Qualifications for Phase II, Grays Harbor and Willapa Bay Sedimentation Dynamics and Mitigation Measures Project

Introduction

DSI, LLC (DSI) is pleased to submit our qualifications to provide professional services to support the Grays Harbor Conservation District (GHCD) in partnership with Grays Harbor and Pacific Counties. DSI understands that a Phase I literature review, analysis, and identification of the scope required for subsequent work (Phase II) has been developed. We understand that for Phase II, professional services are now required for the physical investigation, project development, prioritization, and a list of preliminary mitigation best management practices (BMPs) for Grays Harbor and Willapa Bay. As stated in the RFQ, GHCD requires a firm with direct experience in sediment survey design and analysis, extensive knowledge of estuarine habitat requirements, knowledge of Willapa Bay and Grays Harbor geography, and with experienced professional engineers licensed in Washington State on staff or on retainer.

DSI is an environmental science and engineering firm whose principals have over 35 years of experience in providing client focused solutions in water resources, water quality, hydropower, contaminated sediments and groundwater. With offices located in Edmonds, WA (our headquarters) and Asia, DSI offers our services on a worldwide basis. DSI understands how critical water and environmental policy/practice is to sustainable development and therefore assists in the development of integrated water/ environmental policy, regulation and capacity building internationally.

If selected, DSI would utilize a subcontract with Raedeke Associates, whose extensive local experience in aquatic habitat, biology, and ecology would inform the development of alternative management strategies and guide the evaluation of habitat metrics (both quantitative and qualitative) to compare the relative cost-benefit of each alternative.

Working together, DSI and Raedeke Associates can help the GHCD weigh the costs and benefits of different alternative strategies while considering the myriad of impacts that different courses of action may have for shellfish and other ecologically and economically important species. An important element in the development of the sediment transport model and alternatives analysis will be to address the ways in which the results overlap and influence (or are influenced by) other regulatory considerations, especially the influence of listed species, critical habitat of listed species, and Essential Fish Habitat. All of these factors are present in Grays Harbor and Willapa Bay for multiple species and habitats.

To accomplish the goals of this project, DSI and Raedeke have suggested an alternative approach which relies an existing Environmental Fluid Dynamics Code+ (EFDC+) model for Grays Harbor (developed by the USACE with support from DSI), and a fully 3D Physical Habitat Simulation (PHABSIM) analysis which can integrate sediment bed, water quality, or other relevant parameters which may be important for shellfish and other species. The combination of a more physically robust sediment transport approach combined with a rigorous habitat evaluation for multiple species and life stages would support a more comprehensive analysis of viability for future shellfish growing, and cost-effectiveness of preferred mitigation measures and BMPs. This would be accomplished using a multi-criteria optimization method, which we believe will provide GHCD and other stakeholders with the opportunity to implement the best available strategies while recognizing and minimizing unintended ecological and economic costs.

Qualifications and Relevant Experience

DSI LLC

DSI, LLC has been providing clients with solutions to their water management issues since 1999. DSI has successfully completed dozens of projects similar to this proposed sediment study for Grays Harbor. See the project list on the next page and Appendix A for our project references. DSI provides the following services to our clients worldwide:

- Water Resources Engineering & Planning
- Environmental Engineering & Planning
- Hydropower Engineering & Planning
- Coastal Engineering
- Morphological Studies
- Contaminated Sediments
- Groundwater Studies
- Field Data Collection and Management

Some of DSI's recent relevant projects include:

- Water quality studies on the San Joaquin-Sacramento River Delta (Sacramento, CA), the Caloosahatchee Estuary (Tallahassee, FL) and Upper Cook Inlet Beluga Whale Biological Evaluation (Anchorage, AK),
- Contaminated sediment modeling of PCB's and other toxics in Newtown Creek (NYC, NY), Portland Harbor (Portland, OR) and the Housatonic River (MA, USA)
- Salinity studies on Lower St John's River Estuary (Jacksonville, FL) and Indian River Lagoon (Jacksonville, FL)

Additionally, DSI has worked with Dr. Earl Hayter (USACE) to enhance sediment transport models of Grays Harbor and the Lower Duwamish Waterway – Elliot Bay. DSI's extensive experience in both numerical model development and in the execution of complex hydrodynamic and sediment transport studies make DSI uniquely well suited to lead a multi-disciplinary project of this nature.

DSI brings a team of water resources specialists to bear with a considerable range of experience in hydrologic, sediment transport and water quality modeling.

- As Senior Consultant for this project, Mr. Paul M. Craig has nearly 40 years of related experience in hydrology, hydrodynamics, sediment transport, toxics and water quality.
- Senior Hydrodynamic Modeler, Dr. Nghiem Tien Lam has worked on dozens of complex hydrodynamic and sediment transport studies including the Sacramento-San Joaquin River Delta in California.
- Senior Sediment Transport Modeler, Dr. Jeffrey Jung, has supported sediment transport studies in natural waterways including the Willamette (Oregon) and Tachia Rivers (Taiwan).

DSI has previously supported work on Grays Harbor through technical support for Earl Hayter of USACE on the EFDC model grid for that study and has gained a familiarity with the site through this work. DSI has developed sediment transport model survey plans for coastal and estuarine projects in a number of locations in North America including the Sacramento-San Joaquin River Delta, the largest estuary on the west coast.

Raedeke Associates, Inc

Raedeke Associates was started in 1979 to provide unbiased scientific assessments of natural resource issues. Over that time, the character, integrity and objectivity of our multidisciplinary team has allowed them to become a well-respected member of the consulting community. We have previously developed habitat conservation plans and coordinated the assessment and monitoring of threatened and endangered species. Raedeke Associates current work in Grays Harbor has provided valuable exposure to habitat classification and life history information on listed and EFH species that will be directly applicable to this project.

Raedeke Associates aquatic sciences specialist, Mr. Bill Taylor, has over 30 years of experience working in fisheries, freshwater and marine water habitats. His experience guiding the development of restored intertidal areas, identification and protection of critical habitat areas, and the assessment of habitat impacts from project designs would all contribute directly to the success of this project.

EFDC_Explorer Modeling System

DSI is the developer of the EFDC_Explorer Modeling System (EEMS), which is a full-featured commercial-grade graphical modeling framework comprised of the EFDC+ model, graphical software of pre- and post-processing (EFDC_Explorer), and grid generation (CVLGrid). This system is used by USACE, Environment Canada, USEPA and many other governmental, research and commercial entities in the United States and other countries. The EFDC+ model is based on EPA-accepted modeling technology and has long been considered among the most technically sound and defensible models for hydrodynamic, sediment transport, water quality, and toxic transport studies in rivers, estuaries, lakes, reservoirs and coastal systems. Figure 1 shows an image of the Grays Harbor model in the EEMS interface.

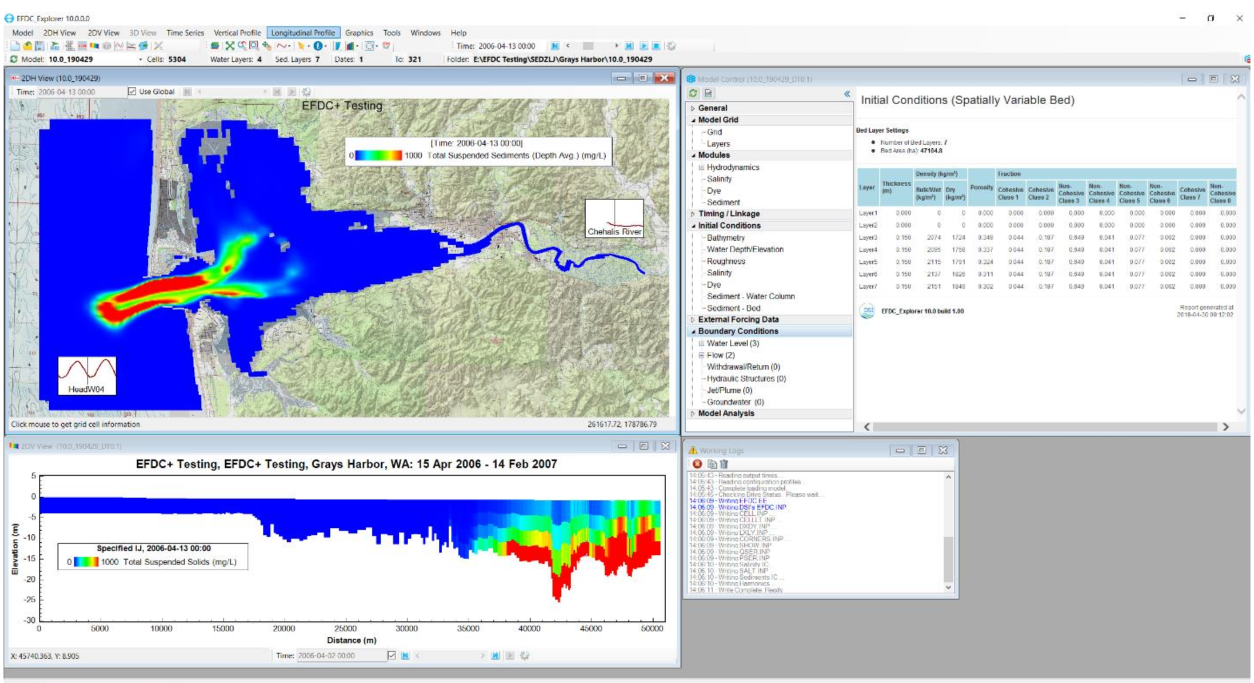


Figure 1 EFDC Sediment Transport Model of Grays Harbor Using EEMS.

EFDC_Explorer (EE) is a Windows-based GUI for pre- and post-processing of EFDC+ models. EE is designed to support model set-up, Cartesian and curvilinear grid generation, testing, calibration, and data visualization, including 2D & 3D plots and animations of EFDC+ model results. It provides extensive post-processing capabilities for statistical analysis of model output compared to measured data. DSI has used EFDC_Explorer to build hydrodynamic and sediment transport models for more than 10 years. DSI is continually updating the EFDC+ capabilities and improving EFDC_Explorer. Examples include developing an internal wind-wave sub-model, implementing a Lagrangian particle tracking and oil spill sub-model.

EEMS has also been enhanced to serve as a full capable and highly advanced 3D Physical Habitat Simulation Model (PHABSIM), incorporating water quality, sediment, toxics and many other highly relevant sub-models. Currently, other PHABSIM models do not include water quality. Instead, PHABSIM concentrates on simulation of physical habitat based on depth, velocity, and a channel index. Furthermore, PHABSIM, River2D and similar IFIM models are restricted to 2D simulation. With its full 3D capabilities, EEMS is one of the most powerful habitat suitability criteria options currently available. EEMS allows users to develop quantitative comparisons between alternatives. This is in addition to the more traditional qualitative approach that is often used on these types of projects.

DSI also uses third-party tools for modeling including Delft3D, SMS, HEC-RAS and others. The RFP requests that the current modeling be performed with the hydrodynamic circulation model CMS-Flow, coupled with CMS-Wave, both developed by the USACE. CMS-Flow is a 2D finite-difference numerical approximation of the depth-integrated continuity and momentum equations, with rectilinear grid. The model simulates currents, water level, sediment transport, and morphology in the coastal zone. However, it is understood that the current model does not implement sediment transport. Although CMS is possibly adequate for the current task, our preferred approach would be to use our own modeling tools so that we can have flexibility in addressing complex or unique issues which may arise during the course of the project. For this particular study we recommend the use of EFDC+ for the hydrodynamic and sediment transport component. CMS-Flow can be used if required, and EFDC+ can also be linked to CMS-Wave if necessary.

The project team for this project is listed below. All DSI resources are available to begin the project at the proposed start date of August 1, 2019.

Project Lead

Paul M. Craig, M.S., P.E. – President and Senior Consultant

Mr. Craig is a licensed Professional Engineer (WA, TN) with nearly 40 years of experience in the areas of hydrology & hydraulics (H&H), hydrodynamics, water quality, sediment transport, contaminated sediments, water resources and hydropower. He has managed and conducted numerous engineering and water resource studies of many types of water systems including rivers, lakes, reservoirs, and estuaries. Mr. Craig has extensive experience with a large number of 1D, 2D and 3D water quality models including EFDC, CE-QUAL-W2, CE-QUAL-RIV1, and QUAL2K. He has specialized experience conducting multi-dimensional environmental hydrodynamic modeling and studies supporting TMDL's and waste load allocations. Mr. Craig's understanding of both the theory and practice of hydrodynamics and sediment transport provides him with unique insights into how to solve erosion and sedimentation problems in natural systems.

Mr. Craig is the principle developer of the widely used EFDC_Explorer Modeling System.

Aquatic Specialist

Bill Taylor, M.Sc., Aquatic Scientist, Raedeke Associates, Inc.

Mr. Taylor has 30 years professional experience as an aquatic sciences consultant, covering field monitoring and scientific analysis in water quality, fisheries and hydrology in the Pacific Northwest. Bill has worked extensively in assessing stormwater; stream, lake, estuarine and coastal ecosystems; and has collaborated with numerous state and local agencies and tribes for habitat and water quality mitigation planning and regulatory compliance. His marine environment assessments have included intertidal and riparian assessments in multiple locations including Grays Harbor.

Sediment Transport Modeler – Sr.

Jeffrey Jung, Ph.D., Environmental Engineer

Dr Jung is water resources engineer with expertise in hydraulics, sediment transport modeling, and statistics, including sensitivity and uncertainty analyses for numerical model simulations. Dr Jung recently built a sediment transport model to support allocation of cleanup costs at the Portland Harbor Superfund site in Oregon and participating in Remedial Investigation/Feasibility Study of EPA Superfund for Newtown Creek in NY.

Hydrodynamic Modeler – Sr.

Nghiem Tien Lam, Ph.D., Senior Water Resources Engineer

Dr. Lam has background and experience in hydrology, coastal engineering, hydrodynamics, wave dynamics, sediment transport, coastal morphology, and water quality. He also has experience on numerical methods, numerical modeling, statistics, optimization and control theory, decision support system, database system, GIS, computational graphics and computer programming. Dr. Lam is also an associate professor at the Faculty of Marine and Coastal Engineering, Water Resources University, Vietnam. His lectures are on the subjects of coastal hydrodynamics, ocean waves, sediment transport, numerical methods, numerical modeling for undergraduate and post-graduate courses.

Hydrodynamic Modeler – Jr.

Bui Minh Hoa, M.Sc., Water Resources Engineer

Mr. Hoa has worked for seven years for DSI in the areas of hydrologic and hydrodynamic modeling. Hoa has worked extensively with the EFDC model for a range of projects including supporting the Little Bow River Water Quality Model, Instream Hydrodynamic and Water Quality Model Development for the Oldman River, and the North Saskatchewan River Hydrodynamic and Water Quality Model Calibration.

Project Manager

Thomas Mathis, M.Sc., Water Resources Engineer

Mr. Mathis has managed and supported numerous engineering design analyses and water resource studies of many types of water systems including rivers, lakes, reservoirs, and estuaries. His technical input and project management skills have supported dozens of planning documents, feasibility studies and design specifications. He also supports the development, testing, marketing and training of DSI's EFDC_Explorer hydrodynamic, toxics and water quality modeling system.

Services Rendered:

EFDC Hydrodynamic Model
Sediment Transport Study
Bed Morphology
Water Quality
Sensitivity Study
Water Supply
Water Resources Planning
Flooding Control
Environmental Impacts

Client:

Sacramento District USACE
California
USA

Contact:

Earl J. Hayter
Earl.J.Hayter@erdc.dren.mil

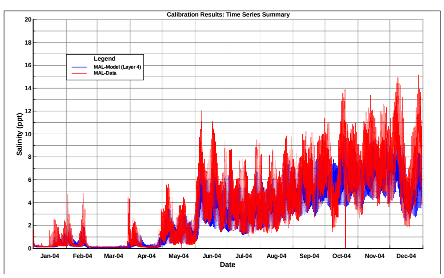
Gene Maak
c.maak@usace.army.mil

Dates of Performance:

Apr 2010 to March 2012

Status of Project:

Completed



Salinity Calibration at Surface Layer.

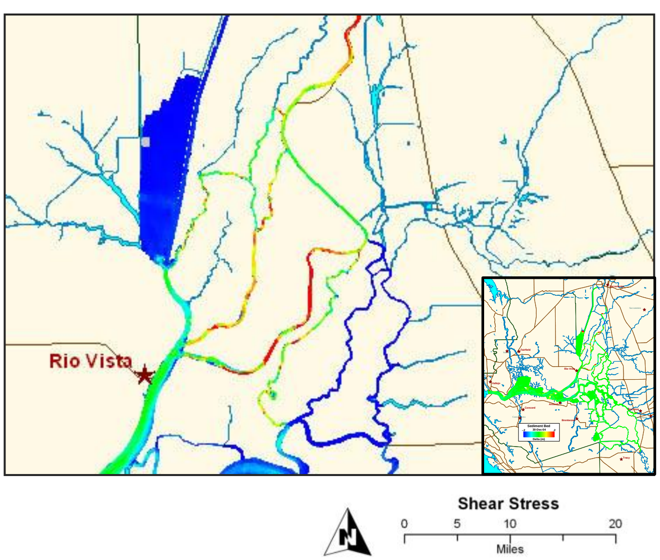
3-Dimensional Hydrodynamic Model of the San Joaquin Delta: Hydrodynamics, Sediment, Water Quality Modeling

The Sacramento San Joaquin River Delta (Delta) is the largest estuary on the west coast and covers more than 738,000 acres. The study area for this project is the San Joaquin River Delta from Vernalis, California to Suisun Bay, the Sacramento River from Freeport, California to its confluence with the San Joaquin River, and Suisun Bay and west to Carquinez Strait.

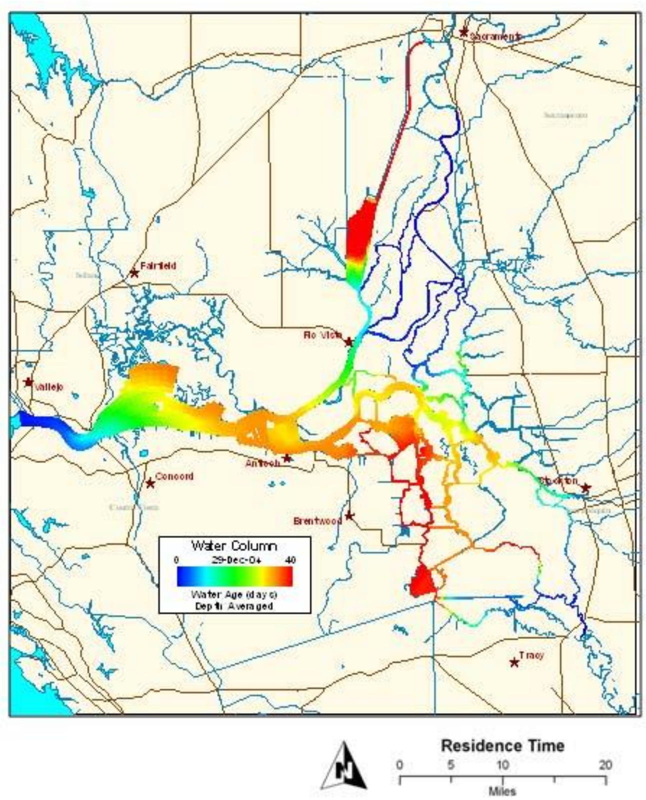
A 3-Dimensional hydrodynamics, sediment transport, and water quality models were setup for the Sacramento-San Joaquin Delta and a model was calibrated with measured flow, salinity, water temperature and total suspended solid, water quality data from more than ten stations in the Delta. The hydrodynamic model developed for this project was a coarse hydrodynamic model using the Environmental Fluid Dynamics Code (EFDC).

With 11,708 horizontal cells and four vertical layers it is a sophisticated structured grid representation of this highly complex waterbody. Simulated parameters also included five riverbed layers with morphology changes during calculation. A sensitivity study of the WQ parameters was also performed. The results provide information and the location of deposition or erosion in the system. The model serves as a basis for advanced watershed management, ecosystem restoration, water storage and water quality planning and management supply.

The following figure shows the coarse scale model with Water Residence time analysis and Deposition Erosion map.



Close up of deposition & erosion map after 1 year simulation.



Water Residence Time Analysis.

Hydrodynamic Modeling Results for the Biological Evaluation of the Effects of Discharge Permit Reauthorization on Cook Inlet Beluga Whales

Services Rendered:
Biological Evaluation
EFDC Hydrodynamic Model
Dissolved Constituent Analysis
Water Col/Sediment Bed Interaction
Sediment Transport
Environmental Impacts

Client:
Coastline Engineering
Achorage, AK, USA
and
CH2M Engineering for
Anchorage Water & Wastewater Utility,
Anchorage, AK, USA

Contact:
Doug Jones, CE
dougjones@gci.net
Phone: (907) 338-6626

John Spencer, CH2MHill
Brett Jokela, AWWU

Dates of Performance:
Oct 2009 to Mar 2010

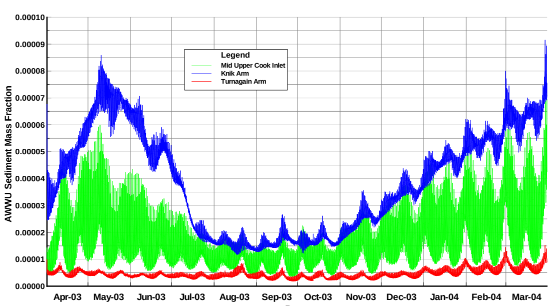
Status of Project:
Completed

The U.S. EPA review of the Anchorage Water and Wastewater Utility (AWWU) application for renewal of the Asplund National Pollutant Discharge Elimination System permit and associated 301(h) waiver, required a biological evaluation to determine whether permit reauthorization is likely to affect the continued existence of the Beluga whale and other species protected by the ESA, or adversely modify their habitat.

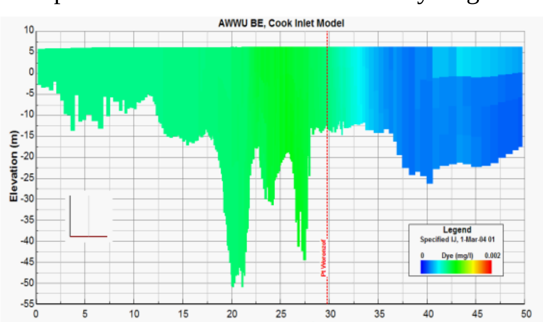
Numerical modeling was used to quantify effluent constituent concentrations in receiving waters and sediments affected by the discharge. EFDC was selected as the most appropriate farfield model to address the mixing, fate, and transport of the pollutants of concern. EFDC_Explorer was used to simulate the hydrodynamic and transport processes based on: tidal forcing; density effects; open water and iced-over conditions; an integrated nearfield plume sub-model dynamically coupled to the farfield circulation model; wind-generated currents; inflow from major rivers; and effluent loading from AWWU.

The resulting model was successfully calibrated and produced accurate circulation simulations and a nearfield plume dilution study. The model was helpful in provide ecological risk assessment.

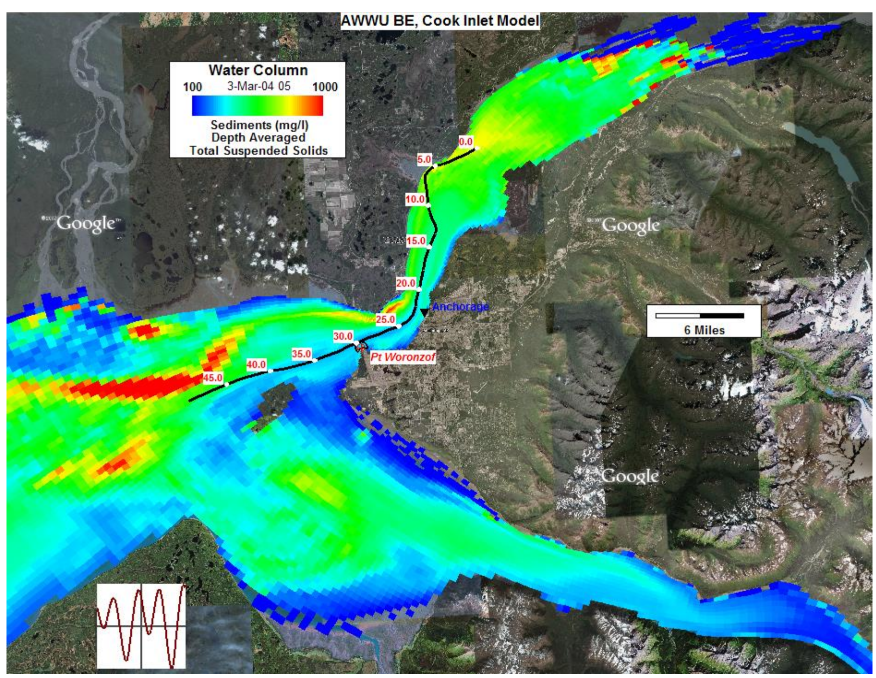
The following figures show the suspended sediment mass fractions for various regions in the project area, as well as plan view and profile view of the water column dye animations.



Suspended Sediment Mass Fraction by Region



Vertical Profile of Dye: Knik Arm (Winter)



Dye Animation at Knik Arm (Winter)

Lower St Johns Estuary Salinity Intrusion Study

Services Rendered:
EFDC Hydrodynamic Modeling
Salinity Modeling
Sensitivity Analysis
Habitat Analysis

Client:
USACE Jacksonville District

Contact:
Mr. Steven Bratos
Senior Coastal Engineer,
USACE, Jacksonville.
Steven.M.Bratos@usace.army.mil

Dates of Performance:
2017-2019

Status of Project:
Completed

DSI has supported two phases in the evaluation of the Jacksonville Harbor Navigation Project for USACE. The study uses EFDC+ with Sigma-Zed for hydrodynamic and salinity modeling to evaluate changes to the salinity in the Lower St Johns River (LSJR). The Jacksonville Harbor feasibility study (USACE, 2014) demonstrated that the partially-stratified LSJR estuary required a three-dimensional hydrodynamic model to accurately simulate salinity variations with depth. The purpose of this study was to evaluate potential impacts of salinity intrusion into the estuary on the aquatic habitat and create a basis for evaluating multiple management scenarios to support decision-making. To model the LSJR estuary, the EFDC+ hydrodynamic and salinity model was utilized. Five separate simulation periods were used for model calibration and validation. Data collected by USACE, NOAA, USGS, and the St Johns River (SJR) Water Management District were used to calibrate the EFDC+ model for water surface elevation and salinity. Following model calibration, an 8.5-year Production Run (PRP) from January 2008 to June 2016 was run in order to evaluate the long-term trends in salinity intrusion and analyze the long-term behavior of the estuary in relation to salinity stress on locations in the estuary with submerged aquatic vegetation beds (SAV), and wetlands. A habitat analysis concerning submerged aquatic vegetation and wetlands was performed which serves as a baseline for comparison with alternative management and future change scenarios for the basin.

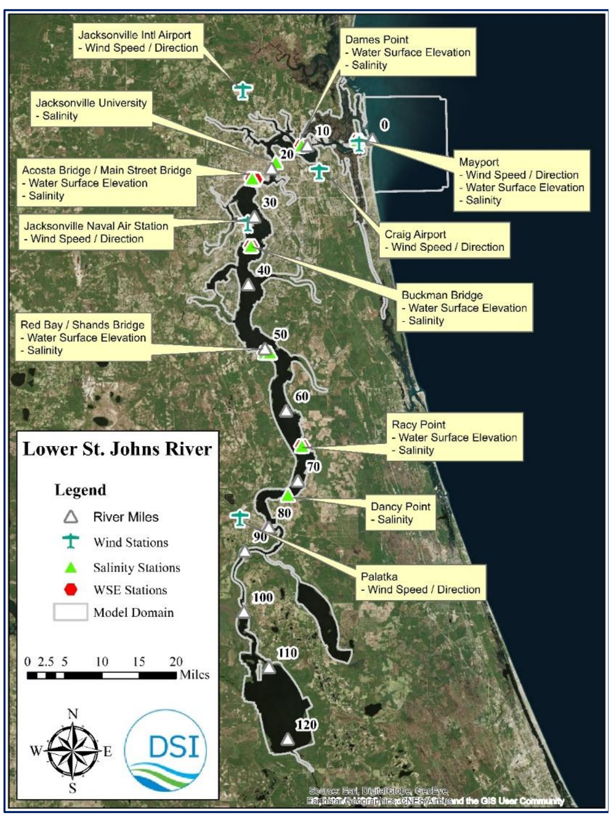


Figure 1. Geographical overview of the Lower St. Johns River model domain, with data and wind stations indicated by callout boxes.

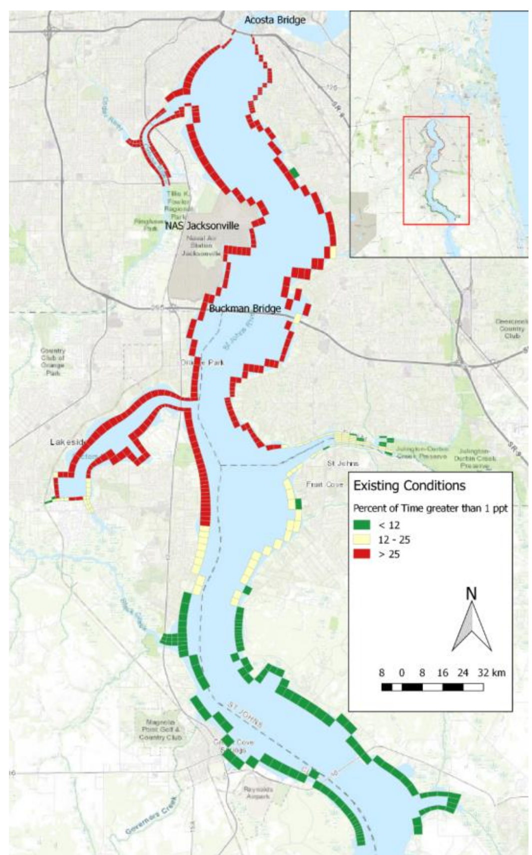


Figure 2. Percent of time exceeding 1 ppt salinity under existing conditions for wetland shoreline cells.

Methodology and Background

In addition to the scope of work outlined in the RFQ, GHCD has stated that a component of the project shall include the development of a sediment survey work plans, quality assurance project plan, and methods for the analysis of the resulting data. DSI has extensive experience in developing survey plans and strategies, documentation and methods for assuring sample quality. As a result of our experience in sediment transport modeling, DSI is uniquely situated to provide detailed evaluations of data trends, uncertainty, and the implications for sediment transport processes.

The scope of work outlined in the RFQ details nine separate tasks (excluding the contingency) which have been discussed below:

Task 1. Data Preparation -- Data preparation will consist of collecting the existing ERDC models and reviewing the model and calibration reports. A review of the collected literature will also be made. Additional data will also be collected including any updated bathymetry for the area and significant changes which should be reflected in other model parameters. DSI has extensive experience working with and quantifying the uncertainty of bathymetric datasets, which is an important component in the calibration of a sediment transport model. This includes adjusting or quantifying uncertainty in vertical and horizontal datums, instrumentation, and addressing a range of other factors which can impact data quality. Generally, when adjustments are made to bathymetry, the model must be recalibrated to observed conditions.

Data processing may be required including converting available datasets to required units and coordinate systems for the modeling, trimming datasets to the project area, merging datasets, and/or transforming datasets to a common vertical datum. DSI have a wide range of experience compiling model input and calibration data from a wide variety of sources and have developed and refined techniques for identifying and filling data gaps. We also utilize powerful and efficient tools for data processing, automation, QA/QC, and file preparation. Additionally, EFDC_Explorer software has automatic quality control routines which can identify problems with model boundary conditions before the model has even started running.

If the EFDC+ model from the USACE is used as a starting point, then the model would need to be recalibrated using additional data from the Chehalis River, Willapa River and other tributaries to account for additional sediment loading from upstream. This is because the current USACE model considers resuspension from the bed as the only source of sediment to the model.

Task 2. Model Assembly and Review – DSI will support GHCD in getting the existing models loaded onto their computers, reviewed and get the models running for the current conditions as modeled.

An EFDC+ model of Grays Harbor has been developed by USACE, using the state-of-the-art SEDZLJ sediment transport approach (Hayter 2012). DSI has supported the development of this model and regard it as a significant addition in the development of a more robust and scientifically defensible study of Grays Harbor and Willapa Bay. DSI recommends using the USACE EFDC model in place of the current CMS-Flow model. It is understood the current CMS-Flow model has not been configured for sediment transport. Additionally, the suggested approach of using particles to simulate sediment transport is not recommended as it does not consider the differential settling rates of the sediment and interactions between different size classes on the bed. In general, DSI recommends a continuous (as opposed to discrete, i.e. particle approach) sediment transport modeling. This approach will provide GHCD with a more physically robust sediment transport analysis and provide a higher degree of certainty when evaluating alternative management strategies or activities over the current proposed approach.

Task 3. Update models for Current Bathymetry – DSI will interpolate the model elevations to the current bathymetry conditions. The models will be re-run and the results compared to the previously run models. These model runs will then be considered the baseline condition model for this study.

Task 4. CMS Flow/CMS Wave Coupled Run for Baseline Model – It is recommended that an EFDC+ fully internally coupled hydrodynamic and wave models will be run for the baseline condition rather than CMS. Two wave scenarios will be modeled to represent different wave conditions (directions). If analysis of the data deems it necessary, additional wave analysis using a coupled SWAN model can be made. This may address issues regarding steady vs unsteady waves methods.

Task 5. PTM (Particle Tracking Model) Model Run for the Baseline Model – It is recommended this task be modified to include two options: 1) If the CMS model is used then the PTM should be used to assess transport of sediment due to dredging operations and other coastal processes based on the baseline model flow fields generated for both wave scenarios. Results will be compared to observed sedimentation patterns. 2) However, it is recommended that the fully coupled EFDC sediment model with bed morphology option will be run to better determine patterns of sediment erosion and deposition, and these will be compared to measured data.

Task 6. CMS Flow/CMS Wave Coupled Run for Alternatives Models – Either the CMS or EFDC model will be run for the alternatives condition. This model will be run using the same two wave conditions used in the baseline model.

Task 7. PTM Model Run for the Alternatives Models -- PTM (CMS option) or full sediment transport (EFDC+ option) will be used to assess transport of sediment due to dredging operations and other coastal processes based on the model flow field generated using hydrodynamic model for the alternative models. Results will be evaluated to determine the benefits and effectiveness of the alternatives.

Task 8. Reporting – DSI will summarize the modeling process and document the model results, comparing the various mitigation alternatives and summarizing conclusions and recommendations in a report. The results of the mitigation alternatives will be compared using a multi-criteria optimization method, which can help weight subjective considerations such as project costs and expected benefits in an objective way. The report will be provided in digital format as a Microsoft Word document and PDF. Digital model files, including any relevant animations, time series, or other graphical output will be included in a digital appendix provided on a hard-drive.

Task 9. Communication -- Communication with the project team and other key stakeholders will be critical to the success of this study. This task includes time for email and phone communication, frequent (1 – 2x per month) status meetings, emails, progress reporting, web meetings for model updates and presentation, and a minimum of two trips by our team for face-to-face meetings and site visits related to this project.

Schedule

Task	Duration/Frequency	Start Date	End Date
1. Data Preparation	4 weeks	8/1/2019	8/29/2019
2. Model Assembly and Review	3 weeks	8/29/2019	9/19/2019
3. Update models for current bathymetry	2 weeks	9/19/2019	10/3/2019
4. Wave-Flow coupled baseline model	2 weeks	10/3/2019	10/17/2019
5. Sediment Transport model development and simulation	6 weeks	10/17/2019	11/28/2019
6 & 7. Alternative models (Fully coupled flow and sediment transport)	7 weeks	11/28/2019	1/16/2020
8. Reporting	8 weeks	11/28/2019	1/23/2020
9. Communications	1-2x per month	8/1/2019	1/31/2020

Closure

We trust that the information provided in this response adequately describes the team's qualifications, experience, previous projects, and methodology. If you have any questions or comments, please contact the undersigned.

Sincerely,

Paul Michael Craig, P.E.

President and Senior Consultant

DSI, LLC

References

DSI, LLC (2018). EFDC+ Theory Guide. https://eemodelingsystem.atlassian.net/wiki/spaces/ETG/overview

Hayter, E. J. (2006). Evaluation of the state-of-the-art contaminated sediment transport and fate modeling system. EPA, September 2006.

Hayter, E. J., et. al. (2012). Dredged Material Placement Site Capacity Analysis for Navigation Improvement Project at Grays Harbor, WA, USACE, 2012.