in decision on whether to proceed with deepening of the harbor as well as the extent of that deepening, and serve as the basis for obtaining Federal funding for any recommended action.

**3.0 OBJECTIVE.** The objective of this study is to prepare several designs of a dissolved oxygen injection system that would increase dissolved oxygen levels in the harbor. This work effort will use the enhanced version of the hydrodynamic and water quality models to size and locate the system components and ensure the dissolved oxygen effectively mixes throughout the portions of the harbor that have the critical dissolved oxygen problems.

**4.0 WORK TO BE PERFORMED BY THE CONTRACTOR.** This study will be conducted in three phases, with multiple activities being performed in each phase. Computer models presently exist for both the riverine portion of the Savannah River from J. Strom Thurmond Dam to downstream of Clyo, Georgia (river model) and for the Savannah Harbor from Clyo to the Atlantic Ocean (harbor models consisting of EFDC and WASP). The harbor models were enhanced through recent efforts by Tetra Tech, under contract to the US Army Corps of Engineers. The enhanced version of the models will be used in this evaluation. The Contractor is responsible for running both the riverine and harbor models to perform this work.

The Contractor will evaluate the dissolved oxygen needs in the portions of the harbor that demonstrate recurring critical D.O. problems. EPA's TMDL identified that area as generally being between the Houlihan Bridge and the Bight (just downstream of the junction with South Channel), and in the Back River up to the Sediment Basin.

The dissolved oxygen standard proposed for the harbor by EPA in the 2004 Draft TMDL will be used as the proposed Georgia standard. All three components of EPA's proposed D.O. standard (1-, 7-, and 30-day average values) should be evaluated. The D.O. improvement systems should be designed to meet the most stringent of the three components.

The Contractor will use these models to determine the amount of oxygen that needs to be added to the waters to meet the applicable water quality standards. The modeling results will identify

the amount of oxygen to be added, the location along the channel where that addition is needed, and the depth in the river at which the oxygen should be introduced. Based on those identified oxygen addition needs, the Contractor will develop feasibility-level designs for a system to introduce that oxygen. The Contractor should review existing land uses in the harbor and initially attempt to locate the landside facilities at either existing Federal or local government facilities, or lands in industrial use. The Contractor should discuss his initial set of tentative landside facility locations with the Corps before finalizing the facility siting. Other than those guidelines, the Contractor does not to consider the availability or cost of acquiring the lands.

The dissolved oxygen improvement designs will be based on use of an off-stream (on-land) system to improve the D.O. of waters obtained from the river and then reintroduce those waters back into the river. Speece cones will be the mechanism used to increase the D.O. content of the side-stream waters. Information about this technique can be found in the 2005 Savannah District report titled "Identification and Screening Level Evaluation of Measures to Improve Dissolved Oxygen in the Savannah River Estuary" or from a company website found at [www.eco2tech.com](http://www.eco2tech.com).

For all three tasks, the Contractor will develop feasibility-level designs for the entire dissolved oxygen injection systems and a preliminary cost estimate. For the landside facilities, these designs will use standard-size Speece cones (possibly multiple units operating in parallel) to add oxygen to the waters. Multiple units (cones) could be used at a given site. A standard design layout will be developed for the landside facilities that will include at least the following components:

- Speece cone(s)
- Intake and discharge lines
- Oxygen storage
- Structures
- Pumps
- Fencing
- Parking
- Amount of land needed within the fence
- Amount of land needed for access to the river
- Power needs of the facility
- Not to include roadway to the facility

For the aquatic components of the system, the designs will identify the depth of the intake and discharge lines, the size and type of the intake and discharge lines, the size of the screening needed at the ends of the intake (and/or discharge line), and generally use standard-sized components.

For each landside facility, the Contractor will provide (1) a listing of the facility components, and (2) a plan view figure showing the layout of the facility.

The Contractor will develop preliminary cost estimates for construction, annual operation, and long term operation (include major rehab) of each of the dissolved oxygen injection systems he designs. The estimates will include the features in the list on the previous page, but do not need to include the cost of a roadway or power to each site, or the cost of land.

Two trips to Savannah would be included in this work. These trips would be conducted at the conclusion of the work, where the contractor would meet with the Corps and non-Federal sponsors to present his findings and conclusions. Assume a separate trip, each one full day in Savannah, would be required to present the work conducted for each task.

The results of each task will be reported visually, through charts and tables, and through written descriptions. The Contractor will prepare a summary report describing the models and procedures used, as well as his findings and conclusions. A separate report will be prepared to cover the work conducted in Task I and Task II. Each of those reports will be updated after completion of Task III. Electronic copies of the model input files and outputs will be provided for designs developed for each task.

**Task I** is the development of four designs for dissolved oxygen injection systems that would allow the harbor to meet state water quality standards (both Georgia and South Carolina). The following inputs and criteria will be used for the four designs:

<u>Design</u>	<u>River Flows</u>	<u>Point Source Loading</u>	<u>D.O. Standard</u>
I-A (Existing)	1997 (Average Flows)	2004	SC & GA
I-B	1999 (Drought Flows)	2004	SC & GA (Existing)
I-C (Proposed)	1997 (Average Flows)	2004	SC & GA
I-D	1999 (Drought Flows)	2004	SC & GA (Proposed)

The present 42-foot authorized navigation project, including provisions to account for existing advance maintenance and overdepth dredging, would be used in this first task.

**Task II** is the development of five designs for dissolved oxygen injection systems that would mitigate for the potential effects on dissolved oxygen from a harbor deepening. For designs A and B, the Contractor will assume a 6-foot deepening of the harbor (to a 48-foot authorized channel depth). It is assumed that the maximum potential deepening would produce the maximum effects on dissolved oxygen. These two designs allow identification of the maximum size dissolved oxygen injection system that would be needed to mitigate for potential effects on dissolved oxygen from a harbor deepening. The Contractor will need to run the models in both the Existing Condition and With Project Condition. The dissolved oxygen improvement system

would be a component of the harbor deepening that would allow the waters of the estuary to remain at the dissolved oxygen characteristics they demonstrate under the Without Project Condition. The following inputs and criteria will be used for the two designs:

<u>Design</u>	<u>River Flows</u>	<u>Point Source Loading</u>	<u>D.O. Standard</u>
II-A (Proposed)	1997 (Average Flows)	2004	SC & GA
II-B	1999 (Drought Flows)	2004	SC & GA (Proposed)

The second phase of this task is development of identification of D.O. improvement system designs for the following three alternate depth scenarios: 44-, 45-, and 46-foot authorized channel. The Contractor will review the results of the work he performs for Designs II-A and II-B to identify which scenario requires the largest D.O. improvement system – identify whether a larger system is required for average flows or for drought flows. The Contractor will then use that information to develop D.O. improvement system designs (using the river flows requiring the largest system) for the alternate depth scenarios.

<u>Improvement Design</u>	<u>Channel Depth</u>	<u>Point Source Loading</u>	<u>D.O. Standard</u>
II-C	44 Feet	2004	SC & GA (Proposed)
II-D	45 Feet	2004	SC & GA (Proposed)
II-E	46 Feet	2004	SC & GA (Proposed)

These three improvement designs provide designs for the dissolved oxygen improvement systems needed to mitigate for potential effects on dissolved oxygen from the intermediate harbor deepening alternatives.

**Task III** is an update to the results of Tasks I and II, to be performed once the SH Expansion Project reaches a tentatively recommended plan for deepening the navigation channel. Assuming channel deepening is found to be warranted, once the amount of that deepening is identified, the Contractor will rerun the final designs developed during Tasks I and II with the proposed new channel depth and mitigation features. The Contractor may need to revise the designs he developed in Tasks I and/or II to ensure they remain as effective with the project modifications proposed in the SH Expansion Project. This effort will identify those changes and develop new designs for each of the scenarios in Task I. This effort will also identify those changes and develop a new design for the one Task II scenario -- for the tentatively recommended channel depth. The Contractor will run the Task II scenario for the tentatively recommended plan for both the average and drought river flows to estimate the operating costs for each of those scenarios. Should EPA and the States have reached agreement on the new water quality standard to be used in the harbor by the time the SH Expansion Project reaches a tentative recommendation, the Contractor will use that new standard rather than the ones now shown in Tasks I and II of this SOW.

The update of Task II should be conducted first. The Contractor should assume that the system designed in the Task II update would be in place when he updates the designs in Task I.

**5.0 MATERIALS TO BE FURNISHED BY SAVANNAH DISTRICT.** Savannah District will provide no materials for this work.

**6.0 DELIVERABLES.** All deliverables should be provided to the U.S. Army Corps of Engineers, Savannah District, Attn: PD-E (Mr. William Bailey), P.O. Box 889, Savannah, GA 31402.

**6.1 MONTHLY PROGRESS REPORTS (Deliverable 1).** Submit one (1) copy by the 10<sup>th</sup> of each month documenting the previous month's efforts.

**6.2 DRAFT REPORT FOR TASK I (Deliverable 2).** Submit ten (10) CDs containing a report describing the activities conducted during this work, the tools and procedures used, and the findings and conclusions. Information describing the D.O. situation under each scenario will include the following:

- Plan view map of the estuary showing the location of recurring low D.O. levels (critical area)
- For the critical area (same list as in final post-processor developed under separate scope of work):
  - Plan view map showing minimum D.O. level through the water column for the model grid
  - Cross-section views (four equally-spaced along the channel length) showing minimum D.O. levels
  - Table showing volume of water meeting and not meeting existing Georgia water quality standard for D.O.
  - Table showing volume of water meeting and not meeting existing South Carolina water quality standard for D.O.
  - Table showing volume of water meeting and not meeting new/proposed Georgia water quality standard for D.O.
  - Plan view map showing grid locations that do not meet existing Georgia water quality standard for D.O.
  - Plan view map showing grid locations that do not meet existing South Carolina water quality standard for D.O.
  - Plan view map showing grid locations that do not meet new/proposed Georgia water quality standard for D.O.
- Descriptions of the dissolved oxygen improvement systems designed in Section 4.0 of this SOW, including the information listed on page 3.
- Descriptions of approximate fishery habitat effects produced by the dissolved oxygen improvement system. This consists of running the EFDC and WASP results through the post-processor to identify approximate fishery habitat effects. No specific river flows or months are required.

This report is to document the contractor's technical work on this delivery order. Savannah District and others may review the report, but contractor need only revise the report to address written comments provide by Savannah District.

**6.3 FINAL REPORT FOR TASK I (Deliverable 3).** This will be an update of the Draft Report, with the content being revised to address District review comments of the Draft. Submit ten (10) bound copies of the final version of the Summary Report. Submit twenty (20) CDs containing the Summary Report. Submit one (1) CD containing the report in both Microsoft WORD and ADOBE Acrobat formats.

**6.4 DRAFT REPORT FOR TASK II (Deliverable 4).** Submit ten (10) CDs containing a report describing the activities conducted during this work, the tools and procedures used, and the findings and conclusions. Information describing the D.O. situation under each scenario will include the following:

- Plan view map of the estuary showing the location of recurring low D.O. levels (critical area)
- For the critical area (same list as in final post-processor developed under separate scope of work)::
  - Plan view map showing minimum D.O. level through the water column for the model grid
  - Cross-section views (four equally-spaced along the channel length) showing minimum D.O. levels
  - Table showing volume of water meeting and not meeting existing Georgia water quality standard for D.O.
  - Table showing volume of water meeting and not meeting existing South Carolina water quality standard for D.O.
  - Table showing volume of water meeting and not meeting new/proposed Georgia water quality standard for D.O.
  - Plan view map showing grid locations that do not meet existing Georgia water quality standard for D.O.
  - Plan view map showing grid locations that do not meet existing South Carolina water quality standard for D.O.
  - Plan view map showing grid locations that do not meet new/proposed Georgia water quality standard for D.O.
- Descriptions of the dissolved oxygen improvement systems designed in Section 4.0 of this SOW, including the information listed on page 3.
- Descriptions of approximate fishery habitat effects produced by the dissolved oxygen improvement system. This consists of running the EFDC and WASP results through the post-processor to identify approximate fishery habitat effects. No specific river flows or months are required.

This report is to document the contractor's technical work on this delivery order. Savannah District and others may review the report, but contractor need only revise the report to address written comments provided by Savannah District.

**6.5 FINAL REPORT FOR TASK II (Deliverable 5).** This will be an update of the Draft Report, with the content being revised to address District review comments of the Draft. Submit ten (10) bound copies of the final version of the Summary Report. Submit twenty (20) CDs containing the Summary Report. Submit one (1) CD containing the report in both Microsoft WORD and ADOBE Acrobat formats.

**6.6 FINAL REPORTS FOR TASK III (Deliverable 6).** This task consists of updates to the Final Reports, with the content and designs being revised to address the District's recommendations concerning harbor deepening and any agreement reached between EPA and the States on the new water quality standard to be used in the harbor after issuance of the Contractor's reports for Task I and Task II. Submit twenty (20) bound copies of each Updated Final Report (Task I and Task II). Submit twenty (20) CDs of each Updated Final Report (Task I and Task II). Submit one (1) master CD for each report that contains both Microsoft WORD and ADOBE Acrobat formats. Submit one (1) electronic copy of the input files and raw model output of each model run (both EFDC and WASP model outputs). The model output desired is that provided by the model before any post-processing is performed. Depending on the size of the files, a separate DVD could be required for each modeling scenario.

**7.0 SCHEDULE.** The Contractor shall adhere to the following project schedule.

<u>Milestone</u>	<u>Due Date</u>
Initiate work	1 week after issuance of the Delivery Order
Monthly Progress Reports	10 <sup>th</sup> of each month until completion of the D. Order
Draft Report – Task I	8 weeks after issuance of the Delivery Order
Final Report – Task I	3 weeks from receipt of comments on Draft Report
Draft Report – Task II	5 weeks after issuance of the Delivery Order
Final Report – Task II	3 weeks from receipt of comments on Draft Report
Final Reports – Task III	4 weeks from receipt of input from CESAS

The Government expects to provide comments on the Draft Reports after a 30-day review period. CESAS expects to provide input allowing Task III to be started within 6 months of delivery of the first Draft Report.

**8.0 POINT OF CONTACT.** Mr. William Bailey (CESAM-PD-E) will be the US Army Corps of Engineers' point of contact for this work. He can be reached at 912-652-5781 (FAX 912-652-5787) or at the following address:

Mr. William Bailey  
ATTN: PD-E  
US Army Corps of Engineers  
Savannah District  
P.O. Box 889  
Savannah, GA 31402-0889

All invoices will be sent to the following address for processing:

US Army Corps of Engineers  
Savannah District  
Attention: CESAM-PD-E/Supon  
P.O. Box 889  
Savannah, Georgia 31402-0889

A copy of the **final** invoice will be send to:

US Army Corps of Engineers  
Savannah District  
Attention: CESAS-CT-C/MAJ Goolsby  
P.O. Box 889  
Savannah, Georgia 31402-0889