Sediment Management: Assessment, Design and Remediation
Table of Contents

Section 1   About Geosyntec p | 3
Section 2   Sediment Management Services p | 6
Section 3   Experience p | 18

OUR CLIENT-FOCUSED PRACTITIONERS APPLY RELIABLE AND SUSTAINABLE SOLUTIONS TO THE INVESTIGATION, EVALUATION, AND REMEDIATION OF SEDIMENT SITES TO MANAGE HUMAN HEALTH AND ECOLOGICAL RISK ON BEHALF OF ALL STAKEHOLDERS.
SECTION 1 | About Geosyntec
About Geosyntec

Recognized for technical excellence and outstanding quality, Geosyntec excels in working with the private and public sectors on new ventures and complex problems involving the environment, natural resources, and civil infrastructure. Founded in 1983, Geosyntec is an environmental, natural resources, and civil infrastructure consulting and engineering firm with over 1200 engineers, scientists, and related technical and project support personnel located in 80 offices throughout the United States, Canada, and Australia.

We are known for our technology leadership, broad experience, and exceptional client service. Our professionals continue to develop new technology applications and capabilities that advance the state of the practice. Our applied research partnerships with leading universities, NASA, USEPA, Department of Defense, and others are producing better methods for the in situ remediation of recalcitrant chemicals in the environment; management of urban watersheds to reduce pollutant loadings; protection of endangered species from the impacts of stormwater runoff; design of industrial and municipal waste disposal facilities; and geotechnical and seismic analysis for design of earthen structures and other critical facilities.

Our private sector clients represent a variety of industrial and professional service sectors, including chemical, aerospace, oil and gas, mining, pharmaceutical, diversified manufacturing, advanced technology, power and utility, real estate, law, and environmental management. Our public sector clients include federal, municipal, state/ regional, and nonprofit organizations. We deliver solutions through Geosyntec and our seamlessly integrated divisions SiREM, Savron, and Geosyntec Europe.
Geosyntec Services

We develop and refine our core practices in areas where innovation can deliver practical solutions with substantially improved benefits to our clients when compared to traditional approaches. We focus on service offerings where we can create exceptional value for our clients. The following are key practice areas for the firm:

• Contaminated Site Assessment and Cleanup
• Environmental Planning and Management
• Air Quality Management and Air Pollution Control
• Water and Natural Resources Assessment, Management, and Restoration
• Water and Wastewater System Planning, Engineering, and Design
• Waste Management Planning, Engineering, and Design
• Civil Site Engineering and Design
• Geotechnical and Geoenvironmental Analysis, Modeling, and Engineering
• Facility Hazard Definition and Risk Management
• Building Health Evaluations and Rehabilitation
SECTION 2 | Sediment Management Services
Geosyntec Consultants | Statement of Qualifications

SECTION 2 | Sediment Management Services

Geosyntec Has a History of Success With all Aspects of Sediment Site Management Including

- Remedial Investigation
- Risk Assessment
- Treatability And Pilot Testing
- Feasibility Studies
- Remedy Design
- Regulatory Negotiation
- Remedy Implementation

Qualifications Overview

Parties responsible for sites with impacted sediments and surface waters have benefitted from our broad range of capabilities in this practice area. We provide comprehensive and value-added solutions to the management of marine, estuarine, and riverine systems where sediments have been impacted by contaminants from multiple sources.

Our world-class engineering and scientific staff brings together the expertise and resources to meet and resolve the most complex sediment projects. Geosyntec has extensive experience with all aspects of sediment site management including remedial investigation, risk assessment, treatability and pilot testing, feasibility studies, remedy design, regulatory negotiations, and remedy implementation. We conduct these activities with the ultimate goal of developing a remedy that will reduce risk with minimal disruption and costs. We assess the overall environmental impacts and sustainability of different remedies as part of the process in selecting the remedial approach that best meets the objectives of all stakeholders.

Geosyntec applies innovative methods and strategies to address project challenges:

- Streamlining remediation to position properties for redevelopment
- Using adaptive site management (ASM) strategies to achieve more cost-effective remedies
- Minimizing long-term cost exposure through alternative remedies
- Assessing true risk
- Allocating costs and supporting client litigation
- Designing facilities for operational cost savings

Understanding and Managing Site Complexities

Contaminated sediment sites present complex challenges. Geosyntec offers the knowledge and experience of some of the nation’s leading practitioners for assessing and managing these sites. We have years of experience developing holistic conceptual site models (CSMs), applying risk management and adaptive management principles, and preparing robust and implementable remedial designs (RDs). Our clients benefit from our practice capabilities and the new technology applications we develop.
SECTION 2 | Sediment Management Services

Conducting Site Investigations
Geosyntec has extensive experience in developing and implementing site investigations in estuarine, riverine, harbor, coastal, and offshore settings, including in highly congested urban environments and sites with complex regional influences. Our work plans are safe, implementable, and designed to answer specific study questions with the end goals in mind. We apply both conventional and advanced tools and techniques, as appropriate, to evaluate site conditions. We apply relational databases, three-dimensional visualization tools, customized risk assessment algorithms, and fate and transport models to convey to clients and regulators the significance of our investigative findings.

Performing Alternative Evaluations and Feasibility Studies (FSs)
Geosyntec works with our clients, their legal counsel, and regulators to develop remedial action objectives, alternative evaluations, and FS reports that meet client goals while satisfying regulatory requirements. We are experienced in a wide range of sediment remediation technologies from monitored natural recovery (MNR) and enhanced natural recovery (ENR), to dredging, capping, and in situ stabilization. Our staff develop remedial alternatives to achieve remedial action objectives (RAOs), reduce risks, lower life cycle costs to our clients, and be responsive to regulatory input.

Developing RDs and Implementing Remedial Actions (RAs)
Geosyntec is experienced in designing, constructing, and monitoring the performance of RDs and RAs related to large, complex sediment sites. We provide comprehensive and value-added solutions with the ultimate goal of designing remedies that are constructible, sustainable, cost-effective, and permanent. Our technical specifications and drawings are prepared to minimize construction change orders. Our in-house treatability testing laboratories conduct routine and state-of-the-art studies related to sediment fate and transport, treatment, stabilization, ebullition, water treatment, and geotechnical behavior. We are also experienced in conducting pilot studies and demonstration projects to evaluate design approaches. Our construction services include quality assurance, environmental monitoring, construction management/oversight, engineer-of-record, and resident engineer.

Supporting Environmental Forensics
Our practitioners are experienced with the nuance and complexity of collecting and evaluating the multiple sources of information necessary to understand the history of a sediment site. These sources include industrial and municipal dischargers and their operations, system hydrodynamics, chemical fate and transport, and relevant risk pathways. We gather historical maps, photos, facility permits, sewer connection records, operational histories, spill records, and site-specific forensic data to help our clients gain a more complete picture of the historical events and current conditions at the site that may be contributing to contamination.

Assessing Environmental and Business Risks and Developing Responsive Solutions
Our practitioners are experienced in providing third-party strategic consulting and environmental and business risk management services to our clients and their legal counsel. We apply our skills in site investigations, historical data analysis, environmental forensics, fate and transport modeling, and statistical analyses to evaluate potential historical and/or current contaminant contributions to the sediment site in question and become trusted advisors to our clients by using the results of these activities to provide our clients with recommendations on addressing both environmental and business risks.
Sediment Management Services

Our sediment management practice’s assessment, design, and remediation expertise has been utilized by Fortune 500 companies and government agencies on complex sites across the U.S. and in international locations. Clients benefit from our comprehensive experience and core services provided to expedite the best solution.

Service Areas

- Site Characterization/Remedial Investigation
- Biological Assessment and Monitoring
- Human Health and Ecological Risk Assessment
- Natural Resource Damage Assessment (NRDA)
- Feasibility Studies
- Treatability and Pilot Studies
- Numerical Modeling
- Remedial Design
- Permitting, Compliance and Regulatory Support
- Geotechnical Engineering
- Construction Services
- Litigation Support
Site Characterization/Remedial Investigation

Understanding your site is the first step
Sediment sites pose unique management challenges due to the breadth and complexity of sources, pathways, and receptors. Sources may include discharge points, nonpoint sources, and groundwater/surface water interaction; pathways may include surface water, groundwater seepage, and biological uptake; and receptors include humans and sensitive ecological species.

The first step in managing complex sediment sites is a sound program of site characterization and CSM development. We characterize not for the sake of science but to focus specifically on

• characterization of relevant risk scenarios that are driven by site conditions as opposed to regional conditions,
• identification of remedial needs for these scenarios, and
• informed analysis of viable management alternatives.

Site characterization is rooted in the understanding of the site-specific physical, chemical, and biological interactions that occur at a sediment site. At each stage in the process, we weigh the relevance of each data collection endeavor to determine a final management strategy. Our studies include comparisons to regional conditions to place site impacts in the context of regional stressors that typically prevail in industrialized corridors.

Geosyntec characterizes the physical system through our in-house hydrodynamic characterization skills and equipment (Acoustic Doppler Current Profiling and water quality logging), specialized groundwater/surface water interaction tool kit, customized sampling methods for sediment geochronology, and our extensive skill set in 1-D, 2-D, and 3-D numerical modeling for simulating hydrodynamics, sediment transport, and chemical fate and transport. With a sound physical understanding of the site and larger system, we evaluate the stability of site conditions and the implications for future transport potential of constituents. We characterize the chemical setting through a full suite of analytical sampling expertise, including biologically active zone and deep sediment coring, automated and manual surface water monitoring, groundwater flux evaluations, passive and active sediment porewater sampling, and biological residue sampling of benthic macroinvertebrates, insects, and fish tissue. Our chemical characterization also addresses critical geochemical factors, such as nutrients, redox conditions, and organic carbon degradability, so that we can explain not just what chemicals are there but also their significance and environmental fate.

We develop an understanding of the biological setting through habitat surveys, fish community studies, and specialized studies of watershed human use. This is the last critical piece in the puzzle to understand the significance of site constituents to potential receptors.

Biological Assessment and Monitoring

Addressing the ecological endpoints
Geosyntec’s biological assessment and monitoring creates an accurate picture of the affected environment. Our services provide a reliable evaluation of the health of streams, rivers, lakes, and ocean environments and can offer a less expensive alternative to complex chemical testing programs. Geosyntec’s team offers a high

---

**BIOLOGICAL MONITORING SERVICES**

- Fish tissue collection for analysis of chemicals of concern
- Fish population and macroinvertebrate/plankton community studies
- Sediment infaunal invertebrate studies
- Habitat inventory and assessment
- Sediment and water quality toxicity testing
- Ecological risk assessment
- Natural Resource Damage Assessment
- National Environmental Policy Act (NEPA) – Environmental Impact Statements
- Fish kill investigations
- Clean Water Act (CWA) Section 404 wetland permitting
- CWA Section 401 water quality certification
- Threatened and endangered species surveys and Section 7 consultation
- Stream relocation, permitting, engineering design, and construction oversight
- Data management, Geographic Information Systems (GIS), and GPS locating for sampling accuracy and year-over-year comparison capabilities
- Food web modeling
degree of experience to evaluate the ecological health of a given environment and show how organisms integrate the effects of varied stressors at a site over time. This means Geosyntec can characterize the long-term ecological issues and the status of highly valued biological communities. By examining a variety of species, their life stages, their survival, and their health, Geosyntec deciphers and then informs clients on the complex relationships among habitat, bioregion, and ultimately water and sediment quality.

Geosyntec’s experienced biologists efficiently collect fish and invertebrate for both site investigations and National Pollutant Discharge Elimination System (NPDES) permit compliance. We partner with industry-leading laboratories to analyze samples, compile all metric scores and data in a project database, and use GIS capabilities to define spatial relationships and ensure data consistency and comparability.

As a part of our long-term monitoring program, Geosyntec has monitored the concentrations of chemicals found in fish tissue over many years for our clients. Often, the fish community is exposed to chemicals via direct or indirect uptake from contaminated sediments. By monitoring the fish tissue concentrations over time, the effectiveness of a sediment remedy is evaluated. Additionally, biota-sediment accumulation models are developed and refined to support informed management decisions. This approach has been applied to both active remedies (e.g., dredging) and passive remedies (e.g., MNR). These monitoring data provide our clients and the regulatory agencies with an accurate picture of the affected environment.

Risk Assessment and Natural Resource Damage Assessment

Clearing away assumptions and uncertainties with solid analysis

The complex nature of sediment sites poses significant challenges. By developing realistic estimates of risk, the uncertainty and conservatism of cleanup levels are reduced, resulting in more cost-effective remedial solutions. Our collective experience in sediment sites has shown that a “removal first” approach is not always cost-effective, often fails to address the actual risk from impacted sediments, and may ultimately result in more ecological harm to the environment. Geosyntec’s approach is to identify the risk and develop an adaptive management strategy to address this risk through a combination of MNR, removal, capping, and institutional control measures.

We also recognize the importance of restoration in addressing remedial impacts as well as providing value through the NRDA process. This comprehensive approach provides a cost-effective solution and addresses the true risk, resulting in effective remediation.

The complexity of these sites and the need to focus on risk, both to support investigation and selection of remedial methods as well as potential NRDA claims, requires an excellent working relationship and technical reputation with regulators. While USEPA’s mandate is to focus on risk mitigation, at the local level it is often a challenge to build consensus for innovative remedies. Geosyntec personnel have the experience necessary to work with state regulators and USEPA to develop logical
and effective remedial approaches that cost-effectively and efficiently mitigate current and future site risk. We help clients achieve regulatory approval through our skillful negotiating capabilities and by leveraging our depth of experience in implementing proven approaches.

Feasibility Studies

**Identifying cost-effective, sustainable remedies**

Geosyntec recognizes the environmental complexities and processes associated with sediment remediation, and we develop FS reports based on the unique, site-specific factors that need to be taken into account for successful remedy evaluation and implementation. We apply our expertise in the physical, biological, and chemical characterization of sediments, upland watersheds, surface waters, marshes, and biota to assess potential risks to ecological systems and human health; and we evaluate remedies that meet the client and regulatory objectives for remediation and restoration.

Our FS experience spans a broad geographic range, as well as estuarine, riverine, and lacustrine settings. Geosyntec FS reports have addressed a range of contaminants, including mercury and other metals, Polychlorinated biphenyls (PCB), polycyclic aromatic hydrocarbons (PAHs), and volatile organic compounds (VOCs). The more complex FS efforts conducted by Geosyntec staff have included multiple alternatives, addressing as many as eight contaminated sediment management units at one time. We maintain close relationships with university researchers to provide peer review support, and our staff has a thorough understanding of U.S. Army Corps of Engineers research and guidance documentation to guide project technical evaluations.

Treatability and Pilot Studies

**Supporting optimal remedy design**

For over a decade, Geosyntec has operated a treatability laboratory supporting design and evaluation of conventional and innovative technologies to address chemicals in sediments, groundwater, and other media. Treatability testing is conducted by SiREM, a division of Geosyntec dedicated to providing laboratory services to support the design of effective remedies for challenging environmental problems. Site-specific treatability studies conducted in our laboratory provide valuable data that help identify the physical, chemical, and biological processes that can be used to mitigate potential risks associated with chemicals in the environment and to advance RD. These studies are critical for understanding and demonstrating attenuation processes that can occur in sediment for various management approaches, such as, natural conditions are maintained, cap material is placed on top of sediment, or amendments are added to the sediment or cap material.

Geosyntec’s laboratory treatability testing services provide a scientific basis for selecting a sediment remedy and can reduce management costs by enabling optimized design that targets contaminants most effectively. Laboratory treatability testing is used to screen a variety of amendments to measure their ability to degrade or sequester contaminants. These site-specific data are used to support the design of full-scale remedies or of larger-scale field pilot tests. Laboratory testing can assess site-specific natural and enhanced processes including, biological
transformations such as methylation of mercury and biodegradation of organic contaminants, adsorption of contaminants on activated carbon amendments or natural organic matter, precipitation of metals and other sequestration processes, and redox shifts following sediment manipulation. Laboratory treatability testing can provide key analytical data on the impact of natural processes and amendments on the speciation of contaminants (such as total mercury versus methylmercury), porewater concentrations of contaminants, total concentrations in sediments, and bioavailability.

**Numerical Modeling**

**Understanding the fate and transport of sediments and chemicals of concern**

Geosyntec has extensive experience in hydrodynamic, sediment transport, and chemical fate and transport modeling. Geosyntec’s numerical modelers routinely address the specific requirements for a variety of project types, such as remedial investigations numerical modeling to support CSM development in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) or Resource Conservation and Recovery Act (RCRA) process; FS numerical modeling to evaluate remedial alternatives; RD modeling to assess cost-effective strategies and implementation sequencing for Record of Decision (ROD) RD goals; allocation modeling to support source identification and allocation of costs for cleanup or litigation proceedings related to cost recovery; and fate and transport modeling to support NRDA studies. Geosyntec’s numerical modelers have the knowledge and depth of experience to address the project requirements, our expertise encompasses:

- 1-D, 2-D, and 3-D hydrodynamic, sediment transport, and chemical fate and transport modeling
- Ecosystem modeling, including eutrophication and habitat-oriented output
- Computational Fluid Dynamic modeling
- Surface water modeling (fresh and saline) in rivers, reservoirs, lakes, and estuaries
- Upland pollutant load modeling from urban (residential, commercial, and industrial) and agricultural land uses
- Bank erosion modeling
- Bioaccumulation modeling
- Watershed loading and sediment recontamination modeling (hydrology and stormwater modeling)
- Evaluation of remedial actions
- Expert witness/litigation support
- NPDES/CERCLA/RCRA strategic regulatory and permitting support
- Strategic technical reviews
Remedial Design

**Developing designs to meet stakeholder needs**

Geosyntec recognizes the environmental, engineering, and regulatory stakeholder intricacies associated with sediment remediation projects. Our first step is to work with our clients, technical personnel, and legal counsel to develop strategic goals and a conceptual RD that meets client objectives.

We have learned the importance of working with all stakeholders, including regulators, throughout development of the remedial design. This approach is important to ensure remedial goals are met and that they align with the financial status of the client during the timeline of the project execution. Similarly, it is important to educate the regulators during the design process on the remedial approaches that are being developed so that regulatory approval and acceptance is a smooth process. Our clients gain time- and cost-efficiencies through our stepwise approach through the RD phase. The following are key elements in developing a cost-effective RD:

- **Understanding Site Characteristics** – We develop a robust characterization of the sediments to minimize the contaminated sediment volumes that need removal, capping, treatment, or cause disturbance to the natural habitat. Our scientists and engineers develop an in-depth understanding of the hydrology and hydraulics of the water bodies to select appropriate remedial methods that minimize resuspension, release, and residual contamination.

- **Detailed Design** – Clients receive full-service turnkey design services that integrate value engineering, quality assurance, and client review at each step of the process. Using collaborative internet-based technologies, we facilitate cost-effective reviews to streamline the client and regulatory approval process. For example, we have developed password-protected cloud-based data repositories that provide easy access for clients and regulators.

- **Plans and Specifications Preparation** – We have several sets of standard design details, allowing us to quickly produce site-specific plans, specifications, and engineering cost estimates.

- **Design Constructability Reviews** – Our seasoned construction services group provides constructability input and reviews during the design process, providing a valuable practical perspective. We also consult with sediment remediation contractors to further substantiate our designs.

- **Monitoring and Closure Planning** – We put forth our best efforts to seamlessly integrate validation and monitoring into all stages of the RD. Through experience we know that upfront regulatory approval of monitoring and closure plans provides quicker regulatory closure and reduces the potential for costly long-term monitoring.

- **Cost Estimating** – Our staff prepare detailed cost estimates as part of the design
Permitting, Compliance, and Regulatory Support

**Negotiating the best solution and most economical remedy for you**

Geosyntec’s engineering and environmental permitting teams have in-depth knowledge of federal, state, and local environmental laws and regulations pertaining to contaminated sediment management. We work extensively with various regulatory agencies at the federal level including USEPA, U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, and National Marine Fisheries Service, and with permitting agencies at the state and local levels. Geosyntec staff help to keep our clients’ facilities and sites in compliance with changing regulations and anticipate shifts in policy that could affect compliance, business operations, or strategic new projects. Our clients have benefited by our success at limiting adverse permitting requirements and achieving favorable permit conditions through our proactive, scientific-based research and data collection; environmental documentation; innovative engineering; and one-on-one relationships with key decision-makers within the various agencies.

Geosyntec’s staff has thorough knowledge and understanding of the following federal and state permitting laws and regulations on contaminated sediment management:

- CWA Section 304 (water quality standards), Section 401 (water quality certification), and Section 404 (dredge and fill)
- Section 10 of the Rivers and Harbors Act
- Essential Fish Habitat Provisions of the Magnuson-Stevens Fisheries and Conservation Act
- Endangered Species Act Section 7 Biological Assessments
- Marine Protection, Research, and Sanctuaries Act
- Fish and Wildlife Coordination Act
- NEPA and related state laws
- Section 106 of the National Historic Preservation Act

With detailed working knowledge and experience with the laws and regulations listed above, Geosyntec provides the following professional consulting services for our clients:

- CWA Section 10/404/401 permitting (maintenance dredging for fill-related projects)
- Federal and State agency consultation and negotiations
- Wetland delineation and jurisdictional determination support
- Protected species surveys
- Water quality sampling and analysis, aquatic chemistry, and biological surveys
- Stream, wetland, and salt marsh mitigation assessment, design, and permitting
SECTION 2 | Sediment Management Services

• NPDES and Land Disturbing Activity permit applications
• Sediment and sedimentation analyses
• Shoreline protection maintenance
• Upland confined disposal facility dike stability condition and mudline surveys

Geotechnical Engineering

Stabilizing complex sediment sites
We apply our expertise in geotechnical engineering design as part of sediment monitoring, containment, and removal remedies at subaqueous and upland sites. Geosyntec has long been recognized as a leader in the field of soft soil geotechnical design. We have demonstrated experience in site characterization and developing sound engineering solutions for sites with extremely soft foundations. This expertise has been applied to the evaluation of sediment stability in the assessment of capping and dredging. For example, our work at Onondaga Lake in Syracuse, New York, encompassed sediment stability analysis and the design of a sediment consolidation area to hold more than 2.5 million cubic yards of dredged lake sediment containing heavy metals and other contaminants. This design also resulted in significant cost savings. Our geotechnical engineering professionals are engaged at difficult and challenging sites where the development of dependable, cost-effective foundations and other geostructural solutions are critical to the success of the project. Our professionals have responded to the challenges of unfavorable site conditions, such as those typically found in dredge disposal and soft sludge disposal sites, by developing and applying sophisticated approaches to investigate and characterize sites; analyzing foundation behavior; altering the engineering characteristics of the soil and rock through soil improvement; and remediating sites.

Construction Services

Saving time and money
Geosyntec was the first company to offer construction quality assurance (CQA) services for environmental projects in the U.S. We have provided construction management or construction oversight on more than 750 projects nationwide, maintaining our position of industry leadership by developing many of the methods, standards, and procedures in use today. Our primary construction service areas include the following:

• Construction management
• Construction oversight
• Resident engineering
• CQA

Our clients have saved time and money during construction projects through the efforts of our skilled and accomplished construction team. For example, on one project, when steel prices rose unexpectedly, we saved our client hundreds of thousands of dollars during construction by quickly reengineering the design from a steel sheetpile cutoff wall to a geomembrane cutoff. On another project, inconsistencies in the construction documents prepared by others had resulted in several potential change orders;
Geosyntec negotiated on behalf of our client to reduce the potential costs of the change order claims by 33%.

**Litigation Support**

**Providing the legal community with reliable results**

As a trusted technical resource to leading law firms throughout the United States, Geosyntec provides the specialized expertise necessary for lawyers to counsel their clients and advocate for client interests on a wide range of matters related to environmental management, compliance and enforcement, toxic tort, and general litigation matters. Our staff are valued members of litigation support teams due to our sensitivity to the legal process and our ability to develop strategies that respond to legal, public relations, and business concerns.

Law firms choose Geosyntec because of our comprehensive qualifications and capabilities to address the most challenging problems related to contaminated sediment management, including sediment assessment, remediation, and restoration of natural and man-made waterways, marshes, and wetland sites. Geosyntec works one-on-one to provide sediment-related strategic technical support to assess potential liabilities and cost allocation. We provide remedial investigations and FS reports that often include identifying possible contaminated sources, quantifying source contribution, and evaluating contribution assessments. Our practitioners are adept at quickly grasping the scope and implications of key issues and sharing sound, defensible, technical insight with clients.

Our staff prepare expert reports and have testified both in deposition and at trial. They are familiar with the nuances of civil trials in both state and federal court. Geosyntec technical experts may serve as technical consultants to counsel, rather than testifying experts, providing privileged and confidential technical analyses, strategy development, and work products for exclusive use by counsel; these materials are generally not considered discoverable. We maintain strict separation between communication and work produced by testifying experts (discoverable) and litigation consultants (confidential). Geosyntec is often retained prior to the filing of litigation as a confidential litigation consultant to help the plaintiff client develop a case or to assist the defendant client in preparing for the onset of litigation.

**LITIGATION SUPPORT SERVICES**

- Environmental liability evaluation
- Technical issue valuation
- Technical support during discovery
- Strategy identification and implementation
- Cost estimates in support of litigation
- Cost allocation
- Trial preparation support
- Settlement negotiations
- Deposition and trial testimony
- Agency negotiation
RI/FS at the Berry’s Creek Superfund Site

BERGEN COUNTY, NEW JERSEY

Geosyntec has performed comprehensive RI/FS services for the Berry’s Creek Study Area (BCSA), a sediment mega-site in the New Jersey Meadowlands, across the Hudson River from New York City. Berry’s Creek is a tidal tributary of the Hackensack River, and with its watershed, encompasses 12 square miles and 22 river miles. The site is impacted by organic and inorganic constituents arising from numerous point and non-point sources. Geosyntec has provided a broad range of services, including the following:

- Program management for our own personnel and 40 subcontractors
- Leadership of varied field campaigns over 10 years, encompassing more than 100 tasks addressing abiotic and biotic media characterization requirements
- Leadership of multiple site characterization and FS reporting efforts
- Development, design, and implementation of multiple laboratory treatability and pilot studies addressing thin cover alternatives for impacted sediments
- Agency interaction and client advocacy, including more than two dozen presentations to USEPA, New Jersey Department of Environmental Protection (NJDEP), and multiple resource trustees

Geosyntec successfully developed and implemented numerous field efforts addressing challenging site conditions and data quality objectives. We safely negotiated a range of implementation challenges, including difficult site access over an expansive site in an urban estuary and a full range of field conditions, including hurricane-targeted sampling, winter events, and overnight monitoring. We developed and deployed customized sampling equipment and methods addressing a broad range of atypical surface water, porewater, sediment, and biota sampling requirements; we also negotiated streamlined approaches to data validation throughout the RI.

Working in a team with several consultants, Geosyntec identified and developed several key demonstrations of the CSM of sediment transport and natural recovery. Tidally synchronized sampling events for marsh-waterway interaction demonstrated the stability of the Phragmites marshes and their benefit to the system as a sequestering agent for Chemicals of Potential Concern (COPCs). We implemented and continually refined methods of high-resolution sediment
coring and geochronology using COPCs and multiple ambient radioisotope markers. The intensive data collection and analysis further demonstrated the clear stability of the marshes and the variations in deposition and resuspension conditions in selected waterway segments. Additionally, we led several components of mercury geochemistry CSM development, including (i) high-resolution marsh cores to evaluate methylation/demethylation controlling factors, (ii) sequential extraction to characterize the relative mobility/bioavailability of mercury compartments, and (iii) voltammetric microelectrode studies to characterize mercury biotransformations. These studies helped the client group to target RAs and forecast the effects of potential alternatives on the mobility/bioavailability of mercury.

For the FS, Geosyntec deployed our in-house treatability testing laboratories to develop and implement novel tests of sediment amendment performance for mercury, methylmercury, and PCBs. After testing several dozen amendment combinations and identifying the most promising solutions for the primary COPCs, Geosyntec performed engineering design, CQA, and performance monitoring for two years of successful field pilot testing of thin-cover solutions.

Geosyntec began FS activities for the site early in the RI process, consistent with USEPA guidance, to generate insights to support RI refinement. Early-stage FS activities included preparing of a candidate technologies memorandum, a development and screening of remedial alternatives memorandum, and an RI/FS work plan addendum. Geosyntec led a detailed FS for the Phase 1 interim RA. The FS included five waterway and five Upper Peach Island Creek (UPIC) marsh alternatives involving sediment removal and/or capping/backfilling. In its Proposed Remedial Action Plan (PRAP), USEPA selected the options evaluated most favorably in the FS, and the group was pleased with the USEPA’s selection of them as the preferred alternatives.

The RI/FS was undertaken with recognition that remediation would best be performed within an ASM framework, given the size, complexity, and urban setting of the watershed, and the influence of regional surface-water and sediment flows. The RI findings, when interpreted within the ASM framework, led USEPA to recommend a multiphased approach for remediating legacy contamination at the site. This provides the Group the opportunity to assess the benefits of the Phase 1 interim RA on natural recovery rates in the tidal marshes and downstream waterway segments prior to performing a supplemental FS. This important outcome for the BCSA Group was made possible in significant part through the clarity and strength of the RI and FS reports.
Remedial Design Gowanus Canal Superfund Site

BROOKLYN, NEW YORK

Geosyntec is the project coordinator and engineer of record to conduct the RD, lead regulatory negotiations related to the design, and provide overall technical direction for this Superfund site located in a canal in a major urban center. The canal is a large sediment mega-site regulated by USEPA Region 2 under CERCLA with an existing ROD.

The Superfund site is a man-made waterway almost two miles long; its construction dates back to the 1860s. The adjacent waterfront is primarily commercial and industrial, and includes concrete plants, warehouses, and parking lots. The site is near several current and planned residential neighborhoods. Multiple manufactured gas plants operated along the canal dating back to the 18th century, in addition to other legacy industrial operations. The canal also receives discharges from several combined sewer overflows from local stormwater and wastewater collection systems, and from a variety of permitted and non-permitted point sources.

Geosyntec’s role as the primary technical consultant and project coordinator for the Gowanus Canal Remedial Design Group (the Group) is in support of the overarching goal of establishing a RD that is constructible, sustainable, cost-effective, and permanent. Geosyntec’s services have encompassed the following:

- Refining the CSM by compiling several data sources into a single integrated and comprehensive data visualization package
- Developing and implementing more than 25 predesign investigations including assessment of groundwater to surface water discharge; NAPL mobility in the sediments; bulkhead structural integrity; capping treatability studies; geotechnical conditions; and debris management
- Leading regulatory interactions on all technical and permitting matters
- Providing project optimization and strategic technical direction for the Group under dynamic circumstances
- Overseeing hydrodynamic and sediment transport model refinements
- Performing detailed evaluation and design of remedial components that are described only conceptually in the ROD
- Scoping and planning for a holistic pilot study of the remedy to optimize overall remedial design

Geosyntec provides excellent project management for the Group as project coordinator and developed or continues to develop the following:

- Master project schedule integrating predesign field investigations and design elements in a fast-paced project
- Real-time cost projections and spend curves for the anticipated lifetime of the project
- Comprehensive Quality Assurance Project Plan (QAPP fully compliant with Uniform Federal Policy)
- Refined and expanded database integrating several data sources into a four-dimensional visualization of NAPL and COPC distribution in distinct sediment layers
- Detailed evaluations and construction recommendations for the geotechnical stability of potentially impacted bulkheads and similar waterfront structures as part of source control requirements of the ROD
Newtown Creek Superfund Site

BROOKLYN, NEW YORK

Geosyntec is providing professional engineering services, technical expertise, and creative strategies related to the Newtown Creek Superfund site for which National Grid has been listed as a potentially responsible party (PRP). This Superfund site is a large sediment mega-site, and is regulated by USEPA Region 2 under CERCLA. The site is currently in the RI/FS stage of the CERCLA process, and Geosyntec serves as the primary technical consultant for National Grid, directly supporting their efforts as part of the larger PRP group in the development of field investigation programs, data analyses, data interpretation, and development of project and remedial strategies.

The site is almost four miles long and was one of the busiest hubs of industrial activity in the mid-1800s. More than 50 industrial facilities were located along its banks, including oil refineries, petrochemical plants, fertilizer and glue factories, sawmills, and lumber and coal yards. Numerous industrial facilities still operate along the creek. As a result of the extensive historical industrial activity along the creek, the site is currently considered one of the nation’s most polluted waterways.

Phase 1 and 2 field investigations have been completed, and the RI report is currently being finalized. A field investigation to support the FS work has also been completed. Major elements of the field efforts have included surface water and sediment sampling, point source discharge sampling (storm sewers, combined sewers, and other discharges), groundwater sampling, sampling and toxicity testing of ecological resources such as fish and crab, and sampling in selected background areas outside of the site. The completed RI will identify the nature and extent of contamination throughout the site and the potential human and ecological risks posed by the COPCs. The FS will then evaluate reasonable remedial alternatives to address the identified risks. Geosyntec is National Grid’s technical representative on all aspects of both the RI and the FS.

Geosyntec is providing extensive technical review and analysis of existing datasets for the site. We are also evaluating approaches for optimizing future investigations to ensure that essential information is collected in a cost-effective, efficient, and safe manner. The benefit of Geosyntec's efforts on behalf of National Grid is expected to be the issuance of a comprehensive RI/FS that will be used by USEPA to prepare a ROD that incorporates a well-thought-out, constructible, sustainable, cost-effective, and permanent remedy for the site.
Ada Pond, Sediment Investigation, Remedial Design, and Construction Management

MILLVILLE, NEW JERSEY

Rio Tinto has responsibility for this site through its subsidiary company, Alcan Global Pharmaceutical Packaging Inc. (Alcan). The 48-acre site has a long history of industrial use, primarily for glass manufacturing. Alcan is identified as the responsible party for conducting the remediation of the property under the NJDEP Industrial Site Recovery Act and is engaged in environmental investigation/remediation at this site. Geosyntec’s specific role on the project was to obtain regulatory closure of the Ada Pond system. Ada Pond is a 2.9-acre pond located in the west-central portion of the site. The pond received noncontact cooling water and storm water runoff and also served as a source of water for fire protection. Two distinct layers of geologic material (Stratum 1 and Stratum 2) were identified beneath Ada Pond. Stratum 1 consisted of fine-grained deposits containing elevated levels of extractable petroleum hydrocarbons (EPH), PAHs, PCBs, and metals. Stratum 2 consisted of native sand with elevated concentrations of EPH, PAHs, PCBs, and metals in isolated areas. The RD included dredging 12,000 cubic yards of impacted sediments, dewatering sediments, disposing sediments at an approved off-site landfill, and placing a 6-inch sand cap.

Geosyntec’s scope of work included completing combined remedial investigation report/remediation action work plan (RI/RAWP), as well as predesign investigation activities, dewatering tests, construction drawings and specifications, permitting construction oversight, and a RA report. To date, Geosyntec has completed the RI activities within Ada Pond, which included sampling and analyzing surface water, sediments, and storm water. Geosyntec also completed a remedy alternatives evaluation and prepared the RAWP. The predesign investigation activities included vibracoring and sediment probing to create dredge prisms, as well as conducting a bathymetric survey and dewatering tests. The testing was conducted to evaluate possible dewatering approaches to be used during the dredging operation and any stabilization requirements for disposal. These tests evaluated various polymers to be used for Geotubes. Geosyntec was the design engineer who prepared the construction drawings and specifications and participated in the contractor procurement activities. Two contractors were solicited—one for remedial construction and one for transportation and disposal. Geosyntec provided full-time construction oversight and quality assurance during the remedial construction.

The investigation and construction were completed with zero loss-time incidents. Geosyntec prepared a RI/RAWP to expedite the schedule. Geosyntec worked closely with the NJDEP Land Use Regulation Program, and it was determined that Ada Pond was an unregulated water body. Additionally, Geosyntec evaluated contracting options for the transportation and disposal of the sediment. From this evaluation it was determined the project would realize cost saving by contracting directly with Rio Tinto. Finally, to achieve site closure goals established by Rio Tinto, dredging operations were completed through the winter months.
SECTION 3 | Experience

Pierson’s Creek Superfund Site, Operable
Unit 2 Remedial Options Evaluation and
Project Coordination

NEWARK, NEW JERSEY

Geosyntec is completing an expedited RI and FS at Operable Unit 2 (OU-2) of the Pierson’s Creek Superfund site. The primary objective of the project is to obtain regulatory closure in an expedited time frame for this active chemical plant while minimizing the impact to business operations. The facility operates in a highly industrialized area with extremely limited space.

Geosyntec prepared a comprehensive database and helped transition OU-2 from the NJDEP to USEPA Region 2 management under the Superfund program. During this transition, Geosyntec continued to focus on the goal of expediting the timeframe to obtain regulatory closure. As part of this goal we evaluated remedial options to address the entire OU-2. This process included treatability studies and evaluations of potential off-site disposal sources. These activities provided USEPA with sufficient information to show that there are limited remedial options; as such, USEPA limited the scope of the RI and allowed the use of much of the historical information.

Geosyntec began work by obtaining all known data reports, conducting data validation, and developing a comprehensive site database. After reviewing previous investigations and RA conducted at the site, Geosyntec developed a report evaluating a range of remediation technologies for the solid material in the stormwater channel, including on-site treatment and disposal, as well as excavation, off-site treatment, and disposal. Samples were collected for treatability testing to evaluate the feasibility of treatment technologies, including chemical oxidation and thermal treatment. At the same time, Geosyntec worked with the newly assigned USEPA Region 2 case team, including meeting with the case team and inspecting the site. USEPA generally agreed that measures taken to secure the on-site material were appropriate and protective and that the treatability testing and permitting performed were appropriate steps in the process of implementing the final remedy. Groundwater was sampled to evaluate the delineation of constituents of concern, verify the current groundwater Classification Exception Area and prepare submittals to NJDEP. Geosyntec worked with the client’s legal team negotiating with USEPA on a final order and statement of work to complete the RI/FS for OU-2. Geosyntec, as project coordinator and environmental consultant, has submitted a site characterization report, an RI/FS work plan, a health and safety plan, a QAPP, and preliminary risk assessment documents. Geosyntec is presently working on the RI and a memorandum regarding the identification of candidate technologies and development and screening of remedial alternatives.
Activated Carbon Pilot Study Puget Sound Naval Shipyard

BREMERTON, WASHINGTON

The U.S. Navy, funded through the Environmental Security Technology Certification Program (ESTCP), conducted a pilot study to evaluate the potential effectiveness of an innovative remedial technology at Pier 7 of the Puget Sound Naval Shipyard and Intermediate Maintenance Facility. The goals of the pilot were to determine the feasibility and effectiveness of activated carbon (AC) in reducing the bioavailability of PCBs in remediating sediment and to document the long-term performance and stability of the AC remedy under active Navy pier conditions. AC amendments have the potential benefit of reducing the bioavailability of PCBs by actively sorbing contaminants from sediment, enabling a cost-effective remedy in conditions where capping or dredging may not be feasible.

Geosyntec staff participated in a multi-investigator demonstration of the remedial project. Staff evaluated changes in availability of PCBs in sediment via environmental chemistry modeling and measurement of PCBs in porewater using in situ solid-phase microextraction fibers, assessed ecological responses of benthic macroinvertebrate communities to reactive amendment addition, and monitored placement and stability of the AC amendment. Geosyntec staff were key team members in the project, participating in the RD scoping, field monitoring, data analysis and reporting, and communication of the results; and presenting key aspects of the study at national scientific conferences. Annual project monitoring for three years after AC amendment has confirmed the successful stability, coverage, and penetration of the AC amendment, achievement of target rate increases in total organic and black carbon content in sediment, a 70–90% reduction in PCB availability as a result of the amendment, and no significant changes in the native benthic infaunal community (i.e., absence of ecological side effects).

Hunter River Sediment Remediation

NEW SOUTH WALES, AUSTRALIA

Geosyntec staff provided engineering, environmental, and regulatory negotiation and permitting services for the Hunter River Sediment Remediation program on a site adjacent to the former BHP Billiton Newcastle Steel Mill. The project encompassed dredging, treating, and disposing of 1.5 million cubic yards of sediment of which 960,000 cubic yards were contaminated with PAHs. The RD had five major elements: mechanical dredging using environmental clamshell buckets; landside development for offloading, dewatering, storage, and handling; sediment treatment with cement to stabilize and solidify the PAHs; transport of treated sediments for nearby off-site disposal; and landfill design. The process design included installing sheet pile walls to stabilize the river bank and prevent contaminants from migrating to the river.
Enhanced Natural Recovery/Activated Carbon Pilot Study Lower Duwamish Waterway

SEATTLE, WASHINGTON

The Lower Duwamish Waterway Group (LDWG) is conducting a pilot study to evaluate the potential effectiveness of an innovative remedial technology in the Lower Duwamish Waterway (LDW). The goals of the pilot are to determine whether ENR amended with AC can be successfully applied to reduce the bioavailability of PCBs in remediated contaminated sediment as compared to ENR without AC. The purpose of the ENR and ENR+AC treatments is to reduce the exposure of aquatic organisms to COCs, including PCBs. ENR+AC may have the potential added benefit of reducing the bioavailability of PCBs by actively sorbing contaminants from LDW sediment. Both remedial treatment options offer many advantages over more traditional sediment remedy applications such as dredging and capping, including cost effectiveness, demonstrated risk reduction, sustainability, and logistical effectiveness.

Geosyntec staff have been working with LDWG, LDW stakeholders, and other team members to design and implement the pilot study. A key part of this work has included the design of a monitoring study involving a variety of measurements to gauge the placement, resilience, and performance of the ENR and ENR+AC remedies over the 3-year monitoring period. As a part of the planned monitoring work, Geosyntec has designed and configured innovative porewater passive samplers to achieve sensitive detection capabilities necessary to monitor low levels of PCBs in sediment and remedy layer porewater before and after remedy placement. Geosyntec implemented the baseline and post-amendment (1 year after remediation) porewater monitoring at over 200 locations in the study area, including a detailed data analysis and statistical evaluation to confirm the sampling design for later monitoring events. Additionally, Geosyntec has provided support in design of the remedy, evaluating the expected effectiveness of the selected design through advanced AC modeling, as well as addressing potential ecological concerns associated with the ENR and ENR+AC materials. Technical deliverables have included presentations to USEPA and other stakeholders as well as monitoring and design documents. During the next two years, Geosyntec will continue to work with LDWG in planning and executing the monitoring programs, interpreting remedy performance data, and communicating results to stakeholders.

To date, Geosyntec’s support in the RD and monitoring plan for the pilot study has helped the project to stay on track and address numerous challenging questions from USEPA and other stakeholders. Through advanced statistical power modeling, Geosyntec staff have helped maintain optimal levels of sampling design to address pilot study questions without unnecessary oversampling. Using innovative fate modeling, Geosyntec staff have also demonstrated optimal configurations for the AC treatment that will enable reductions of PCBs to be detected within the three-year post remedy study period, reducing uncertainty and potentially costly and ineffective overapplication of expensive AC treatments. Geosyntec staff also reconfigured a passive sampling deployment device to meet the challenging deployment environment, saving over $20K in additional equipment costs. Initial results from the Year 1 study have indicated that ENR and ENR+AC have reduced PCB availability by 70–90% from baseline, indicating a successful and effective remedy.
Onondaga Lake Sediment Remediation
SYRACUSE, NEW YORK

Geosyntec provided technical expertise and creative strategies to support remediation of Onondaga Lake, a sediment mega-site in upstate New York. The selected remedy combined targeted dredging of more than 2.5 million cubic yards of sediment contaminated with heavy metals and organic contaminants, placement of dredge materials in a sediment consolidation area (SCA), thin-layer isolation capping, and MNR.

Geosyntec designed an innovative sealed sheet pile barrier wall, nearly 1.5 miles long, to cut off migration of contaminated groundwater from an upland site. The barrier wall was essential to limiting sediment recontamination after lake dredging and capping. Geosyntec’s extensive geotechnical analyses demonstrated the technical feasibility of constructing an SCA over the soft materials of a former Solvay wastebed. Geosyntec spearheaded stakeholder and regulatory discussions that ultimately allowed the SCA to be considered equivalent in status to a non mixed waste landfill. This critical strategy eliminated the need for costly subgrade stabilization and gave more design flexibility, resulting in significant construction cost savings.

Geosyntec also conducted extensive biodegradation treatability testing to better understand the natural biodegradation of organic contaminants that will take place in the sediment and sediment cap. This information was critical in developing and substantiating the design of the reactive cap and MNR for the site.

Portland Harbor, Pre-Remedial Design And Baseline Sampling
PORTLAND, OREGON

Geosyntec is co-leading the pre-RD and baseline sampling program for the 10-mile long Portland Harbor Superfund site located on the LWR near downtown Portland, Oregon. USEPA's selected remedy is expected to remove 3 million cubic yards of sediment and place an engineered cap over 176 acres at a cost of $1.2B. Field staff are collecting 2,000+ data points, including surface grabs, sediment cores, surface water, sediment traps, fish tissue, background porewater, fish tracking, and bathymetry studies, all in a fast-track 12-month period. Results will be used to establish baseline conditions, revise the CSM, and refine the remedial footprint size, volumes, and costs for design. Geosyntec was selected by the PRP group to help them navigate this process, develop and scope the work plans, design a statistically robust random sediment sampling plan, collect quality data, and produce Pre-RD reports for agency approval.
Bolsa Chica Wetlands Restoration

HUNTINGTON BEACH, CALIFORNIA

Geosyntec provided total project solutions to support restoration of wetland ecosystems to the Bolsa Chica Lowlands, as well as the engineered systems needed to protect ongoing oil production infrastructure. The site encompasses 1,250 acres of degraded coastal wetland that has been affected by oil field activities for over 80 years. Geosyntec performed a wide range of investigation, technical evaluation and modeling, design, and construction services as part of the investigation and remediation phase. Geosyntec planned and implemented remediation of oil-impacted sediments across nearly 1,000 acres. There were more than 100 individual excavation sites, with excavation volumes of 100 to 10,000 cubic yards, and three excavation crews working simultaneously. Contaminants of Concern (COCs) consisted of crude oil, refined products, metals, and PCBs. Geosyntec oversaw and managed all operations and developed a unique field database tool to centralize detailed tracking of volumes, progress, and other data. This tool allowed streamlined regulatory reviews; certain areas received closure within days of submitting the site documentation.

The wetlands restoration involved massive amounts of excavation and construction to establish a direct connection with the Pacific Ocean and build full tidal and muted tidal habitats. Geosyntec’s detailed geotechnical and hydrogeological investigations supported the design of levees, tidal basins, culverts, and a 5,000-foot-long subsurface shallow groundwater barrier and saltwater intrusion control system to protect the existing neighborhood from restoration impacts. We provided construction CQA for nearly 3 million cubic yards of sediment excavation, construction of 4 miles of reinforced levees, 1.5 miles of Pacific Coast Highway realignment, and placement of 370,000 cubic yards of disposed sediments to build nesting habitats. Geosyntec planned and designed the operations to be extremely responsive to the needs of the client and other stakeholders in this high-profile project. Significantly, oil production was able to continue during the sediment remediation, enabling the client to continue generating revenue. The nesting habitats were constructed over a core of disposed oil-impacted sediments, saving millions of dollars in off-site disposal costs.
Marsh Sediment Removal Action and Risk Assessment

BRUNSWICK, GEORGIA

One of the most complex CERCLA remediation projects in USEPA Region 4, the LCP Chemicals Site, is adjacent to an ecologically sensitive estuarine marsh in coastal Georgia. Geosyntec applied technical expertise and advanced analytical methods to support a two-tiered sediment remedy. For a time-critical removal action in the 450-acre saltwater marsh, we used a mass removal efficiency approach to demonstrate that a far less costly sediment removal program (13 acres) than originally conceived would meet the short-term remedial objectives and quickly restore local fisheries. Next, Geosyntec’s baseline ecological risk assessment entailed geostatistical and other specialized analyses of data from 700 sampling locations. Area-weighted averaging was performed across five study domains defined by hydrologic boundaries to provide representative exposure point concentrations. Monte Carlo simulations and selective sequential extraction analyses for mercury speciation were used to provide additional, more realistic inputs of contaminant loading and biological exposure. We provided support in negotiations with federal and state regulatory agencies, and it was ultimately agreed that a marsh monitoring program would be more appropriate than additional sediment removal in the estuary. The monitoring program, currently in its 13th year since the completion of removal activities, allowed the Georgia Department of Natural Resources to significantly relax fish consumption advisories.

Passive Bioremediation at Aberdeen Proving Ground

ABERDEEN, MARYLAND

Geosyntec partnered with the U.S. Geological Survey to develop and install a new treatment technology to biodegrade solvents in high-velocity groundwater seeps into tidal wetlands. The team worked collaboratively to devise a passive treatment system that could be installed with minimal disruption to the wetland and no maintenance requirements. The system, a thin mat bioaugmented with a dehalogenating microbial consortium, involved several technical innovations: development of the bioaugmentation culture; design and lab testing of the bioreactive mat matrix; invention of a solid-state hydrogen detection device to measure environmentally significant concentrations of dissolved hydrogen; and modification of techniques to sample water within and below the mat. Geosyntec installed the first of its kind bioreactive mat system. Monitoring demonstrated contamination concentration reductions in excess of 99% and complete degradation of solvents. The reactive mat remained stable in the tidal wetland and proved to be exceptionally successful, continuing to remediate groundwater beyond the first year with no ongoing maintenance.
SECTION 3 | Experience

Sediment Removal at a Gas-Fired Energy Plant

PORT WASHINGTON, WISCONSIN

Geosyntec developed and implemented sediment removal plans for several critical path projects at the We Energies Port Washington power generating facility on the shore of Lake Michigan. For an intake and discharge tunnel removal project, the selected method was to isolate tunnel segments and dewater and solidify the sediment in place. We worked with the off-site disposal facility to develop an appropriate field solidification testing program to ensure that the solidified sediment met landfill acceptance criteria. This prevented the need for temporary on-site storage of the solidified material. For an emergency intake tunnel, the sediment was removed from the tunnel and mixed with a polymeric additive within geotubes to facilitate the dewatering and solidification process prior to off-site disposal. We assisted with the dredging permit, including evaluation of polymer toxicity/dosage and discharge water quality criteria. The sediment removal was critical to plant reconstruction activities and continued operations. Geosyntec worked with the client through several feasibility iterations to develop practical removal plans that caused the least disruption to plant operations and met the criteria of the Wisconsin Department of Natural Resources permits, the on-site water treatment facility, and disposal facilities. Our unique and creative approach to each sediment removal effort resulted in significantly reduced project time and cost.

Terry and Dupree Creek Sediment Remediation

BRUNSWICK, GEORGIA

Through detailed site investigation and close delineation of contamination, Geosyntec implemented a streamlined and effective sediment remediation program while safeguarding sensitive receptors along the creeks. The site includes four source areas, three dredge spoil disposal areas (the largest about 70 acres), and an outfall ditch, all impacted by toxaphene from years of nearby industrial discharge. Our removal action work plan included sediment excavation and dredging of 35,000 cubic yards, steel sheet pile to delineate and stabilize dredge areas, and sediment dewatering and stabilization for off-site disposal. Geosyntec prepared the bid package and provided construction management, CQA, and GIS data management services during removal operations. We developed customized sampling devices using vacuum extraction and a real-time, statistically driven tracker of removal goal attainment to guide construction decision-making. Geosyntec continues to provide biannual fish tissue sampling to monitor remedy effectiveness.
32-Acre Former Fertilizer and Pesticide Manufacturing Facility

JACKSONVILLE, FLORIDA

A 32-acre former fertilizer and pesticide manufacturing facility in Jacksonville, FL, is located in a heavily industrialized area along the St. John’s River. Site process history led to contamination of soil and groundwater within and beyond the property boundaries and contamination of sediment and surface water in the St. John’s River. COCs include organo-chloride pesticides (OCPs), PCBs, and metals.

The site remedy specified by the CERCLA ROD includes several interrelated and complimentary remedial components and technologies designed to treat or contain soil, sediment, groundwater, and surface water that have been impacted by site-related constituents. Contaminated sediments will be addressed by constructing an environmental bulkhead and dredging impacted sediment outside of the bulkhead for containment inside the bulkhead. The environmental bulkhead will be constructed as a vertical steel wall. The wall will be constructed offshore and will extend from above the surface of the water into the sediment such that it is both structurally stable and impedes the flow of groundwater to the St. John’s River.

Geosyntec’s role on the project is to implement the ROD, beginning with a predesign investigation and following with RD and oversight of RA. The PDI was designed to refine the extent of contaminated sediments; obtain the data required to design the environmental bulkhead; and obtain the data required to define the limits of dredging required outside of the environmental bulkhead. The PDI reduced characterization uncertainty and provided sufficient data to complete the RD in a single COC sampling mobilization. Sampling was also designed to establish the dredging boundary for the RD to eliminate the need for field verification during the RA.

The two-tiered PDI sampling scope, completed with zero lost-time incidents, included a higher density of shallow (ponar or box core) and lower density of deeper (vibracore) sediment samples to focus characterization on the more heavily impacted, biologically active zone, while allowing for depth delineation. Porewater samples using in situ custom peeper methods and ex situ laboratory sampling with SP3™ samplers were collected to evaluate a potential groundwater-to-surface-water pathway and support the interpretation of shallow sediment data. Bathymetric and side scan sonar surveys were conducted to establish bathymetry and evaluate the extent of debris and obstructions. A geotechnical evaluation was conducted along the selected environmental bulkhead alignment to provide required design data.

Sediment and bathymetric data were integrated into a cost analysis to select the optimal placement for the environmental bulkhead. Balancing the costs of installing the bulkhead and dredging outside the bulkhead with the redevelopment benefits of an expanded bulkhead for future commercial use, the optimal bulkhead location was determined to be approximately 100 feet from shore. Future work to be completed on this project will include completing the RD, preparing construction drawings and specifications, permitting, overseeing construction, and submitting the RA report.
Hydrodynamic, Sediment, and Fate and Transport Modeling Litigation Support

KALAMAZOO RIVER, MICHIGAN

A confidential client sought expert litigation support and potential expert witness testimony for a cost recovery trial relating to current and future cleanup costs along the Kalamazoo River, specifically Operable Unit 5 of the Allied Paper/Portage Creek/Kalamazoo River CERCLA site. The client was interested in better understanding the fate and transport of PCBs from their facility along the Kalamazoo River system during a limited discharge time period. In addition, the client needed expert technical support to review numerical modeling (Delft3D) and other analyses conducted by other parties in the case, who were also evaluating the fate and transport of PCBs along the river.

Geosyntec developed a 2-D hydrodynamic, sediment transport and PCB fate and transport model of Portage Creek. The model, developed using the Environmental Fluid Dynamics Code (EFDC) framework, was calibrated and validated against flow, water level, velocity, total suspended solids, and PCB data, and then utilized to predict the fate of PCB releases occurring from the 1950s to 1970s. Geosyntec also developed a hydrology model of the Kalamazoo River Basin and analyzed bank erosion (in particular, from former impoundments upon the drawdown of three dams). Model assumptions, development and results were documented in a suite of expert reports that were submitted to the judge for consideration. Geosyntec also conducted technical reviews of modeling work conducted by other parties, including a detailed review of the model documentation as well as focused reviews of the model input and output files.

Solutions for Navigation and Dredged Material Management

ELBA ISLAND, SAVANNAH HARBOR, GEORGIA

At the Southern Liquid Natural Gas terminal at Elba Island, Geosyntec designed a ship turning basin that involved dredging 4 million cubic yards of material and placement of 4,500 linear feet of shore protection to control erosion. We also designed subgrade improvement measures for relocation of a dike over soft marsh and dredge spoils. The basin enables natural gas ships to turn adjacent to their own docks, eliminating the need to go farther into the busy Savannah Harbor. Geosyntec also developed an innovative long-term dredged material management plan, a critical issue for continued operation of the terminal. The plan incorporated dredging quantities based on river sedimentation studies, modeling of the desiccation and consolidation of the dredged sediment, measures to promote dewatering, and a schedule of periodic dike raisings using in-place dredged sediments as fill material. This plan optimizes storage capacity and design life of the confined disposal facility, providing capacity for the next 30 years of operation, and resulted in significant ongoing operational cost savings.
Ecological Risk from MTBE at a National Wildlife Refuge

**SEAL BEACH NAVAL WEAPONS STATION, CALIFORNIA**

Seal Beach National Wildlife Refuge is a 965-acre wetland and estuary habitat contained within the Naval Weapons Station. The Navy planned full-scale active remediation to clean up methyl tert-butyl ether (MTBE) compounds in groundwater and sediments. Geosyntec conducted a detailed ecological risk screening and concluded that there was no significant threat to the Refuge from the contaminants. We recommended a confirmation round of groundwater sampling to evaluate MNR as the most feasible method to achieve regulatory goals for the site. This conclusion and recommendation were based on our thorough understanding of federal and state regulatory guidance, our own prior studies, and expertise in the use of MNR to remediate MTBE. Regulators agreed with Geosyntec’s evaluation, saving the Navy the significant cost ($300K) of active remediation and preventing the Refuge from being disrupted. Geosyntec’s value engineered approach provided closure of the site within 2 years of our analysis.

Ecological Risk Assessment of Little Vermilion River

**LASALLE, ILLINOIS**

Several hundred thousand cubic yards of zinc slag material is present along the banks of and within the Little Vermilion River and is of interest in ongoing CERCLA activities related to a former zinc processing facility. Geosyntec conducted a biological assessment to evaluate potential adverse effects to the aquatic community in this segment of the river. Our bioassessment consisted of four major tasks: evaluation of aquatic habitats, fish community surveys, benthic macroinvertebrate surveys, and tissue analyses of aquatic organisms. The sampling and assessment were conducted in accordance with Illinois Department of Natural Resources and Illinois Environmental Protection Agency (IEPA) field collection and data analysis protocols. Geosyntec’s biological assessment firmly demonstrated that the biotic integrity of fish and macroinvertebrate communities is good and comparable to unaffected areas of the river, and provided a weight-of-evidence component to the ecological risk assessment. This risk assessment is a key component of an ongoing FS effort. The results of the risk assessment demonstrate that slag material in the river does not create an unacceptable risk to the environment; therefore river dredging is not necessary. Furthermore, the risk assessment is a central part of the argument that the mass of the slag pile along the banks of Little Vermilion does not need to be removed if stabilized and covered to prevent future surface erosion and stormwater runoff into the river. USEPA and IEPA agreed with this assessment. The PRAP does not include costly sediment remediation. The remedial action is focused on upland activities to prevent future degradation of the river.
Bailey Disposal National Priorities List (NPL) Site, Tidal Marsh Waste and Sediment Remediation through Relocation and On-Site Containment

BRIDGE CITY, TEXAS

Originally part of a tidal marsh near the Texas/Louisiana border, the Bailey Waste Disposal Superfund site was used in the 1950s to construct two ponds as part of a fishing camp. The ponds were formed by dredging the marsh and using the dredged sediment to form dikes. Over time, a variety of wastes, including industrial waste, refinery waste, tarry sludges, municipal waste, and debris were placed as fill material within the interior of the dikes. This waste spilled over the dikes, contaminating adjacent areas of the marsh. An original ROD called for site-wide, in-place consolidation and stabilization of sediments and wastes. This original design, developed by others, proved difficult to construct and costlier and more time consuming than originally estimated. When the remediation contractor could not stabilize the site wastes due to the quantity of large debris in the waste, USEPA determined the remedy to be technically infeasible and construction was halted. The PRP Group then retained Geosyntec to perform a Focused Feasibility Study (FFS) to evaluate alternative potential remedies, develop a FFS for the selected alternative, and provide CQA and resident engineering service during construction.

The project included removing tarry wastes from a tidal marsh and developing an in-place closure for other wastes within the former disposal area. COCs included petrochemical constituents and arsenic. Geosyntec developed a remedy that included removing and restoring marsh, consolidating highly compressible disposal pit sludges in place, capping the disposal pits with a lightweight composite barrier, removing hot spot areas (wastes in the marsh and on-site disposal pits) and disposing of the material off-site, and collecting and treating consolidation water during remedy implementation. The FFS included a risk-based technical equivalency demonstration, developed by Geosyntec, to illustrate that the performance of the revised remedy exceeded that of the original remedy.

Waste removal activities took place concurrently with the development of the revised design to avoid regulatory penalties and mitigate site management costs. Geosyntec developed the revised design, provided on-site resident engineering and CQA services throughout all phases of work, and assisted with regulatory negotiations and the drafting of two Explanation of Significant Differences (ESD’s) and a ROD amendment. All components of the revised remedy have been constructed.

Geosyntec was able to develop an alternative, implementable remedy that is estimated to have saved the PRP Group $20M compared to the implementation cost of the original remedy. The FFS resulted in a preferred alternative involving waste removal from several acres of tidal marsh, marsh restoration, waste consolidation, lightweight capping, hot spot waste stabilization, and off-site disposal. Based on the FFS, USEPA issued a ROD amendment and two ESD’s. At the second five-year USEPA review, the remedy was found to be “protective of human health and the environment. Over 156,000 cubic yards of hazardous materials in two capped waste areas of 10 acres were addressed to prevent direct contact and off-site migration. Sensitive wetlands have been protected and made safe for wildlife and recreational activities.” The remediated site has withstood several large hurricanes and flooding events. USEPA is presently seeking concurrence from the Texas Commission on Environmental Quality to delist the site from the NPL.
Hydrodynamic, Sediment, Fate and Transport, and Food Web Model Litigation Support

LOWER FOX RIVER, WISCONSIN

A confidential client sought analysis of the scientific viability of the remediation alternatives selected for PCBs for this CERLCA site. As part of the evaluation of a potential remedy challenge, the client sought an independent review of the 1-D hydrodynamic, sediment transport, and PCB fate and transport models; the underlying assumptions; and how the models were used in determining the selected remedial alternative, given more recent information and understanding of how the original work was conducted. A second phase of work was conducted to review a 3-D hydrodynamic, sediment transport, and PCB fate and transport model developed using the EFDC framework for apportionment models commissioned by one of the PRPs.

Geosyntec conducted a detailed review of the model used in developing RA alternatives, and the model used in apportionment analyses, their formulation, the analyses to support the model development modeling assumptions, model documentation, the various remedial alternatives evaluated by the agencies, and the assumptions used. Analogous analyses were conducted related to food web modeling for the RA alternatives. Geosyntec’s model review included review of the model documentation, model re-creation, sensitivity analyses, and a detailed review of source code (for the remedial alternatives model only), model input and output files, and and codes prior to and after processing.

The Geosyntec team developed draft opinions and provided strategic regulatory support to the client for potential negotiations with the state and federal regulatory authorities. In a second phase of work, Geosyntec provided expert testimony in the form of deposition and trial testimony. Geosyntec provided a robust and detailed expert review of hydrodynamic, sediment transport, and fate and transport models focused on PCBs in the water column and sediments, and food web modeling. The review resulted in concise expert information to guide the client in the process of assessing remedial alternatives.
Sediment Investigation and Remedial Action Implementation

SOUTHERN CALIFORNIA

This project involved assessing and remediating marine sediment adjacent to a storm drain outfall which historically drained an aeronautical manufacturing site. Following completion of upland remediation activities, PCB impacts were identified in nearshore sediments adjacent to a former storm drain outfall. The project objective was to define the extent of these impacts and to design, permit, and implement a cost-effective RA to address the residual impacts.

Following an extensive storm drain clean out and disconnection from potential upgradient sources, the extent of PCB impacts at the storm drain outfall was identified across a one-acre area in the adjacent embayment. Through cooperative negotiation with the Regional Water Quality Control Board (RWQCB), an ENR remedy was established as the preferred remedial alternative. The remedy involved extracting a limited amount of sediment over a 30-foot by 80-foot area adjacent to the shoreline and placing 6 inches of sand mixed with an AC layer to reduce potential bioaccumulation from residual PCB impacts. This combination of clean sand and AC in the upper 6 inches of sediment will reduce total PCB concentrations and bioavailability of PCBs to benthic invertebrates. Geosyntec’s related scope included development of bench-scale treatability testing to demonstrate the ability of AC to reduce PCB bioavailability, evaluating the benthic community, negotiating with regulatory agencies, designing ENR, permitting, and implementing the remedy.

Through extensive negotiation with the RWQCB, a focused investigation was approved to evaluate the lateral extent of contaminant impacts. Using these data, the RWQCB concurred that our client’s area of impact did not overlap with those of other parties and could be handled separately from the larger investigation of the embayment. The proposed ENR remedy and the streamlined investigation process developed a new and quicker path to closure for managing sediment sites in San Diego Bay. Bench-scale pilot studies demonstrated a 98% reduction in PCB bioavailability with application of a 3% AC amendment to the sand layer. The RWQCB concurred that the reduction of bioavailability could be factored into the evaluation of the final remedy, setting a final remediation goal of achieving an “equivalent bioavailable PCB concentration” equal to or below the regional PCB background concentrations in the bay.
Sweetwater Marsh Sediment Streamlined Risk Evaluation San Diego Bay National Wildlife Refuge

CHULA VISTA, CALIFORNIA

The Sweetwater Marsh Unit of the San Diego Bay National Wildlife Refuge managed by U.S. Fish and Wildlife Service, is a 135-acre wetland and uplands area impacted with several chemicals, primarily metals, associated with circa-1900 burn ash and landfill wastes. The objectives for the site were to assess and restore areas physically and chemically impacted by burn ash and associated chemicals, while preserving available terrestrial and aquatic habitat, home to several special-status wildlife species.

Geosyntec conducted a streamlined risk evaluation (SRE) to identify the needs and scope of remediation at Sweetwater Marsh. We conducted several rounds of chemical sampling at the site, including advanced geochemical sampling (e.g., Simultaneously extracted metals/Acid-volatile sulfide [SEM-AVS]) to understand the availability of metals associated with burn ash and nearby aquatic sediment. We also evaluated several years of U.S. Fish and Wildlife Service sediment, bioaccumulation, and ecological data to aid in the SRE. Multiple lines of chemical, biological, and physical evidence were incorporated into the site-specific SRE to identify sediment-associated ecological and human health risks. Additionally, Geosyntec derived spatially- and site-specific risk-based remedial goals to provide strategic guidance in balancing risk of remedy with existing wetlands and uplands ecological resources. Geosyntec designed a remedial approach that targeted areas of potentially unacceptable chemical risks.

The SEM-AVS analysis enabled a better understanding of metal availability in sediment, demonstrating that burn-ash associated metals in sediment were mineralized and unavailable for uptake by biological receptors. This evaluation provided confidence that many areas of the site did not require remediation, despite the presence of concentrations of metals that were above sediment screening levels and geological background ranges. Spatially-explicit risk assessment techniques also streamlined the remedial footprint derivation process and resulted in a remedy approach that more accurately protects risk site-wide, while minimizing impacts to valuable natural resources and sensitive habitat areas that did not present chemical risks.
Houston Ship Channel Remedial Design

**GREENS BAYOU, HOUSTON, TEXAS**

Greens Bayou, a part of the Houston Ship Channel system, and its tributaries have been contaminated by decades of industrial discharge. Geosyntec initially evaluated the site conditions and dynamics of this complex system. Our comprehensive data review employed advanced geostatistics, environmental chemistry and forensics, and data visualization techniques to construct a GIS. We then created a detailed CSM to characterize soil, sediment, and groundwater conditions, and describe site-specific mechanisms for sediment transport and contaminant transport via groundwater and stormwater runoff. We also conducted extensive geotechnical analyses related to planned remedial dredging of the bayou to evaluate the stability of waterfront structures and a dredge spoil disposal area during and after dredging. Using the CSM, Geosyntec developed practical soil, sediment, and groundwater remediation plans focused on preventing recontamination of the bayou after dredging. Methods included excavating and containing impacted upland soils, constructing hydraulic containment cutoff walls, extracting and treating groundwater, excavating sediment, and capping. Our RD became part of a court-ordered remedy to restore water quality in the bayou, remediate contaminated sediment, and prevent recontamination of sediment by groundwater.

Feasibility Evaluation of a Subaqueous Sediment Cap

**PALOS VERDES PENINSULA, CALIFORNIA**

As a result of Geosyntec’s risk assessment and the implementation of an alternative method of remediation, a joint defense group saved millions of dollars and met their goal of mitigating the impact of DDT- and PCB-contaminated ocean floor sediment. USEPA had proposed in situ capping of a 37-square-mile area of the sea floor, 130 to 170 feet deep, off Palos Verdes Peninsula in Southern California. The cap was to be placed by dumping dredged sand or crushed rock from hopper barges. Geosyntec applied technical expertise and experience to evaluate the geotechnical feasibility of the capping remedy. Our scope of evaluations included slope stability, consolidation settlement, potential resuspension of impacted sediment, and seismically-induced sediment and cap liquefaction. We also analyzed geotechnical challenges that might occur during the placement process, including segregation of cap materials, bearing failure of the underlying sediment, turbidity flows, and squeezing of the sediment into the cap. Given the uncertainties associated with construction of the remedy and associated environmental impacts, Geosyntec recommended implementation of institutional controls, such as a prohibition on fishing in the area, together with MNR. Our staff demonstrated to regulators that the more intensive and far more expensive capping method would do more damage than good to the DDT-impacted sediments, habitats, and surrounding natural communities. The Geosyntec-recommended approach was accepted and implemented.
We are engineers, scientists and innovators.

Delivering technology-based, best-value solutions to our clients as true partners and trusted advisors.

Sediment Management Contacts

**NORTHWEST**
Howard Cumberland  
hcumberland@geosyntec.com  
(971) 271-5898

Anne Fitzpatrick, LHG  
alfitzpatrick@geosyntec.com  
(206) 496-1461

**NORTHEAST**
Chris Greene, PE  
cgreene@geosyntec.com  
(978) 206-5714

Dave Himmelheber, PhD, PE  
dhimmelheber@geosyntec.com  
(609) 493-9012

**SOUTHEAST**
Pete DeHaven, PE  
pdehaven@geosyntec.com  
(919) 424-1834

Darrell Nicholas, PE  
dnicholas@geosyntec.com  
(865) 291-4706

**SOUTHERN CALIFORNIA**
Jason Conder, PhD  
jconder@geosyntec.com  
(714) 465-1226

Wendy Hovel, PhD  
whovel@geosyntec.com  
(858) 716-2892

**NORTHERN CALIFORNIA**
Anju Wicke  
awicke@geosyntec.com  
(510) 285-2703

Tony Smith, PhD, PE  
tsmit@geosyntec.com  
(510) 285-2770

**GREAT LAKES**
Greg Gibbons, PE  
ggibbons@geosyntec.com  
(630) 203-3364

Jen Wilkie, PhD, PE  
jwilkie@geosyntec.com  
(312) 416-3938

**CANADA**
Danielle Thorson, PE  
dthorson@geosyntec.com  
(519) 515-0876

Matt Vanderkooy, PG  
mvanderkooy@geosyntec.com  
(519) 515-0877

**SOUTHERN CALIFORNIA**
Jason Conder, PhD  
jconder@geosyntec.com  
(714) 465-1226

Wendy Hovel, PhD  
whovel@geosyntec.com  
(858) 716-2892

**NORTHERN CALIFORNIA**
Anju Wicke  
awicke@geosyntec.com  
(510) 285-2703

Tony Smith, PhD, PE  
tsmit@geosyntec.com  
(510) 285-2770