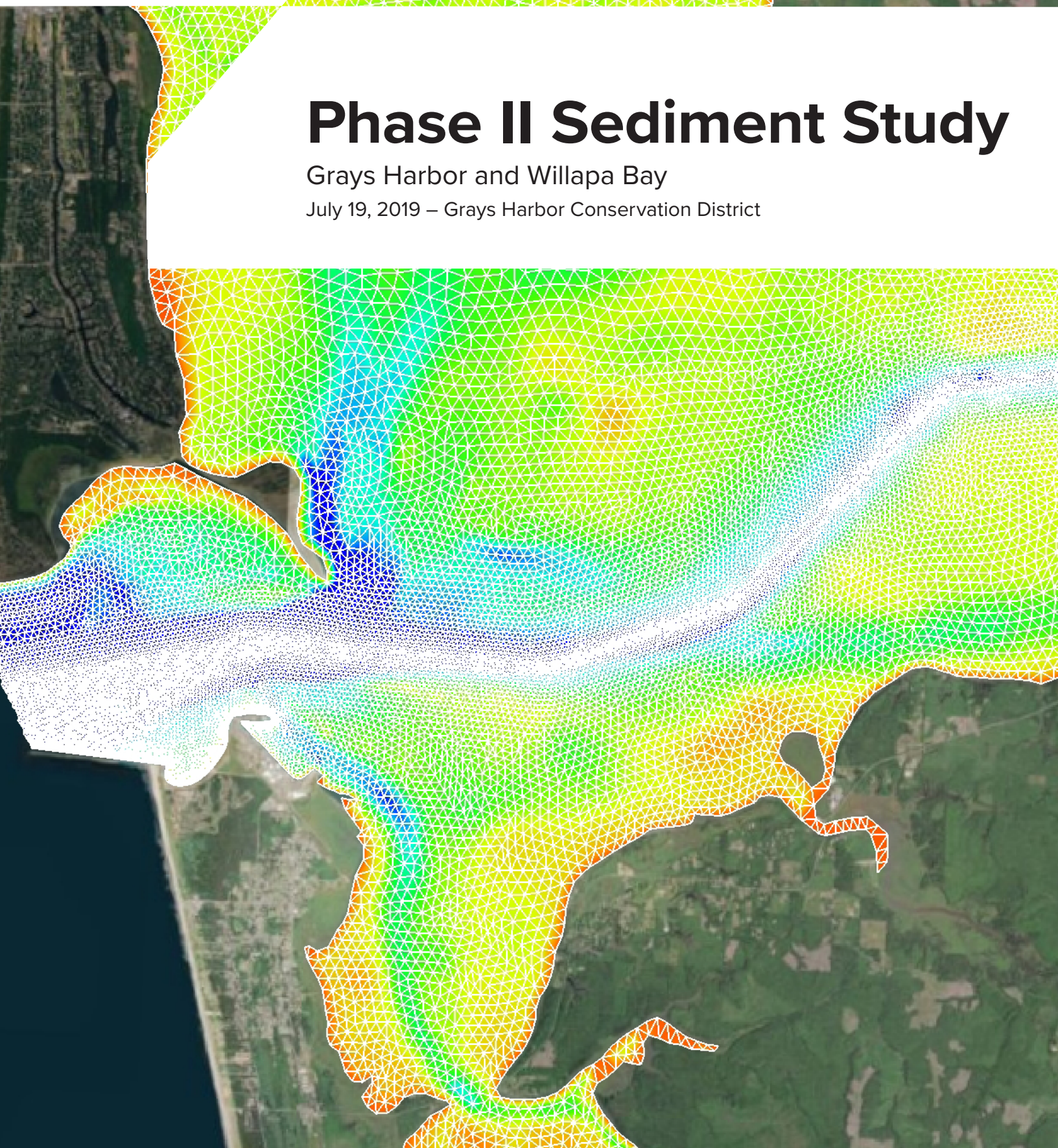
MOTT MACDONALD

Phase II Sediment Study

Grays Harbor and Willapa Bay

July 19, 2019 – Grays Harbor Conservation District



MOTT MACDONALD

Grays Harbor Conservation District (GHCD)
Attn: Brandon Carman
330 Pioneer Ave West
Montesano, WA 98563

Request for Qualifications – Phase II Sedimentation Dynamics & Mitigation Measures Study

July 19, 2019

Dear Mr. Carman:

Mott MacDonald is pleased to submit this Statement of Qualifications to conduct mapping, modeling, and documentation and assessment of sediment and erosion dynamics in Grays Harbor and Willapa Bay to identify preferred mitigation measures for impact to shellfish growing beds.

110 James Street
Suite 101
Edmonds WA 98020
United States of America

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mottmac.com

Mott MacDonald is an engineering consulting firm that delivers innovative solutions for public and private clients. The Ports & Coastal Practice Group within Mott MacDonald (formerly Coast & Harbor Engineering) is staffed with over 35 coastal engineers who excel in analyzing and designing complicated and unique coastal engineering projects in open coasts, estuaries, and riverine environments.

The Mott MacDonald Project Team has been assembled to meet your project's needs and produce a successful outcome. Our Team includes specialists with extensive experience in developing innovative solutions in dynamic and complex coastal and estuarine environments. Additionally, the Team is composed of firms with whom we have longstanding working relationships, and a history of executing coastal engineering design projects on time and on budget with: Confluence Environmental; and Washington State Department of Ecology.

The Mott MacDonald Team has the experience and qualifications GHCD is looking for. As outlined by our prior Southwest Washington project experience, we have direct experience in sediment survey design and analysis, estuarine habitat requirements, and deep knowledge of Willapa and Grays Harbor estuary processes. We feel these projects will provide GHCD with our Team's well-rounded and varied experience, and show why we are the right Team for the Phase II work.

We appreciate you taking the time to review our Statement of Qualifications. If you have any questions, please do not hesitate to contact me at 425.778.6042 or by email at shane.phillips@mottmac.com. We look forward to providing engineering consulting services for this study.

Sincerely,

Mott MacDonald, LLC

R. Shane Phillips, P.E.

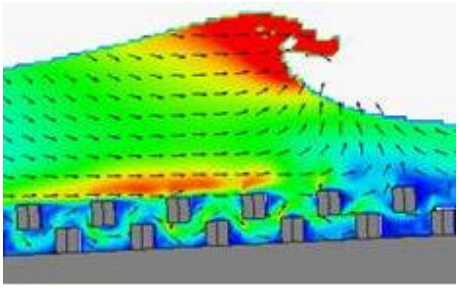
Vice President, Principal Coastal Engineer

Contents

1 Qualifications and Relevant Experience

Mott MacDonald, LLC (Mott MacDonald) combines coastal, estuarine, water resources, and ports expertise to deliver high quality coastal processes analysis and innovative designs that meet the client's goals and objectives.

Our Coastal and Ports practice (formerly called Coast & Harbor Engineering) provides specialty engineering services in numerical modeling, coastal processes assessments, sediment transport and pathways analysis, and design of various shoreline erosion protection, restoration, and planning projects located on open coasts and in estuaries, lakes, and rivers. Mott MacDonald engineers perform feasibility studies, numerical modeling of coastal, geomorphologic, littoral, and hydrodynamic processes, and all phases of engineering design, planning, permitting assistance, and construction management for coastal improvements and ecosystem restoration actions.



Innovative Modeling: 3D Wave Modeling of Living Shoreline Oyster Reef

Coastal/Estuarine Processes Analysis & Design

Evaluation, assessment, and design of estuarine habitats including shellfish beds, eelgrass, forage fish, and juvenile salmon is a core competency of our coastal practice. Our engineers specialize in analyzing physical processes and their effects in the coastal and estuarine zone areas. By analyzing and simulating waves, currents, winds, sediment transport, and morphologic processes, we assess the project's feasibility for planning, permitting, and design. Our engineers routinely develop, verify, and apply sophisticated numerical modeling tools and analysis techniques and commercial computational fluid dynamics codes, and they contribute to open-source code development projects. Mott MacDonald's capabilities and expertise are applied on coastal/estuarine projects to quantify and display project performance and minimize impacts to the environment.

Channel Morphology & Sediment Transport

Sediment studies have been directed at forecasting sediment shoal migration, maintenance dredging estimates for navigation channels, predicting bank erosion and tidal channel shifting, coastal barrier overtopping and breaching, designing bank protection and flood control structures, assessing feasibility of disposing dredged material, and quantifying risk of erosion of bottom sediments. Mott MacDonald staff have analyzed river and tidal channel geometry and sediment processes using aerial photographs, current measurements, drogues, field observations of flow, channel features, and moveable-bed and fixed-bed hydraulic models. Sediment survey design and analysis is central to our practice's technical focus.

Coastal Erosion and Sea Level Rise

Mott MacDonald engineers are experienced in preparing studies of sea level rise (and fall) impact on shorelines, beaches, estuaries and port infrastructure. They use a wide range of tools to determine the most accurate sea level rise estimates at project locations, including analysis of meteorological and tidal records, computer modeling, and agency-approved estimates. Shore protection design and monitoring capabilities include semi-soft solutions; beach nourishment (i.e., cobble, gravel, and sand); perched and pocket beach evaluation; traditional and bioengineered shoreline protection; wave attenuation and beach-retaining structures; and sediment budget analysis. Predictions of sea level rise for selected return periods are provided and used to evaluate potential impact to shorelines and infrastructure in terms of wave/current/inundation loading, scour and any other hydrodynamic /sediment transport potential impact.

Numerical-Hydrodynamic Modeling

Mott MacDonald specializations within coastal processes analysis and modeling include estuarine morphodynamics modeling, beach profile evolution modeling, shoreline position and longshore sediment

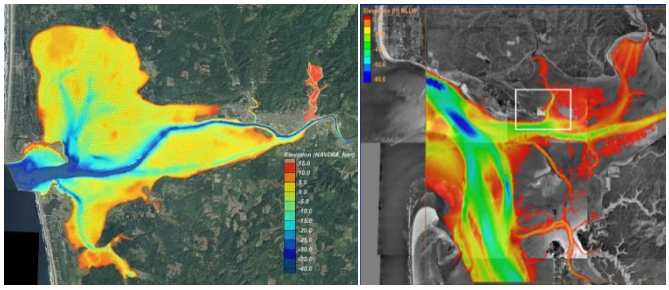
transport modeling, wave prediction and transformation modeling, tidal inlet channel hydraulics and sediment transport, dredging and material disposal technology, beach substrate seasonal monitoring; water quality analysis, sediment particle tracking analysis and GIS data and aerial photography analysis. We have experience with USACE models such as CMS-Wave, CMS-Flow, PTM and ADCIRC in applications of estuarine habitat assessments and geomorphic/erosion analysis. We are able to frequently update our modeling tools and available coastal data for calibration through our frequent project work on the WA coast, use of our specialty coastal practice for these types of projects, and good working relationship with federal, state, and local government agencies collecting data.

Aerial Photograph and Coastal Survey Data Analysis

The Mott MacDonald Team routinely assesses air and satellite photos and coastal survey data to estimate historical shoreline change and assesses patterns relative to current and future conditions. Long-term and short-term coastline evolution signals are evaluated and incorporated into planning and development of engineering solutions. Mott MacDonald has experience conducting this type of work on the Pacific Ocean, Southwest Washington, Puget Sound, and the Gulf Coast. Analysis is conducted through a combination of GIS tools and engineering analysis. Our coastal engineers are adept at data analysis and synthesizing existing data to efficiently process information to assist with conducting coastal/estuarine assessments.

Coastal Engineering in Washington State

Our coastal engineering staff is very familiar with the waterways, bays, coastal areas and waterfronts of Washington. We have worked as the coastal engineer for Pacific County, Port of Grays Harbor, Grays Harbor County, City of Ocean Shores, WSDOT, WDFW, Port of Willapa Harbor, and other coastal communities addressing coastal erosion, dredged material management, and estuary restoration project needs. Our work for waterfront communities often involves the evaluation of the nearby coastal processes, developing a comprehensive knowledge of current and future water level and wave conditions, and designing structures to be resilient against wave impact, scour, erosion, and sea level rise, while also providing habitat enhancement benefits.



Prior Mott MacDonald coastal modeling work; Grays Harbor (left) and Willapa Bay (right)

Washington and Oregon Coastal Hydrodynamic Analysis & Modeling Examples

- Grays Harbor North Jetty Assessment
- Wishkah River Flood Modeling
- Tokeland Marina Dredging Flow Lane Disposal
- Oregon LNG Dredged Material Disposal Site
- Suislaw River Shoreline Erosion Feasibility

Key Team Members

For this opportunity, we have assembled a highly qualified Team, and have worked with each subconsultant on similar coastal processes and estuarine restoration projects. Our Team and their roles include:

Firm	Role
Mott MacDonald	Technical Lead Consultant & Engineer, coastal engineering and analyses, alternatives development & evaluations
Confluence Environmental Co.	Shellfish & Estuarine habitat criteria & assessments
WA State Department of Ecology	Existing data compilation & analyses support

CONFLUENCE ENVIRONMENTAL COMPANY

Founded in 2007, Confluence Environmental Company (CE) is a certified small business providing a full suite of services including ecological studies involving sampling, monitoring, and analysis; fish and wildlife habitat investigations; remote sensing for mapping and monitoring of natural resources; environmental regulatory strategy and compliance; and environmental permitting. CE has extensive experience working in estuarine, marine, and freshwater environments in the Pacific Northwest and California for local, state, and federal agencies as well as private clients. Project types include marine

and estuarine ecology, shellfish and sediment toxicity, shellfish monitoring, habitat classification and taxonomy, nearshore and estuarine oceanography and circulation, dredging impacts, water quality, plankton and larval transport, and tideland and saltmarsh alteration and restoration. CE has worked with shellfish growers along the West Coast for years and is at the forefront of ongoing research in the marine setting with respect to sensitive habitats and species including eelgrass and Endangered Species Act-listed species. We also work extensively on shellfish aquaculture and eelgrass issues in both Grays Harbor and Willapa Bay and are very familiar with the existing conditions and dynamics of both of these systems.

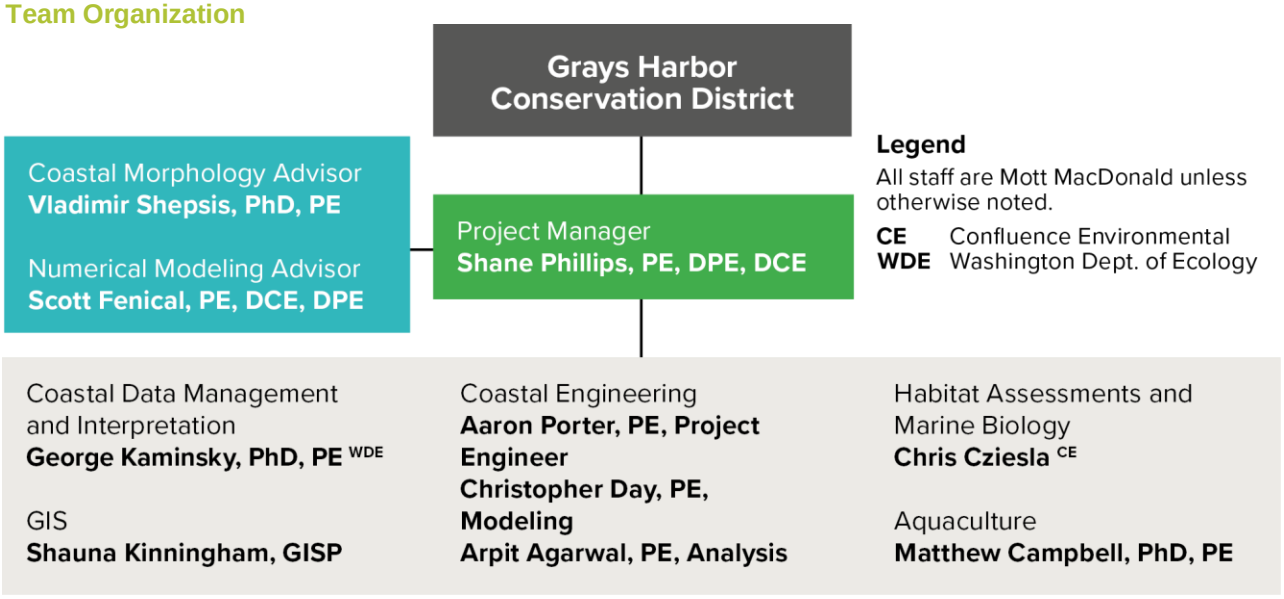
DEPARTMENT OF ECOLOGY State of Washington

The Coastal Monitoring & Analysis Program (CMAP) led by George Kaminsky is a unit of the Coastal/Shorelands Section in the Shorelands and Environmental Assistance (SEA) Program of Washington State Department of Ecology. CMAP was established in 1997 to perform applied research and monitoring related to coastal hazards, natural resources, coastal zone management, and technical assistance. CMAP provides coastal scientific and engineering expertise to the State and other agencies and develops best available science and data products to support coastal planning and management activities and non-regulatory solutions.

Team Collaboration & Prior Working Experience

Mott MacDonald's integrated Team was organized to deliver the right people at the right time for the duration of this project. Our resources are comprised of highly respected firms and individuals with proven achievements in coastal processes analysis, sedimentation and erosion analysis, best available science development and innovation of habitat improvements in the coastal and estuarine environments. We have prior working experience with all our key team members on numerous similar projects. These current projects include the North Willapa Shoreline Erosion Stabilization Demonstration Project (Ecology) for Pacific County and the McSorley Creek Estuary Restoration Project (Confluence) in King County, and City of Kenmore Park Improvement projects (Confluence). Key Team members Shane Phillips, Vladimir Shepsis and George Kaminsky have worked together on numerous coastal Washington projects since 1996.

Team Organization



Project Manager

Mott MacDonald's Project Manager, ***Shane Phillips*** has extensive experience executing and managing complex coastal projects with specialized elements including hydrodynamic modeling, sediment transport, coastal erosion, dredging and dredged material disposal, and habitat enhancement projects in Washington State. He will provide overall project management and leadership services as well as senior level QA/QC. Shane has worked with all Team members in the past on coastal erosion and estuarine restoration type projects and will work closely with the Project Team to ensure the work is being executed on time, on budget and meeting the overall goals and objectives of the study. His project management experience also includes coordinating with regulatory agencies such as U.S. Army Corps of Engineers, WDFW, WA Department of

Ecology and other agencies. Shane was the project engineer in 1998 during the design of the SR 105 Emergency Stabilization project conducted in Willapa Bay and is the Project Manager for the current North Willapa Shoreline Erosion Stabilization Demonstration Project. Shane has organized the Mott MacDonald Team to align directly with the needs of the project to ensure efficient delivery of the highest level of coastal and estuarine expertise and evaluation. A resume for Shane is provided in Appendix A.

Key Personnel

The following are key members of the Mott MacDonald Team who will lead the project and interact with Grays Harbor Conservation District (GHCD). Full resumes are in Appendix A.

Our Technical Advisors will be ***Dr. Vladimir Shepsis*** and ***Scott Fenical.*** Dr. Shepsis will apply his 40+ years of worldwide coastal engineering and morphology expertise to the development of innovative and appropriate alternative solutions in Grays Harbor and Willapa Bay. Vladimir served as Project Manager and lead coastal geomorphologist for the 1998 SR 105 Emergency Stabilization project. His in-depth knowledge of coastal processes and morphology enhances the quality of the design and reduces the overall time and cost of projects. Scott has over 20 years of experience in coastal numerical modeling and analysis and served as the lead Numerical Modeler for the SR 105 Emergency Stabilization project.

Chris Cziesla (Habitat Assessments & Marine Biology) is a biologist with over 23 years of experience in West Coast estuaries. As a principal-in-charge, project manager, and technical expert he has served on hundreds of projects including those involving marine and estuarine ecology, shellfish and sediment toxicity, habitat classification and taxonomy, nearshore and estuarine oceanography and circulation, dredging impacts, water quality, shellfish monitoring, plankton and larval transport, and tideland and saltmarsh alteration and restoration.

Aaron Porter (Coastal Engineer & Project Engineer) is a licensed engineer with specialized expertise in coastal processes analysis, dredging and sedimentation, beach restoration, marine environment feasibility studies, the application of numerical wave and flow modeling, and sediment transport modeling. Aaron has worked on coastal, riverine, and estuarine projects Willapa Bay and Grays Harbor. Aaron will lead the coastal engineering analysis work and coordinate all numerical modeling efforts.

Christopher Day (Coastal Engineer) is a licensed engineer with 20 years of experience. Chris' varied and diverse background includes beach erosion studies, coastal structure design, calculation of hydrodynamic forces, sediment budget analyses, flooding analyses, 1, 2, and 3-D numerical modeling, erosion modeling, morphodynamic modeling, and wave modeling. Chris will serve as a lead numerical modeler for the project.

Arpit Agrawal (Coastal Engineer) is a licensed engineer with experience as a project manager and project engineer in planning and data collection efforts, alternatives analyses, and tidal circulation, wind wave and sediment transport modeling and analysis for estuarine and shellfish restoration actions in California, Texas and Louisiana. Arpit will help lead the coastal analysis and modeling work.

Matt Campbell (Aquaculture Engineering) is a coastal and marine biological engineer with unique specialized expertise in coastal processes analysis, estuarine restoration and shellfish development technologies. Matt has developed unique and innovative systems for shellfish growth in artificial reef systems. Matt will be an advisor and contributor to the habitat evaluations and aquaculture engineering.

George Kaminsky (Coastal Data Management & Interpretation) is a professional civil engineer and senior coastal engineer with Washington Department of Ecology. He has 30 years of applied research experience in coastal engineering and geomorphology with expertise in coastal morphology monitoring, beach change, sediment budgets, coastal morphodynamics, and shoreline change prediction. He will provide monitoring, management, and interpretation of coastal data. He co-directed the SW WA coastal erosion study from 1996 to 2002 and has worked on state and federal WA coastal projects since 1991.

Kevin Smith (Experienced Hydrographer) would provide in-water survey and drone services as needed.

2 Description of Project Experience

Our team's coastal/estuarine engineering and marine biology experience in southwest Washington extends back to the early 1990's. Our project leaders have worked on or led numerous major studies, analyses and designs for coastal erosion protection, estuary restoration, dredged material management and shellfish aquaculture projects in Grays Harbor, Willapa Bay and the Pacific Coast shoreline.

Having implemented mitigation measures such as strategic dredged material placement and sedimentation and erosion reduction measures in storm impacts and sea level rise mitigation, as well as habitat restoration improvement actions, we have the knowledge and experience to deliver the most innovative, cost-effective, and world-class solutions to some of the most challenging projects. Our experience includes projects located throughout coastal Washington, Puget Sound and other US coastal areas. This local experience combined with national level exposure provides us the ability to bring the highest quality analysis capabilities to develop innovative and successful sedimentation redesign and shellfish and estuarine habitat restoration.

The following is a selection of prior project experience for Mott MacDonald and Confluence Environmental (CE) in SW Washington pertaining to coastal processes

	Grays Harbor	Willapa Bay	Hydrodynamic Modeling & Analysis	Sedimentation/Erosion Dynamics	Shellfish and Aquatic Habitat Assessment	Stakeholder Engagement	Dredged Material Management	Restoration & Mitigation Planning & Design
Pacific County North Willapa Bay Erosion Assessment		X	X	X				
Pacific County Willapa Shoreline Protection Demonstration		X	X	X		X		
Port of Grays Harbor Channel Deepening	X		X	X		X	X	
Port of Grays Harbor Westport Marina Upland Disposal	X		X	X		X	X	
Port of Willapa Harbor Assistance with Flow Lane Disposal		X	X	X	X	X	X	
Port of Willapa Tokeland Marina Dredging		X	X	X	X	X	X	
Port of Willapa Raymond Shoreline Stabilization		X	X	X				
Port of Willapa Harbor Airport Levee Bank Stabilization		X	X	X				X
WSDOT SR 520 Pontoon Constr. Consulting Services (MM/CE)	X		X	X	X	X	X	X
Port of Willapa Bay Center Dredged Material Planning		X	X	X	X	X	X	
Port of Grays Harbor Navigation Channel Deepening Study	X		X	X		X	X	
Port of Grays Harbor Westport Marina Dredging	X		X	X		X	X	
Port of Grays Harbor Chehalis River Navigation Assessment	X		X	X				
City of Ocean Shores Emergency Shoreline Stabilization Repair	X		X	X		X		
Port of Grays Harbor North Jetty Repair Assessment	X		X	X		X		
WDFW Johns River Wildlife Area Dike Removal	X		X	X		X		X
Grays Harbor County Wishkah Rd-Kersh Flood Levee Modeling	X		X	X		X	X	
Taylor Shellfish Aquaculture Circulation Interaction Study (CE)		X	X	X	X	X		X
Quinault Marina Sedimentation Assessment	X		X	X			X	
USACE Willapa Bay Programmatic & BA Dredged Material Disposal (CE)		X		X	X	X	X	
USACE Grays Harbor Navigation Channel Deepening SEPA/NEPA (CE)	X		X	X	X	X	X	X
WA State Parks Twin Harbors Park Coastal Hazard Assessment	X		X	X		X		X
Port of Ilwaco Navigation Channel Sedimentation Management			X	X		X	X	X
Westway Terminal EIS Hydrodynamics	X		X	X				

North Willapa Bay Shoreline Protection Demonstration

Pacific County, WA

2018 – 2019 *ongoing*

Firm's role/responsibility: Project goal is to develop a concept design of a preferred erosion protect demonstration project. Mott MacDonald is leading a team that includes six subconsultants. Tasks include data compilation and review, assess project site coastal erosion processes, assemble engineering design and permit application documents, develop final engineering documents, develop an erosion protection Master Plan, and facilitate stakeholder and public involvement processes.

Conducted wind wave analysis and modeling, erosion and sedimentation assessments, evaluation of tidal channel morphological changes, and aerial photograph analysis. Assisted with development of evaluation protocols, prioritization methodology and recommendations. Alternatives evaluation included review of a range of improvement concepts relative to maintenance, effectiveness in meeting the established criteria, impacts assessment, and compatibility with other nearby shoreline management and erosion protection measures.

Similar elements:

- Shoreline erosion/ stabilization
- Numerical modeling
- Geomorphologic assessments/ analysis
- Stakeholder outreach
- Coastal processes analysis/modeling
- Adaptive management techniques
- USACE Coordination – Coastal Engineering

Shane Phillips, Project Manager: Overseeing all coastal engineering project tasks and leader for project execution including subconsultants (geotechnical, surveying, biological sciences, public involvement and stakeholder engagement).

Aaron Porter, Project Engineer: Develop erosion protection concept, assemble design documents, obtain environmental permits and assisted with numerical modeling.

Vladimir Shepsis, Senior Advisor: Advisor and lead for development of analysis approaches and range of mitigative solutions.

George Kaminsky, Data Analysis: Lead existing data assessments and assistance with coastal processes analysis.

Client contact info: Pacific County, Kathy Spoor, County Admin. Officer, PO Box 6, South Bend, WA 98586-0006, 360.875.9334 X 2235, kspoor@co.pacific.wa.us

Budget: $630,500

Port of Grays Harbor – On Call Coastal Engineering and Dredging Consulting

Grays Harbor, WA

2010 – 2018

Firm's role/responsibility: Mott MacDonald has provided specialty coastal, dredging and navigation engineering to the Port of Grays Harbor for the past 12 years. Projects and tasks conducted by Mott MacDonald include the following:

North Jetty Repairs Study & Analysis: Conducted coastal engineering analysis and feasibility study to investigate relationships between north jetty structure wave overtopping relative to adjacent City of Ocean Shores erosion and beach stability. Conducted wave analysis and localized computational fluid dynamic analysis (CFD) for wave overtopping and corresponding beach response. Conducted evaluation of historical beach surveys, aerial photographs, jetty repair details and jetty surveys to aid in the analysis and determination of jetty crest elevation relationship to beach erosion. Worked with technical committee and USACE navigation and coastal staff throughout the duration of the work.

Federal Channel Deepening Study & Analysis: Assisted the Port during scoping and execution of US Army Corps Deepening Study. On behalf of the Port, worked with USACE during execution of deepening study and EIS. Reviewed technical studies including dredging disposal, dredging design, navigation, sediment sampling and characterization. Mott MacDonald evaluated revised navigation channel alignments to reduce capital dredging and future maintenance dredging. Assessment included review of estuarine hydrodynamics and sediment transport patterns relative to the navigation channel. Conducted independent coastal analysis to aid in the review of USACE deepening study.

Port Terminal 1-4 Enhancements: Conducted coastal engineering analysis including numerical wave modeling to assist in the improvements to the vessel berth. Evaluated dredging scenarios and dredging window for conducting maintenance dredging at terminals 1 to 4.

Westport Marina Dredging: Feasibility study, preliminary engineering and final engineering design for marina and entrance channel dredging and dredged material disposal project. Work included existing data compilation, data analysis, sedimentation rates, and upland disposal planning. Developed preliminary and final engineering design for maintenance dredging. Worked with stakeholders and regulatory agencies to develop dredged material management plan.

Similar elements:

- Feasibility study
- Coastal processes analysis
- Wave & tidal circulation modeling
- Dredging engineering
- Assessment of environmental impacts
- Dredged material management
- Stakeholder coordination
- USACE coordination – navigation & coastal engineering
- Sediment Survey Design and Analysis
- Flowlane disposal analysis in Grays Harbor

Vladimir Shepsis, Project Manager: Project Leader and Manager for each project.

Aaron Porter, Project Engineer: Coastal engineering analysis and modeling for North Jetty repair project.

Shane Phillips, QA/QC Support: Provided technical review support on North Jetty Repairs and Federal Deepening Projects.

George Kaminsky, Technical Committee Member: Technical reviewer for North Jetty repair study.

Client contact info: Port of Grays Harbor, 111 S. Wooding Street, Aberdeen, WA 98520, Gary Nelson, Executive Director, 360.533.9530, Cell 360.580.3572, gnelson@portgrays.org

Budget: $250,000

Taylor Shellfish Aquaculture Circulation Interaction Study

Willapa Bay, WA

Summer 2016

Firm's role/responsibility: Confluence designed and implemented field studies to assess effects of off-bottom cultivation techniques to the local and surrounding environment in tidal flats used for aquaculture in Willapa Bay. Studies were conducted during summer 2016 to measure effects of off-bottom flip bags to currents and sediment transport, oyster food resources, and shading of submerged aquatic vegetation. Currents were measured during late flood tide and early ebb tide within and adjacent to flip bag plots between the Palix River and Willapa Channels in Willapa Bay. Results indicated the interactions of flip bags with currents do not result in significant effects to currents or sediment transport. Confluence studied oyster food resources with two studies by assessing availability and measured reduction of chlorophyll resources up-current and down-current of flip bag plots, and also by comparing growth rates of oysters surrounding flip bag plots to oysters within flip bag plots. Measurable reductions in oyster food resources were only observed during ebb tides and within plots, and remaining food resources were sufficient to support oyster growth within and beyond the flip bag plots A light study (shown above) evaluated whether shading from off-bottom culture techniques keeps light levels below minimum thresholds necessary for eelgrass survival or growth. Light meters were positioned 0, 2.5 and 5 ft. from the flip bag lines in parallel and perpendicular orientations, and photosynthetically active radiation measurements were recorded every 10 minutes between July 7-Sept 1. A 3-D model was developed to measure potential shading of direct sunlight at months or seasons outside the study period.

Similar elements:

- Sediment transport
- Oyster habitat
- Aquatic vegetation
- Data collection
- Numerical modeling
- Assessment
- Estuarine processes

Chris Cziesla, Principal in Charge: Oversaw project to design and implement field studies to assess effects of off-bottom cultivation techniques to the local and surrounding environment.

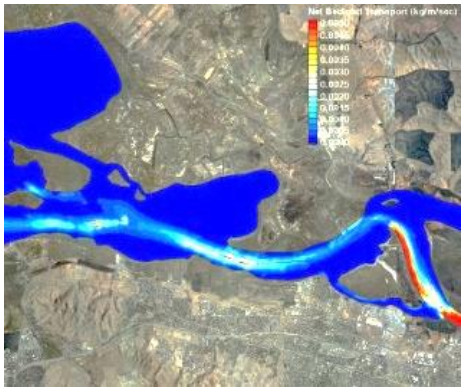
Client contact info: Diane Cooper, Taylor Shellfish, 130 SE Lynch Road, Shelton, WA 98584, 360.432.3305, DianeC@taylorshellfish.com.

Budget: $90,000

Sand Mining Resource Analysis and Impact Analysis

San Francisco Bay and Suisan Bay, CA

2008 – 2012



Mott MacDonald performed coastal engineering analysis for evaluating potential future sand resources within certain California State Lands Commission (CSLC) sand mining lease areas in Central San Francisco Bay and Suisun Bay. Sand mining was proposed to occur within designated CSLC lease areas using a variety of dredging methods over the next 10-year period and evaluated the potential impacts of the proposed mining lease renewal. The study consisted of data collection/processing, morphological analysis and hydrodynamic modeling, and covered a wide spectrum of physical processes including tidal and river circulation, salinity, sediment transport (seen to the left), and morphology. The following two evaluation methods were used to assist in conducting the hydrodynamic evaluation of sand mining impacts:

Bottom Morphology Change and Mining Resource Evaluation using hydrographic survey data: Mott MacDonald conducted bottom morphology change analysis and mining resource evaluation based on analysis of historical bathymetries.

Hydrographic Numerical Modeling of currents, salinity and sediment transport/morphology: Mott MacDonald evaluated impacts by direct comparison of hydrodynamics, salinity, and sediment transport/morphology for existing conditions and two after-mining scenarios.

Results were summarized in a report and Mott MacDonald provided stakeholder and agency updates through progress meetings throughout the duration of the work.

Similar elements:

- Morphological analysis
- Hydrodynamic modeling
- Sediment transport analysis
- Tidal Circulation Modeling
- Stakeholder Engagement
- Coastal resources impact assessment
- Dredging Impacts Assessment
- Estuarine Physical Processes

Scott Fenical, Project Manager: Evaluated impacts of sand mining (dredging) on San Francisco sediment transport and potential links to ongoing erosion at open-coast Pacific Ocean beaches.

Vladimir Shepsis, QA/QC: Vladimir conducted review of the modeling results and interpretation.

Client contact info: CA State Lands Commission, Chris Huitt, Staff Environmental Scientist, 916.574.1938, huittc@slc.ca.gov

Budget: $134,000

3 Methodology and Background

Our approach outlines the need to establish criteria, a basis of analysis and objectives, and stakeholder coordination to focus the use of coastal modeling tools to properly evaluate the conditions and develop corresponding corrective or mitigative actions for the benefit of the shellfish habitat. This approach has been demonstrated to be successful through prior Mott MacDonald experience on complex coastal erosion projects such as SR105 Stabilization, Pacific County North Cove Erosion Assessment, Port of Grays Harbor North Jetty Shoreline Erosion and others. Our approach includes a refresh on prior studies to update to current conditions utilizing available existing data and new technologies which were not available when those prior studies were conducted. This will allow our Team to develop an up to date, analytical desktop model of the conditions (environmental and anthropogenic factors) impacting sediment dynamics in both Willapa Bay and Grays Harbor. This desktop model will help focus the criteria, analysis and modeling and help build consensus with stakeholders prior to initiating the numerical modeling, impacts assessment and alternatives evaluation work. The following is a more detailed description of our work approach:

Existing Data Compilation: Compile, assemble and review historical information, data and knowledge to provide a baseline condition for development of the Basis of Analysis and modeling efforts.

- Data Compilation, Preparation & Analysis. Compile data from public domain, teaming partners and Mott MacDonald database such as prior modeling work, measured tidal current data, aerial photographs, biological data. Review prior field data analysis for applicability to new study including grain size morphometries, bedform changes, aerial photo comparisons. Asses need for limited new data collection.
- Summary Assessment of Coastal Processes and Existing Models. Based on District's Phase I work, Mott MacDonald Team's prior experience and knowledge, and review of prior studies and best available science, summarize the geomorphologic and hydrodynamic processes, climate change, and relative sea level rise considerations for the project area. Compile and review prior numerical modeling and coastal processes work conducted by USACE, ERDC, Ecology, Coast & Harbor Engineering/Mott MacDonald to utilize existing model grids for new modeling efforts.
- Summary of Anthropogenic Considerations & Factors. Document and summarize modifications to the natural environment that could impact the natural physical and ecosystem processes such as Navigation Channel Dredging, Dredged Material Disposal, entrance jetties, etc.
- Summary of Shellfish Habitat and Ecosystem Background. Review current science and knowledge of shellfish growing in the coastal estuaries, relying upon our Team's experience with local growers and access to industry expertise including the Pacific Shellfish Institute.

Study Criteria Development & Basis of Analysis: Development of evaluation criteria and formulation of a Basis of Analysis will be critical for conducting the assessment and coastal processes analysis work. Shellfish growing areas in Willapa Bay and Grays Harbor have multiple factors which make them suitable for successful aquaculture operations including appropriate elevation, substrate type, circulation, food resources, and stable sediment dynamics to name a few. Identification of critical habitats and corresponding species of concern (oyster, crab, eelgrass, juvenile salmon rearing) will be conducted in close coordination with the District and corresponding criteria for use in the study developed. In order to prioritize and target the focal areas for tasks identified in the RFQ, we propose to use the following methods to identify important geographic areas:

- Identify current important shellfish culture and critical habitat areas in both estuaries through a review of existing shellfish operations and targeted interviews with local shellfish aquaculture operations. Our Team has well established relationships with many shellfish growers in both estuaries to rapidly identify, map and characterize shellfish aquaculture locations.
- Document current use of shellfish aquaculture beds in terms of growth phase and production. Current shellfish aquaculture operations utilize different geographies for a variety of purposes. Document prior use areas, areas of concern and areas of prior impacts to aid in the assessment of historical conditions and processes effecting shellfish beds.

- Document current shellfish aquaculture beds culture methodology. A variety of shellfish aquaculture methods (ground, bag and longline culture) are employed in both estuaries, which have different physical requirements. Current shellfish methods will be reviewed and characterized to identify common habitat and physical characteristics to target sediment and erosion dynamic efforts. Determine operational and survivability criteria such as maximum wave height, range of desirable current velocity, acceptable rate of change and thickness or sedimentation or erosion.
- Identify sensitive and critical habitats (eelgrass, juvenile salmon) and invasive species of concern (burrowing shrimp) to assist in evaluating contribution or impacts to shellfish operations and to assist in development connectivity to potential mitigative strategies.
- Document and summarize critical geographic areas (specific to Grays Harbor & Willapa Bay), features, and processes utilizing GIS type systems to assist in conducting spatial analysis work.

Coastal/Estuarine Processes Analysis & Modeling: Develop a planning level framework for evaluation of critical habitat and conduct coastal processes analysis and modeling to assess hydrodynamic and morphologic (sedimentation and erosional) risks posed to identified areas of concern, and which may be used to evaluate mitigation alternatives. Coastal processes analysis will utilize a combination of methods to assist with identifying the critical physical conditions (erosion, sedimentation, waves, tidal currents) creating risks to shellfish and sensitive habitats. The approach is to include analysis of historical changes and develop sediment transport pathways and track morphological changes and recent trends. Specific analysis approach details will be developed and coordinated with the District and stakeholders. Coastal processes analysis will be conducted to describe existing conditions and will be calibrated against available information. An updated aerial photographic analysis at intertidal shoals of concern will be conducted to track shoal migration. It will be important to understand if shoal migration is slowing, consistent, or speeding up. Hydrodynamic modeling will be conducted to address changes in wave energy and subsequent overtopping, using models such as CMS-WAVE and CMS-FLOW. Coupled hydrodynamic/sediment transport modeling will be conducted using a model system such as PTM to evaluate sedimentation pathways and risks. Modeling analysis would include particle fate assessment due to identified natural and anthropogenic sources, such as wave-induced erosion, dredging, dredge disposal, and finer sediments from major tributaries of the estuary such as the Chehalis River. Upon completion of a calibrated numerical modeling system (natural and anthropogenic), interpretation of the results and characterization of the model outputs would need to be conducted for use in a spatial analysis to develop an understanding of how, when, and why sediment migration events occur, and how they relate to areas suitable for shellfish growing.

Evaluation of Mitigative Strategies: Develop cost-effective strategies and methods to mitigate impacts to protect and enhance critical habitats in the estuaries. Upon completing the coastal analysis and identification of areas of risk, an evaluation and prioritization of potential remedies and mitigative actions will be developed in coordination with the District. The mitigative strategies would be evaluated utilizing the coastal processes analysis and modeling tools. Focus of the evaluation will be to develop long-term sustainable solutions for the shellfish industry and which work with the natural and anthropogenic environments that exist. These could be a modification to historical dredged material management practices, use of new technologies for shellfish growing, new best management practices, new shellfish growing areas, or other adaptive management techniques.

Communication & Reporting: Provide overview of results throughout the study in coordination with key stakeholders to build consensus on outcomes prior to finalization. Develop stakeholder engagement strategy that will be an integral part of our planning framework to get necessary input on methodology, impacts assessment results, alternatives being evaluated and study outcomes. Key stakeholders could include the District, shellfish growers, USACE, Port, WDFW, Ecology, WDNR, and others who are knowledgeable and critical to a successful outcome. Visualizations are essential for communicating with stakeholders, the public, and for future project funding. Our approach is to provide periodic updates of analysis results for internal meetings and external stakeholder meetings to help focus on educating the audience to help build trust and understanding in the work objective and product to assist in the process of engagement and obtaining input prior to delivery of final results. A report summarizing findings inclusive of the periodic updates will be provided.

4 Schedule

A draft schedule associated with our work approach (described in Section 3) is provided below. The approach and schedule were developed based on our prior experience working on complex coastal analysis and planning projects similar to this project. In this study we plan to develop a mutual understanding of critical criteria and project objectives, summarize coastal processes based on historical information, get agreement from stakeholders, and develop an assessment of impacts and corresponding mitigative measures based on the agreed upon criteria and site-specific physical processes analysis outcomes. The important aspects of our proposed approach and corresponding schedule are as follows, and work items are summarized in the proposed work schedule below:

Proposed word schedule [1]

Work Item	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Contract start date		2							
Kickoff meeting and stakeholder engagement planning									
Communication and PM plan*		15							
Data compilation and anaylsis									
Progress meeting #1*			11						
Data gap analysis and assumption memo*			17						
Study criteria and basis of analysis									
Basis of analysis*				29					
Progress meeting #2*				16					
Coastal processes analysis and modeling									
Progress meeting #3*					13				
Progress meeting #4*						10			
Evaluation of mitigative strategies									
Progress meeting #5*							7		
Reporting									
Draft report*								14	
Final report*									1

[1] Note: Assumes an NTP on August 2 (two weeks later than RFQ date due to two-week extension for submittal).
* Indicates Deliverables

- **Kickoff Meeting & Stakeholder Engagement Planning:** Establishment of lines of communication, discussing available data and prior studies, project goals, schedule and outlining stakeholder engagement plan and development of a steering committee. Establishing a stakeholder engagement plan will help determine critical milestones for check-in points to ensure input is obtained at the important steps in the analysis and assessment process. Develop a project specific communication and project management plan for engagement of project team, stakeholders and the District. This includes development of a detailed project schedule, progress meetings, stakeholder meetings, and deliverables. Mott MacDonald will develop a project management plan (PMP) based on our negotiated scope of work and results of the kick-off meeting prior to starting execution of the work. The PMP will include a master schedule timeline for the work utilizing MS Project that identifies critical dates such as progress meetings stakeholder outreach and deliverables. Meetings will be a combination of regular, scheduled teleconference (WebEx, Skype or similar) with the Team, and other meetings, as needed, to discuss critical or complex decisions that may develop and require attention in-between the regular progress meetings. The goal is to ensure the District and stakeholders are informed of the key aspects of the project in order to provide the needed input to advance the work.
- **Data Compilation & Analysis:** Develop a desktop analytical model of both estuaries utilizing prior studies but updated with current information. This task will include mapping of critical project elements utilizing GIS, and development of a data gap analysis and assumptions memo. This would include the

areas of concern, available data sources, active and historical shellfish beds, sediment data, and other data of importance This is a critical first step to get concurrence on historical and current processes to build consensus on physical processes effecting the project areas. Progress meeting with the District to gain input and a corresponding meeting with stakeholders is critical prior to completing the subsequent steps of the study. The development of the desktop model based on prior studies and existing data will help inform the basis of analysis and modeling approach. This will be coordinated as part of the Progress Meetings #1 and #2 and documented in the Data Gap Analysis and Assumptions memorandum.

- **Study Criteria & Basis of Analysis:** Develop criteria in coordination with stakeholders (during Progress Meeting #1) and subsequent documentation and review of criteria for the study and corresponding Basis of Analysis that will outline the framework for the analysis and evaluations to be conducted in the study. Concurrence from stakeholders on the criteria to be used and the analysis methodology is critical to obtain prior to initiating the new modeling work. Outcomes of this task would be conducted during Progress Meeting #2 and documented in the Basis of Analysis memorandum.
- **Coastal Processes Analysis & Modeling:** This work would include Tasks 2 through 5 of Section III of the RFQ (page 4). Coastal processes analysis and modeling will be developed to utilize tools recognized by the US Army Corps and supplemented with other tools needed to evaluate the agreed upon conditions and areas of concerns. We will coordinate analysis/modeling approach and corresponding results of historical and existing conditions modeling/analysis with stakeholders in Progress Meeting #3 to assist in developing concurrence and agreement on results and outcomes prior to conducting new modeling work. Conduct numerical modeling targeted at those critical areas identified in the Basis of Analysis, stakeholder outreach, and Progress Meeting #3. Present finding of coastal processes analysis and impacts assessment in Progress Meeting #4. Results of the modeling work would be utilized to develop and assess mitigation alternatives.
- **Evaluation of Mitigative Strategies:** This work would include Tasks 6 through 7 of Section III of the RFQ (page 4). Evaluation of mitigative strategies will be conducted once the coastal processes analysis/modeling work is complete and the stakeholders are in agreement with the approach and outcomes of the analysis. In our experience, it's critical that concurrence and mutual understanding of the site-specific physical processes get developed as the site processes will guide the development of mitigative strategies. This approach results in greater success in obtaining agreement on the preferred alternative outcomes and results in solutions that work with the site conditions leading to more successful outcomes for the project. Present draft results of evaluation during Progress Meeting #5.
- **Reporting:** Project deliverables will be outlined in the negotiated detailed scope of work but would include the Tasks outlined in the RFQ. Deliverables will include the following:
  - *Communication and Project Management Plan Memorandum*
    - Refined plan of work and schedule based on the negotiated SOW (RFQ Task 9).
  - *Data Gap Analysis and Assumptions Memorandum*
    - Summary of data availability and assumptions (RFQ Tasks 1 & 2).
  - *Study Criteria and Basis of Analysis Memorandum*
    - Summary of project criteria (RFQ Task 1).
  - *Progress Meetings (5 total)*
    - Presentation of Project Status in MS PowerPoint format at each progress meeting. These serve multiple purposes, including early identification of any unanticipated issues or data gaps, concurrence on deliverable format, and stakeholder buy-in (RFQ Tasks 1-7 & 9).
  - *Draft and Final Report*
    - Once comments are received from the stakeholders in Progress Meeting #5, coordinate an outline of the final report and develop the final documentation for use by the District and Partners to conduct Phase III – Implementation (RFQ Tasks 1-8).

Appendix A – Resumes

MOTT MACDONALD

R. Shane Phillips, PE, D.CE, D.PE

Personal summary

Education:

BS, Civil Engineering, Washington State University, 1993, Pullman, WA

Registrations:

Professional Engineer

WA #34656, 1997
OR # 88031, 2013
CA #57552, 1997
ID #16847, 2016
TX #90683, 2002
LA #30666, 2003

Memberships:

American Society of Civil Engineers

Certifications:

ASCE certified Diplomate in Coastal & Ports Engineering.

Awards:

2007 American Association of Port Authorities (AAPA) National Environmental Improvement Award for Mitigation for Port of Anacortes Fidalgo Bay Eelgrass Mitigation Project.

2018 ASCE Seattle Section Project Award – WADNR Aquaculture Net Pen Assessment

Highlights:

Experience working on coastal hydrodynamics, erosion protection and port facility improvement projects in both Willapa Bay & Grays Harbor since 1996 (> 12 projects).

Shane is a Coastal/Civil Engineer and Vice President of Mott MacDonald with 26 years of experience. Shane has been responsible for conducting and managing multi-disciplinary teams on feasibility and planning studies, stakeholder engagement, regulatory permitting, engineering design, and construction administration for environmental remediation, erosion protection and ecosystem restoration actions, deep-draft port developments, small craft harbors, navigation facilities, and waterfront parks. He oversees all project phases from conceptual design and analysis through construction including data collection, environmental permitting, numerical modeling and analysis, and engineering design.

Experience related to Willapa and Grays Harbor estuaries includes coastal engineering (beach nourishment, ecosystem restoration and erosion protection), civil engineering (marinas, levees, parks, dredging, jetties, piers), coastal processes analysis (hydrodynamics, morphology, sediment studies), and planning studies (flood protection, erosion protection, coastal hazards).

Selected projects

Willapa Bay North Cove Erosion Demonstration Project, Pacific County, WA. Project Manager. Ongoing erosion at Washaway Beach in Pacific County WA needed a long-term plan to address erosion risks to SR105, cranberry bog agricultural areas, a drainage district tide gate and private properties along a 1 mile stretch of shoreline exposed to the Pacific Ocean. Work included coastal processes analysis (nearshore geomorphology and wave processes), evaluation of alternatives (beach nourishment, rock revetment, dynamic revetment and groins), stakeholder and public involvement and development of a long-term erosion mitigation plan.

SR105 Emergency Erosion Stabilization; WSDOT, Pacific County, WA. Project Engineer. Shoreline erosion at SR105 near Tokeland threatened to close the state highway. Worked on coastal processes analysis, erosion risk assessments, development of erosion mitigation alternatives to protect the highway from wave and tidal current induced erosional processes. Led the final engineering design and engineering services during construction for the rubblemound groin, underwater dike and beach nourishment.

Fidalgo Bay Habitat Improvement, Port of Anacortes, Anacortes, WA: Project Engineer. Project consisted of conducting hydrodynamic analysis and design of an in-water mitigation site with the purpose of creating eelgrass habitat in response to agency requirements due to planned dredging and development at the Port of Anacortes. Work included wave analysis, geomorphologic change analysis, and sediment stability analysis. Analyzed the Port's proposed dredge area to determine suitability of this material in the construction of the mitigation site. *The project received the 2007 American Association of Port Authorities (AAPA) Environmental Improvement Award*.

Johns River Habitat Restoration Dike Analysis, WDFW, Markham, WA: Project Manager. WDFW planned to restore the estuary by breaching a flood control dike at Johns River, adjacent to Hwy 105 near Markham, WA. Mr. Work included a site assessment, evaluation of hydrodynamic processes, geomorphologic assessment, flooding impact assessment and constructability assessment. Critical aspects included a tidal channel migration analysis to determine risks of dike breach to the adjacent highway and bridge abutments.

Coos Bay Crossing Scour Hazard Assessment, Coos Bay, OR: Project Engineer. A 10-mile distance of the proposed new Liquefied Natural Gas pipeline in Coos Bay, Oregon crosses water, with varying bay conditions including a navigation channel, sub-tidal flats, tidal channels, river slough channels, and bridge crossings. Shane conducted a geomorphic analysis and hydrodynamic and navigation analysis to support a scour assessment for the proposed cross bay pipeline crossing route. Determined the areas and depth of possible scour along the alignment, assisting with pipeline alignment to minimize scour hazard, and developing pipeline alignment design criteria to address scour hazards. Provided summary technical report.

Grays Harbor North Jetty Submerged Breakwater, Grays Harbor, WA: Project Engineer. Developed design for submerged breakwater at western end of Grays Harbor North Jetty, oriented parallel to adjacent Ocean Shores shoreline. Goal was to control inlet navigation channel shoaling due to sediment transport bypassing North Jetty and to reduce local shoreline erosion problems. For feasibility study, Mr. Phillips evaluated the performance and function of

the submerged breakwater structure with field measurements combined with 2- and 3-D physical and numerical modeling.

Port of Willapa Harbor Tokeland Marina Storm Damage Repairs, WA: Project Manager. The Port of Willapa Harbor Tokeland Marina suffered extensive damage during winter storm events. The three marina elements that sustained the most damage were the timber bulkhead, timber jetty, and stone revetment and qualified for FEMA disaster relief funding. Mr. Phillips conducted feasibility engineering, final engineering design and construction administration for repairing the Tokeland marina facility.

Port of Willapa Harbor Airport Erosion Stabilization Project, Raymond, WA: Project Manager. Airport suffered extensive damage to flood control levees during winter storm events. Conducted site assessment, coastal processes analysis to determine causes of erosion and develop erosion protection schemes to prevent similar future erosional events. Worked with FEMA to develop project worksheet and funding. Led analysis, engineering design and construction administration for the repair of over 1.5 miles of levee.

North Jetty Properties Shoreline Erosion Protection, Ocean Shores, WA: Project Engineer. Conducted shoreline erosion assessment for long term erosion trends and developed erosion protection schemes. Lead design engineering and field engineer during construction of shoreline protection project located adjacent to the North Jetty.

West Bay Franks Tidelands Nearshore Restoration Project, Olympia, WA: Project Manager. Nearshore restoration project feasibility study consisting of site assessment, evaluation of coastal processes, geomorphologic dynamics, habitat features, and shoreline structure removal. Evaluation of site improvements included nearshore restoration, shellfish habitat improvements and juvenile salmon rearing habitat improvements.

Cypress Island Aquaculture Net Pen Failure Assessment, WDFW & WDNR, Cypress Island, WA: Mr. Phillips was lead engineering investigator for forensic assessment of the failure of salmon net pens. Work included coastal processes analysis (tidal currents, waves, water levels, passing vessels) and review of historical conditions to assist in development of a range of potential causes contributing to the failure. Participated in multi-agency work group.

Livingston Bay Pocket Estuary Restoration Feasibility Study, The Nature Conservancy, Port Susan Bay, WA: Mr. Phillips was Project Manager for restoring tidal flow to 10-acre pocket estuary, improving access for juvenile salmonids and other fish, restoring salt marsh habitat in the interior of the pocket estuary, and restoring natural hydrologic and shoreline processes in a cost-effective and ecological manner. Analysis of coastal processes established an understanding of physical project site conditions. Mr. Phillips developed permit level engineering design and application documents, final engineering design and bid package preparation and provided engineering assistance during construction.

West Bay Bird Island Restoration and Enhancement, Galveston Bay, TX: Project Engineer. The project goal was to create bird nesting/habitat in the middle of the Bay utilizing dredged material. Conducted coastal engineering analysis, preliminary design, final design and construction phase assistance for expansion of an island to expand migratory bird habitat in Galveston Bay. Work included coastal engineering analysis (waves, currents, morphology) hydrographic surveying, geotechnical investigation, dredging assessment (material source investigation and dredged material placement), and constructability review.

McFaddin National Wildlife Refuge Shoreline Stabilization, TX GLO, Sabine Pass, TX: Project Manager. The McFaddin National Wildlife Refuge Shoreline Protection Project was located near Sabine Pass, Texas. Vessel wake erosion along the Gulf Intracoastal Waterway (GIWW) shoreline had caused saltwater intrusion and disruption of habitat processes in marshes adjacent to the waterway, and continued to threaten the viability, productivity, and quality of nearly 45,000 acres of marshlands on the refuge. Mr. Phillips was Project Manager responsible for data collection, preliminary and final engineering design, environmental permitting, and construction administration. The project consisted of two miles of rock breakwaters and revetments and bioengineered smooth cordgrass for shoreline protection. Breakwaters were designed to reduce wave energy to protect sensitive shoreline from erosion, but also allow some wave overtopping and tidal flow to inhibit sedimentation of the protected area to further enhance seagrass growth.

MOTT MACDONALD

Vladimir Shepsis, PhD, PE

Personal summary

Education:

PhD, Oceanographic Engineering (Coastal Hydraulic Engineering), Marine Institute, Moscow, Russia, 1981

BS and MS, Civil Engineering (Hydraulic Engineering), College of Water Engineering, Kiev, Russia, 1973

Registrations:

Professional Engineer

WA #34455, 1997-2019
TX #87238, 2000-2019

Memberships:

American Society of Civil Engineers

Western Dredging Association

Washington Public Ports Association (WPPA)

Highlights:

Has completed multiple coastal engineering projects in Grays Harbor and Willapa Bay areas.

Extensive experience in numerical modeling of coastal processes.

Dr. Shepsis is a coastal engineer specializing in shoreline erosion protection structures investigation, coastal processes analysis, numerical modeling, coastal morphology, engineering design and monitoring. He has 45 years of combined national and international design and construction engineering experience. He is internationally recognized for developing practical, creative approaches to engineering problems that involve coastal processes and numerical modeling of complex hydrodynamic processes, including extreme events such as tsunamis and hurricanes. A specific strength is in designing wave-current and sediment protection structures i.e., breakwaters, jetties, and groins. Through his many years of coastal engineering activities, he has attained worldwide practical knowledge in design and construction of this type of wave protection and sedimentation prevention structure.

Dr. Shepsis is particularly qualified in the use of computer modeling of waves and currents, sediment transport, shoreline change, and structure interaction with waves and the shoreline, and has extensive computer modeling experience in Puget Sound and other U.S. regions. He has conducted numerous feasibility studies, alternatives development and selection, and preliminary and final design of complex shoreline erosion, coastal restoration, cleanup, and protection projects. His in-depth knowledge of coastal processes and capabilities in computer simulations of hydrodynamics of waves, currents, sediment transport, and coastal morphology enhances the quality of the design and reduces the overall time and cost of projects.

Selected projects

North Willapa Bay Erosion Assessment, Pacific County, Willapa Bay, WA: Project Manager. Dr. Shepsis developed a preferred erosion protection concept for the North Willapa Shoreline Erosion Protection Demonstration Project. The project site is an approximately 6-mile length of shoreline that has been subjected to severe long-term coastal erosion. Tasks included data collection and review; criteria development; engineering assessment; shoreline erosion assessment; and obtaining environmental permits for construction of the demonstration project.

State Route 105 Emergency Stabilization Project, FHWA, Willapa Bay, WA: This was an emergency project designed and constructed to protect a portion of the highway from the effects of ongoing erosion at North Cove. The project was managed and directed by Dr. Shepsis for the Federal Highway Administration (FHWA) and WA State Department of Transportation to stabilize the beach in front of the highway. The erosion resulted from a combination of northward migration of a 90-ft deep tidal channel and direct ocean wave impacts. The project consisted of three components: 300,000 cubic yards of dredging for beach nourishment, a multi-purpose groin/breakwater, and a submerged dike. The project was constructed in the summer/fall of 1998. Because of the uniqueness of the design, the project has attracted worldwide attention from engineering and scientific communities.

Port of Grays Harbor Westport Marina Upland Disposal, Grays Harbor, WA: Project Manager. Project goal is to identify an upland site for disposal of contaminated material to be dredged at Westport Marina. Dr. Shepsis is providing engineering support to the Port for this dredging and disposal work at Westport Marina, including site selection, conceptual engineering, preliminary and final design and assistance with construction management.

Port of Grays Harbor Advance Maintenance Dredging Improvement, Grays Harbor, WA: Dr. Shepsis, Project Manager, provided engineering assistance in determining and implementing the economically optimal clearance for advanced maintenance dredging at the Port of Grays Harbor federal navigation channel. He conducted an investigation for Phase 1, and for Phase 2 a demonstration project was conducted that included coordination with and assistance to the USACE with permitting of the optimal AMD clearance, conducting a monitoring program, and preparing a final report on the results of the demonstration project.

SR 520 Pontoon Construction Engineering Services, Aberdeen, WA: The goal was to determine if the channel was sufficient for transporting pontoons for the project. Dr. Shepsis analyzed data for comparison of sedimentation in the navigation channel from two hydrographic

surveys. He determined average thickness of sediment deposition over the entire channel area. Based on the analysis, it was preliminarily concluded the channel appeared sufficient for pontoon towing operations. Maintenance dredging was not recommended at this time. He made recommendations that detailed hydrographic surveys be conducted during the next one to two months, and that a final conclusion be developed on needs for maintenance dredging.

Tokeland Marina Maintenance Dredging, Port of Willapa Harbor, Raymond, WA: Dr. Shepsis identified and specified the pertinent dredge, provided justification for funding of the dredge, and design and permitting of dredging operations. He prepared an engineering cost estimate and specifications for maintenance dredging operations with a hydraulic dredge.

Lower Columbia River Port Communities Navigation, Port of Ilwaco, WA: Project involved the coordination with local port community leaders to identify and develop conceptual solutions to coastal problem areas along the Lower Columbia River. Project areas included alternatives ranging from shore protection to dredging and dredge material disposal. Dr. Shepsis was a Design Engineer and assisted with site analysis, quantity estimates and report preparation.

Port of Willapa Harbor Assistance with Flow Lane Disposal, Raymond, WA: Dr. Shepsis, Project Manager, conducted analysis and numerical modeling of hydrodynamic conditions and sediment transport at the proposed flow lane disposal site for the Bay Center dredging project. The results of the analysis were to assist the Port with environmental permitting.

Curtis Wharf Dredging and Fidalgo Bay Habitat Improvement, Port of Anacortes, WA: The project consisted of the design of an in-water mitigation site with the purpose of creating eelgrass habitat in response to agency requirements due to planned dredging and development at the Port of Anacortes. Dr. Shepsis analyzed the Port's proposed dredge area to determine suitability of this material in the construction of the mitigation site, designed the mitigation site cross-sections and the sequence of construction. He also developed construction cost estimates for various dredging disposal and mitigation site fill alternatives. *The project received the 2007 American Association of Port Authorities (AAPA) Environmental Improvement Award*.

Oregon LNG Dredged Material Disposal Sites Analysis, Warrenton, OR: Estimated the extreme tsunami water surface elevation for proposed LNG facility with numerical modeling based on a design tsunami event. Sediment transport modeling was used for a tsunami scour analysis. Analyzed surge, hydrodynamic, and hydrostatic forces on the protective seawall.

Jordan Cove LNG Coastal Engineering Modeling and Analysis, Coos Bay, OR: Dr. Shepsis assisted Jordan Cove Energy Project in developing technical information requested by Oregon Department of Environmental Quality. He conducted hydrodynamic numerical modeling to analyze potential effects on the natural hydrodynamics, sedimentary processes and morphology, and vessel hydrodynamics and vessel heat discharge associated with terminal operation on the terminal and mitigation sites. Technical information was provided for major pipeline stream crossings at Kentuck Slough; Willanch Slough; and Coos River.

Siuslaw River Shoreline Erosion Feasibility Study, OR: Conducted feasibility study for a temporary shoreline erosion protection measure to protect the toe of the bluff from erosion by waves and currents and to minimize potential slope failure until a long-term measure was developed and implemented. He conducted numerical modeling of coastal processes and developed feasible solutions. Coastal engineering analysis included numerical modeling of waves, currents and morphological processes for existing and with alternative conditions. The developed alternatives included a no-action alternative, groins, and armor slope protection. The alternatives were compared and a preferred one was recommended and designed.

West Bay Bird Island Restoration & Enhancement, GLO, Galveston Bay, TX: As Senior Technical Advisor on Phase 1, Dr. Shepsis developed alternatives for stabilization of WBBI and directed a geomorphic analysis through statistical analysis of rectified historical aerial photos and bathymetric charts showing tidal channel migration. Developed an innovative solution to prevent island erosion due to tidal channel migration by implementing an underwater geotube dike to divert flow away from the island and dredging a relief channel for tidal flow.

Cameron Parish Shoreline Restoration, CPRA, West of Holly Beach, LA: Goal was to increase the barrier headland longevity by nourishing the beach profile to delay further shoreline retreat. Dr. Shepsis evaluated shoreline coastal processes; evaluated borrow source locations and configurations to determine impact on wave climate and effects on morphology. He simulated wind-wave growth and propagation, wind and wave-generated currents, sediment transport, erosion/accretion processes, and beach morphology processes. Developed alternatives that included cross-sectional and longitudinal configurations of beach fill and dune.

MOTT MACDONALD

Scott Fenical, PE, D.CE, D.PE

Personal summary

Education:

BS, Mechanical Engineering, University of California, Santa Barbara, 1994

MS, Ocean Engineering, Texas A&M University, 1996

Registrations:

Professional Engineer

CA #59466, 1999
LA #30643, 2003
TX #116337, 2014
FL #84427, 2018
NY #099306-1, 2018

Highlights:

Diplomate Status in Coastal Engineering, ASCE

Diplomate Status in Port Engineering, ASCE

22 years of experience performing hydrodynamic and sediment transport modeling.

Expertise using a wide variety of commercial and in-house numerical modeling codes.

Navigation and vessel hydrodynamics expert, including development and application of industry-leading vessel hydrodynamics tools.

Practice leader for one of the largest coastal groups in the U.S.

Mr. Fenical serves as Coastal and Maritime Practice Leader for Mott MacDonald. He has 22 years of professional experience specializing in coastal processes analysis and numerical modeling, hydrodynamics, sediment transport and scour analysis, shoreline protection, marine habitat design, dredging, and scour protection design. Scott's coastal analysis experience includes development, verification, and application of advanced numerical models to simulate tidal and river current circulation, sediment transport under waves and currents, scour from vessel hydrodynamics and propeller wash, water quality, wind-wave generation and transformation, and underwater noise impacts. He also prepares and reviews engineering plans and specifications for coastal/shoreline structures including breakwaters, groins, revetments and beach nourishment, and dredging.

Selected projects

SR-105 Emergency Stabilization Project, Willapa Bay, WA: Mr. Fenical completed 2-D hydrodynamic modeling, preliminary design and final design for SR-105 Emergency Stabilization Project in Willapa Bay. The final design includes beach nourishment, underwater dike and a multi-purpose rock groin. Beach nourishment was designed to dissipate wave energy reaching shore and diminish the destructive effect on the embankment supporting the highway. A borrow site was designated and permitted for dredging. The volume of beach nourishment was estimated at 350,000 cubic yards. The dike was designed using rock to be placed by bottom-dump barges to divert tidal flow away from the rapidly eroding shoreline near State Highway 105. The multi-purpose rock groin was designed to be placed by truck from elevation +25 feet (MLLW) to elevation –18 feet (MLLW) at which point it joins with the underwater rock dike. He analyzed raw and processed wave, current, current profile, tide, hydrographic survey, topographic survey and aerial photography data as part of the SR-105 Emergency Stabilization Project Monitoring Program.

South Beach Stabilization, Grays Harbor, WA: Mr. Fenical analyzed topographic and hydrographic survey data to determine erosion and accretion trends at South Beach, WA near the Grays Harbor entrance. Determined predicted shoreline location over time and maintenance requirements for beach nourishment to protect the City of Westport, WA.

SR520 Pontoon Construction Design Build Engineering Analysis, Grays Harbor, WA: Provided coastal engineering design criteria for the SR520 floating bridge tow-out channel, which is part of the casting facility for concrete pontoons being fabricated for the bridge. Mr. Fenical performed numerical modeling of propwash from tugs that were to operate in the channel. The purpose of the numerical modeling was to determine potential hydraulic forces that would disturb the channel bottom and slope material and alter channel dimensions.

Willapa Navigation Project, Willapa Bay, WA: Collected, processed, and analyzed directional wave and current data in the inlet channels to Willapa Bay to determine economically feasible navigation channel locations. Project was partnering effort with Coastal ad Hydraulics Laboratory (CHL), Waterways Experiment Station (WES), Army Corps of Engineers. Performed historical wave climate, inlet morphology, and inlet engineering analysis. To evaluate maintenance requirements for channel alternatives, 2-D hydrodynamic modeling of currents, waves, and sediment transport was conducted using newly developed modeling tools from CHL.

San Francisco Bay-Delta Sand Mining Impact Analysis; CA: Project Manager responsible for evaluating historical data and conducting Bay-wide 3D hydrodynamic, salinity, and sediment transport/morphology modeling for evaluating decade-scale impacts of sand mining (dredging) on San Francisco sediment transport and potential links to ongoing erosion at open-coast Pacific Ocean beaches. Participated in regional agency sediment transport panels and presented work at agency groups evaluating future implications of mining practices.

Mission Bay Shoreline Clean-Up and Shoreline Protection; Port of San Francisco, CA: Project Manager responsible for performing coastal processes analysis, evaluation of site contaminated sediments and removal and disposal options and providing preliminary and final design and construction management for rock revetment and seawall stabilization.

Puget Island Bank Protection at Pancake Point; Columbia River, CA: Project Engineer responsible for investigating the feasibility of placing sand dredged from the Columbia River Navigation Channel using hydrodynamic modeling and sediment transport modeling.

America's Cup Coastal Engineering Impact Analysis; San Francisco Bay, CA: Project Manager responsible for evaluation of all potential coastal processes impacts of the 34th America's Cup (AC34) as part of the EIR performed by the City of San Francisco. Evaluated potential changes in hydrodynamics and sediment transport on a Bay-wide scale and any adverse effects potentially caused by the proposed AC34 marine facilities.

Paradise Beach Park Beach Restoration and Shoreline Protection, Tiburon, CA: Coastal engineering analysis and conceptual design for beach restoration concepts at Paradise Beach for Marin County. Analysis included coastal processes modeling and design criteria development, beach morphology evaluation and shoreline protection concepts. Design included preparation of plans and cost estimate for beach nourishment, shoreline retention arc (low-crested rock structure) and rock revetment as seawall toe protection.

San Francisco-Oakland Bay Bridge Eelgrass Mitigation Site, Oakland, CA: Coastal analysis, numerical modeling and conceptual design assistance for eelgrass habitat areas used as mitigation for reconstruction of the east span of the San Francisco-Oakland Bay Bridge. Modeling included waves, wave-generated currents and sediment transport, and bottom mound stability during storm events. Mr. Fenical advised on the types of materials likely to remain stable and protect the habitat during storm events of various return periods.

Middle Harbor Shoreline Park and Public Access Beach, Port of Oakland, CA: Performed and managed coastal processes analysis, field measurements, numerical modeling and design of protective features for eelgrass habitat (rock breakwaters/roosting islands, porous sheetpile breakwater). Coordinated habitat analysis and design with members of the Technical Advisory Committee (local, state and federal agencies) on a monthly basis. Managed coastal engineering design of new public access beach and public access features, including coastal process analysis, field data collection, and development of final engineering design plans.

Tinsley Island Shoreline Protection, Tinsley Island, CA: Project Manager. Performed coastal processes analysis, vessel wake analysis, shoreline erosion evaluation and concept design of shoreline protection enhancements for St. Francis Yacht Club.

West Bay Bird Island Restoration and Enhancement, Galveston Bay, TX: Coastal Engineer. Mr. Fenical evaluated alternatives proposed for the stabilization of WBBI as part of a geomorphic analysis through numerical wave, tidal current and sediment transport models.

Sediment Fate and Transport Analysis, Portland Harbor Superfund Site, Portland, OR: Hydrodynamic and sediment transport modeling Lead for Daimler Trucks in Swan Island Basin as part of Portland Harbor Superfund Site Allocation. Managed and performed 3D numerical modeling of hydrodynamics, sediment transport, and contaminant/tracer movements. Modeling covered the entire Willamette River system from the Falls to downstream in the Columbia River, and discrete outfall flows and sediment transport inputs.

Sediment Fate and Transport Analysis, Lower Duwamish Waterway (LDW) Superfund Site, Seattle Harbor, WA: Sediment Transport Expert representing King County. Managed and performed 3D numerical modeling of sediment transport as part of LDW Superfund Site clean-up allocation process, supporting contaminant transport analysis efforts. Modeling included site-wide 30-year Environmental Fluid Dynamics Code (EFDC/SEDZLJ) modeling of hydrodynamics, salinity, sediment transport and morphology, fine-scale unstructured 3D modeling of flows, sediment transport as well as transport of other types of materials with particle tracking tools.

Jordan Cove LNG Modeling and Coastal Analysis, Coos Bay, OR: Project Engineer responsible for conducting vessel hydrodynamic modeling, dynamic mooring analysis, hydrodynamic modeling, sediment transport analysis and modeling, and mixing zone/cooling water quality impact analysis according to Oregon DEP regulations.

Oregon LNG Hydrodynamic Modeling; Warrenton, OR: Responsible for developing a 3D circulation model of the Lower Columbia River Estuary for use in navigation simulations for the Oregon LNG Terminal. Modeling simulations were also used for analysis of sedimentation.

Oregon LNG Terminal Circulation Modeling, Warrenton, OR: Mr. Fenical developed a 3D circulation model of the Lower Columbia River Estuary for use in navigation simulations for the Oregon LNG Terminal near Astoria, OR. Mr. Fenical verified the hydrodynamic model with measured currents from several stations near the project site, and processed and analyzed the model results. Final modeling results were developed into format appropriate for the full bridge simulator used to evaluate navigation conditions, including multiple combinations of tidal and river flow current conditions.

CONFLUENCE
ENVIRONMENTAL COMPANY

Chris Cziesla

Personal summary

Education:

MS, Marine Biology, University of Oregon, Eugene, 1998

BA, Biology, University of Virginia, Charlottesville, 1991

Certifications and Additional Training:

Qualified Senior Writer for Biological Assessment, WSDOT, 2006 – present

Eelgrass Delineation Guidance Workshop, U.S. Army Corps of Engineers, June 2017

Research Diver, University of Oregon

Openwater SCUBA Diver, NAUI, WA

Highlights:

Shellfish aquaculture experience in Grays Harbor and Willapa Bay

Eelgrass and juvenile salmon rearing habitat planning and restoration experience.

Chris Cziesla has 23 years of experience in West Coast estuaries. He has managed projects and conducted research on dredging impacts, shellfish and sediment toxicity, estuarine circulation, and tideland and saltmarsh alteration and restoration. Chris has worked with shellfish growers along the West Coast for decades and he has been at the forefront of ongoing research in the marine setting with respect to sensitive habitats and species. Chris has written numerous programmatic and project-specific biological assessments, various sections of SEPA/NEPA environmental impact statements, and habitat conservation plans. He has also developed mitigation and restoration plans for sensitive species and habitats including salmonids, shellfish, eelgrass, and wetlands.

Expertise includes marine and estuarine ecology; fish and shellfish ecology; habitat classification and taxonomy; nearshore and estuarine oceanography and circulation; water quality; restoration and mitigation; and local, state, and federal permitting and regulatory compliance.

Selected projects

Shellfish Aquaculture Circulation Interaction Study, Taylor Shellfish Farms, Willapa Bay, WA. Principal in Charge. Oversaw project to design and implement field studies to assess effects of off-bottom cultivation techniques to the local and surrounding environment. Studies were conducted during the summer of 2016 to measure effects of off-bottom flip bags to currents and sediment transport, oyster food resources, and shading of submerged aquatic vegetation. Study results indicate the interactions of flip bags with currents do not result in significant effects to currents or sediment transport; that measurable reductions in oyster food resources are only observed during ebb tides and within plots, and remaining food resources are sufficient to support oyster growth within and beyond the flip bag plots; and that flip bags cause a reduction of light levels immediately adjacent to flip bags but, even in shaded areas, light levels remain sufficiently high to support eelgrass growth.

Eelgrass Study Evaluating Interactions with Shellfish Aquaculture, Taylor Shellfish Company, Willapa Bay, WA. Marine Ecologist. Designed a multi-year study evaluating the interaction between eelgrass beds and various shellfish aquaculture methods. Eelgrass surveys were conducted and physical and chemical data were collected to compare shellfish culture areas to control locations. Eelgrass recovery after disturbance was also documented and evaluated.

Programmatic Biological Assessment (BA) for Dredged Material Disposal, U.S. Army Corps of Engineers (Corps), Seattle District, Willapa Bay, WA. Project Manager. Prepared a programmatic BA for dredged material disposal operations in the Willapa Bay Estuary. Work included evaluation of shoreline and benthic habitats at two dredged-material disposal sites to determine potential impacts to Endangered Species Act (ESA) proposed, listed, and candidate species including coho salmon, cutthroat trout, Steller sea lions, sea turtles, birds, and seven species of whales. Analyzed present-day and historical circulation patterns and bathymetry in the estuary in relation to the disposal activities, sensitive habitats, and species of concern. Conducted consultations with local, state, and tribal biologists to identify issues of concern.

State Route 520 HOV and Bridge Replacement Program, Washington State Department of Transportation, Seattle to Redmond, and Grays Harbor, WA. ESA Program Lead. Directed ESA compliance, integrated with the NEPA analysis, for all SR 520 Program activities for three major projects: Eastside Transit and HOV (Bellevue); SR 520 HOV and Bridge Replacement (Seattle to Redmond); and Pontoon Construction (Grays Harbor County). Relevant work that Chris completed for this program included:

- Conducted extensive collaboration with resource agencies and recognized experts to establish best scientific and commercial data available for evaluation of program activities such as in water pile driving and noise, vessel traffic, and overwater construction, nearshore dredging on listed species and designated critical habitat.
- Led ESA consultation for a mitigation site in Grays Harbor County (Grass Creek Estuary Restoration Project). Served as senior author of the BA, and technical lead for the

coordination with the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS). Provided technical review for the conceptual restoration plan.

- Conducted a study to determine rates of attachment and growth of marine organisms on concrete plates moored in Grays Harbor to answer concerns about what types of aquatic organisms might be expected to be transported from Grays Harbor into Puget Sound during the transportation of replacement pontoons for the SR 520 bridge. Results were used to develop and implement a decision framework to guide WSDOT's efforts to minimize the potential for spreading aquatic invasive species through project activities. European Green Crab, New Zealand Mudsnail, and invasive tunicates were focal species.

ESA Section 7 Consultation for Nationwide Permit (NWP) 48 for Shellfish Aquaculture, U.S. Army Corps of Engineers, Seattle, WA, and Portland, OR. Project Manager. Worked with the Corps and other federal agencies (NMFS and USFWS) to analyze the potential impacts to listed species and their critical habitat from all aspects of shellfish aquaculture. Issues included potential effects to estuarine circulation, primary productivity, competition with other species, effects to the benthic environment, interactions with sensitive habitats, etc. This consultation assimilated the best available science on these topics. The NWP 48 was designed to allow growers to operate in a manner that is compliant with environmental regulations while allowing industry innovation over time.

Shellfish Permitting and Scientific Assistance, Pacific Shellfish Growers Association (PCSGA), Alaska to California. Primary Marine Scientist. Provided ESA and Clean Water Act (CWA) compliance assistance. This project initially focused on synthesizing the scientific literature regarding the interactions of oyster culture operations with ESA-listed species, water quality, and Essential Fish Habitat (EFH). Developed a West Coast programmatic process for compliance with ESA, CWA, and EFH requirements, and included involvement from the Corps and NMFS at the national, regional, and local level to ensure consistency and efficiency for the federal agencies as well as PCSGA members. Products included biological assessments and EFH analyses. This protocol was designed to determine if the grow-out of Pacific oysters was possible at elevations above those where native eelgrass occurs in Humboldt Bay. The study design included a multivariate analysis to provide statistically meaningful outcomes.

Environmental Permitting Assistance for Shellfish Aquaculture, Coast Seafoods, Humboldt, CA. Project Manager and Primary Scientist. Provided permitting assistance for Coast Seafoods' shellfish aquaculture operations in Humboldt Bay. This included the evaluation of all potential impacts of aquaculture activities as required under various environmental regulations including Endangered Species Act, Magnuson Stevens Fisheries Conservation and Management Act (MSA), CWA, California Environmental Quality Act, California Coastal Act, and others. Also included the development of best management practices and mitigation measures to avoid and minimize potential impacts. Coast operations include aquaculture of several species of shellfish and numerous culture methodologies (e.g., bottom culture, suspended culture, raft culture, etc.). Key environmental concerns addressed included potential impacts to eelgrass and other sensitive habitats, facility siting, changes to circulation and sedimentation patterns, interactions with marine birds and mammals, and ecosystem effects.

Regulatory Compliance Assistance, Various Growers, Pacific Northwest, WA. Regulatory Strategist. Collaboratively developed and implemented a permitting approach to address the evolving needs of shellfish aquaculture. The regulatory need for predictable ecological outcomes, along with the industry desire for operational flexibility and predictability, presented a unique challenge. Applied strategies including performance-based standards and adaptive management that enabled all stakeholders to understand future informational requirements and obligations allowing for more robust long-term operational planning.

Miscellaneous Environmental Service and Sediment Sampling and Analysis in Various Northwest States, U.S. Army Corps of Engineers, Seattle, Seattle WA. Program Manager. Assembled a comprehensive team of technical experts to provide the services sought including support for navigation projects and environmental studies. Disciplines assembled for this team include: project management; fish and wildlife ecology; NEPA, ESA, MSA, and other regulatory compliance; watershed analyses; marine and estuarine ecology; biological and physical oceanography; sediment ecology; and toxicology. As program manager, Chris assembled appropriate technical experts from the team to deliver high-quality results for each task order assigned by the Corps. Task Orders included Wave, Current and Suspended Sediment Modelling; Sediment Profile Imaging; Large Woody Debris Monitoring.

MOTT MACDONALD

Aaron Porter, PE

Personal summary

Education:

MS, Coastal and Ocean Engineering, Oregon State University, 2012

BS, Civil Engineering, Oregon State University, 2009

Registrations:

Professional Engineer

CA #83043, 2014-2019
WA in process

Memberships:

American Society of Civil Engineers

Highlights:

Project Engineer for numerous coastal design projects in Grays Harbor County and Pacific County.

Conducted coastal/estuarine hydrodynamic modeling of waves, tides and river currents in Grays Harbor/ Willapa Bay area.

Experience evaluating sedimentation and erosion patterns and thalweg migration in Grays Harbor Navigation Channel and Willapa Bay.

Developing specialized nearshore wave model with Sandia National Laboratory.

Aaron Porter is a coastal engineer with more than seven years of experience in coastal engineering. His experience includes the application of numerical wave and flow modeling, design, rehabilitation, and construction of coastal beaches and structures, geomorphic assessments and conducting specialty studies in the coastal and marine environments. Mr. Porter also has experience in projects throughout the U.S. and abroad which include dredging and sedimentation analysis, marine navigability, shore protection, meteorological and hydrological studies, small craft marinas, energy terminals, breakwater analysis, and flood modeling. He has experience analyzing and modeling shorelines, estuaries, and rivers.

His technical expertise includes a number of projects within or in the vicinity of Grays Harbor and Willapa Bay, including sedimentation analysis, erosion analysis, coastal processes assessment, hydrodynamic assessment, shoreline stabilization design, and incorporation of the complex hydrodynamics and erosion dynamics at both the Grays Harbor and Willapa Bay entrance channels into coastal project design recommendations.

Selected projects

North Willapa Bay Erosion Assessment, Pacific County, WA: Project Engineer. This project is currently ongoing. Demonstration project for approximately 1 mile of shoreline that had been impacted by long-term severe erosion. Mr. Porter is currently completing developing a preferred erosion protection concept, assembling engineering design documents, and obtaining environmental permits. The selected alternative is a Dynamic Revetment. Mr. Porter led the design team in development of the Dynamic Revetment, which would be the longest known dynamic revetment constructed in the U.S. Mr. Porter led assessments of erosion dynamics relative to potential design alternatives, and coordinated with USACE, WA Dept. of Ecology, and other stakeholder groups.

Grays Harbor Navigation Channel Dredging and Sedimentation, Port of Grays Harbor, Grays Harbor, WA: Project Engineer. Mr. Porter evaluated sedimentation in the Navigation Channel by analysing sediment transport processes. Reaches analysed included the Crossover Channel and South Reach adjacent to Whitcomb Flats. Also, a maintenance dredging optimization analysis was completed to determine the preferred dredging period (time for dredging), dredging geometry, and corresponding clearance for advanced maintenance dredging.

Wishkah Road-Kersh Flood Levee Project Hydraulic Analysis, Grays Harbor County, WA: Project Engineer. The goal was to eliminate or reduce Wishkah Road flooding problems. Mr. Porter, Project Engineer, collected existing project site data (tidal records; water level measurements; river discharge; previous studies), developed and calibrated a 2-D numerical river and tidal current model of the Grays Harbor estuary area. He conducted 2-D hydrodynamic modeling, and developed and evaluated flood protection alternatives. Mr. Porter conducted statistical analyses to develop potential extreme event combinations of river flow and high tide events. Sensitivity tests of the numerical modeling were conducted based on results of the statistical analysis to determine the controlling event combination. With results of the modeling, he compared project conditions and existing conditions to evaluate alternative protection measures including levee, sheet pile walls, and raising the road. A preferred alternative was selected by Mott MacDonald for further analysis and design.

City of Ocean Shores Shoreline Stabilization (Geotube) Repair, City Ocean Shores, Ocean Shores, WA: Project Manager. Mr. Porter was project manager for the Geotube Repair project constructed in Ocean Shores, WA, within the vicinity of the North Jetty. The project objective was to protect existing infrastructure upland of the existing geotubes which had deteriorated due to wave and debris. Mr. Porter assessed hydrodynamics and erosion at the site, and led design of the shoreline stabilization repairs which included a geotextile bag structure approximately 200 feet long by 15 feet high. He conducted construction oversight for the project and was the point of contact for the City of Ocean Shores. The project was completed in fall 2015.

North Jetty Repairs, Port of Grays Harbor, Ocean Shores, WA: Project Engineer. Mr. Porter conducted a conceptual-level feasibility study in order to estimate the minimum level of repairs required to satisfy the stability of the City of Ocean Shores' shoreline. The study included review of existing data, engineering analysis, computational fluid dynamics (CFD) modeling, development of North Jetty repair alternatives, and calculation of cost estimates.

City of Warrenton Marina Dredge Design, City of Warrenton, OR: Project Manager. Mr. Porter conducted conceptual, preliminary, and final engineering design for dredging of the Hammond Boat Basin. He assisted the City to obtain environmental permits for dredging and materials disposal in the Columbia River. Material has been permitted for open-water disposal in the Columbia River. He assisted the City with phasing the dredge area priorities due to the limited in-water construction window.

McSorley Creek Estuary Restoration at Saltwater Creek State Park, Des Moines, WA: Project objective was to restore a heavily armored beach and channelized creek bed to near-natural conditions and to improve habitat areas. Mr. Porter, Project Manager, performed conceptual-level design of coastal elements for the restoration project. He managed an assessment of existing conditions and was on site for inspection of the geotechnical investigations. Presented findings of the existing condition coastal assessment to WA State Parks and King County. Managed the Mott MacDonald portion of a feasibility report containing restoration concepts for review by WA Parks and King County. Oversaw modeling of proposed design changes to the estuary entrance using the sediment transport model, XBEACH. Sediment transport due to wave action was tested in response to design storm events.

Port of Kalama Maintenance Dredging at CHS/Temco Berth, Kalama, WA: Project Engineer. Due to increased sedimentation, the majority of recent dredging at the Port of Kalama had occurred at the CHS/TEMCO facility. Mr. Porter conducted preliminary engineering analysis and numerical modeling to estimate maintenance dredging requirements at CHS/TEMCO. Work included particle tracking modeling (PTM) of dredge disposal sediment using results of a combined tide and flow numerical model of the Columbia River.

Port of Everett Mt. Baker Terminal Beach Monitoring, Everett, WA: Mr. Porter, as Project Manager, monitored the restoration of Mt. Baker Terminal beach for Year 10 of the monitoring and compiled all information into a technical report, to be delivered to the Client. The beach was observed during a site visit on September 8, 2015.

Olympic View Resource Area Superfund Site Sediment Cap, City of Tacoma, WA: Mr. Porter is conducting a coastal processes analyses (waves, tides) and geomorphological assessment of the Olympic View Resource Area sediment cap in Tacoma. He is evaluating scour risk due to wave orbital velocity as well as evaluating likely sediment transport pathways. Climate change and sea-level rise risk have been incorporated into the design parameters. He is developing recommendations for the stable grain size and suitable gradations of the sediment cap erosion protection layer to protect the underlaying sand cap layer.

Port of Seattle Sedimentation Engineering Services, Seattle, WA: Mr. Porter, Project Engineer, estimated sedimentation rates at three areas of Berth 3. Berth 3 is located along the northern end of Terminal 5. He estimated future depth conditions at the berth as of December 2013 and December 2014. Depth conditions were estimated for two scenarios: Scenario 1) 50 ft depth; and 51 ft (project depth +1 ft advance maintenance). Spatial distribution of sedimentation in the West Waterway area adjacent to Berth 3 was also predicted.

Port of Kingston Carpenter Creek Estuary Restoration, Kingston, WA: An estuary restoration project was proposed by Kitsap County Public Works along West Kingston Road. Work includes culvert removal. Mr. Porter conducted a qualitative review of the proposed Phase 2 restoration action to determine if there is a potential for additional geomorphologic changes that could result in additional sedimentation to the Port's marina basin.

Wave Energy Model Development, Sandia National Laboratories, Albuquerque, NM: Mr. Porter is part of a team at Sandia National Laboratories which is developing SNL-SWAN, a modified version of the open source code Simulating WAves Nearshore (SWAN) that includes a validated Wave Energy Converter (WEC) Module to improve modeling of the frequency and sea state dependent wave energy conversion of WECs. As no wave farms have yet to be deployed, the purpose of this model is to improve environmental impact assessments of wave farms numerically, in lieu of large-scale testing. Existing numerical models do not have the necessary combination of features necessary to accurately and efficiently model the effect of wave farms in the far field. Mr. Porter led engineering analysis of experimental data and model validation, and supported direction and testing of model code development for SNL-SWAN.

MOTT MACDONALD

Christopher Day, PE, D.CE

Personal summary

Education:

BSCE, Civil Engineering, University of Miami, 1994

MS, Applied Marine Physics, University of Miami, 1996

Registrations:

Professional Engineer

FL #60052, 2003
OR #93301, 2018
WA #51809 (Civil), 2014

Memberships:

Academy of Coastal, Ocean, Port, & Navigation Engineers

American Shore & Beach Preservation Association

American Society of Civil Engineers

Highlights:

Over 20 years of experience in coastal engineering analysis and numerical modeling.

Has completed numerous beach erosion, coastal protection, erosion analysis, and flooding protection projects in Puget Sound and throughout Washington and Oregon.

Mr. Day is a coastal engineer with over 20 years of varied and diverse experience in the coastal engineering field.

His background includes beach erosion studies, coastal structure design, flooding analyses, mooring line analyses for moored vessels in ports and harbors, morphodynamic modeling, and wave modeling. Mr. Day also specializes in flood insurance rate mapping changes and planning for recreational shoreline properties and boating facilities.

Selected projects

Twin Harbors & Grayland State Parks - Pre-Feasibility Assessment of Hydraulics and Sea Level Rise, Westport, WA: Senior coastal engineer. Mr. Day conducted an assessment of tidal flooding and beach erosion risks in response to chronic flooding of campgrounds at Twin Harbors and Grayland State Parks considering storm tides, sea level rise, and observed beach erosion patterns.

Bauer's Landing Shoreline Engineering Assessment: Senior civil engineer. Analysis and development of conceptual alternatives to address chronic sedimentation at the Bauer's Landing boat ramp and chronic erosion on the downdrift shoreline.

Kinder Morgan Bays Fork Creek Exposure Project, Allen County, KY: Design of bank protection in order to prevent the exposure of pipelines by a meandering stream.

Appeal of FEMA Preliminary Flood Insurance Rate Map at Southshore Development, Newport, OR. Senior coastal engineer. Successful appeal of 2017 preliminary Flood Insurance Rate Maps at six oceanfront properties in Newport, Oregon based more realistic storm erosion estimates.

City of Warrenton Technical Review of Federal Emergency Management Agency (FEMA) Clatsop County Flood Study, City of Warrenton, Clatsop County, OR: Coastal engineer. Mr. Day conducted a peer review of FEMA flood insurance study along the communities of Warrenton and Astoria, OR.

Grays Harbor South Beach and Westport-By-The-Sea Flood Map Revision Projects, Appeal of Preliminary Flood Insurance Rate Map, Windermere Real Estate and , Westport-By-The-Sea, Westport, WA: Coastal engineer. Mr. Day completed a review and appeal of a draft Special Flood Hazard Area by the Federal Emergency Management Agency based on dune morphology and observed long-term and storm-driven beach erosion trends.

Pacific Northwest LNG Terminal in Prince Rupert, BC, Prince Rupert, B.C., Canada: Numerical modeler. Evaluation of terminal's impacts on wave propagation, tidal circulation, sediment transport, scour, and shoaling using the SWAN and Delft3D-FLOW models.

Chayvo Coastline Protection Project, Exxon Neftegas Ltd., Sakhalin, Russia: Numerical modeler. GENCADE shoreline change model in support of the coastline protection project along the Chayvo Well Site, Sakhalin Island, Russia.

Inlet Management Study of Longboat Pass and Adjacent Beaches, Manatee County, FL and Town of Longboat Key, FL: Coastal engineer. Mr. Day conducted wave propagation modeling, long-term erosion analysis, sediment budget evaluation, and preparation of an engineering report.

Fort Story Sand Nourishment and Shoreline Stabilization, Naval Facilities Atlantic Command, Fort Story, VA: Numerical modeler and coastal engineer. Delft3D long-term and storm-driven erosion modeling, sediment budget evaluation, preparation of engineering report.

East Pass Inlet Study and Management Considerations, City of Destin, Destin, FL: Coastal engineer and numerical modeler. Conducted Delft3D long-term and storm-driven erosion modeling, long-term erosion analysis, a sediment budget evaluation, and preparation of an engineering report.

Captiva and Sanibel Islands Beach Renourishment Projects, Captiva Erosion Prevention District, Captiva, FL: Coastal engineer and numerical modeler – Economic storm damage modeling, long-term and storm-driven erosion modeling, beach fill design, preparation of engineering design report, annual monitoring reports.

Central Palm Beach County Comprehensive Erosion Control Project, Reformulated Shore Protection Alternatives, FL: Coastal engineer and numerical model – Erosion rate analysis; Delft3D modeling of beach, breakwater, and groin performance.

Palm Beach Midtown Beach Renourishment and Expansion Project, FL: Coastal engineer and permitting assistant. Completed an erosion rate analysis, beach fill design, preparation of construction plans and specifications, construction inspection, and construction-phase office support.

South Siesta Key Beach Restoration Project, Sarasota County, FL: Numerical modeler and coastal engineer – Economic storm damage modeling, long-term and storm-driven erosion modeling, long-term erosion analysis, beach fill design, state and Federal permit application, construction plans and specifications, annual monitoring reports.

Town of South Palm Beach/Town of Lantana, Erosion Control Study, FL: Coastal engineer and numerical model – Erosion rate analysis; Delft3D modeling of beach, breakwater, and groin performance.

Town of Palm Beach Post-Frances and Jeanne Monitoring Reports, FL: Coastal Engineer. Mr. Day completed an analysis of storm-related erosion losses following the passage of hurricanes Frances and Jeanne.

MOTT MACDONALD

Arpit Agarwal, PE

Personal summary

Education:

MS, Civil Engineering, University of Delaware, 2005

Bachelor of Technology, Naval Architecture & Ocean Engineering, Indian Institute of Technology, 2003

Registrations:

Professional Engineer

TX #104878, 2009

Highlights:

Expertise in coastal engineering analyses and numerical modeling.

Project experience includes living shorelines, marsh creation, shoreline erosion and protection control, shellfish and estuarine and aquatic habitat enhancement.

Mr. Agarwal has experience as a project manager and project engineer in planning and data collection efforts, alternatives analyses, and design for a variety of coastal design work including ports, marinas, and shoreline stabilization projects. He is proficient in performing sophisticated analytical and numerical analysis on a variety of meteorologic and oceanographic data types. His work experience has ranged from developing his own computer codes and using available numerical models to performing modeling and analysis of wave transformation, tide and wind induced currents, propeller wash, sediment transport, shoreline change, and morphology. He supports engineering design with and a variety of analysis tools to determine wave and current forces and impact loads, and has worked extensively applying hydrodynamic and coastal numerical models.

Selected projects

Biloxi Marsh Living Shoreline Project, Coastal Protection and Restoration Authority of Louisiana (CPRA), St. Bernard Parish, LA: Coastal engineer for a living shoreline project that will build approximately 11 miles of shoreline protection to reduce shoreline erosion and enhance ecological habitat. Responsible for managing the coastal engineering analysis which includes shoreline change analysis, hindcast modeling of water level and waves at the project site and evaluation of wave transmission using wave-structure modeling. Modeled waves to evaluate the efficiency of various bioengineered products in reducing the shoreline erosion.

Living Shoreline Demonstration, Coastal Protection and Restoration Authority of Louisiana (CPRA), St. Bernard Parish, LA: Coastal engineer for a demonstration project which evaluated living shoreline products to reduce wave energy that reached the shore and stimulate oyster growth to increase the biodiversity in the immediate area. Responsible for the development and management of Shoreline change analysis and wave modeling. Assisted in the product evaluation using wave-structure modeling, development of design drawings and cost estimates.

Calcasieu Ship Channel Salinity Control, Coastal Protection and Restoration Authority of Louisiana (CPRA), Cameron Parish, LA: Coastal Modeler for large scale restoration efforts to manage salinity into Calcasieu Lake and surrounding wetlands, an area of approximately 1300 square miles. Guided the coastal engineering team on the circulation modeling effort and developed the analysis procedure to analyze the performance of different alternatives during the feasibility stage of the project which aided in choosing the preferred alternative for the future detailed design phase.

La Quinta Terminal Aquatic Habitat Mitigation Phase I, Port of Corpus Christi Authority, Corpus Christi, TX: Coastal engineer responsible for hydrodynamic modeling analyzing wind, water levels, bathymetric change, vegetation and topographic conditions to determine the optimal elevation range for planting smooth cordgrass.

Bahia Grande Restoration, Texas General Land Office, Cameron County, TX: Coastal Engineer for a project designed to re-establish tidal exchange between Laguna Madre/Gulf of Mexico and the Bahia Grande complex by constructing and stabilizing a tidal exchange channel into the Bahia Grande basin from the Brownsville Ship Channel. Conducted history and literature review to understand the existing conditions and process at the project site. Performed numerical modeling of tide and wind generated currents, calibration and verification of the developed model by comparing the simulated currents with measured existing flow rates. Additional responsibilities included developing inlet dynamics using Escoffier curve, as well as the development and testing of conceptual alternatives to maximize the flow into and out of the Bahia Grande.

Shoreline Protection and Erosion Control, Texas A&M University at Galveston (TAMUG) Galveston, TX: Coastal engineer for a coastal engineering analysis which identified and predicted the movement of sediments along the TAMUG shoreline that may be moving into the TAMUG mooring area. Responsible for sediment transport and morphology modeling and analysis for sedimentation reduction. Performed site visits to collect the geotechnical data, and for analysing wind and wave climate, water levels, sediment sources and sinks, sediment transport pathways. Performed numerical modeling to simulate wind-wave growth and transformation to project site, wind and wave-generated currents, sediment transport, and

erosion/accretion along the shoreline. Assisted in developing and testing conceptual alternatives and 30% design of the final selected alternative.

Bayou Bonfuca Marsh Creation Numerical Modeling, Coastal Protection and Restoration Authority of Louisiana (CPRA), LA: Coastal engineer responsible for developing wave models for evaluating changes to the wave climate leeward of the proposed borrow sites for the Bayou Bonfuca Marsh Creation Project (PO-104). Conducted the borrow area impact analysis using the numerical model SWAN to assess the impact of the borrow area on local wave energies impacting the shoreline.

Calcasieu Lake Borrow Area Wave Analysis, Coastal Protection and Restoration Authority of Louisiana (CPRA), Cameron Parish, LA: Coastal Engineer responsible for assisting in the statistical analysis of winds at the project site. The project consisted of numerical modeling of wind generated waves at a proposed borrow site for the Cameron-Creole Watershed Grand Bayou Marsh Creation Project (CS-54).

San Luis Pass Inlet Management Study and Emergency Treasure Island Shoreline Stabilization, Brazoria/Galveston County, TX: Coastal engineer for a project which developed an understanding of the processes controlling the morphology of San Luis Pass and developed a plan to stabilize the Treasure Island shoreline from further erosion. Performed shoreline change analysis at the project site. Computed storm induced overwash using numerical model SBEACH. Conducted morphological modeling to assess changes in hydrodynamics and morphology. Calibrated and validated developed model. He then developed sediment budget to quantify sediment transport pathways in and adjacent to San Luis Pass.

Maintenance Dredging Plan and Sedimentation Reduction Analysis, Aransas County Navigation District No. 1, Aransas County, TX: Coastal engineer responsible for developing a maintenance dredging plan and study the sedimentation of the Leggit and Blevin Channels. Mr. Agarwal developed a numerical code using MATLAB programming language to compute the longshore sediment transport rates along the coastline of Leggett and Blevin channel from the available wave modeling results. Participated in preparing a technical report summarizing the sediment transport analysis which helped in gaining a qualitative insight into the direction and magnitude of sediment transport which later helped in designing of maintenance dredging plans.

Former Scott Paper Mill Cleanup Project, Port of Anacortes, WA: Coastal engineer for project that determined the feasibility and developing conceptual engineering plans for alternative shore protection design at the former Scott Paper Mill Site near the Port of Anacortes. Conducted numerical wave modeling and wave-induced sediment mobility analysis. Participated in developing the preliminary design of structural modifications at site which included new breakwaters, pier, floats, etc. and removal of some of the existing structures which were causing deteriorating affects to the shoreline. Performed an analysis to determine the stable diameter for cap material required to protect the sea bed from further erosion due to wave and current action. Conducted the tidal flow hydrodynamic modeling to develop sufficient tidal currents information for eel grass habitat design at the project site. An important area of concern for the eel grass habitat at the site was shading due to the construction of new structural components. Developed a methodology to compute the shading area due to various kinds of structures on the sea bottom and its variability with sun's position. Incorporated this methodology into an excel spreadsheet for ease of use and portability.

MOTT MACDONALD

Matthew Dwain Campbell, Ph.D., PE

Personal summary

Education:

BS, Biological Engineering, Louisiana State University, 2002

MS, Biological and Agricultural Engineering, Louisiana State University, 2004

PhD, Biological and Agricultural Engineering, North Carolina State University, Expected 2019

Registrations:

Professional Engineer

TX #101011, 2008

Memberships:

American Society of Civil Engineers (ASCE)

Coasts, Oceans, Ports, & Rivers Institute of ASCE

American Shore and Beach Preservation Association (ASBPA)

World Aquaculture Society (WAS)

Aquaculture Engineering Society (AES)

Patents:

Biologically-Dominated Artificial Reef (2006). US Patent No. 7,144,196

Artificial Materials Conducive to Attract and Grow Oysters (2012). US Patent No. 8,312,843

Mature Modular Reef (2015). US Patent No. 9,144,228

Highlights:

Engineering expertise in coastal hydrodynamics and aquaculture system design.

Mr. Campbell is a senior coastal and aquaculture engineer with extensive experience with the integration of biology and engineering in the coastal environment. He has developed several patented technologies that have led the market in nature based solutions in the coastal environment. His 12 years of experience in the coastal engineering field has given him keen insight into coastal development and dynamics throughout the world. He has a proven track record of innovation and integration of traditional coastal engineering principles with biological and ecological processes. Mr. Campbell has a research associate position at North Carolina State University Marine Aquaculture Research Center with an emphasis on marine aquaculture engineering. Mr. Campbell is leveraging his background in coastal engineering to investigate aquaculture techniques and technologies that will promote a more sustainable industry.

Selected projects

NCSU Hydrodynamic Effects on Oyster Aquaculture Systems: Researcher responsible for developing model of upflow oyster aquaculture system based upon packed bed reactor theory. He developed a mechanistic Bayesian model based upon experimentation of hydrodynamic properties of oyster beds and growth studies. This model was used to develop optimization strategies and design criteria for oyster upflow systems.

Barataria Oil Spill Response, Louisiana Gulf Coast: Coastal Engineer/Modeler responsible for conducting circulation modeling in Barataria Bay and assisting in oil spill capture methodology during the oil spill response following the 2010 BP oil spill off the coast of Louisiana. He coordinated modeling results with the U.S. Coast guard and other response team members to assist in the efforts. He conducted field visits to Grand Isle, LA to observe collection techniques in Barataria Pass that utilized barges mounted with booms and oil collection systems. Assisted contractors in developing alternatives for protection of the estuary from oil penetrating the bay.

Bio-Engineered Oyster Reef Demonstration Project, Cameron Parish, LA: Coastal Engineer for a demonstration project which evaluated a new concrete oyster reef technology, the Oysterbreak™ (developed by ORA Technologies), and compared the performance of the Oysterbreak™ structures to traditional rock structures in their ability to provide shoreline stabilization to a marsh shoreline in the open Gulf of Mexico in very weak soil conditions. Responsible for conducting the analytical and numerical modeling of the structures to assess stability and ability to reduce wave impacts on the shoreline. He also developed innovative methods to evaluate this technology employing state-of-the-art empirical, analytical, and numerical methodology.

Columbia University Storm Surge Assessment, New York, NY: Coastal Engineer who developed numerical modeling grid which computed flood elevations for a range of storm conditions at the Columbia University's Manhattanville development site. The work was a component of the overall flood risk assessment project. Flood at the site was expected to be controlled by rising water levels in the ocean, storm surge, wave-induced setup, and backwater effects from the Hudson River. Tasks included data compilation and processing, hydrodynamic modeling, and storm surge modeling using ADCIRC+SWAN.

Cedar Bayou/Vinson Slough Restoration, Aransas County, TX: Cedar Bayou is located in the Texas Coastal Bend and divides San Jose Island from Matagorda Island. This connection historically allowed for sufficient tidal exchange to maintain surrounding intertidal marsh habitats. The tidal exchange supports fish, oysters, and marsh grasses in these areas. Mr. Campbell served as Project Manager and Senior Coastal Engineer for the project to restore the hydraulic connection between the Gulf of Mexico and Mesquite, San Antonio, and Aransas Bays. He was responsible for directing the analysis for inlet stability, coastal morphology, and salinity modeling efforts. He developed design alternatives and the construction bid package. He also coordinated with the US Army Corps of Engineers on existing permit restrictions to allow contractors more flexibility during construction. Mr. Campbell acted as project manager during construction coordinating with the contractor, owner, resource agencies, and the Corps of Engineers in order to successfully deliver the project to completion. This project was selected for the Sustainability Award for Mott MacDonald competing against projects worldwide.

Crescent Bar Recreational Improvements, Crescent Bar, WA: Coastal Engineer responsible for assisting in development of recreation programs for the shoreline Management Plan for Grant County PUD No. 2 (PUD). PUD was planning on making upland and in-water recreational improvements to the Priest Rapids Project at Crescent Bar, located on Wanapum Lake. He conducted feasibility engineering analysis and preliminary design process for the in-water components at Crescent Bar and was responsible for the following elements: 1) Dredging of entrance channel from entrance buoys to boat ramp including vicinity of bridge and boat launch; 2) Shoreline stabilization along PUD property and existing campground (approximately 1,100-ft of shoreline) 3) mooring buoy arrangement and design; and 4) Evaluation of relocating swimming beach.

La Quinta Aquatic Mitigation Project, Corpus Christi, TX: Project Manager responsible for the development of the coastal engineering analysis and final design of a mitigation project creating 6.6 acres of smooth cordgrass and 19 acres of seagrass habitat in an existing Corps Beneficial Use Site in Corpus Christi Bay. He worked with ecological services staff to establish design and construction elevations and circulation channels sufficient for smooth cordgrass and seagrass establishment. He also managed the development of specifications for planting and survival to meet requirements for mitigation.

Shamrock Island Shoreline Restoration, Corpus Christi, TX: Project Manager and Coastal Engineer responsible for the development of design concepts and analysis approach. He coordinated with client on goals and project alternatives and also managed budget and deliverables for project. He coordinated with resource agencies to develop solutions on the island that were in line with project partners goals. He was also responsible for assembling permit documents and coordination with the Corps of Engineers. He oversaw the development of bid and construction documents and coordinated with contractors and negotiated cost savings for best and final offers for construction.

Post-Hurricane Ike Assessment of Damage to Surfside Revetment Project, Surfside, TX: An assessment of damage to the Surfside Revetment project was conducted after Hurricane Ike to determine the extent of damage along the revetment, Beach Drive, and engineered beach seaward of the revetment. A topographic survey, engineering assessment, and summary documentation were developed to calculate the amount of damage and recommend engineering solutions to repair the revetment. Conceptual cross-sections and plan views for the revetment repair were provided along with timelines and costs for reconstruction. Mr. Campbell provided input on the data collection plan to accurately represent the damage at Surfside. He also conducted the technical analysis of the damage assessment and design of the proposed revetment reconstruction.

Master's Thesis/ Louisiana State University: Mr. Campbell developed a thesis entitled, "Analysis and Evaluation of a Bioengineered Submerged Breakwater." In response to Louisiana's extreme coastal erosion, Mr. Campbell explored the use of oysters to mitigate erosion. Mr. Campbell's research involved a technology, termed as OysterbreakTM, which is a bioengineered submerged breakwater. He evaluated the wave dissipation characteristics as oysters propagated on the structure. In addition, settlement patterns were analyzed by quantifying the biological fouling for various flows, elevations, and seasons. Mr. Campbell evaluated the wave interactions with the structure in a series of scaled wave tank tests.

DEPARTMENT OF ECOLOGY
State of Washington

George Kaminsky, PhD, PE

Personal summary

Education:

PhD, Marine Science, University of Sydney, Sydney, NSW, Australia

Dissertation: Shoreface Behaviour and Equilibrium, 2008

MS, Oceanography, University of Washington, Seattle, WA, 2000

BS, Ocean Engineering, Florida Institute of Technology, Melbourne, FL, 1989

Registrations:

Professional Engineer

(Civil) WA

Highlights:

Co-directed the Southwest Washington Coastal Erosion Study from 1996-2002.

He has three decades of coastal erosion and processes analysis experience in Southwest Washington.

Dr. George Kaminsky is a senior coastal engineer with the Washington State Department of Ecology with 28 years of applied research experience in coastal engineering and geomorphology with expertise in coastal morphology monitoring, beach change, sediment budgets, coastal morphodynamics, and shoreline change prediction. He plans, develops, conducts, and oversees independent studies related to coastal natural hazards, coastal erosion, coastal geology, natural resource management, beach nourishment, and coastal engineering practices.

Since 1997 he has directed and supervised the Coastal Monitoring & Analysis Program, providing scientific and engineering activities and expertise to the state and consultation services to Federal, state, local, and tribal governments and other agencies. He co-directed the Southwest Washington Coastal Erosion Study from 1996-2002 with the USGS Coastal and Marine Geology Program. Previously he served as lead Project Engineer for flood and erosion hazard reduction projects, and reviewed, evaluated, and inspected state-funded projects for compliance with engineering design standards, flood hazard management plans, and other requirements.

During and immediately after his undergraduate degree, he performed coastal processes research with the U.S. Army Corps of Engineers, Coastal and Hydraulics Laboratory (formerly the Coastal Engineering Research Center), where he investigated breaking waves and surf zone processes, large-scale bedforms in navigation channels, storm surges, longshore currents, and dredged material disposal berms. He is a registered Professional Engineer in Washington State and holds a B.S. degree in Ocean Engineering from Florida Institute of Technology, an M.S. degree in Oceanography from the University of Washington, and a Ph.D. from the University of Sydney.

Key strengths

- Nearly three decades of expertise in coastal mapping, long-term beach morphology monitoring, and change analysis and determination of trends and variability.
- Directed, supervised, and participated in a wide variety of multi-disciplinary coastal science and research projects.
- Knowledge and experience with coastal processes, breaking waves, sediment transport, and resulting changes of the shoreline, beach, shoreface, mudflats, and other coastal morphologies.
- Experience with technologies including GIS, aerial imagery and photogrammetry, GPS (GNSS), laser scanners (lidar), multibeam echo sounders, side scan sonar, inertial navigation systems, single beam echo sounders, sound velocity profilers, ground-penetrating radar, RFID PIT tag readers, vibracorers and sediment samplers.
- Experience with impact assessment of waves, storms, coastal structures, sediment budgets, and water levels on beaches and nearshore environments and habitats.
- Understanding of the relationships between coastal processes, sediments, geology, substrate, geomorphology, hydrogeology, climate variability, aquatic and terrestrial vegetation, and human influences on coastal change, including dredging and dredged material placement.

Project Experience

George Kaminsky has been working on southwest Washington coastal erosion and sedimentation issues from 1991 to present.

From 1996 – 2002 he co-directed the Southwest Washington Coastal Erosion Study with the USGS. Most of this effort was focused on the ocean coast, though significant attention was afforded to changes within the estuaries of Willapa Bay and Grays Harbor. George was directly involved with shoreline and morphology change analysis extending from Toke Point to North Cove in Willapa Bay, and Damon Point and Half Moon Bay in Grays Harbor.

From 2001-2004 George participated in the feasibility study with the USACE for the Shoalwater Bay Erosion Project. Following the 1990 widening and deepening of the Grays Harbor Navigation Project, oyster growers began to express increasing levels of concern about accelerated erosion of tidal flats due to the dredging. In 2003, George provided a detailed technical peer review of the Whitcomb Flats analysis by Phil Osborne.

In 2004, he participated in a boat tour by Mike Linn of Coast Seafoods to observe conditions of oyster beds throughout Grays Harbor and discuss rapid changes occurring associated with erosion and sedimentation of the tidal flats and the impacts to the industry. George provided consultation to the WDNR Aquatics Program through 2009 on efforts to partner with the Corps to investigate ways to address the migration of Whitcomb Flats and the associated downgrades in the classification of oyster growing tidelands owned by WDNR. George was engaged in many meetings and discussions on the Corps section 111 study to consider their maintenance activities and possible erosion mitigation measures for deflation and landward migration of flood tidal shoals and associated reduction in commercial oyster production.

More recently, George has monitored topographic and bathymetric changes along Empire Spit and Graveyard Spit from Toke Point to the SR-105 groin with surveys conducted in 2014, 2015, 2016, and 2018. George oversaw the baseline topobathymetric survey for the Willapa Shoreline Erosion Protection Demonstration Project in 2018 and subsequent monitoring of the North Cove dynamic revetment to present.

In 2018, George also identified erosion hazard areas for Grays Harbor County and wrote the coastal erosion chapter of the Grays Harbor Hazard Mitigation Plan 2018. George and his Ecology CMAP team have also mapped eelgrass in Puget Sound using single beam and multibeam echosounders.

Selected Publications

Antolínez, J.A.A., Anderson, D., Méndez, F., Ruggiero, P., and Kaminsky, G.M. 2019. Understanding long term coastal change and variability using a simple and efficient multi-process model, Coastal Sediments 2019, pp. 2091-2102, https://doi.org/10.1142/9789811204487_0179

Stevens, A.W., Weiner, H.M., Ruggiero, P.R., Kaminsky, G.M., and Gelfenbaum G.R. 2019. Beach topography and nearshore bathymetry of the Columbia River littoral cell, Washington and Oregon: U.S. Geological Survey data release, https://doi.org/10.5066/P9W15JX8

Weiner, H.M., Kaminsky, G.M., Hacking, A., and McCandless, D. 2017. Shoalwater Bay Berm Monitoring: 2014-2016 Assessment of Coastal Morphology Change, Washington Department of Ecology Publication 17 06-024, 86p.

Talebi, B., Kaminsky, G.M., Ruggiero, P., Levkowitz, M., McGrath, J., Serafin, K., McCandless, D. 2017. Assessment of Coastal Erosion and Future Projections for North Cove, Pacific County, Washington Department of Ecology Publication 17-06-010, 35p.

Ruggiero, P., Kaminsky, G.M., Gelfenbaum, G., and Cohn, N. 2016. Morphodynamics of prograding beaches: A synthesis of seasonal- to century-scale observations of the Columbia River littoral cell, Marine Geology, v 376, pp. 51-68.

Kaminsky, G., von Twistern, B., Brissette, M., Beaudoin, J., Weiner, H., and Hacking, A. 2016. Dual-head Mapping. xyHt, 3(8):16-23.

Warrick, J.A., Gelfenbaum, G., Stevens, A.W., Miller, I.M., Kaminsky, G.M., and Foley, M.M., 2015. Coastal change from a massive sediment input: dam removal, Elwha River, Washington, USA, Proceedings of Coastal Sediments 2015.

Kaminsky, G.M., Baron, H.M., Hacking, A., McCandless, C., and Parks, D.S. 2014. Mapping and Monitoring Bluff Erosion with Boat-based LIDAR and the Development of a Sediment Budget and Erosion Model for the Elwha and Dungeness Littoral Cells, Clallam County, Washington, Report to the Washington Department of Fish and Wildlife, 44p.

Stevens, A.W., Gelfenbaum, G., Ruggiero, P., and Kaminsky, G.M. 2012. Southwest Washington littoral drift restoration—Beach and nearshore morphological monitoring: US Geological Survey Open-File Report 2012-1175, 67 p.

Ruggiero, P., Reid, D., Kaminsky, G., Allan, J. 2007. Assessing shoreline change trends along US Pacific Northwest beaches, Proceedings of Coastal Zone ‘07, Portland, OR.

MOTT MACDONALD

Kevin Smith

Personal summary

Education:

A.A.S, Oceanography, Shoreline Community College, Washington, 1994

North Sea Certified Commercial Diver, Seneca College, Toronto, Ontario, 1986

A.S., Electronics Engineering Technology, St. Clair College, Windsor, Ontario, 1985

Training/Certifications:

Underwater Acoustics for Biologists & Conservation Managers, Applied Technology Institute, Maryland, 2010

USCG/STCW compliant training (First Aid & CPR, Fire Fighting, Survival at sea), 2016

40-Hour Hazwoper (29 CFR 1910.120) compliant. (8-HR refresher, 2016)

US Part 61 Private Pilot – Part 109 UAS certification (commercial operations)

Transport Workers Identification (TWIC) Card

Memberships:

Member of Marine Technology Society

Associate Member of National Society of Professional Surveyors .

Mr. Smith has over 26 years of marine field experience in hydrographic surveys, environmental sampling, habitat delineation, underwater hazardous material remediation, and underwater construction. He has expertise in developing and implementing efficient field sampling and survey strategies to optimize equipment and personnel providing good data returns that exceed client expectations. He has conducted and provided technical support for circulation, sediment, water quality, and biological investigations. He has participated in sediment transport studies, dredged sediment characterizations, remedial investigations, and feasibility studies at contaminated sediment sites. He has also managed tasks and marine habitat characterization and mitigation projects focused on eelgrass, shellfish, and macroalgae. As well as a background with laboratory practice and protocols, Mr. Smith has national and international experience with design and development of environmental monitoring instrumentation and platforms that includes UAS operations with 2D and 3D aerial photogrammetry objectives. Below are some example projects Kevin has been involved in:

Selected projects

San Francisco Sand Mining, Plume Tracking, CA: Survey Leader. Delphis-TSS is collecting real-time current and bathymetric survey data during water quality monitoring around dredge operations in San Francisco Bay and the Suisun Channel. The survey is conducted to accurately map the discharge plume from sand mining operations at multiple locations around San Francisco sand mining lease areas. Parameters from the current data collected are correlated to recorded turbidity levels to develop a three-dimensional model of the discharge plume. Chemistry results of collected water samples are compared to the respective location within the plume from which the sample was collected. Delphis-TSS now supports the 2016 follow-up surveys to be collected around the mining operations.

Coos Bay, Oregon, Sediment Tracer and Current Study, OR: Contractor/Field Manager. Delphis-TSS provided field support to RPS-EH to conduct real-time current vertical profiles along the inside navigation channel and jetties to offshore reaches at the entrance to Coos Bay, OR as part of an integrated tracer study contracted by the USACOE. Part of the study included focused data collection of significant turbulence occurring around the north jetty during ebb conditions. Mr. Smith also led the field effort to collect marine sediment samples along a specified grid near tracer deployment locations. Mr. Smith was responsible for recovering bottom mounted current meters and a tide gauge at the site.

Priest Lake Thorofare Bathymetric and Hydrologic Survey, Idaho Water Resource Board, Priest Lake, ID: Surveyor. Mr. Smith was responsible for planning and collecting single-beam bathymetry data and conducting multiple real-time ADCP current data collection within the Thorofare and along the north end of Priest Lake in Idaho to assess sedimentation to further Thorofare maintenance design studies.

Tulalip Bay and Marina Bathymetric Survey, CG Engineering for Tulalip Tribe, Tulalip, WA: Surveyor. Mr. Smith was responsible for planning and collecting single-beam bathymetric data within the 350-acre Bay as well as high resolution bathymetric data within the marina for permitting and design requirements. Baseline eelgrass delineation data was extracted from the bathymetry data and delivered to project biologist to help refine their efforts.

Lopez to Shaw Island (OPALCO) Cable Lay, WA: Provided technical support to acquire and report in real time, currents affecting cable lay and ROV operations as well as precise positioning of the cable barge and cable along a precise corridor between the islands.

High Velocity Current Study, Puget Sound Energy, Deception Pass and Admiralty Inlet, WA: Measured and recorded real time water velocities along multiple transects across Admiralty Inlet and Deception Pass to assess conditions for offshore energy study options.

Dutch Harbor, Unalaska Island, Geophysical Data Collection, AK: Project Manager. Delphis Technical Support and Solutions, LLC (Delphis-TSS) is providing ongoing seafloor monitoring of outfalls for a fish processing facility that includes bi-annual bathymetric surveys, underwater videography, and core sampling to map the site around the outfalls as part of clients' present NPDES permit requirements. Side-scan and sub-bottom profiling were conducted as part of a reference base in 2007. EPA has commented on preference of Mr. Smith's approach to seafloor monitoring as compared to past diver surveys typical to the state.

Delphis-TSS provided bathymetric survey and imagery data as part of the 2015 Benthic Impact Study and the development of the site remediation plan and Quality Assurance Project Plan (QAPP). Delphis-TSS now supports the 2016 site remediation effort and subsequent follow-up surveys.

Kitimat KNLG, British Columbia, Oceanographic Data Collection, B.C., Canada: Contractor/Field Manager. Delphis-TSS provided field support to RPS-EH as part of a site evaluation study conducted by Kitimat LNG during the construction of the LNG terminal in Kitimat, BC. along the Douglas Channel and within Clio Bay. Mr. Smith assisted with the design, preparation, deployment, and maintenance of various oceanographic instrumentation platforms including Metocean buoys, bottom mounted current meters and instruments, as well as onshore tide and weather stations. Mr. Smith served as the field crew leader during the instrument recovery in 2016 and maintains on-call status to service problems with remaining site instruments.

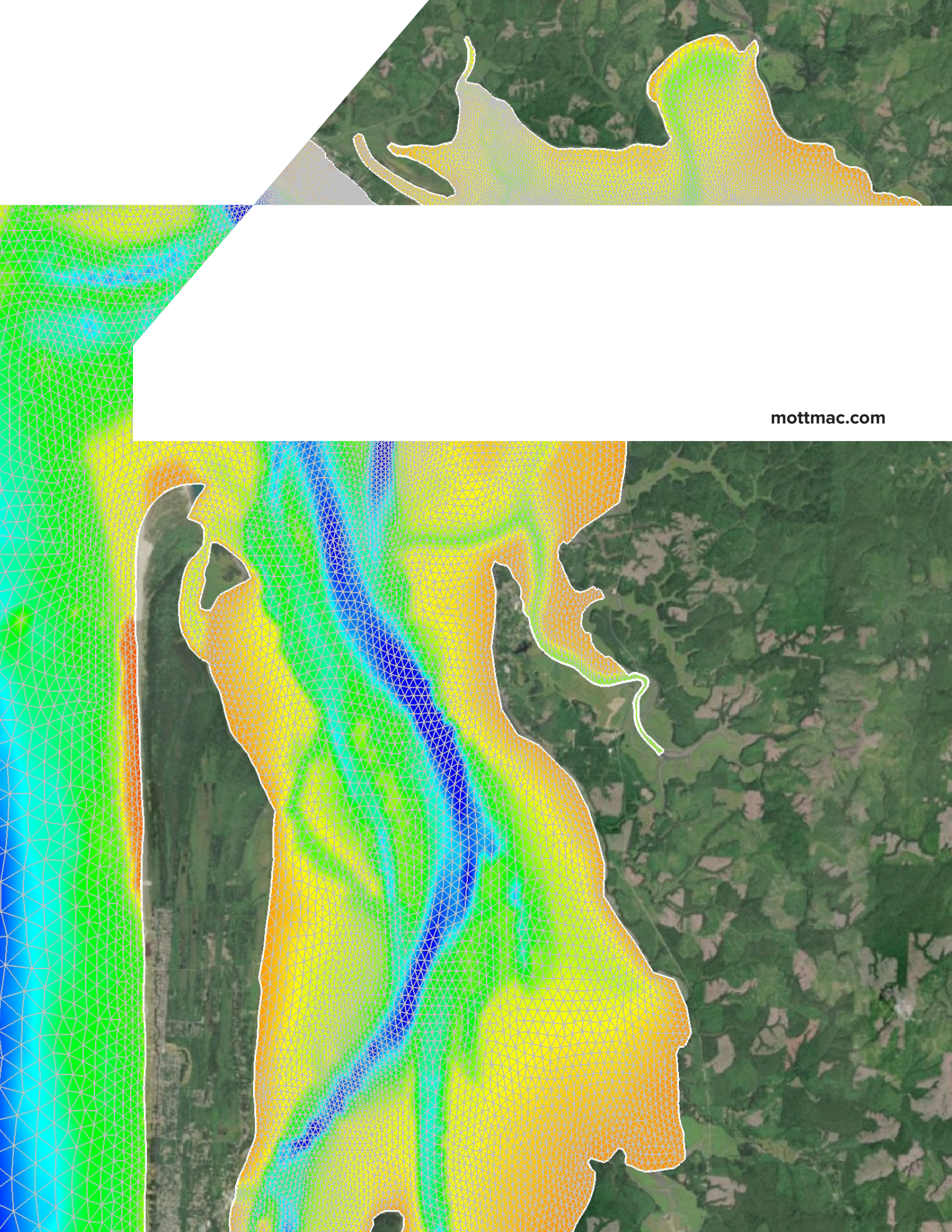
NOAA Hawaii Current Meter Project, HI: Project Manager. Mr. Smith provided logistical and field planning and support for tidal current mooring stations within the State of Hawaii to update the NOAA Tidal Prediction Tables. For the 2011 study a total of thirty (30) stations were occupied around the main Islands of Hawaii. Station depths ranged from 8m to 240m requiring various instrument platforms such as Trawl Resistant Bottom Mounts, SUBs moorings, and deep-water moorings. The project was 100% successful. All 30 deployed moorings were recovered with full data sets that included the 2011 Japanese tsunami.

Congo River, Angola, Oceanographic Data Collection: Survey Field Manager. As the Survey Field Manager, Mr. Smith was responsible for coordinating and conducting multiple real-time current surveys that included CTD profiles performed for daily tidal cycles over three years providing current data and bathymetric data for modeling programs. Intense single-beam, dual frequency bathymetric surveying was conducted over the entire site on each visit to develop three dimensional models and monitor sedimentation in the dredge area as well as providing accurate dynamic current data to develop the LNG tanker Pilot training model. Additional project work included deploying, servicing, and successfully recovering four bottom-mounted current meters and two deep water moorings.

Coeur D'Alene River Real Time Current Profiles, Idaho Department of Environmental Quality, ID: Mr. Smith was tasked with measuring and recording water velocities across the Coeur D'Alene River at multiple transect locations from Cataldo, ID to Harrison, ID (approx. 26 river miles) during a high flood stage condition to collect data to develop a contaminant distribution model along this Superfund area. Water levels typically exceeded the river banks requiring surveys across unusual water velocity data collection areas such as farm fields and open ranges as part of this study.

NOAA Alaska Current Meter Project, SE AK: Project Manager. Mr. Smith provided logistical and field planning and support for tidal current mooring stations within the State of Alaska to update the NOAA Tidal Prediction Tables. For the 2008 study a total of fifty-one (51) stations were occupied, all within SEAK. Station depths ranged from 15m to 590m. The project was 100% successful. All 51 deployed moorings were recovered with full data sets.

Sabine River Current Measurement, Sabine, TX: Field Manager. Mr. Smith was responsible for conducting multiple real-time ADCP current surveys performed for daily tidal cycles that included CTD profiles. Additional project work included deploying, servicing, and successfully recovering four bottom-mounted current meters.



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