ECOLOGICAL & STREAM RESTORATION DESIGN SERVICES

Providing the highest quality professional services to our clients

Project Portfolio

jmt.com

About JMT

The fundamentals of a successful ecological or stream restoration project are understanding the underlying causes of an impaired system and following a design approach that provides sustainability through long-term stability. JMT takes a holistic approach to restoring ecosystems using robust assessment and analysis techniques. Our interdisciplinary team of water resource engineers, environmental scientists, geologists, ecologists, biologists, and landscape architects works closely together to develop a design that considers form, function, stability, and ecological uplift.

Founded in 1971, JMT is a 100% employee-owned firm that provides a full range of multidisciplined engineering, architectural, and related services to public agencies and private clients throughout the United States. We are dedicated to providing high quality services and long-term success for ecological and stream restoration projects.

We have expanded our ecological and stream restoration capabilities in recent years through advanced training, strategic partnerships with academia, monitoring of our own project designs as well as others implemented within our industry, and key hires and additions, such as Tidewater Environmental Services.

Contents

Upper Little Patuxent

TMDL Stream Restoration (Design-Build)

Howard County, MD

Prior unstable conditions

After with stable conditions

Project Highlights

- Maryland State Highway Administration's (MSHA) first-ever TMDL-focused design-build stream restoration.
- Restores approximately 4,200 feet of streams.
- Nutrient reduction included 2,620 lbs/yr of TN, 965 lbs/yr of TP, and 1,254 tons/yr of TSS.
- Through soil excavation of the post-settlement alluvium, an additional 34,200 lbs of TN, 12,600 lbs of TP, and 16,363 tons of TSS were removed.
- Enhances stream substrate and improves habitat for fish, herpetofauna, and macroinvertebrates.

The project restored approximately 3,700 feet of the main stem and 500 feet of an unnamed tributary to meet NPDES, MS4 and Total Maximum Daily Load (TMDL) reductions for total nitrogen (TN), total phosphorus, and sediment (TSS) contributing to the degradation of the Chesapeake Bay.

JMT, as lead designer, provided a cost-effective and stable solution that used stream and floodplain restoration methodologies. The project was honored in 2015 with the Maryland Department of Transportation Environmental Excellence Award and the Maryland Quality Initiative State Engineering Award for Green/Sustainability/Environmental Excellence, for the team's efforts to prevent and eliminate pollution.

Our approach included both stream and floodplain restoration, blended to meet the constraints of a narrow valley, existing forest resources, and confinement due to sewer line encroachments. The enhanced design methodology focused on water quality improvements, design stability for up to the 100-year storm, increased flood storage capacity, and dramatic reduction of sedimentation to downstream receiving waters.

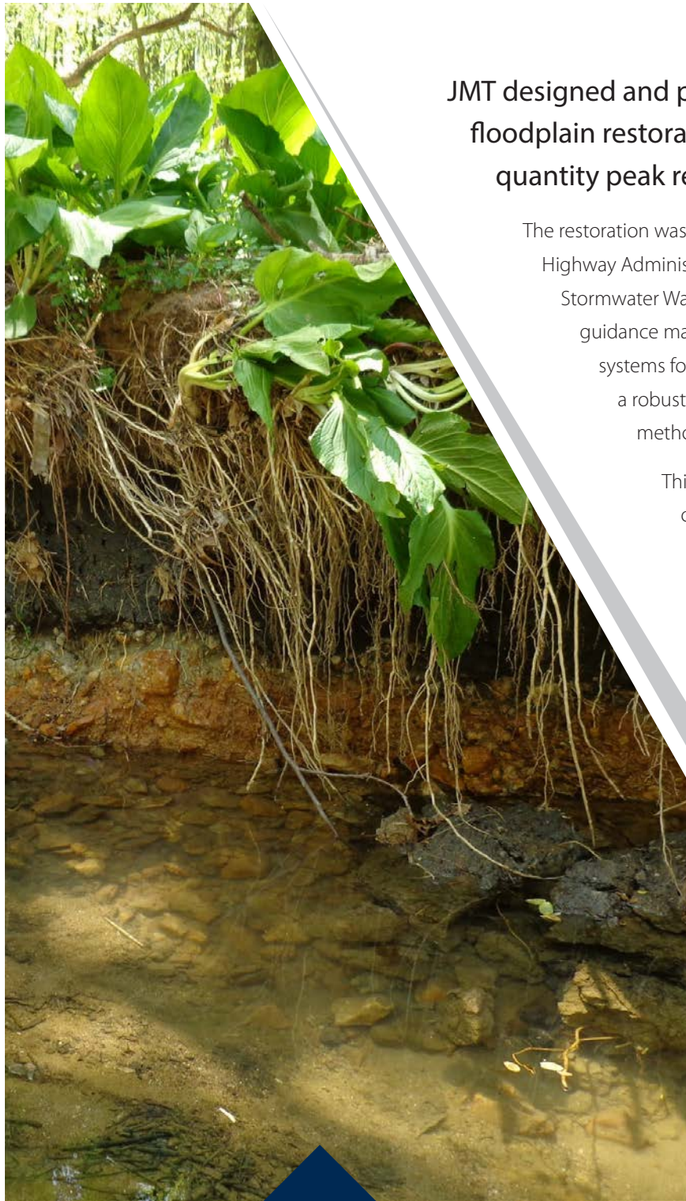
In addition, JMT provided a stream functional uplift through increasing vegetative value and re-purposing trees, logs, and other on-site woody debris to enhance aquatic and riparian habitat. This approach limited the required amount of hard armor and rock necessary for stabilizing the stream, reducing construction costs and future maintenance costs.

Key benefits of this project were creating a dense riparian root system, which protects stream banks from erosion and promotes sediment and nutrient processing, and reconnecting the floodplain with the active groundwater table, enhancing hyporheic exchange. This interaction enhances channel base flow during dry periods and maintains cooler water temperatures year-round.

As a benefit of the design-build and agency coordination process, JMT reduced overall wetland, stream, and forest impacts, and attained authorization for the project through state programmatic and federal Nationwide 27 permitting instruments. These instruments typically have a faster turnaround compared to individual permits, expediting the schedule.

As a result of the project, JMT was able to help MSHA meet the following goals:

- Protects existing infrastructure while still conveying the 100-year and smaller flood discharges in a stable manner.
- Reduces sediment and nutrient pollution, contributing toward meeting TMDL goals for the watershed.
- Preserves existing wetland and forest resources, limiting project impacts through an iterative design alternatives analysis.
- Noticeably lifts the ecological functions and values of the wetland and stream resources.



JMT designed and permitted the first stream and floodplain restoration project to meet stormwater quantity peak reduction requirements in Maryland.

The restoration was accomplished on behalf of the Maryland State Highway Administration (MSHA). JMT utilized the "Accounting of Stormwater Wasteload Allocations and Impervious Acres Treated" guidance manual for national pollutant discharge elimination systems for stormwater as part of our design, along with a robust stream and floodplain restoration design methodology.

This project, which will restore more than 5,200 feet of stream, fulfills the compensatory mitigation requirements of unavoidable impacts to Waters of the United States, and provides stormwater water quality benefits for the TMDL goals of the watershed.

Great Seneca Creek Tributary Restoration

Montgomery County, MD

JMT conducted an in-depth, multidisciplinary assessment to support the design. Geomorphic assessments included reviewing previous studies, natural resource inventories, historic investigations, hydrologic and hydraulic analyses, stream bank sediment and soil studies, sediment mobility studies, and geomorphic data analyses to develop an understanding of the existing impacts within the stream corridor, current geomorphic processes, and causes of instability.

Our design establishes a restored floodplain elevation that will correspond closely to the elevation of the historic floodplain valley bottom that existed prior to damming, deforestation, and associated sedimentation following European settlement of the region. By reconnecting the proposed streambed to the basal gravels of the historic floodplain and providing a permeable layer in a well-connected floodplain, multiple environmental benefits will be realized, including flood flow attenuation, improved hyporheic exchange, wetland restoration, and functional uplift of stream and wetland habitats.

To expedite permitting, JMT worked closely with state and federal regulatory agencies to address permitting issues and obligations, integrating a diverse array of agency comments into the final design. We developed a diverse design alternatives analysis to demonstrate the final design as the preferred alternative, achieving the greatest functional uplift with appropriate avoidance, minimization, and mitigation measures addressing resource impacts on site. Measures included the re-use of woody vegetation as an integral habitat substrate of the restoration, providing wetland texture, stream grade control, and providing enhanced denitrification biochemical benefits in the hyporheic zone.

As a result of the project, JMT assisted MSHA in meeting the following goals:

- Extensively reduces sediment and nutrient pollution, contributing toward meeting TMDL goals for the watershed, and helping meet stormwater quality requirements for the redevelopment of I-270.
- Addresses stormwater management quantity requirements in the floodplain, simultaneously meeting compensatory mitigation requirements onsite.
- Demonstrably lifts existing ecological functions and values of wetland and stream resources.

Project Highlights

- Restores approximately 5,200 feet of streams.
- Attenuates flooding and reduces sedimentation.
- Reestablishes a dense riparian root system which promotes and increases sediment and nutrient processing.
- Blends stormwater management and ecological restoration into a sustainable natural system.
- Provides a functional uplift of natural resources.

Watergate and Arnott Fen Compensatory Wetland Mitigation Projects

Delaware Water Gap National Recreation Area, PA and NJ

Project Highlights

- Restores approximately 5,800 feet of streams and more than 60+ acres of wetlands.
- Designs for specific habitats of critically endangered and threatened species.
- Restores cold water, native trout fisheries.
- Enhances recreational and educational opportunities.
- Enhances the cultural landscape through preservation of cultural resources and restoration of historic landscapes.

JMT is providing comprehensive services to the National Park Service (NPS) in support of the compensatory mitigation associated with impacts to wetland and stream resources at the Delaware Water Gap National Recreation Area (DEWA).

The project includes stream and wetland restoration design to mitigate impacts associated with the construction of the new Susquehanna to Roseland electric transmission line. The project will restore essential habitat for rare, threatened, and critically endangered species in two states, and includes supporting cultural resource investigations; wetland, forest, fisheries and benthic studies; permitting; modeling; and NEPA evaluations. The project occurs in diverse and sensitive locations at two sites within DEWA – one in Pennsylvania, the other in New Jersey – and is part of a $66-million compensatory mitigation package funded by Pennsylvania Power and Light Electric Utilities and the Public Service Electric and Gas Company. These projects are currently the largest wetland and stream restoration projects being managed by NPS service-wide, and the first NPS ecosystem restoration projects designed with climate resiliency in mind.

As a key component of each project, JMT is proposing to remove historic impacts from road building, dam construction, and agriculture/deforestation, which will allow ecosystems to self-form and adapt toward a stable equilibrium, remedying centuries of impact due to unsustainable land use practices.

The Arnott Fen site is located in Pennsylvania and restores approximately two acres of prime habitat. This area has historically been the home of multiple highly-sensitive and rare species. Restoration at the Arnott Fen will focus on removing an internal road that has disrupted the hydrology of the larger system. Data are currently being collected and will be used to determine design methodologies to restore species-specific habitats, and naturalize historic impacts.

The Watergate site is located in the New Jersey portion of DEWA along Van Campens Brook, which is one of the highest quality brook trout and wood turtle watersheds in the state. The topography and hydrologic regime of this site was heavily altered by owners previous to NPS by installing 13 dams and associated ponds, and limiting aquatic organism passage. Additionally, deforestation and agriculture have impacted the site, accumulating sediments and burying historic floodplain wetlands. The proposed improvements to Watergate include restoring fish passage to Van Campens Brook by removing the intact and remnant pieces of dams, enabling brook trout populations to freely move through the reach for the first time since the dams were installed. The proposed restoration design will also include reconnecting Van Campens Brook to the floodplain, creating opportunities for wetland creation and habitat improvements, wood turtle foraging, and nesting locations over approximately a 60-acre footprint.

As a result of the project, JMT will help NPS achieve the following goals:

- Fulfillment of compensatory mitigation goals.
- Restoration of unique habitats disturbed through centuries of impacts.

Shipley's Choice Dam Rehabilitation, Culvert Replacement and Stream Restoration

Anne Arundel County, MD

Project Highlights

- Restores approximately 3,700 feet of streams.
- Provides design services for the removal of a 20-foot-high failing SWM facility dam and the restoration of the area to a natural channel and riparian floodplain system.
- Protects and enhances existing expansive wetlands immediately upstream of the dam and culvert.
- Uses native coastal plain materials.
- Incorporates Rosgen stream inventories and assessments, geomorphic surveys and analysis, and a sediment mobility study.
- Relocates existing 16-inch gravity sewer line, 16-inch water line, and 16-inch sanitary force main to improve fish passage through the proposed culvert.

JMT was contracted by Anne Arundel County for a multifaceted project removing a failing, high hazard stormwater management facility dam, and will restore approximately 3,700 feet of natural channel and associated floodplain.

The project also involves replacing an existing 66-inch CMP culvert (downstream of dam) with a 10-foot by 7-foot box culvert to mitigate for increases in discharges due to removal of the dam, to pass the 50-year flood without overtopping of the roadway, to re-establish aquatic organism passage, and to provide long-term geomorphic stability at the crossing. The dam removal is under order of a Consent Decree issued to the County by the Maryland Department of the Environment.

A major design objective was to transition the stream through the dam footprint and connect the floodplain areas without utilizing "hard armoring" techniques.

We strived to preserve and enhance as much of the existing wetlands and stream channels as possible. To achieve this, the design focused on enhancing existing reaches upstream of the dam removal and culvert replacement using native coastal plain materials such as sand substrate and buried logs harvested from disturbed areas. The design created and enhanced existing micro-channels in the floodplain areas to create a highly attached riparian wetland stream system.

JMT performed Rosgen stream inventories and assessments, hydrologic and hydraulic modeling, geomorphic surveys and analysis, natural resource assessments, and sediment mobility studies of the sand bed system.

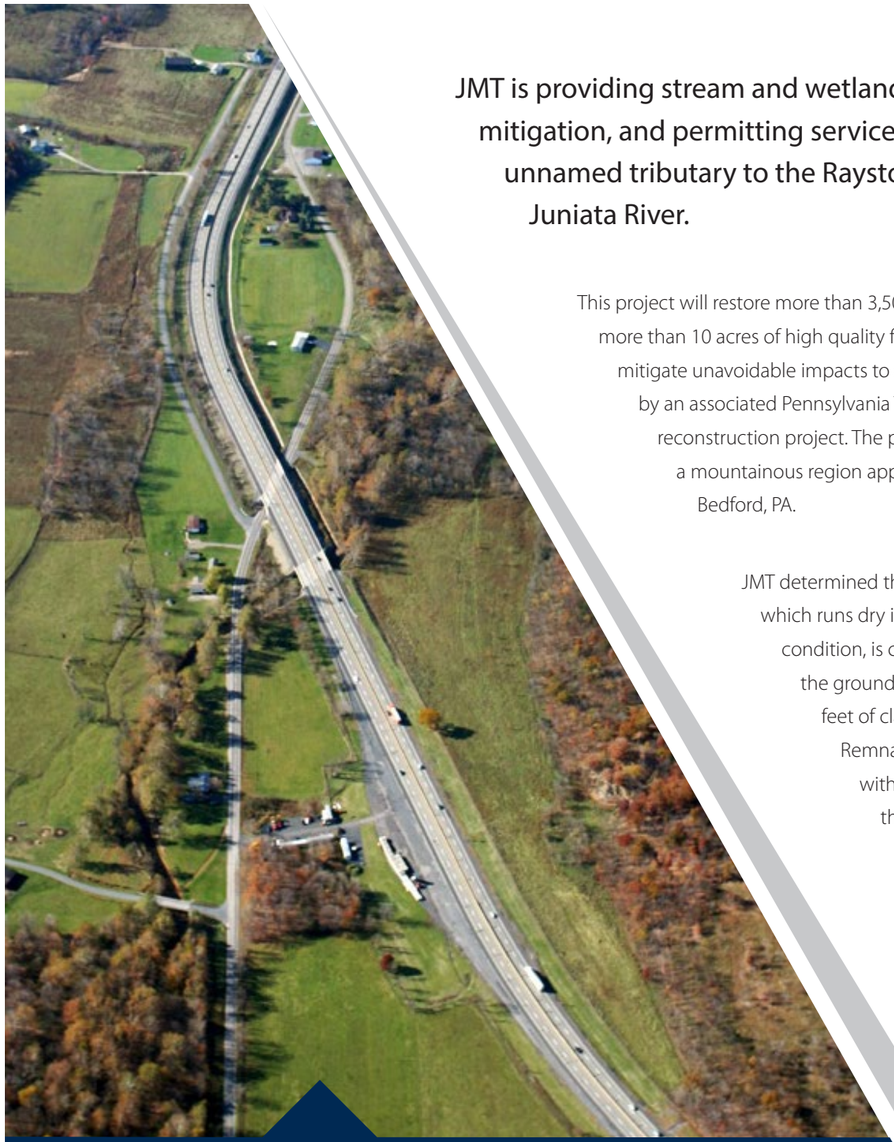
The design strategy serves to preserve or improve stream ecology and wildlife habitat in conjunction with increases in the hydraulic stresses associated with the removal of the dam.

The culvert replacement requires relocating several water and sewer lines that cross the existing culvert in order to provide fish passage through the proposed hydraulic structure.

A length of existing gravity sanitary sewer line that runs parallel to the stream valley will be relocated outside the limits of the active channel and proposed floodplain to protect the utility infrastructure.

JMT assisted the County with the following goals:

- A design plan to restore ecological resources and meet the requirements of a consent decree.
- Repair, replace, and protect existing infrastructure.
- A cost-effective ecological restoration plan that naturalizes an impacted floodplain, uses materials found on site, and safely conveys design flood discharges.



JMT is providing stream and wetland restoration design, mitigation, and permitting services to restore an unnamed tributary to the Raystown Branch of the Juniata River.

This project will restore more than 3,500 linear feet of stream and more than 10 acres of high quality floodplain wetlands, and it will mitigate unavoidable impacts to all aquatic resources caused by an associated Pennsylvania Turnpike Commission roadway reconstruction project. The project area is located within a mountainous region approximately 20 miles west of Bedford, PA.

JMT determined that the existing perennial stream, which runs dry in the summer due to its perched condition, is completely disconnected from the groundwater aquifer due to several feet of clay caused by a historic milldam. Remnants of the milldam are present within the project site and include the dam crest and millrace.

Unnamed Tributary to the Raystown Branch of Juniata River Restoration

Bedford and Somerset Counties, PA

The proposed restoration design will restore the stream and valley bottom to a pre-European settlement condition utilizing only natural materials found on site, a significant savings in construction cost compared to conventional restoration practices. The project will reconnect the proposed streambed to the groundwater aquifer, enhancing hyporheic exchange and maintaining base flow through the entire year.

JMT conducted an extensive hydrologic investigation, quantifying runoff delivered to the site, as well as monitoring the ground water elevation through a series of wells and digging observation trenches to characterize subsurface, groundwater conductive layers. This information was used to design an offline pasture stock watering system to allow the land owner to conduct livestock operations without the need for cattle to access the restored stream. The project limits will be placed in a permanent conservation easement. A fencing system to protect the conservation easement is proposed in addition to the restoration work.

The design is focused on improving water quality; decreasing sedimentation, groundwater recharge and hyporheic exchange; improving hydraulic efficiency and function; establishing equilibrium with the available sediment supply; and improving in-channel and riparian ecological and biological function. The project will create a diverse valley bottom ecosystem buried by several hundred years of sedimentation through stream and floodplain restoration. JMT is also providing permitting and regulatory agency coordination with the Pennsylvania Department of Environmental Protection following special program guidance for stream and wetland restoration projects that fully identify and remove past anthropogenic impacts and serve to restore to a self-sustaining system.

JMT assisted the Pennsylvania Turnpike Commission with attaining the following goals:

- Meeting complex compensatory mitigation goals.
- Creating stable conveyance of flood flows and stormwater.
- Providing functional uplift and restoration of floodplain wetlands and stream base channel.

Project Highlights

- Restores approximately 3,500 feet of streams and more than 10 acres of high quality floodplain wetlands.
- Provides complete stream and wetland restoration design, mitigation, and permitting.
- Provides habitat for the endangered Indiana bat.
- Restores the valley bottom to a pre-settlement condition using only natural materials.
- Reconnects surface water and groundwater to create diverse hydrologic conditions to support diversity of native flora and fauna.

Nash Run Stream Restoration

Washington, DC

Project Highlights

- Restores approximately 1,400 feet of streams.
- Includes a trash BMP collection system capable of removing 100% of all floatable trash prior to entering the restoration.
- Creates 1.08 acres of wetlands in an urbanized area of the District where none previously existed.
- Provides a variety of native tree, shrub, and herbaceous species adapted to the hydrologic regime.
- Delivers significant cost savings through assisted contractor negotiation.

The Watershed Protection Division of the District Department of the Energy & Environment (DOEE), in cooperation with the SWM Division of DOEE, selected JMT to design approximately 1,400 feet of stream restoration within the District limits.

The project was originally tasked as an 800-foot reach of stream restoration and increased to 1,400 feet once DOEE recognized the additional benefits that could be achieved through JMT's approach. JMT developed final designs and bid-ready construction documents to restore a highly-degraded section of a first order tributary to the Anacostia River to provide water quality improvements and meet TMDL and MS4 permit requirements for the river. Services continued following advertisement, assisting in bidder evaluation and negotiations, saving DOEE approximately $600,000 from the selected contractor's initial bid.

Nash Run is an ultra-urbanized tributary with 49% of the watershed covered by impervious area that contributes 3% of the total floatable trash load to the Anacostia River. The entire watershed upstream of the project area is piped, resulting in a flashy urban system with intense discharges, confined within 15 feet of vertical banks. JMT delivered an integrated design that maximizes removal of trash and sediment from stormwater, provides the stable conveyance of flood flows, and increases water quality and ecological functions. Our design focused on maximizing floodplain area to provide re-connection, flow attenuation, riparian wetland creation, and aquatic and riparian habitat enhancements. JMT integrated multiple restoration and stabilization measures to create a naturalized system, utilizing woody debris and other measures to improve habitat and reduce erosion.

In order to meet hydraulic constraints, JMT assessed several trash and debris collection systems. Ultimately, we worked closely with Storm Water Systems in Atlanta to develop the custom trash collection unit that would remain permanently in the upstream scour hole to capture all floatable trash and polluted organic street matter as part of an integrated ecosystem restoration approach.

JMT also provided flood relief for several adjacent properties by reducing the extent of the 100-year flood boundary through the design of a new culvert crossing midway along the restoration reach. The culvert replacement included a multiple cell design to provide more efficient conveyance as well as aquatic organism passage by depressing the main cell bottom to create a backwater permanent pool elevation.

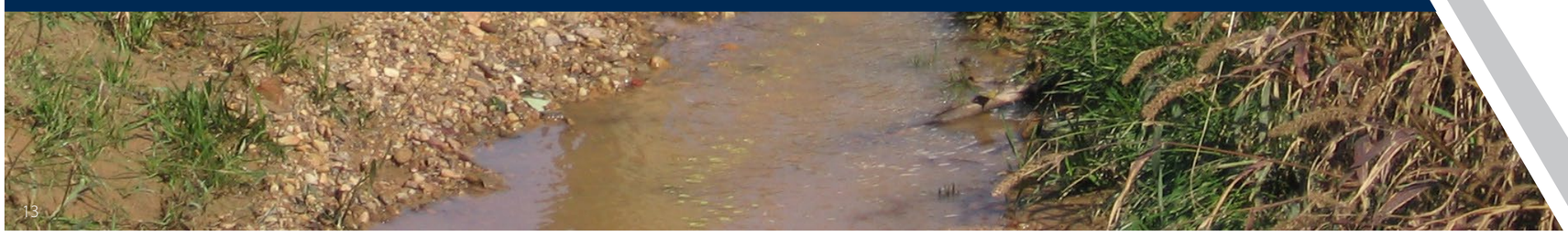
Supporting services included a geomorphic watershed and sediment mobility analysis, streambank/soil analysis, flow gage installation/analysis, H/H analysis, ESC design, archaeological investigations, and environmental permitting. Multiple properties were affected, and, as such, community outreach/ coordination was essential to project success.

JMT assisted DOEE in meeting the following goals:

- Floodplain, ecological and TMDL goals met through an integrated approach.
- Reduction of construction costs through assisted contractor negotiation.
- Protection of property and infrastructure.

Stemmers Run Stream Restoration

Baltimore County, MD



JMT, in support of highway reconstruction for the Maryland Transportation Authority (MDTA), completed a detailed stream relocation and restoration plan for 4,000 feet of Stemmers Run and its tributaries.

The design daylighted nearly 900 feet of multiple piped portions of stream, and restored floodplain function to entrenched sections of the existing channel.

JMT completed a detailed existing and ultimate conditions hydrologic analysis for the 4.1-square-mile watershed utilizing the methodology detailed in the Maryland Hydrology Panel Report, which involved flood frequency analysis and weighting of the fixed region regression results based on a downstream gage. Ultimately, a calibrated TR-20 model was developed. Hydraulic floodplain models for existing and proposed conditions were developed using the USACE HEC-RAS.

JMT accurately modeled the proposed bridges and culverts and restored stream valley to precisely account for the hydraulic impact of the 29 bridge piers within the interchange.

A detailed H/H report was prepared and submitted to FEMA for a Letter of Map Revision (LOMR) for the revised portion of Stemmers Run upon completion.

JMT assessed the overall geomorphologic characteristics of the stream to determine stability and sediment regime, including quantitative and qualitative assessments of plan form, channel dimension, streambed profile, channel material composition, and loading rate.

The highly constrained stream valley presented several challenges that drove many of the critical design components of the stream restoration. The downstream limit of restoration was defined by new culvert design requirements to maintain existing flood control and the upstream limit was defined by the extent of the MDTA right-of-way and preservation of an existing bridge. The plan form was constrained by the multitude of bridge piers/abutments and roadway geometry requirements. Due to the bimodal sediment regime of the reach, the design approach utilized a compound channel to accommodate a range of discharges and associated sediment transport capacity.

In-stream structures were designed for low-flow habitat, grade control, and reduction of near-bank stress. Coupled with an enhanced substrate and reconstructed facet sequence, in-channel habitat was improved for a variety of aquatic species and benthic macroinvertebrates. Flow separation features, critical to the foraging and spawning of forage fish species, were also integrated into the restoration plan.

JMT assisted MDTA in meeting the following goals:

- Developing a stable stream location and restoration plan to protect infrastructure as well as enhance habitat.
- Daylighting previously piped stream channel.
- Developing an LOMR for FEMA floodplain compliance.

Project Highlights

- Restores approximately 4,000 feet of streams.
- Provides stream restoration assessment, monitoring, and design for Stemmers Run through the I-95/I-695 Interchange.
- Uses culvert removal/stream daylighting of nearly 900 feet as part of the interchange mitigation.
- Conveys the stream through the re-constructed interchange, which includes 29 bridge piers.

Unnamed Tributary to Cranberry Run Restoration

Harford County, MD

Project Highlights

- Restores approximately 800 feet of streams.
- Minimizes impacts to wetlands, waterways, and floodplains.
- Maintains/discharges natural groundwater flows and seeps associated with waters of the U.S. and wetlands.
- Replaces existing deteriorated steam channel with a new stream and highly attached floodplain.

JMT, as lead designer, restored approximately 800 feet of an unnamed tributary to Cranberry Run adjacent to Aberdeen Proving Ground (APG) from its confluence with Cranberry Run, relocating it from the roadway footprint and restoring a natural channel and floodplain.

This coastal plain stream was highly altered by roadway and industrial development encroachments to the stream corridor, including channel straightening, piping of open channels, and roadway embankments and culverts across the floodplain, resulting in a stream system that was laterally confined and incised. Project goals for the relocated channel were to minimize impacts to wetlands, waterways, and floodplains; maintain and discharge natural groundwater flows and seeps associated with Waters of the U.S. and wetlands; provide a new stream channel and associated floodplain capable of conveying water and sediment in a stable manner; and replace the existing deteriorated stream channel with a new stream having natural channel features in order to improve water quality and ecological benefits.

The proposed design approach for the relocation/restoration of the stream channel provided a sustainable stream system with a channel capable of maintaining its natural bed material of sand and small gravel with a highly-attached floodplain. This lowered channel shear stresses and resulted in stream corridor stability, the creation of floodplain wetlands, water quality improvements through floodplain settling and filtering, and improved habitat for a variety of aquatic, terrestrial, and macroinvertebrate species.

JMT performed a geologic study, watershed assessment, discharge analysis, geomorphic assessment, hydraulic analysis, and sediment mobility assessment of the stream corridor. The hydrologic analysis was performed using the Natural Resource Conservation Service (formerly SCS) Technical Release 55 (TR-55) and 20 (TR-20) hydrologic models, and the hydraulic analysis was conducted using HEC-RAS.

JMT prepared the geomorphic design report, construction drawings, ESC design, and landscape design, as well as obtained MSHA approvals, MDE ESC, and non-tidal wetlands and waterway approvals.

JMT assisted MSHA with meeting the following goals:

- Relocating and restoring a portion of stream and adjacent floodplain to protect infrastructure.
- Eliminating sediment and attached nutrients to the downstream receiving waters.
- Enhancing habitat through an uplift of stream and wetland functions and values.

Scotts Level Branch Restoration Projects

Baltimore County, MD

Project Highlights

- Restores approximately 9,400 feet of streams and 20 acres of wetlands.
- Reduces flood shear, depth, and velocity.
- Meets TMDL goals for the watershed.
- Restores floodplain wetland and stream systems jointly, for a functional uplift of habitat.

JMT is leading the design for two impaired stream reaches near Randallstown, MD, restoring approximately 9,400 feet of Scotts Level Branch as well as multiple small tributaries and outfalls.

The projects, when completed, will restore more than 20 acres of floodplain wetlands, as well as meet Baltimore County goals for TMDL nutrient and sediment loading reduction. These projects are some of the first stream restorations in the State of Maryland with climate resiliency as a primary goal.

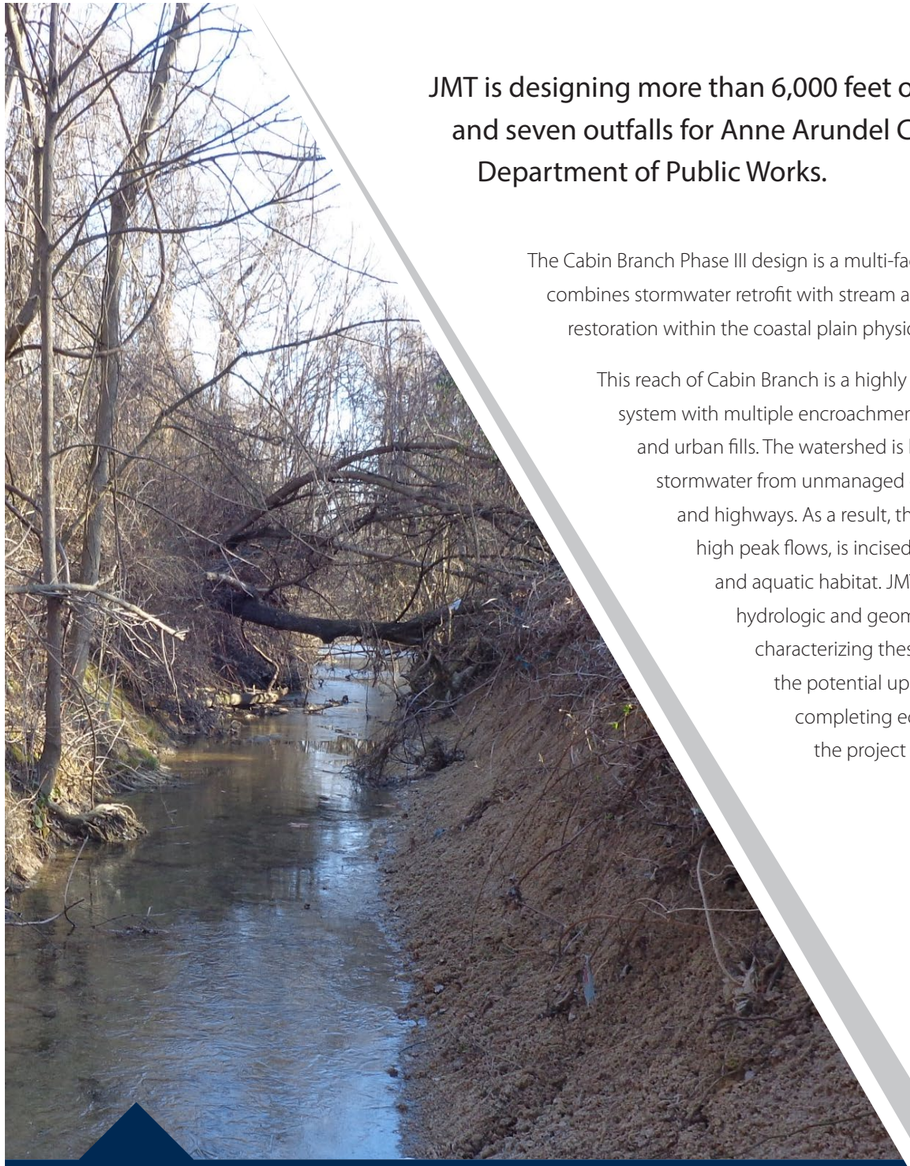
The smallest of the projects, at Marriottsville Road, will restore 1,500 feet of stream and multiple stormwater outfalls between dense residential developments. JMT is using a hybrid floodplain restoration and natural channel design approach, restoring a floodplain that was heavily impacted by urban fill, development, and historic unsustainable land uses such as deforestation and dam building. JMT is proposing a combined stream and wetland system, which provides aquatic habitat, sequesters carbon and sediment, and processes nutrients. We are providing all aspects of design services, including natural resource studies, permitting, modeling, and all phases of design through the final phase.

Scotts Level Park represents the largest restoration segment in the project, with a footprint of approximately 60 acres and estimated stream length of 7,900 feet. This reach has multiple utilities, sections of concrete channel, and various constraints that necessitate a feasibility model of ecosystem restoration design. JMT provided a complete analysis to allow the County to weigh multiple design methodology alternatives. We are providing a conceptual design for the entire reach, and at this time bringing only the first phase of the project to full design. In addition to the full final design scope, JMT is also providing a TUFLOW 2D model for hydraulic analysis validation, allowing shear stress to be modeled at specific locations and specific design scenarios to be weighed at various constraints. This will result reducing the amount of hard armoring necessary, and an anticipated savings of construction costs.

A climatic resiliency analysis of each design alternative is included, allowing the County to select alternatives and techniques that work with a changing climate. Plan species were selected based on anticipated shifts in species composition due to changes in temperature and precipitation, and hydraulics design accounted for anticipated changes in flood frequency.

JMT is assisting the County with meeting the following goals:

- Meeting TMDL goals across an entire watershed.
- Protecting infrastructure sustainability.
- Reducing maintenance and adaptive management through in-depth assessment and analysis of resilience and design sustainability.
- Enhancing habitat through an uplift of stream and wetland functions and values.



JMT is designing more than 6,000 feet of stream and seven outfalls for Anne Arundel County Department of Public Works.

The Cabin Branch Phase III design is a multi-faceted approach that combines stormwater retrofit with stream and floodplain valley restoration within the coastal plain physiographic province.

This reach of Cabin Branch is a highly impacted coastal stream system with multiple encroachments from utilities, highways, and urban fills. The watershed is highly urbanized, receiving stormwater from unmanaged commercial development and highways. As a result, the stream experiences high peak flows, is incised, and has poor riparian and aquatic habitat. JMT completed a complete hydrologic and geomorphic assessment, characterizing these issues and determining the potential uplift and nutrient savings by completing ecosystem restoration work at the project site.

Cabin Branch Phase III Stream Restoration

Glen Burnie, MD

JMT is also completing a full natural resources study of the project area, including agency coordination and wetland and forest investigation. JMT is delineating the hydric soils in the project study area, as well as buried hydric soils that have been impacted by historic unsustainable land uses, such as mill pond impoundment and valley filling through development.

JMT is providing detailed modeling of the existing conditions, and proposing a design plan that restores the stream and a connected floodplain wetland complex, improves flood storage, and provides flow attenuation. At a later design phase, JMT will assist the County with replacement of culverts and other infrastructure to provide the greatest TMDL benefit and ecological uplift allowable.

The project includes a detailed cost analysis for a variety of methodologies, allowing the County to make informed decisions for the greatest benefit at the most reasonable costs.

JMT is assisting the County with meeting the following goals:

- Meeting diverse TMDL goals for sediment, nutrients, and improving ecological processing of those parameters.
- Protecting infrastructure sustainably, lowering shear stress adjacent to roads and utilities, and stabilizing slopes.
- Removing invasive species and restoring native habitats.
- Enhancing habitat through an uplift of stream and wetland functions and values.

Project Highlights

- Restores approximately 6,000 feet of streams and more than 10 acres of wetlands within the coastal plain.
- Reduces flood shear, depth, and velocity.
- Meets TMDL goals for the watershed as part of a coordinated, watershed-wide approach.
- Restores floodplain, wetland, and stream continuity to support the functional uplift of valley bottom ecosystem.

Mill Creek Mitigation Bank

Richland County, SC

Project Highlights

- Naturalizes and conserves 1,360 acres of essential flood plain habitat in perpetuity.
- Restores and enhances 298 acres of wetland.
- Restores and enhances 27,730 linear feet of stream.
- Improves and restores habitat for the federally threatened wood stork and other species.
- Flood attenuation and filtration.
- Improves connectivity and naturalizing hydraulics for biocomplexity.

With infrastructure being a high priority for South Carolina over the next two decades, approved projects will require mitigation credits to offset unavoidable impacts to wetlands and streams. To meet this need, JMT (previously as Tidewater Environmental Services) has received state and federal approval of credits on the Mill Creek mitigation bank.

The bank, located near Congaree National Park, is one of the largest banks in the state and has been highly coveted by conservation groups. The project was conceived, planned, and permitted by JMT through an innovative model using public-private partnerships and cooperation. Ultimately, Richland County aims to create greenways and trails to conserve, enhance access, and use these abundant natural resources.

Our team will develop the mitigation bank on 1,360 acres of land. The bank will conserve, restore, and enhance 685 wetland acres and 35,262 linear feet of streams, which will be returned to a more natural condition through removing a dam and other man-made obstructions. This will improve connectivity and naturalizing hydraulics and bio complexity. A significant area of natural bottomland hardwood floodplain will be restored from open fields and planted pine. The project will preserve a complex of naturalized resources, which will enhance foraging habitat for several species, including the federally-threatened wood stork.

Spring Fishburne

Drainage Improvements

Charleston County, SC

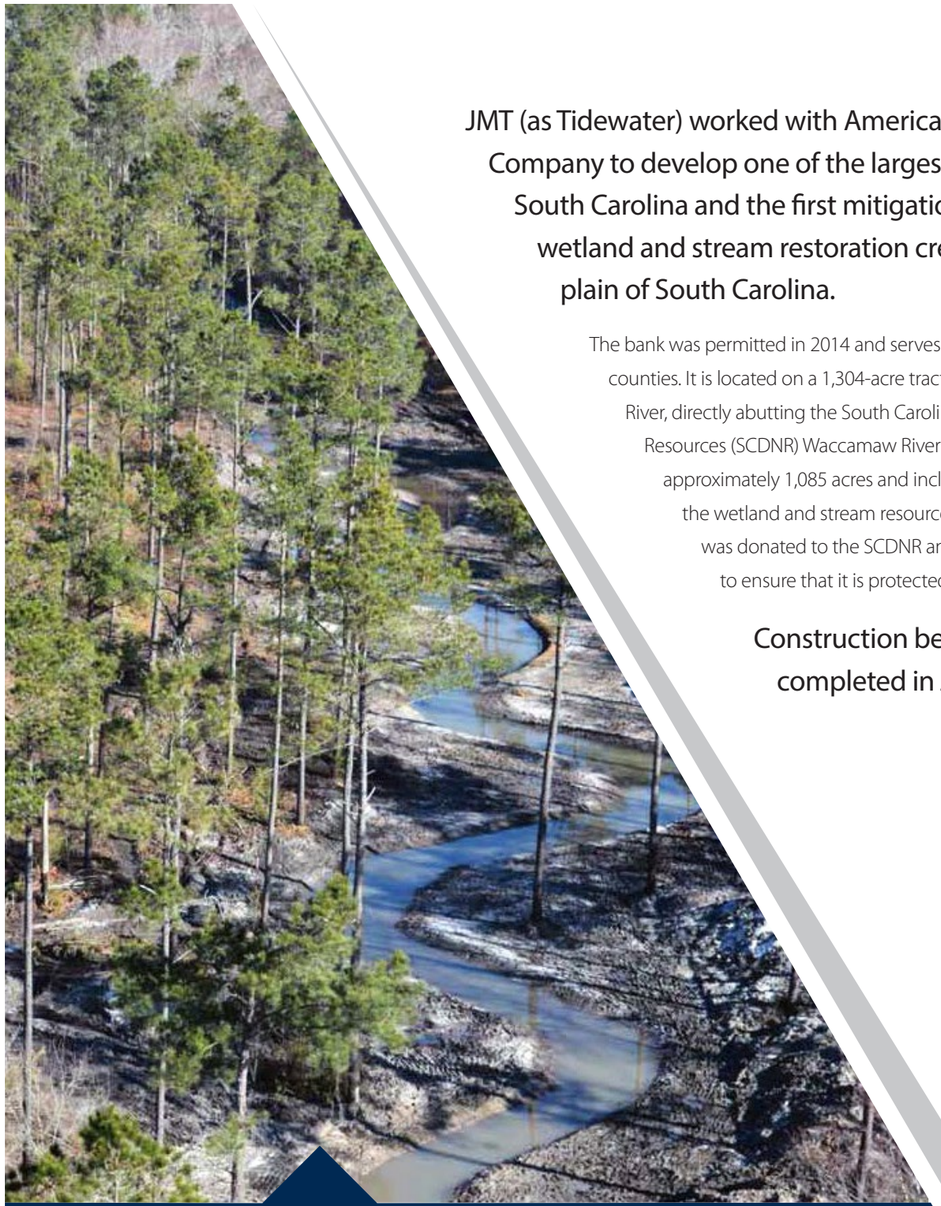
Project Highlights

- Mitigation plan will be used to offset the impacts associated with the US 17 Septima Clark project.
- Coordinated with the City of Charleston and United States Forest Service (USFS) to select mitigation sites located in the Francis Marion National Forest.
- Secured permits for the project from state and federal regulatory agencies within six months of submitting the permit application.

JMT (and previously as Tidewater) has worked with the City of Charleston and its prime contractor since 2007 to provide natural resource, permitting, and environmental documentation services for the US 17 Septima Clark transportation infrastructure reinvestment project.

The project includes the construction of a deep tunnel and pumped outfall stormwater management system to alleviate flooding issues within the Spring/Fishburne drainage basin in Charleston, SC. For this project, JMT performed a variety of services, including developing the NEPA categorical exclusion document, coordinating with multiple federal and state regulatory agencies, performing wetland and critical area delineations, developing a mitigation and wetland restoration plan, conducting protected species surveys, conducting an essential fish habitat assessment, developing project alternatives, and permitting for wetlands and navigable waters for the project. We secured permits for the project from state and federal regulatory agencies within six months of submitting the permit application.

Since application approval, JMT has continued to develop the mitigation plan that will be used to offset the impacts associated with the project. Numerous sites have been evaluated to find a location that complies with applicable permitting and mitigation regulations promulgated by the U.S. Environmental Protection Agency (USEPA), USACE, and SCDHEC-OCRM. The selected mitigation site is located in the Francis Marion National Forest on lands owned by USFS. JMT has collected baseline data, developed mitigation plans, and prepared NEPA documents in consultation with USFS. The mitigation plan includes the restoration of eight acres of salt marsh that is currently planted in pine. The restoration plan will also help USFS achieve certain forest management goals within this area of the national forest.



JMT (as Tidewater) worked with American Timberlands Company to develop one of the largest mitigation banks in South Carolina and the first mitigation bank to offer both wetland and stream restoration credits in the coastal plain of South Carolina.

The bank was permitted in 2014 and serves Horry and Georgetown counties. It is located on a 1,304-acre tract north of the Waccamaw River, directly abutting the South Carolina Department of Natural Resources (SCDNR) Waccamaw River Heritage Preserve. The bank is approximately 1,085 acres and includes a 150-foot buffer around the wetland and stream resources. The entire 1,304-acre tract was donated to the SCDNR and is now a part of the preserve to ensure that it is protected in perpetuity.

Construction began in 2014 and was completed in July 2016.

Carter Stilley Wetland & Stream Mitigation Bank

Horry County, SC

Approximately 8,467 linear feet of stream and 427 acres of wetlands have been enhanced or restored. An additional 279 acres of wetlands have been preserved. We completed a wetland delineation and GPS survey of the entire tract in eight weeks, collected baseline data to support the overall design, and oversaw construction activities.

Designing a coastal stream system presented unique challenges because the streams are naturally wide, shallow systems with a low slope. We initiated design efforts by assessing the site and collecting sufficient data (topographic, hydrologic, etc.) to evaluate existing site conditions and support development of construction documents and permitting.

During the initial phases of this project, our staff also initiated the process of identifying a reference reach to establish initial design metrics for the restored stream system. We identified and collected data at two reference sites located in the coastal plain of South Carolina and initiated a review of literature and past projects to compile data that included more than two reference sites. This information was used to develop the design criteria, to verify the proposed monitoring plan and performance standards, and to facilitate documentation of functional lift. Based on the metrics derived through this effort, we developed a channel section, plan, and profile to support restoration. The physical dimensions of the channel (section, plan, and profile) were then further refined via analytical and computational methods in order to transpose the form-based metrics to site specific solutions for the Carter Stilley tract.

Project Highlights

- One of the largest mitigation banks in South Carolina.
- The first mitigation bank to offer both wetland and stream restoration credits in the coastal plain of South Carolina.
- Includes 8,467 linear feet of stream, and 427 acres of wetlands enhanced or restored by the proposed restoration activities. An additional 279 acres of wetlands have been preserved.
- Wetland delineation and GPS survey of entire tract completed in eight weeks.
- Bank serves a variety of public and private clients in northeastern South Carolina.

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