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David R. Walsh, M.S.

Senior Project Manager/Coastal Scientist
(Team Leader, Coastal Measurements and Sediments Group)

Field Party Chief/Field Oceanographer
(Oceanography and Measurement Systems Division)

EXPERTISE

Design and implementation of real-time data monitoring systems in coastal and estuarine environments. Oceanographic data collection systems. Coastal and deep-water mooring system instrumentation and deployment techniques. Field operations logistics, efficiency, safety, and shipboard deck operations. Programming, deployment, and data analysis of oceanographic instruments including the ADCP, ADV, and CTD. Mooring design, floatation/hardware components, and acoustic releases.
Research interests in coastal geomorphology and sedimentology. Application of field and laboratory research to resolve and evaluate geologic processes within coastal, estuarine, and oceanic environments. Utilization of GIS and other geospatial software packages to map and define geomorphological processes and sediment characteristics, including the presence of contaminants. Design, acquisition, and interpretation of bathymetric, side-scan sonar, and sub-bottom sonar surveys. Implementation of sediment sampling strategies to ground-truth geophysical survey data (physical properties, sediment stratigraphy, layer thickness) and estimate sedimentation rates.

QUALIFICATION SUMMARY

- 17 years of experience
- Extensive field/shipboard operations and logistics management of geologic and oceanographic sampling
- Experienced in the deployment/recovery of oceanographic mooring systems, instrumentation, and data processing
- Specializes in oceanographic data collection program management and operational logistics for both surface and subsurface systems.
- Use of ADCPs for temporal (moorings) and spatial (vessel surveys) oceanographic studies
- Sediment core collection and characterization
- Geochronological analysis of sediment cores using radioisotopes activities and contaminant histories
- GIS geospatial analysis applications, cartographic transformations, and digital terrain modeling of topographic and bathymetric data
- Geophysical survey data acquisition, processing, and interpretation (bathymetric, side-scan, sub-bottom)

Education
2004 – M.S.
Marine Studies - Oceanography
University of Delaware
1999 – B.S.
Geoscience
Hobart College

Work Experience

- 2018-Present Woods Hole Group, Inc. (Team Leader, Coastal Measurements and Sediments Group)
- 2012-Present Woods Hole Group, Inc. (Sr. Project Manager)
- 2004-2012 Woods Hole Group, Inc. (Coastal Scientist)
- 2001-2004 University of Delaware (Research Assistant)
- 1999-2001 USGS Coastal and Marine Geology Program (Sediment Lab and Mooring Systems Technician)

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KEY PROJECTS

Long-term Measurements of Hydrology, Meteorology, and Sediment Oxygen Demand in the Delaware Estuary. Philadelphia Water Department. 2012–Present. Project Manager

The Philadelphia Water Department (PWD) is in the process of developing a hydrodynamic water quality model of the tidal Delaware Estuary between Trenton, NJ and Delaware City, DE. As part of this process, the PWD contracted the Woods Hole Group (WHG) and their subcontractors to collect data that will be used to calibrate and validate the PWD model. The contract's project is split into two parts: 1) the collection of hydrodynamic and meteorological time-series, and 2) seasonal and spatial characterization of sediment oxygen demand, and other important biogeochemical processes in the model domain.

Hydrodynamic data (current magnitude and direction, conductivity) have been collected at three long-term stations that consisted of an acoustic Doppler current profiler (ADCP), conductivity sensor, data logger, and a surface buoy telemetry system. Data collected at each system were transmitted to the Woods Hole Group base station at 6-minute intervals. In addition to the three long-term systems, multiple short-term (30-day) data collection stations were deployed to characterize currents at specific locations of interest to the PWD modeling team. Multiple water quality monitoring buoys equipped with multiparameter sondes are also maintained throughout the estuarine model domain.

The seasonal and spatial characterization of sediment oxygen demand (SOD) is being performed via direct measurements, along with other relevant sediment parameters. Samples have been repeatedly collected at over 88 stations in the model domain during four separate sediment collection surveys. Additionally, four water quality surveys have been performed since it has since been determined that the water column is a major contributor to the biogeochemical cycling of nutrients and oxygen.

Herring River Real-Time Observation Network (HeRRON). Friends of Herring River. 2015–Present. Project Manager

Woods Hole Group has successfully designed and installed a network of five real-time water quality monitoring stations in the Herring River, Wellfleet, MA. The HeRRON stations will be used to provide baseline data for the restoration of the Herring River estuary, and also provide monitoring information that can be used to assess the management of restoration through implementation of flow controls on a structure that will be constructed as part of the project. Stations are anticipated to provide data for the next 20-years: before, during, and after the restoration construction. All stations are autonomously power with a solar array and transmit data at 30-minute intervals. Sensors are surveyed to provide water level information relative to the vertical datum of NAVD88. Data parameters include water level, temperature, conductivity, pH, dissolved oxygen, and turbidity.

Oceanography Measurement Program, New York Bight. 2008–2009. Field Operations Manager

WHG designed, deployed and maintained two long-term monitoring locations in the New York Bight. Each location contained a complex array of instrumentation designed to fully characterize the oceanographic properties of the water column at the two specific sites over the course of a year. Surface and internal waves, currents, and water column stratification are of primary interest. The effort has included instrumentation mounted to surface buoys, subsurface moorings, and bottom platforms, with all positions monitored by satellite tracking. Quarterly service visits, reports, and data are deliverables to the client.

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KEY PROJECTS (CONTINUED)

Delaware Estuary Regional Sediment Budget. USACE-Philadelphia District. 2009–2012. Coastal Scientist, Project Manager

The objective of this project is to identify sediment sources, transport pathways, and sinks in the Delaware Estuary with application towards a regional sediment budget, with emphasis placed on fine-grained (cohesive) sediments. The budget is being derived from the most up-to-date data available from federal and state government agency sources and the University of Delaware. The final sediment budget is intended to provide a framework for managing sediment and related resources in the estuary. This work is being performed in concert with the Delaware Estuary Regional Sediment Management (RSM) initiative of the United State Army Corps of Engineers Philadelphia District.

Field Data Collection and Historic Chart Digitization, Merrimack River, Newburyport, MA. USACE-New England District. 2012–2013. Project Manager

This multidisciplinary study was performed to assess historic and present conditions within the dynamic Merrimack Estuary and Newburyport Harbor, and to develop long term maintenance strategies. The project was comprised of three tasks. The field program, consisting of Tasks 1 and 2, had the objective to collect current, water level, and salinity data at discrete locations within the project area over a 60-day period. To accomplish this, Woods Hole Group deployed five (5) current meters and four (4) multi-parameter data loggers. The objective of Task 3 was historic chart digitization; to this end, Woods Hole Group processed 27 historic navigation charts or maps of the Merrimack River Estuary. Most charts represent yearly progress maps depicting the depth conditions during the time the jetties at the river inlet were being constructed. Some of the oldest charts (i.e. 1851 and 1880) show the condition of the area prior to the installation of the jetties. All field and chart digitization data were provided to the NAE for internal analysis.

Sediment Boring Collection and Analysis Offshore the Former Aerovox Property, New Bedford Superfund Site, New Bedford, MA. USACE-New England District. 2012–2013. Project Manager

The primary objective of this project was to obtain a vertical profile of contaminants along the former Aerovox Site facility shoreline, from the sediment water interface to bedrock. The secondary goal was to identify potential pathways for contaminant transport within the sediment using analytical data and geotechnical data. The objectives of the project were achieved with twelve (12) sediment borings using a barge mounted sonic drill rig as the sampling platform. One hundred twenty-three (123) analytical field samples were collected from the boring sections. Each sample was collected from a half-foot (0.5) interval of sediment and was submitted for analysis of PCBs (Aroclors), VOCs, and SVOCs, and an archive sample for possible PCB 209 Congeners analysis. All split sediment boring sections were measured, photographed, described, and logged by a trained soil scientist. In all cases, boring collection ceased at bedrock, whether verified with the recovery of a plug of stone, or through drill rig characteristics and feedback provided by the driller. A group of seven (7) site specific contaminants-of-concern were chosen by the USACE-NAE and USEPA for detailed reporting based on: 1) historical usage of these compounds by the Aerovox Corporation and respective degradation compounds, and 2) observations of high concentrations in New Bedford Harbor sediment from this area.

KEY PROJECTS (CONTINUED)

New Bedford Harbor Environmental Monitoring Program, New Bedford Superfund Site, New Bedford, MA. USACE-New England District. 2009–2014. Project Manager
In support of the remediation efforts for the New Bedford Harbor Superfund Site (NBHSS), the Woods Hole Group is performing various types of environmental monitoring. The project includes monitoring, sampling, and chemical analysis as necessary to support ongoing remedial actions and compliance with project remediation requirements. Water quality monitoring was performed in support of dredge operations, and included both vessel based monitoring crews and the use of four (4) real-time telemetry buoys equipped with sensors to monitor temperature, conductivity, turbidity, and DO. The telemetry systems supplemented on-site monitoring, collected a comprehensive data set for the client, and provided alerts to management personnel if water quality parameter thresholds were exceeded. Other environmental monitoring efforts at the NBHSS included groundwater monitoring to support ongoing O&M at the Sawyer Street Confined Disposal Facility, sediment sampling to assist in determining the extent of contamination within the harbor sediments, installation/sampling of sediment traps throughout the upper harbor and support compliance with project goals and objectives, and post-remediation sampling and monitoring.

Mixing Zone Evaluation, Lake Erie. Reserve Environmental Services. 2012–2013. Project Manager
In order to comply with permitting requirements from the state of Ohio, a mixing zone study, dilution monitoring, and effluent diffusion modeling were performed for the client's discharge outfall into Lake Erie. In support of this goal, the Woods Hole Group performed three tasks: 1) characterization of the wave and current environment in the vicinity of the outfall, 2) a 60-day *in situ* monitoring and total dissolved solids (TDS) data acquisition, and 3) dilution modeling at the outfall site, calibrated with field observations. The results of this study revealed that the mixing zone boundary previously imposed on the outfall diffuser was improperly defined and that the application of a different model, Cormix 2, was more technically applicable for the system design and provided a more accurate representation of mixing. The application of the comprehensive field data set with the Cormix 2 model resulted in the recommendation that the area if initial mixing (AIM) boundary be extended. This revised AIM boundary would ensure that performance of the diffuser could be evaluated with a greater degree certainty for a wide range of likely conditions, which in turn provided a realistic operational requirement for the client's permit.

Tisbury Great Pond Transport Study, TGP Munitions Response Site, Martha's Vineyard. UXB International. 2011–2012. Project Manager
One of the more unique projects that Woods Hole Group has worked on in recent time, this project was performed to evaluate the potential for historic UXO (unexploded ordnance) transport from burial in the Tisbury Great Pond barrier beach. The location had been a former aerial bomb training site for the military and contains a number of buried UXO in need of disposal. The WHG evaluation included a field data collection program and development of a calibrated hydrodynamic model to accurately assess the potential for transport of the historic munitions if uncovered by coastal processes. Calibration to a prospective inlet breach of the barrier beach, the most likely cause for acute exposure and transport, was accomplished through comprehensive measurement program scheduled around the actual excavation of a trench through the barrier beach – which quickly developed into a tidal inlet. The field data collection program consisted of three components: 1) deployment of an instrument platform to measurement offshore waves over a 60-day period, 2) deployment of instruments to

KEY PROJECTS (CONTINUED)

measure water levels within Tisbury Great Pond and in the Atlantic Ocean over 30-days, and 3) measurement of inlet current velocities during the 48-hours following inlet excavation. Through incorporation of the observed field data, the calibrated hydrodynamic model was able to confidently identify areas of potential exposure and/or transport of UXO at the site, and these results were used to define the search pattern for remaining UXO in need of disposal by the client.

Sampling and Analysis in Support of the Greenwich Harbor Federal Navigation Project, Greenwich, CT. USACE-New England District. 2011–2012. Project Manager

The objective of this work was to acquire data for the analysis of environmental impacts associated with the proposed maintenance dredging of approximately 300,000 cubic yards of sediments from the Greenwich Harbor Federal Navigation Project (FNP), with proposed disposal of the dredged material at either the Central (CLIS) or Western (WLDS) Disposal Site in Long Island Sound. The environmental sampling consisted of collecting sediment cores from 34 locations and water samples from eight locations within the Greenwich Harbor FNP, as well as sediment grab and water samples from the CLIS and WLDS reference locations. Samples were delivered to the laboratory for analysis of physical, chemical, and toxicological parameters as required by the EPA and NAE Regional Implementation Manual. The results were used to characterize the sediment in order to determine whether it is suitable for offshore disposal at either CLIS or WLDS.

Currents and Sediment Dynamics Studies for the Raritan Bay Slag Superfund Site, Old Bridge, NJ. 2010–2011. Coastal Scientist/Project Manager

The Woods Hole Group performed a one-month field data collection program to characterize the nearshore current, wave and sediment dynamics in the vicinity of the Raritan Bay Slag Superfund Site, as well as quantify the hydraulic and particle exchange between Raritan Bay and Chessequake Creek. The site shoreline is fronted by sandy beaches and engineered structures such as seawalls, groins, and jetties. A major physiographic feature of the site is the Cheesequake Creek Inlet; the construction material of the inlet's western jetty is a known source of contamination at the site. Woods Hole Group quantified the tidal exchange through Cheesequake Creek Inlet, in addition to characterizing the littoral wave and current regime along the shoreline. These data will be used to help understand the wave and current regime and sediment transport dynamics. Estimates of water volumetric flux, as well as suspended sediment flux were calculated, and when coupled with dissolved and particulate contaminant concentrations, the flux estimates were used by the client to refine the conceptual site model (CSM) and to estimate contaminant flux.

Hydrodynamic Analysis and Alternatives Design Assessment for the Restoration of Bride Brook, Rocky Neck State Park, East Lyme, CT. 2007–2010. Coastal Scientist/Project Manager

This project investigated the hydrodynamic characteristics of the degraded Bride Brook estuary and provided an assessment of the potential alternatives designed to restore more natural conditions to the system. The estuary has been structured since the early 20th century by twin elliptical culverts located at the mouth of the estuary on Long Island Sound. Since that time, alewife numbers in Bride Brook have declined and the estuarine salt marsh surface is noticeable degraded with pockets of vegetation die back; these present conditions have spurred a restoration effort. The WHG investigation was performed by collecting field observation data and incorporating the data into a 1-D hydrodynamic model. The model was calibrated and verified using the field observations for

KEY PROJECTS (CONTINUED)

existing conditions, and subsequently modified to conceptual design specifications for two proposed alternatives. The model was used to assess hydrodynamic conditions (water level and velocity) for the two alternatives during typical conditions and extreme event conditions. Model output was used in a channel scour analysis for both alternatives to determine whether scour was likely to occur in the channel. A recommended alternative was chosen by the client based on the WHG investigation report and construction plans for the restoration were provided as final products.

Evaluation of Sedimentation and Associated Contaminant Transport Processes in a Shallow Estuarine Cove, Southeastern, MA. 2004–2006. Coastal Scientist/Interim Project Manager

Woods Hole Group, Inc. executed a comprehensive investigation of the transport processes of sediments and associated contaminants in a shallow estuarine cove located in southeastern Massachusetts. The purpose of this investigation was to provide quantitative results that will assist in the development of required remedial alternatives for this location. The investigation involved: 1) field data collection to quantify and rank transport processes more accurately, 2) laboratory analysis to constrain contaminant "hot-spots" and quantify contaminant mass, and 3) a quantitative characterization of certain hydrodynamic and sediment transport processes, and their associated rates. This investigation was intended to provide a detailed understanding of contamination history and transport processes to aid in determining the possible need for remediation and, as appropriate, provide input for evaluating possible remedial alternatives.

Environmental Assessments and Impact Evaluation of Hammonasset Beach State Park, Madison, CT. 2007–2008. Coastal Scientist/Field Technician Lead

In this multi phase project, Mr. Walsh led the field data collection program, performed a shoreline change analysis, and assisted in writing several report chapters pertaining to the coastal geology and morphology of Hammonasset Beach, and beach nourishment sand sources. In preparation for the wave modeling phase of this project, Mr. Walsh performed a nearshore bathymetric survey and successful deployment of two trawl resistant bottom mounted ADCP moorings (near-shore, offshore) to collect wave and current data over a 60-day time period. A subaqueous sediment sampling program (using a petite ponar grab) was also completed to delineate potential beach nourishment resources.

Historical Shoreline Change Analysis. South Shore, Suffolk County, Long Island, NY. 2004–2008. Coastal Scientist

Woods Hole Group, Inc. (WHG) was contracted to perform an evaluation of historical shoreline change and sediment transport modeling of Long Island's southern shoreline in support of legal proceedings for Suffolk County, New York. The study evolved over a five year period into a comprehensive morphological evaluation of the Suffolk County shoreline. A primary area of focus for this investigation was the vicinity of three groins near Georgica Pond. To that end, a shoreline change analysis, spanning 113 years, 30 miles of shoreline, and 24 data sources, revealed that the background variability of shoreline position to either side of the groins has not changed markedly since the construction of the groins in the early 1960's. Additionally, this work was supported by the development of a process-based analytical model that included time-variable wave spectra (wave heights, periods, and directions) from a linked wave model, and use of the actual bathymetry and shoreline data. The model withstood rigorous legal review and results indicated the three

KEY PROJECTS (CONTINUED)

groins have a small, localized zone of influence on sediment transport. It was found that the natural bathymetric features in the vicinity of Georgica Pond produce changes in the rate that are larger than those caused by the groins. Therefore, the natural features of the regime have just as much influence on the shoreline as the groins. The application of the comprehensive shoreline change analysis, coupled with the advanced technical approach that WHG took with this investigation provided valuable, objective results that assisted the County in their successful legal defense.

NOAA CO-OPS National Current Observation Program, Penobscot River and Bay, Maine. 2006. Field Technician Lead

Mr. Walsh managed the WHG field operations during the Penobscot Current Observation Program in 2006, participating in all three cruises. The program consisted of data collection at nine stations using TRDI ADCPs mounted in both SUBS buoys and TRBM platforms. During this project Mr. Walsh received experience working directly with NOAA CO-OPS personnel, policies, and equipment. GFE instrumentation consisted of TRDI ADCPs, ORE CART, Benthos 875-A PUB, Benthos UAT-376 transponders, and RBR XR-420 CTD. In addition to preparing, maintaining, and deploying the GFE, Mr. Walsh assisted with CTD casts, and prepared the final NOAA formatted log sheets. The experience that the Penobscot Current Observation Program has provided WHG and Mr. Walsh with a working knowledge of NOAA operations and requirements that will prove invaluable to the success of future projects.

Oceanographic Investigation of the Brazilian Shelf and Slope, Southern Atlantic Ocean, Brazil. 2008–2009. Field Technician Lead

The objective of this project is to collect a two-year time-series of oceanographic data at various locations off the Brazilian coast. Mr. Walsh was the lead field technician during the project's initial deployment. Six deepwater moorings are deployed on the continental shelf and slope in water depths ranging from 300 to 2,200 meters. Contour normal CTD transects are also performed are also performed at each 90-day turnaround for data recovery and instrument maintenance. Current magnitude/direction and water physical properties are measured using TRDI 75 kHz ADCPs, Nortek Aquadopp ADVs, and Seabird 37-SMPs.

Offshore Current Observations via a Deepwater Mooring Array, Caribbean Sea, Colombia. 2007–2008. Field Technician Lead

Mr. Walsh was a key participant in six research cruises performed to collect a continuous year-long time-series of oceanographic data at three deepwater locations off the Caribbean coast of Colombia, South America. Mooring water depths ranged between 750 and 1500 meters. Current magnitude/direction and water physical properties are measured using TRDI 75 kHz ADCPs, Nortek Aquadopp ADVs, and Seabird 37-SMPs.

Regional Current Velocity Mapping and Long-Term Observations, Strait of Gibraltar. 2007. Field Technician Lead

Managed the planning and design of a field survey of tidal currents offshore Europa Point, Gibraltar and Ceuta, Spain. The vessel based survey was performed using a TRDI 150 kHz Quartermaster ADCP with bottom-tracking in order to profile currents out to a depth of approximately 350 meters and collect

KEY PROJECTS (CONTINUED)

bathymetric soundings. Subsequent to a rigorous spatial survey mapping current magnitude and direction over a 6 day period, the current meter was deployed in a subsurface mooring to collect a time-series of the complete lunar cycle of tidal currents over 30 days.

Hydrodynamic Observations of the Merrimack River, Manchester, NH. 2006. Coastal Scientist/Field Technician Lead

WHG was contracted to collect a 30-day time series of current velocity and water level in the Merrimack River at Manchester, NH. Mr. Walsh was the lead scientist and field technician for this project that required a unique approach to ensure the successful collection of data. Data collection was performed at two locations across a transect normal to river flow using the Nortek 2 MHz ADP. One instrument was located in the thalweg, and the other was jetted into the river bottom on the shallow (<1 meter) flats flanking the thalweg. Despite the difficulties caused by the riverine water turbulence, water column debris, and shallow water levels, a complete data record was recovered and provided to the client.

Hydrodynamic Observations at the Former Callahan Mine Property, Brooksville, Maine. 2006. Coastal Scientist/Field Technician Lead

Mr. Walsh led the field data collection program for this project located in this interesting coastal Maine estuary. At the project site, a complex interaction between the strong Penobscot Bay tides, an inlet restriction, the flooded former mine pit (>300 feet deep), and the extremely shallow upper estuary created an exceptional hydrodynamic situation and required a unique data collection plan. A time series of currents, turbidity, water level, salinity, and temperature were collected for 60-days at three locations in the estuary in order to characterize these complex hydrodynamics. Subsequent to collection, data were applied to calibrate and verify a 3-D model that was used to estimate the effects of extreme events on the system's hydrodynamics, and to estimate sediment transport potential.

Reverse Osmosis Concentrate Dilution Analysis and Ambient Water Quality Characterization, Melbourne, FL. 2005. Coastal Scientist/Field Technician Lead

Completed collection and processing of field data for application in an analytical model to characterize the dilution of a reverse osmosis (RO) plant discharge in the Eau Gallie River. The field data collection program consisted of measurements of tide, salinity, and temperature over a 45-day period using four strategically placed CTD sensors, a high resolution bathymetric survey, water quality sampling, and additional CTD surveys to account for spatial variability. River flow and discharge data were obtained from the City of Melbourne and other sources to complete the comprehensive data set required for the dilution analysis. The field data was processed and used in an analytical model to simulate the existing discharge and determine if a mixing zone could be achieved and permitted under existing water quality regulations and both the State and Federal level.

Mixing Zone Evaluation, BP Products North America, Whiting Business Unit, Lake Michigan. 2005. Field Technician Lead

Conducted study to support the review of a permit renewal application for a discharge into Lake Michigan. The study included a literature review on Lake Michigan currents to help characterize receiving waters in the vicinity of the discharge. Observations of currents in Lake Michigan were also collected over a 45-day period using two TRDI ADCP systems in order to better determine the discharge site-specific ambient conditions. The current

KEY PROJECTS (CONTINUED)

data were processed and an attempt was made to correlate the currents with wind observations obtained from nearby locations in order to model long-term conditions. This data was then analyzed to define the appropriate ambient water input conditions to use in modeling the discharge's dilution and mixing zone.

NOAA CO-OPS, Physical Oceanographic Real-Time Systems (PORTS), Narragansett Bay, RI. 2004–Present. Field Technician

Over his tenure with WHG, Mr. Walsh has been assisting with the operation and maintenance of sensors comprising the Narragansett Bay PORTS. Duties included on-site service and maintenance, and reporting. Mr. Walsh is knowledgeable with PORTS measurement systems, including current meter, water level, meteorological stations and data telemetry.

Instituto Mexicano del Petroleo Deepwater Oceanography Enhancement, Bay of Campeche, Gulf of Mexico. 2005. Instrument Specialist/Field Technician

Mr. Walsh facilitated and assisted with classroom and field training in the maintenance, programming, and deployment of oceanographic instruments. Specifically, these instruments comprised a 1,500 meter deep-water mooring system. Mooring components included the TRDI 75 kHz ADCP, TRDI 300 kHz ADCP, Nortek Aquadopp ADV, and Benthos 865-A acoustic releases. A one-month training deployment was successfully performed in the May of Campeche, Gulf of Mexico.

Investigation of Sediment Shoaling in Hyannis Harbor, Hyannis, Massachusetts. 2004–2005. Coastal Scientist/Field Technician

Mr. Walsh assisted with the design and implementation of a one-month oceanographic instrument deployment in order to identify processes responsible for the observed shoaling of Hyannis Harbor. The deployment consisted of two TRBM instrument platforms, each housing a Sontek ADV current meter and D&A OBS-3A turbidity sensor. Subsequent to a successful deployment, Mr. Walsh performed the data processing, analysis, and reporting of the time-series data and assisted with reporting.