SLR

Proposal

Engineering Services for Hazard Mitigation Grant Program

Flood Mitigation Scoping Study of the Winooski River and Its Tributaries

Major Disaster Declaration: FEMA-4720-DR-VT

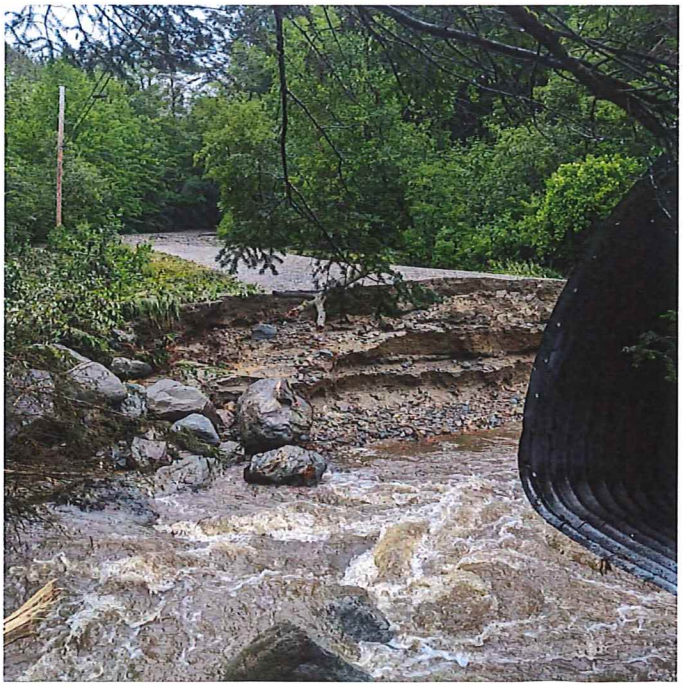
Project #: HMGP-4720-4R

Prepared For:

Town of Richmond, VT

SLR RFP No: 146.021032.00001

October 9, 2024



SLRCONSULTING.COM

SLR International Corporation
1 South Main Street, Waterbury, Vermont, 05676

October 9, 2024

Attn: Mr. Josh Arneson, Town Manager
Town of Richmond
203 Bridge Street, P.O Box 285
Richmond, VT 05477

SLR Project No.: 146.021032.00001

RE: Flood Mitigation Scoping Study of the Winooski River and Its Tributaries

Dear Mr. Arneson,

SLR International Corporation (SLR) is pleased to submit our firm's qualifications and proposal to provide engineering services for conducting a flood mitigation scoping study of the Winooski River and its tributaries in the Town of Richmond.

We believe that our team is uniquely qualified for this project as we specialize in multi-objective flood mitigation where both the natural environment and infrastructure are at risk. We have completed flood mitigation studies in communities across Vermont, such as in East Middlebury, Jeffersonville, Brattleboro, and Bennington, which are also located in dynamic river settings where channel geomorphology, erosion potential, and sediment processes dominate the risk setting. In addition to designing many flood mitigation projects, we have designed floodplain and river restoration projects. You will not find a team that can address the science and engineering needs of this project better.

The proposed project team will be led by Jessica Clark Louisos, PE, and includes water resource engineers and scientists that specialize in hydrology, hydraulics, geomorphology, and flood mitigation. Our team includes members licensed in engineering and Certified Floodplain Managers. In the case that more specialized questions arise during the alternatives analysis, we have an in-house team that extends our expertise to structural engineering, geotechnical engineering, and ecological sciences.

Our team has enjoyed prior experiences working with each of the project partners. We look forward to this new opportunity to work with the Town of Richmond on this important study. If we can provide you with any additional information, please do not hesitate to contact us.

Regards,

SLR International Corporation

Jessica Clark Louisos, PE
Principal Water Resources Engineer
jlouisos@slrconsulting.com

Roy Schiff, PhD, PE
Principal Water Resources Engineer & Scientist
rschiff@slrconsulting.com

Contents

Project Understanding

The Town of Richmond has experienced significant damage due to flooding over the past 20 years with three large flooding events occurring in the past two years. The Winooski River flows east to west through Town and right through the village center. Several tributaries are also prone to flooding and experienced catastrophic flooding this past July. Town roads, recreation fields, and infrastructure, in addition to private homes and roads, have experienced repetitive flooding and erosion damage throughout the Town.

The Winooski River through Richmond has a long history of flooding low lying areas of town. Significant flooding events occurred in July 2023, December 2023, and July 2024. The well for the Town water system, a pump station for the Town sewer system, the Wastewater Treatment Facility, and Volunteers' Green have suffered flood damage in these recent floods. Flooding of water and wastewater infrastructure results in untreated sewage discharges and suspension of potable water pump operations. Road closure from flooded roads prevent and slow travel of emergency services along town and state roads. This project will evaluate alternatives to reduce flooding and seek to mitigate damages along the Winooski River in Town.

Snipe Island Brook and Jones Mill Brook are tributaries to the Winooski River that have experienced recent flash floods with the July 2024 event causing significant flood and erosion damage. Snipe Island and Jones Mill Brooks flow from the north and are small streams under normal flow conditions. Both caused road and driveway washouts along their upper reaches. The low lying areas adjacent to the Winooski River floodplain have many homes and roads along each stream. Significant flooding and erosion damage was experienced by these homes and roads. SLR engineers have visited both streams in the wake of this July's flooding.

Figure 1: Washed out culverts on Snipe Island Brook under O'Neil Drive (photo by Jason McCune-Sanders)

The Huntington River is a major tributary that flows into the Winooski River approximately 3-miles upstream of the village center. Road erosion due to recent flooding along Dugway Road has required repeated repairs. The Halloween flood of 2019 washed out a portion of Dugway Road near Huntington Gorge. A lengthy road closure was required until a wall and riprap protection were installed to repair the slope. In addition, homes near Wes White Hill Road and Cochran Road experienced flooding and property loss during recent flooding.

This flood mitigation scoping study will analyze flood patterns along the Winooski River and its tributaries using state-of-the-art hydraulic modeling techniques. Alternatives to mitigate flooding and erosion risks will be identified and evaluated. A conceptual design sketch and Benefit-Cost Analysis (BCA) will be completed for up to three (3) of the chosen alternatives.

Approach to Scope of Work

Based on our understanding of flood patterns along the Winooski River and its tributaries, we propose the following approach to the scope of work listed in the RFP. We will kick-off the project with meetings to exchange information on flooding patterns and experiences. One meeting will be for the mainstem of the Winooski River and neighborhood meetings will be held for each of the three tributaries.

Modeling is only as good as the data you put into the model, and thus we have partnered with Whiteout Solutions of St. Johnsbury to collect drone-based topography across the project sites. This information will provide high-accuracy elevations of the priority river channels. LiDAR data collection will include topo-bathymetric systems to collect ground and below water elevation data for the Winooski River near the village center and the focus areas on the lower Snipe Island Brook and Jones Mill Brook in the areas where recent flooding has altered terrain, changes that would not show on the available state LiDAR (Figures 2 & 3). Data provided will include digital terrain models, digital surface models, water surface model, ground control points, and a data accuracy report.

SLR will assemble one comprehensive 2D hydraulic model of the project extent (Figure 4) to estimate flood levels under current conditions and to evaluate potential alternatives. The base models will be built using collected and existing LiDAR supplemented with FEMA geometry data where appropriate. The modeling will be validated with past high-water marks and flow records during floods. Model runs will include past flood events to reconstruct scenarios that the community has lived through as well as predicted future flood event levels.

Our team will develop an initial list of alternatives to evaluate and share them with the project team for input which would include representatives from the Town, SLR, and possibly Vermont Emergency Management (VEM). Potential mitigation alternatives will be identified with the project team input and review of past ideas. Additional mitigation alternatives will be identified during site reconnaissance completed by water resource scientists and engineers who have completed many successful flood mitigation projects. We anticipate projects identified may include reduction of constrictions like bridges and culverts in addition to increasing flood storage through restoration and reconnection of floodplains and wetlands. Once we reach consensus, we will use the hydraulic model to evaluate the flood mitigation alternatives.

Our team will present the project findings and recommendations at a team meeting and a public meeting. Our project team lives in and around Richmond and will not be charging mileage due to the close proximity of the project to our Waterbury, VT office.

We understand the urgency of responding to the devastating flooding, but also the time necessary to adequately study the hydraulics and the community process that goes into large flood mitigation projects. We have proposed time in the schedule to meet with the community and gain input. These necessary steps put project tasks outside the proposed project end date of November 18, the current deadline that Vermont Emergency Management (VEM) has set for HMGP 4720 applications. We have proposed one fast-tracked project to be completed ahead of the other project work to meet this deadline, but will need the project to be identified and authorized at the initial kick-off meeting to meet the short deadline. We propose that this project targets one of the VEM priority project types such as floodplain restoration in an area that was recently damaged, for example floodplain restoration along the lower Snipe Island Brook and replacement of a constricting culvert as one project package. In the case that VEM obtains their requested extension of the project deadline to April, there would be more time for project selection and development.

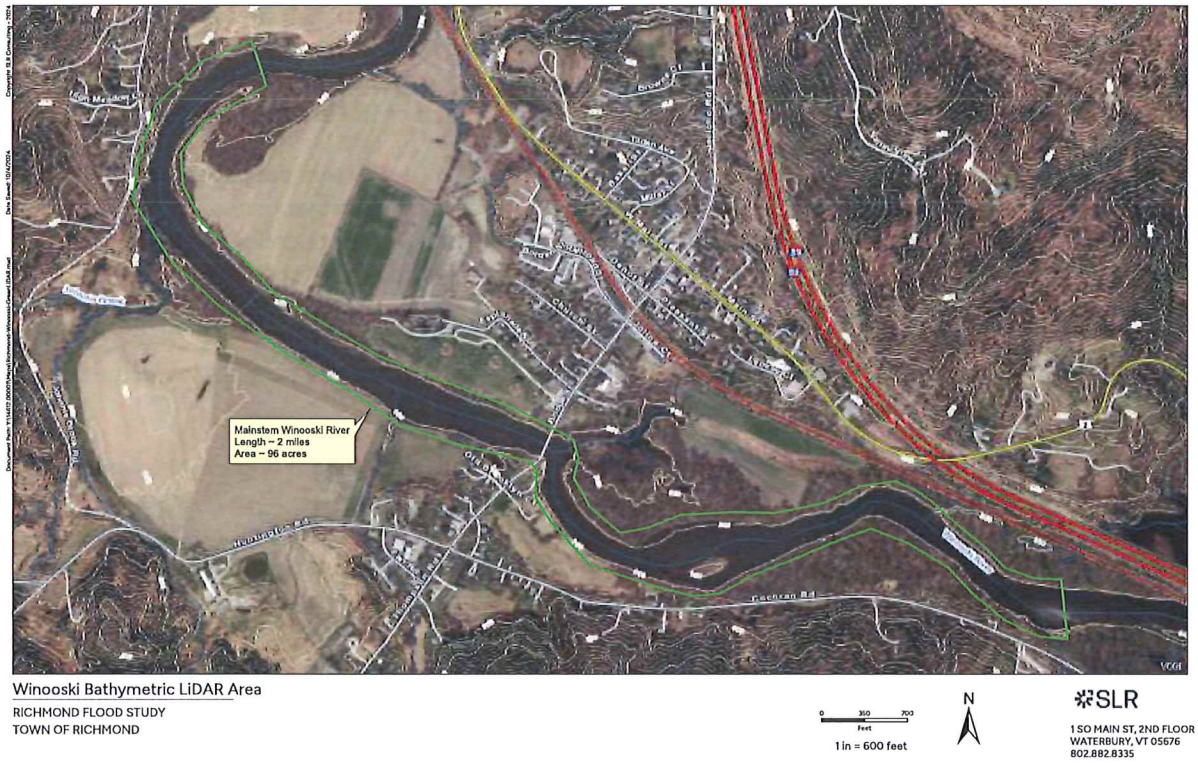
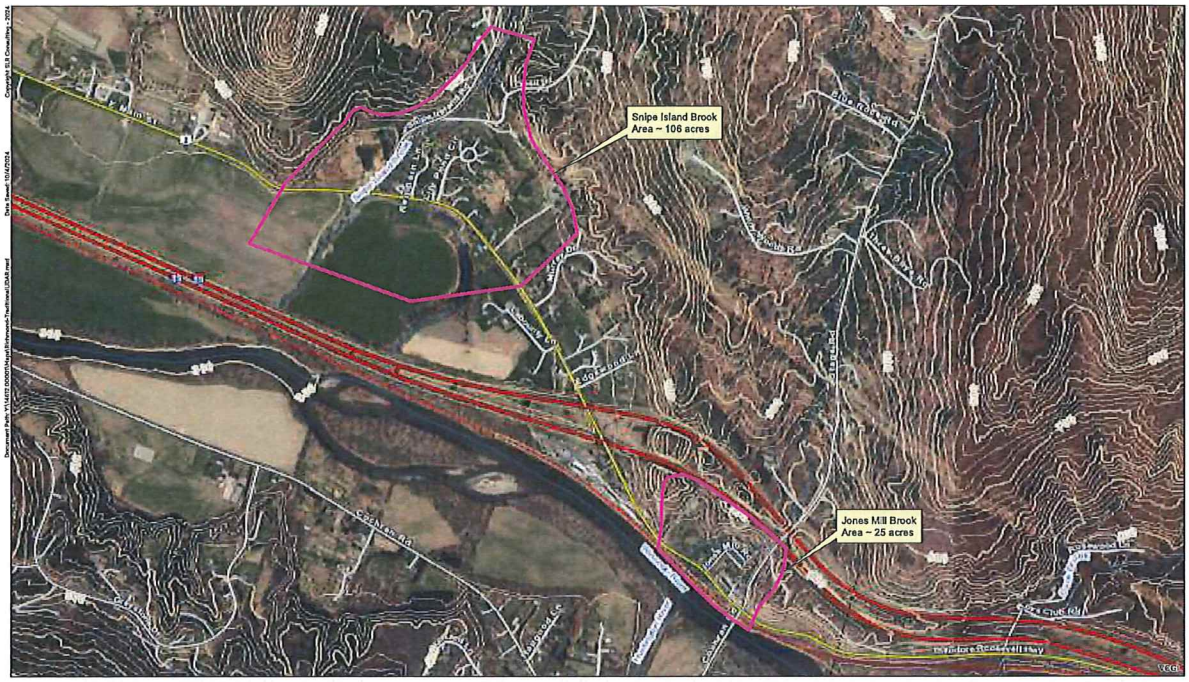


Figure 2: LiDAR data collection area on the Mainstem.



Traditional LiDAR Areas
RICHMOND FLOOD STUDY
TOWN OF RICHMOND

0 350 700
Feet
1 in = 700 feet

N

SLR
1 SO MAIN ST, 2ND FLOOR
WATERBURY, VT 05676
802.882.8335

Figure 3: LiDAR data collection area on the tributaries.

Project Area
RICHMOND FLOOD STUDY
TOWN OF RICHMOND

0 1,250 2,500
Feet
1 in = 2,500 feet

N

SLR
1 SO MAIN ST, 2ND FLOOR
WATERBURY, VT 05676
802.882.8335

Figure 4: Model extent.

Scope of Services

The following proposed scope of services details the project tasks based on our understanding of the project and approach to meeting the needs of the project team. We would be happy to refine the scope as needed with your input. Deliverables are underlined.

1.0 Data Collection and Project Initiation

1.1 Participate in a project team meeting to review existing conditions, previous flood and erosion damage, and project goals will be confirmed. During this meeting, project roles will be discussed, schedule, and plans for project outreach will be determined. Project team members will provide previous information on flooding and analysis. An initial list of alternatives will be compiled. Participate in a public meeting to describe the project elements, hear from the public on flood impacts, and collect initial alternative ideas. In the case that an expedited FEMA application will be completed for the fall deadline, one (1) project will be selected to be advanced ahead of the rest of the schedule.

1.2 Review existing information such as project evaluation areas provided by project partners, FEMA flood maps, FEMA hydraulic models, LiDAR-derived topographic mapping, VTrans and Town bridge plans, and previous geomorphic and river corridor plans.

1.3 Prepare a GIS project base map with existing available mapping to show previous geomorphic information, natural resources, and LiDAR elevation data. This mapping will be used to guide field work.

1.4 Conduct a windshield survey and stream walk to review river and floodplain conditions and collect information required to understand flood and erosion risk. Note locations of flood and erosion risk including structures and infrastructure.

1.5 Perform field survey of key wet channel cross sections, bridge openings, and floodplain features to improve detail in the model. Survey is anticipated to be a combination of topobathymetric UAV elevation and image data collection where LiDAR data needs to be updated and ground survey collected by Whiteout Solutions. A basemap will be created to combine the elevation data sources. An allowance for UAV data has been included, as shown in Figures 2 and 3 in the Approach section, plus eight key bridge openings. LiDAR data collected is for hydraulic study purposes only and not suitable for design or construction.

2.0 Hydraulic Modeling

2.1 Estimate flood peak hydrology from regression equations and scaling of USGS gauge data, compared to FEMA flows. Determine flood estimates of recent flood events. Prepare a hydraulic model of the existing conditions of Winooski River (7-miles) and sections of tributaries of Snipe Island Brook (0.5-miles), Jones Mill Brook (0.5-miles), and the Huntington River (1-mile), as shown in Figure 4. The model will use LiDAR data, supplemented with survey at key locations identified by the project team, and FEMA hydraulic modeling data.

2.2 Perform model validation/calibration based on past flooding in the area to ensure the model generally represents existing flood patterns. It is assumed that the project team will provide past flooding information in terms of date, approximate magnitude of flood, and extent of flooding. The level of detail of the model validation will rely on the availability of past flood information. A table of estimated model accuracy will be made.

2.3 Prepare a draft study report summarizing the above information for review by the project team. The focus will be on existing data and hydraulics results.

2.4 Prepare a draft list of alternatives based on initial project team input, field observations, and review of existing conditions modeling.

2.5 Two (2) neighborhood meetings to review the existing conditions modeling and list of alternatives, one (1) with each Snipe Island Brook and Jones Mill Brook residents.

2.6 Meet with the project team to review the existing conditions modeling and list of alternatives. Project team to select alternatives to include in the alternatives analysis.

3.0 Alternatives Analysis & Concept Design

3.1 Finalize the list of alternatives and use the HEC-RAS model to perform an alternatives analysis to evaluate the project goals, confirmed at the kick-off meeting, for 8-10 alternatives. We envision exploring a range of options such as do nothing, revegetation, floodplain restoration, large wood additions, berm removal, berm relocation, corridor protection, buyouts to move people away from risk, and structure changes. Additional alternatives will be identified in Tasks 1 and 2.

3.2 Delineate the existing and proposed floodplains in GIS to create a map of the 100-year inundation area and any changes due to the alternative.

3.3 Map alternative locations and footprints on project basemap. An alternatives analysis matrix will be created to evaluate each alternative according to project goals. A table of changes to flood elevations and velocities will be prepared.

3.4 Meet with the public to review alternatives and collect feedback. Meet with the project team to review the alternatives. Project team to select three (3) preferred alternatives to include in the conceptual designs.

3.5 Prepare up to three (3) 30% conceptual designs. Design sketches will be prepared in GIS using project base mapping and LiDAR-based elevation data. We anticipate preparing the following plan sheets: existing, proposed plan, typical section, and detail. Develop ballpark cost estimates for conceptual designs.

4.0 Reporting and Presentations

4.1 Prepare a draft memorandum that summarizes the model setup and the results of the alternatives analysis. The memorandum will build upon the summary prepared in Task 2.

4.2 Prepare up to three (3) FEMA Benefit-Cost Analyses, one for each conceptual design of the preferred alternatives. A FEMA BCA toolkit project will be completed along with a summary memo documenting input data. It is assumed that the Town will assist with collection of past damage and repair cost data, elevation certificates, and building data for buildings within the project effect areas.

4.3 Meet with the project team to review the draft memo and alternatives analysis. Prepare a presentation summarizing the project findings and methods. Attend one (1) public meeting to share results.

4.4 Consider feedback and make one (1) round of edits to finalize the memorandum.

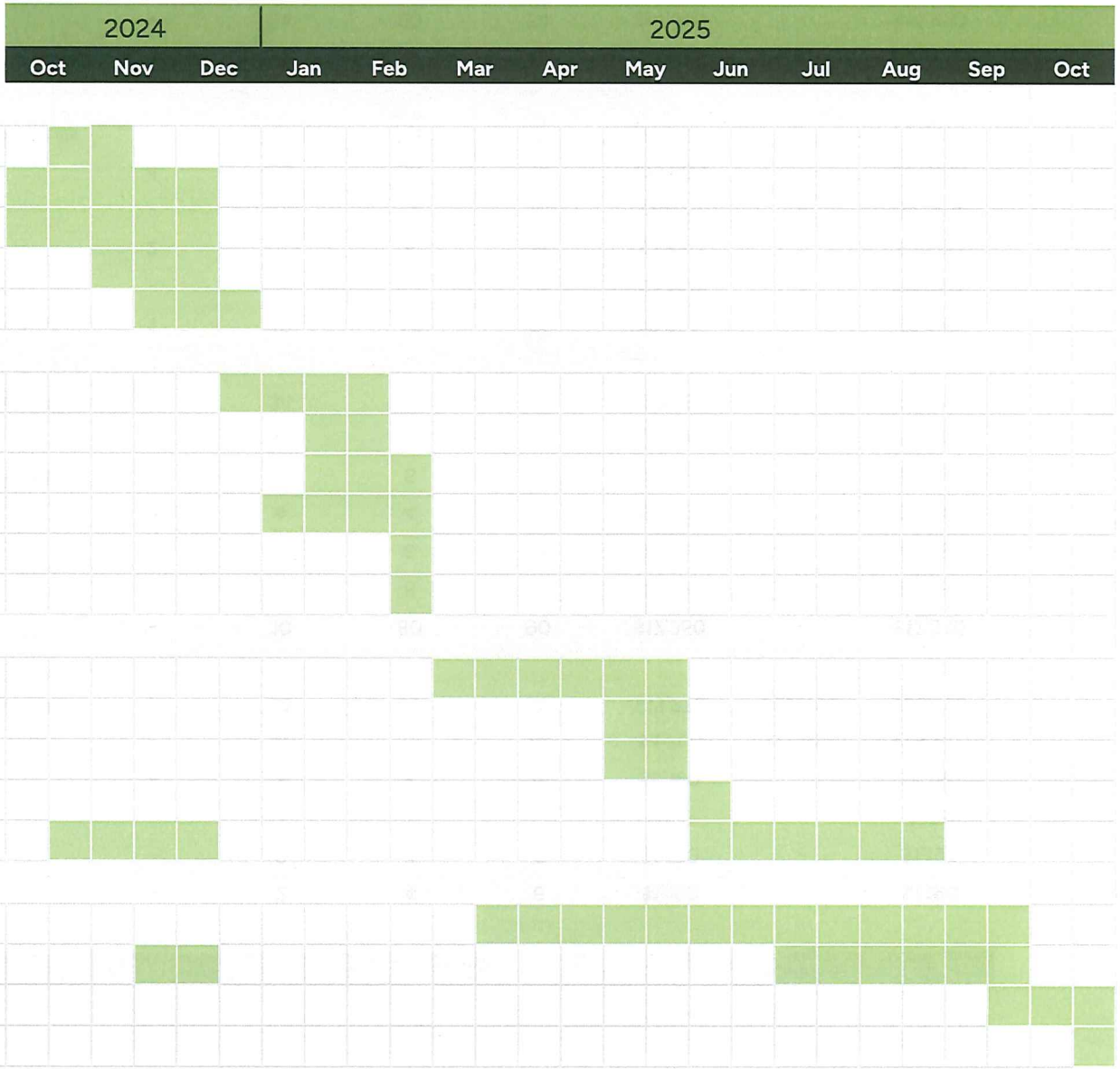
Exclusions and Limitations

The following services are not included in this proposal:

- Hydrologic watershed modeling (i.e. HEC-HMS, HydroCAD)
- Detailed topographic survey across the full project site
- Property boundary survey
- Engineering design, beyond 30% (concept design)
- Construction level cost estimates

Should any of the above items or any additional services be required, they can be provided on an hourly basis or for an agreed-upon lump sum fee.

Project Schedule



Task 1 – Data Collection and Project Initiation	
1.1	Project Kick-off & Public Meeting #1
1.2	Data Review
1.3	GIS Basemap
1.4	Site Visits
1.5	Field Survey
Task 2 – Hydraulic Modeling	
2.1	Hydraulic Model with LiDAR & Survey
2.2	Model Validation
2.3	Existing Conditions & Hydraulics Memo
2.4	Initial List of Alternatives
2.5	Neighborhood Meetings (Snipe Island and Jones Mill)
2.6	Project Team Meeting
Task 3 – Alternatives Analysis & Concept Design	
3.1	Explore Restoration & Flood Mitigation Alternatives
3.2	Flood Path & Velocity Mapping
3.3	Alternatives Matrix to Summarize Results
3.4	Project Team Meeting & Public Meeting #2
3.5	Concept Design (30%)
Task 4 – Reporting and Presentations	
4.1	Draft Report
4.2	Benefit Cost-Analysis
4.3	Project Team Meeting & Public Meeting #3
4.4	Final Report

Cost Proposal

The tasks will be completed for the following lump sum fees based upon the level of effort itemized.

	Project Role	Project Advisor	Project Manager	Project Engineer	Time	Labor	Survey	Fee
	Task Description	**$240**	**$215**	**$190**	**(hours)**	**($USD)**		**($USD)**
Task 1 – Data Collection and Project Initiation								
1.1	Project Kick-off & Public Meeting #1	-	2	4	6	$1,190	-	$1,190
1.2	Data Review	-	2	4	6	$1,190	-	$1,190
1.3	GIS Basemap	-	1	4	5	$975	-	$975
1.4	Site Visits	8	8	8	24	$5,160	-	$5,160
1.5	Field Survey	-	8	16	24	$4,760	$23,480	$28,240
	Task 1 Subtotals	**8**	**21**	36	**65**	**$13,275**	**$23,480**	**$36,755**
Task 2 – Hydraulic Modeling								
2.1	Hydraulic Model with LiDAR & Survey	-	10	80	90	$17,350	-	$17,350
2.2	Model Validation	2	4	8	14	$2,860	-	$2,860
2.3	Existing Conditions & Hydraulics Memo	-	6	6	12	$2,430	-	$2,430
2.4	Initial List of Alternatives	2	4	4	10	$2,100	-	$2,100
2.5	Neighborhood Meetings (Snipe Island and Jones Mill)	-	6	6	12	$2,430	-	$2,430
2.6	Project Team Meeting	-	4	4	8	$1,620	-	$1,620
	Task 2 Subtotals	**4**	**34**	**108**	**146**	**$28,790**	**$0**	**$28,790**
Task 3 – Alternatives Analysis & Concept Design								
3.1	Explore Restoration & Flood Mitigation Alternatives	1	10	40	51	$9,990	-	$9,990
3.2	Flood Path & Velocity Mapping	-	6	15	21	$4,140	-	$4,140
3.3	Alternatives Matrix to Summarize Results	2	4	8	14	$2,860	-	$2,860
3.4	Project Team Meeting & Public Meeting #2	-	5	5	10	$2,025	-	$2,025
3.5	Concept Design (30%)	4	40	50	94	$19,060	-	$19,060
	Task 3 Subtotals	**7**	**65**	**118**	**190**	**$38,075**	**$0**	**$38,075**
Task 4 – Reporting and Presentations								
4.1	Draft Report	1	3	8	12	$2,405	-	$2,405
4.2	Benefit Cost-Analysis	-	24	50	74	$14,660	-	$14,660
4.3	Project Team Meeting & Public Meeting #3	-	6	6	12	$2,430	-	$2,430
4.4	Final Report	2	3	4	10	$1,885	-	$1,885
	Task 4 Subtotals	**3**	**36**	**68**	**108**	**$21,380**	**$0**	**$21,380**
	TOTAL	**22**	**156**	**330**	**509**	**$101,520**	**$23,480**	**$125,000**

ENGINEERING SERVICES FOR HAZARD MITIGATION GRANT PROGRAM
BID FORM

Submit this page along with supporting documents as your complete bid proposal

Lump Sum Engineering Services for Hazard Mitigation Grant Program

$: 125,000.00

The Town of Richmond reserves the right to accept or reject any or all bids, or parts thereof, or to select the bid to be in the best interest of the Town.

Bid submitted by:

Contractor: SLR International Corporation

Address: 1 South Main Street, Waterbury, VT 05676

Phone: (802) 882-8335 E-mail: jlouisos@slrconsulting.com

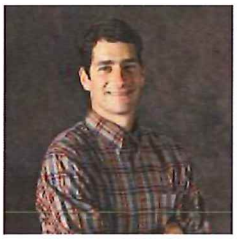
Contractor Authorized Agent Signature: Jessica C Louisos

Printed Name and Title: Jessica Clark Louisos, MS, PE - Principal Water Resources Engineer

Date bid Signed: 10/07/2024

Project Team

Jessica Louisos, MS, PE, is a Water Resources Engineer at SLR who specializes in flood risk mitigation, hydraulic analysis, geomorphic design, river/floodplain restoration, and stormwater treatment design. She has led many comprehensive flood risk mitigation projects, floodplain restoration designs, and watershed master planning. She has worked extensively within the Lake Champlain watersheds. Jessica will serve as Project Manager, will participate in all project tasks, and will be the primary point of contact.



Roy Schiff, PhD, PE, is a Water Resources Engineer and Scientist at SLR who has expertise in floodplain restoration, fluvial geomorphology, bank stabilization, transportation resiliency, water quality assessment, and hydrology and hydraulics. Roy has led channel and floodplain restoration and road protection projects. He led the development of the MRGP protocols, VTrans TRPT, and DEC FFI. Roy will do quality control and assist with geomorphic design elements.

Brian Cote, PE, CFM is a Water Resources Engineer at SLR who specializes in hydrologic and hydraulic analysis and design. His project experience includes design of flood mitigation and erosion protection measures, as well as dam safety analysis and stormwater management. Brian will provide internal review of hydrologic and hydraulic analysis.

Doug Osborne, MS, PE, is a Water Resource Engineer at SLR who has designed many floodplain restoration, dam removals, flood mitigation projects. He will assist with hydrologic and hydraulic modeling.

Alex Marcucci, CFM, is a Water Resources Scientist at SLR and is a Certified Floodplain Manager with field experience in resource assessment and geomorphology. She will assist with data collection, alternatives identification and evaluation, and reporting.

Ethan Ely, MS, PE, is a Water Resources Engineer and UAV (drone) pilot and completes hydraulic modeling for flood risk evaluation. He will assist with field work, data collection and processing, and hydraulic modeling.

Jessica C. Louisos, MS, PE

Principal Water Resources Engineer | Waterbury, VT

Jessica Louisos is a Principal Water Resources Engineer specializing in geomorphological and bio-engineering designs for riverine systems and watersheds. She has designed numerous river restoration, dam removal, stormwater mitigation and green infrastructure, flood mitigation and recovery, bank and gully stabilization, culvert, bridge scour, and aquatic organism passage projects. She has managed projects and performed tasks at all project stages including project scoping, field data collection, modeling, design, permitting, cost estimating, and construction oversight for many projects. Jessica has broad field experience in geomorphic and habitat assessment, stormwater master planning, and construction observation. She has advanced river and watershed modeling experience including multiple hydrology models and one- and two-dimensional hydraulic modeling to inform flood mitigation, bridge scour and design, and restoration projects. Jessica was awarded the 2013 Vermont State Young Engineer of the Year Award.

Years of Experience

17 years with the firm

Professional Registrations

- Professional Engineer - VT, MA, NH, NY; FEMA Benefit-Cost Analysis Certification; Vermont Natural Shoreland Erosion Control Certification; Vermont Rivers & Roads Training

Education

- MS, Environmental Engineering, University of Vermont
- BS, Civil & Environmental Engineering, University of Vermont

Project Experience

Melrose Terrace Floodplain Restoration, Brattleboro, VT
Designed a floodplain restoration and reconnection and bridge improvements including removal of multiple buildings and site redesign to reduce flood hazard risk for the community. Completed geomorphic assessment, hydraulic modeling, engineering design, and Benefit Cost Analysis to assist with project funding.

Beecher Hill Brook Floodplain Restoration, Hinesburg, VT
Managed and designed floodplain restoration along Beecher Hill Brook at a degraded site formerly used and filled by the town garage. Completed hydraulic modeling, geomorphic assessment, project design, revegetation plans, permitting, and cost estimates. The floodplain will be reconnected by removal of buildings and berms, excavating filled land along the river, and raising the river through nature-based log and wood structures in the channel to provide lateral and vertical connectivity to the floodplain.

Sleeper Pond Dam Alternatives Analysis, Newport Center, VT
Completed feasibility analysis comparing alternatives for dam removal, replacement, or repair at a poor condition dam. This analysis included site survey, sediment sampling, hydraulic modeling, permit considerations, and cost estimates to help the client and community determine an action plan for improving safety and water quality.

Jeffersonville Village Flood Study and Hazard Mitigation, Jeffersonville, VT
Recommended flood mitigation projects for the Village of Jeffersonville, a low-lying village center at the confluence of the Brewster River and Lamoille River. Completed advanced split-flow hydraulic modeling at the confluence to study alternatives for flood mitigation. Conceptual designs, cost estimates, and next steps were provided for floodplain mitigation, overflow culverts, bridge replacement, and bypass culverts.

Middlebury River Flood Mitigation Study, East Middlebury, VT
Assisted with field data collection, alternatives analysis, and concept design plans to reduce flood and erosion hazards in the Village of East Middlebury. Participated in public outreach and reviewed FEMA benefit cost analysis.

Youngs Brook Dam Removal, West Rutland, VT
Modeled alternatives and completed design for removal of a large earthen embankment dam on Young's Brook. Completed geomorphic and habitat assessment. This previous drinking water supply dam has been breached, blocked fish passage, and has degraded habitat.

Barnes Camp / VT Route 108 Garage, Stowe, VT
A steep high-elevation headwaters stream on Mount Mansfield is carrying a large amount of sediment and risking downstream infrastructure including a maintenance facility and state highway. Assisted with alternatives analysis and design, reviewed modeling, and completed FEMA Benefit Cost Analysis to assist with project funding.

East Burke Dam Removal, East Burke, VT
Completed field data collection, hydraulic modeling, design plans, and permitting for the removal of the East Burke Dam on the East Branch of the Passumpsic River. Geomorphic assessment and sediment loading analysis informed the design to restore the channel. Oversaw construction and completed post-construction monitoring.

Dog River Flood Study, Northfield, VT
Created hydraulic model to evaluate flood mitigation alternatives for a floodprone neighborhood and make recommendations for dual-benefit projects for incorporation into a new park area following FEMA buyout of multiple homes. Completed concept design and cost opinions for floodplain restoration project.

Marble Mill Park Underground Stormwater Treatment Project, Swanton, VT
Designed underground stormwater treatment retrofit system to treat runoff from a large portion of Swanton Village prior to discharge in the Missisquoi River. Investigated groundwater and soil conditions with groundwater monitoring and test pits. Completed concept design and cost opinions for a variety of filtration systems to maximize phosphorus removal and final design and construction oversight for a hydrodynamic separator.

Lewis Creek Habitat & Geomorphic Assessment, Addison County, VT
Assessed habitat conditions for selected mainstream and tributary reaches using the Vermont Agency of Natural Resources' newly updated Reach Habitat Assessment protocols. Performed Phase 2 Stream Geomorphic Assessment, including new stream habitat protocols for High Knob tributary. Recommendations for restoration and protection of habitat were provided for each reach segment.

Aquatic Organism Passage Restoration Crossett Brook & Beaver Meadow Brook Restoration & Fish Passage, Duxbury & Marshfield, VT
Evaluated potential aquatic organism passage projects on Crossett Brook and Beaver Meadow Brook, tributaries of the Winooski River. Completed final design, permitting, and construction oversight for two culvert retrofit projects and a culvert replacement. Design elements included culvert baffles, roughened river ramp, grade control weir structures, and a new 20-foot-wide open-bottom arch founded on bedrock.

North Washington Bridge Two-Dimensional Modeling, Boston, MA
Created two-dimensional hydrodynamic hydraulic models to evaluate water depth and velocity, inform bridge scour analysis, and provide recommendations for scour countermeasures for a proposed new bridge. The modeling included mesh refinement and specification of boundary conditions for multiple scenarios representing tidal extremes and different hydraulic conditions of the Charles River, including representation of the New Charles River Dam, a complex flood control dam located immediately upstream of the project site.

Memberships and Associations

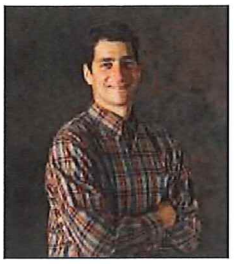
- American Society of Civil Engineers, Vermont Section, Past-President and Government Relations Chair; American Society of Ecological Engineering; South Burlington Planning Commission, Chair; University of Vermont, School of Engineering, Board of Advisors; WTS International, Vermont Treasurer

Awards

- Vermont State Young Engineer of the Year, 2013

Roy Schiff, PHD, PE

Principal Water Resources Engineer & Scientist | Waterbury, VT



Roy Schiff specializes in river and floodplain restoration, geomorphic and habitat assessment, flood mitigation, hydrology and hydraulics, transportation resilience, and sediment transport analysis. In addition to applied restoration work such as channel creation, bank stabilization, and dam/levee removal, he has been involved in several research projects across Vermont and the region evaluating the economic impacts of living in floodplains, drafting best engineering practices to reduce future flood risks, improving protocols for habitat assessment, and creating guidelines for channel restoration. Other experience includes dam removal, dam failure analysis, culvert design, bridge scour analysis, floodplain management, and biomonitoring.

Years of Experience

19 years with the firm | 2 years with other firms

Professional Registrations

- Professional Engineer - VT; Certified Soil Evaluator, University of Massachusetts

Education

- PhD, Stream Restoration & Aquatic Ecosystems, Yale School of Forestry & Environmental Studies
- MS, Environmental Science & Engineering, University of Washington
- BS, Engineering, University of Rochester

Project Experience

Vermont Route 125 Flood Mitigation Analysis, Ripton & Middlebury, VT
Collected field data and performed alternatives analysis to reduce flood impact along Route 125. Assisted with data collection for the FEMA benefit cost analysis. Presented findings to project team and drafted summary memorandum explaining methods and results.

Barnes Camp / VT Route 108 Garage, Stowe, VT
Collected data, performed alternatives analysis, and prepared design to reduce flood and erosion risks to a business, and state highway. Assisted with preparation of a FEMA Benefit-Cost Analysis (BCA). Presented findings to stewardship team to seek design consensus.

Roaring Branch Sediment Management Plan, Bennington, VT
Created a sediment management plan to reduce risks at a hazardous river location in a populated area. Developed screening methods, guided data collection, reviewed data, designed sediment removal, permitted sediment removal, and assisted with implementation.

Middlebury River Flood Study, East Middlebury, VT
Performed data collection assisted with hydraulic modeling, assisted with sediment transport modeling, and developed flood reduction alternatives to reduce flood risks in the Village of East Middlebury, Vermont. Designed and implemented flood mitigation alternatives. Created a sediment management plan.

Roaring Branch Flood Recovery, Bennington, VT
Performed a hydrology, hydraulic, and sediment transport analysis to analyze existing conditions and alternatives to reduce flood and erosion hazards. Assisted with FEMA Benefit-Cost Analysis and performed bid management.

Lamoille River Hydraulic Modeling and Flood Studies, Lamoille County, VT
Led project to prepare mainstem Lamoille River hydraulic model and to evaluate flood mitigation alternatives in Jeffersonville, Cambridge, Wolcott, and Johnson. Coordinated survey, performed field assessments, built model, considered alternatives, prepared reports, and gave public presentations.

Whetstone Brook Flood Control Analysis, West Brattleboro, VT
Performed field data collection and alternatives analysis to help reduce flood risks as the area rebuilds from Tropical Storm Irene. Housing was proposed and the study sought to remove or relocate buildings to reduce flood hazards.

Whetstone Brook Floodplain Restoration at Melrose Terrace, Brattleboro, VT
Conducted site assessment and assisted with alternatives analysis to reduce flood risk by floodplain restoration. Coordinated survey and assisted with hydraulic modeling. Designed the floodplain restoration.

East Burke Dam Removal, East Burke, VT
Led sediment management study, design, permitting, and construction oversight for removal of dam in village setting. Met with landowners to review the merits of the project.

Great Brook Fish Passage & Restoration, Plainfield, VT
Performed survey, alternatives analysis, design, permitting, and construction oversight for retrofits at three concrete box culverts. Following installation performed several rounds of evaluation monitoring to confirm fish passage was improved.

Bristol Flats Alternatives Analysis, Bristol, VT
Assisted with an alternatives analysis to reduce flood and erosion risks in a floodprone corridor on the New Haven River.

Lewis Creek Habitat, Geomorphic Assessment, Addison County, VT
Assessed stream habitat and geomorphic condition on selected reaches along the mainstem and tributaries of Lewis Creek. The work utilized the newly developed Vermont reach habitat assessment protocols developed by the firm. Stream condition was used to establish recommendations for channel protection and management strategies. Assisted with the production of sub-watershed GIS maps for use on a variety of projects by the Lewis Creek Association.

Vermont Economic Resiliency Initiative (VERI) Flood Hazard Mitigation Analysis, Barre, Brandon, Brattleboro, Enosburg, Woodstock, VT
Considered improvements of rural gravel roads to maintain access to homes and businesses during flooding and flood recovery for five Vermont towns. Performed fieldwork and alternatives analysis for Enosburgh and Brattleboro. Assisted with alternatives analysis for other towns. Led discussions about flood mitigation at public meetings. Performed project reporting.

Missisquoi Bay Basin Critical Source Area, Missisquoi River, VT
Participated on project team to research and parameterize river and floodplain contributions of sediment and phosphorus to the Missisquoi River. Performed GIS analyses to develop variables for the basin wide SWAT model. Assisted with reporting.

Winooski Street Bridge Restriction/Flood Study, Waterbury, VT
Led project to identify flood reduction alternatives in Waterbury and Duxbury Villages. Assisted with data collection, hydrology and hydraulic modeling, conceptual design of floodplain restoration, FEMA BCA and HMGP application. Coordinated with town and landowners and presented findings to the town and state.

Memberships and Associations

- American Rivers; American Society of Civil Engineers (ASCE); American Water Resources Association (AWRA); Trout Unlimited (TU) MadDog Chapter

Additional Training

- **Vermont Rivers & Roads Training Program, State of Vermont:** Designed, planned, and implemented advanced training program about fluvial geomorphology and resilient design. The training improves design in river-road conflict areas, and ultimately will lead to a more resilient transportation system and less impacts to river systems.
- **HEC-RAS Training Workshop for Modeling Bridges & Culverts, State of New York:** Designed, planned, and helped teach a training program on hydraulic modeling.
- **Sediment Transport Training Workshop, State of New York:** Designed, planned, and helped teach a training program on sediment transport methods.

Brian M. Cote, PE, CFM

Principal Water Resources Engineer | Waterbury, VT

Brian Cote specializes in hydrologic and hydraulic analysis and design. His project experience includes design and analysis of stormwater management and treatment systems using traditional as well as green stormwater infrastructure and best management practices. Additional project experience includes detention/ water quality basin design; floodplain management; site development and layout; Low Impact Development (LID) design; sediment and erosion control measures; hydraulic analysis of stream channels, culverts, and bridges; dam safety assessment, modification, and removal; as well as the development of construction plans and project specifications.

Years of Experience

27 years with the firm

Professional Registrations

- Professional Engineer - VT
- Certified Floodplain Manager (CFM)

Education

- BS, Civil & Environmental Engineering, University of Vermont

Project Experience

Baker Bridge on Lincoln Road Bridge Inspection, Ripton, VT
Tasked with data collection, site assessment, and base mapping. Assisted with structural assessment of the existing bridge. Performed alternatives analysis to improve crossing considering road alignment, traffic flow, river form and processes, hydraulics, erosion, stormwater runoff, and other environmental aspects of the area.

Route 9 - Whetstone Brook Corridor Resiliency Project, Brattleboro & Marlboro, VT
Assisted VTrans with design and review as part of a FEMA Pre-Disaster Mitigation Grant project. Developed a hydraulic model and alternatives of protective measures including road embankment stabilization and floodplain restoration. Provided technical review of design plans.

Whetstone Brook Pre-Disaster Mitigation Floodplain Restoration, Brattleboro, VT
Led the design of a floodplain restoration project at a former mill site that has been filled historically. Tasked with preparing a hydraulic model using high-resolution LiDAR data supplemented with field survey data. Conducted field reconnaissance to assess existing site conditions and inform design. Conducted an alternatives analysis and prepared matrix to assist with selection of the preferred alternative. Worked with subconsultants to coordinate field survey needs and required soil remediation due to the presence of contaminants. Coordinated and attended project team meetings with the client and Town staff. Prepared preliminary design plans and assisted with the benefit-cost analysis (BCA).

Melrose Terrace Floodplain Restoration, Brattleboro, VT
Tasked with preparing final hydraulic analysis and application package for a FEMA CLOMR application required to receive HMGP funding. Prepared presentation and presented project at a local public hearing for floodplain management permitting. Coordinated and attended project team meetings with client and Town staff. Assisted with the preparation of final plans and specifications.

Winooski Street Bridge Restriction/Flood Study, Waterbury, VT
Tasked with preparing hydrologic analysis and hydraulic modeling of the Winooski River study reach in the villages of Waterbury and Duxbury. Conducted an alternatives analysis to evaluate potential mitigation measures to reduce vulnerability in the most flood-prone areas. Prepared flood inundation and depth mapping and assisted with data collection.

North Washington Street Bridge, Boston, MA
Project team member responsible for assisting with and reviewing the hydraulic modeling and scour computations in support of proposed design for the tidally influenced bridge, locks, and pumping facility located on the Charles River just upstream of the North Washington Street Bridge.

Middlebury River Flood Mitigation Study, East Middlebury, VT
Served as Design Engineer for a flood management and floodplain restoration project along the Middlebury River corridor through a rural village setting. Tasks included field reconnaissance, hydraulic modeling and analysis, sediment transport modeling, and alternatives analysis. Assisted with design of repairs to an existing floodwall and proposed floodwall extension.

Great Brook Bridge Alternative Analysis, Plainfield, VT
Conducted hydrologic and hydraulic analysis of the lower Great Brook in Plainfield, Vermont to evaluate vulnerabilities at two bridges prone to flood and erosion damages. Evaluated alternatives to reduce flood and erosion risks. Prepared concept plans of the preferred alternative.

Lake John Dam Hazard Reclassification, Royalton, VT
Project Manager for a hazard evaluation and reclassification analysis for the Lake John and Lake Casper Dams used as storage for the municipal water system. Work included site reconnaissance, field survey, and a visual inspection of the dams. Tasked with preparing a detailed hydrologic model of the watershed contributing to the impoundments, conducting a dam breach analysis assuming multiple failures scenarios, and developing a 2-dimensional hydraulic model of the downstream channel that passes through the town center before discharging to the White River. Responsible for preparation of inundation mapping and incremental damage evaluation to determine hazard classification of both dams. Results of the analysis were summarized in a report with detailed results attached. Coordinated review of the analysis with the Vermont Dam Safety Program to gain acceptance of the analyses performed and updated hazard classification.

West Branch Little River Management Project, Stowe, VT
Tasked with preparing a hydraulic model of the West Branch Little River to evaluate flooding, sediment transport, and riverbank erosion through the study reach. The farm land and recreational path located along the banks of the river had experienced loss and erosional damage during recent floods. Evaluated alternatives to increase resiliency using a combination of flood mitigation to increase channel capacity during floods and riverbank stabilization to help protect nearby land uses. Prepared construction documents, assisted with bidding, and conducted oversight during construction.

Colchester Point Fishing Access, Colchester, VT
Prepared a detailed hydraulic analysis of the Winooski River at the Vermont Fish & Wildlife Department's fishing access and boat ramp at Colchester Point. Tasked with estimating hydrologic flow rates for several different recurrence intervals and median monthly conditions. Prepared a 2-dimensional hydraulic model of the river channel and boat launch area to evaluate sediment deposition patterns under existing conditions and several alternatives designed to reduce deposition and frequency of dredging required to keep the boat ramp open throughout the summer season. Responsible for preparing conceptual design plans and reporting. Developed construction plans and bid documents for dredging of the deposited sediment. Performed construction oversight during dredging operations.

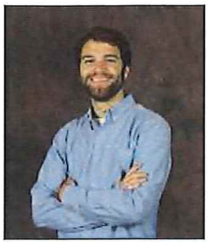
Hinesburg Growth Center Hydrology and Stormwater Assessment, Hinesburg, VT
Assisted with technical review of hydrologic analysis prepared as part of the stormwater assessment and provided guidance with modeling details such as subwatershed delineation, channel routing, storage area routing, as well as peak rate and runoff volume estimations.

Memberships and Associations

- Association of State Dam Safety Officials
- Association of State Floodplain Managers

Douglas Osborne, PE

Associate Water Resources Engineer | Waterbury, VT



Douglas Osborne is responsible for supporting all aspects of Water Resources Engineering projects, particularly floodplain restorations, stormwater treatments, and flood analyses. His experience includes preparing site plans using AutoCAD and AutoCAD Civil 3D for a variety of projects, including water main replacements, culvert replacements and dredging projects; utilizing ArcGIS to create site maps and evaluate land use, surficial geology, and topography surrounding pumping well sites; and supervising construction of water main replacement projects, keeping field book records of completed work and maintaining daily logs of construction progress.

Years of Experience

5 years with the firm | 1 year with other firms

Professional Registrations

- Professional Engineer - VT

Education

- MS, Civil Engineering, University of New Hampshire
- BS, Civil Engineering and International Affairs, University of New Hampshire

Project Experience

VT 15 Overflow Flood Culverts, Jeffersonville, VT
Assisted with culvert design to reduce flood and erosion hazards including alternatives analysis, design review, permitting, and construction oversight.

Vermont Land Trust Forest Flood Resiliency Tool, State of Vermont
Assisted with GIS analysis in creating a screening tool for the Lamoille River watershed to determine downstream impact of development in headwater watersheds.

Beecher Hill Brook Flood Study, Hinesburg, VT
Created a hydraulic model to evaluate alternatives to reconnect an unstable reach of Beecher Hill Brook to its floodplain. Evaluated alternatives for their ability to reduce risk to a downstream culvert, reduce local bank erosion and provide a floodplain deposition zone.

Whetstone Brook Floodplain Restoration at Melrose Terrace, Brattleboro, VT
Participated in data collection, design, and permitting to reduce flood risk by floodplain restoration.

Dog River Floodplain Restoration, Northfield, VT
Assisted with construction oversight and monitoring for floodplain restoration, berm removal, and removal of channel constriction to reduce flooding in the adjacent neighborhood.

Sleeper Pond Dam Alternatives Analysis, Newport Center, VT
Assisted with field data collection and alternatives analysis to determine best action for an existing dam, including repair, removal and replacement. Performed hydraulic modeling (HEC-RAS) of existing conditions and proposed alternatives.

Camp Wihakowi Dam Removal, Northfield, VT
Provided engineering assistance to the Friends of the Winooski River for removal of the Camp Wihakowi Dam on Bull Run. A rapid dam safety assessment, geomorphic and habitat assessment, and survey were completed to inform the design. Sediment analysis was completed to determine the quantity and quality of sediment filling the impoundment behind the dam.

Douglas Osborne, PE
Associate Water Resources Engineer | Waterbury, VT

Wainwright Mill Dam Removal Feasibility Assessment, Salisbury, VT
Completed field data collection, compilation of background data, and feasibility assessment for a mill dam on Halnon Brook also known as Halnon Pond Dam.

Plainfield Health Center Stormwater Design, Plainfield, VT
Completed stormwater runoff calculations, field assessment of stormwater flow and subwatershed boundaries, water quality improvement quantification, and design plans for stormwater improvements and gully stabilization.

Moon Brook Combination Pond Dam Safety Assessment and Hazard Classification, Rutland, VT
Performed dam breach analysis and inundation mapping for Combination Pond Dam. Ran HydroCAD model and illustrated the breach flood wave using unsteady HEC-RAS model. Completed stormwater design calculations and designed hydrodynamic separator.

Mill Pond Dam Removal, Colchester, VT
Created design plans and assisted with permitting for removal of dam and upstream sediments and subsequent channel restoration. Assisted with hydraulic modeling of removal alternatives and construction oversight.

Preston Brook Berm Removal Feasibility Study, Bolton, VT
Assisted with field data collection, mapping, and alternatives analysis to determine risks and benefits of removing berms in an alluvial fan setting. Each alternative was modeled to evaluate the impacts of altered hydraulics on adjacent historic farm buildings, active farm fields, floodplain accessibility, and sediment transport.

Massabesic Lake Dam, Manchester, NH
Performed hydrologic analysis for the Massabesic Lake drainage area. Developed composite curve numbers, computed average sub-watershed land slope in ArcGIS, and delineated hydraulic lengths for sub-watersheds. Assisted with HydroCAD modeling upstream and downstream of dam.

East Calais Post Office Stormwater Design, East Calais, VT
Assisted with final design of stormwater treatment retrofit to add an underground infiltration system under the post office parking area, redesign parking layout, and improve swales. Designed erosion control for a gully including stone stabilization and bio-engineering, including native plantings and log placement.

Gully Stabilization and Stormwater Mitigation at The Health Center, Plainfield, VT
Designed stormwater treatment retrofits and gully stabilization elements from existing developed watershed. Completed stormwater runoff calculations, field assessment of stormwater flow and subwatershed boundaries, water quality improvement quantification, and design plans for stormwater improvements and gully stabilization.

Moosilauke Ravine Lodge Stormwater, Warren, NH
Performed watershed delineation and developed alternatives plans for stormwater site in a steep mountain setting. Assisted with site assessment and HydroCAD modeling.

Gold Brook and Millers Brook Berm Removals
Led field reconnaissance and alternatives analysis for berm removal and floodplain restoration.

Chittenden County Water Quality Planning, Charlotte, Hinesburg, Shelburne, and South Burlington, VT Land Trust Forest Flood Resiliency Tool, State of Vermont
Assisted with site visits and construction inspection of post-project design conditions on local rural roads to determine if road segments met Municipal Road General Permit standards.

Alexandra Marcucci, CFM

Associate Water Resources Scientist | Waterbury, VT

Alexandra Marcucci is an Associate Water Resources Scientist with a background in Environmental Science and Geospatial Technologies. She is a Certified Floodplain Manager and has received training and certification in Natural Shoreline Erosion Control and Wetland Delineation. Alex has experience conducting geospatial analyses using GIS for various natural resources related applications. Her work in the river science field has included conducting geomorphic, habitat, flow, biological, and water quality assessments of streams across New England. She has conducted hydraulic modeling of fluvial systems from small upland streams to large, dynamic rivers. In addition, Alex has conducted wetland delineations, natural resource inventories, watershed planning, and other tasks related to water resource projects.

Years of Experience

2 years with the firm | 10 years with other firms

Professional Registrations

- Certified Floodplain Manager (CFM)

Education

- BS, Environmental Sciences, University of Vermont

Project Experience

Trout Brook Dam Removal Feasibility Study, Berkshire, VT
Complete assessment and design work associated with proposed dam removal on Trout Brook. Performed field data collection and hydraulic modeling of site. Conducted review of natural resources data and identified potential project constraints. Assisted with identification alternatives for dam removal and evaluated alternatives with hydraulic modeling. Calculated sediment volumes and potential sediment export for alternatives. Prepared concept design for dam removal.

Vermont Agency of Transportation Statewide Natural Resource Assessments, Statewide, VT
Performed wetland delineations across Vermont for various transportation- related projects. Completed functional evaluation of wetlands and determined permitting needs. Characterized waterways and evaluated wildlife habitat. Prepared permit applications. Worked with VTrans and make project design recommendations to minimize impacts to wetlands, waterways, and other natural resources.

Charlotte Central School Stormwater Design, Charlotte, VT
Performed wetland delineation at Charlotte Central School, including preparation of Army Corps data forms. Stormwater treatment alternatives will be identified and located to minimize impacts to wetlands and their buffers.

Hinesburg Community School Stormwater Design, Hinesburg, VT
Performed wetland delineation at Hinesburg Community School. Prepared Army Corps data forms and made recommendations for locating potential stormwater treatment infrastructure to minimize impacts to wetlands and their buffers. Evaluated site constraints and assisted with engineering feasibility analysis.

Coastal Salt Marsh Ditch Remediation Design, Hampton, NH
Assisted with evaluation of restoration potential for extensively ditched tidal marsh system in Hampton, New Hampshire. Performed GIS analysis for site evaluation and utilized assessment matrix to prioritize potential restoration sites. Prepared design plans for salt marsh restoration work. Completed permitting for implementation of the project.

McCabe's Brook Stormwater Master Plan, Charlotte & Shelburne, VT
Assisted with stormwater master planning for a combined urban and rural watershed in Charlotte and Shelburne. Attended site visits to evaluate potential stormwater and stream restoration projects within the McCabe's Brook watershed. Conducted GIS mapping of potential project sites. Prepared concept designs for highest priority projects.

Stormwater Concept Design for Lewis Creek River Corridor and Cota Ballfield, Starksboro, VT
Conducted stream geomorphic and habitat assessment for reach of Lewis Creek situated along a town park. Performed wetland delineation at the park and collected field data. Identified projects to improve water quality, geomorphic condition, and habitat of Lewis Creek and improve recreational usability of the park. Prepared concept designs for top priority projects.

Lyman Meadow Neighborhood Stormwater Design, Hinesburg, VT
Conducted GIS analysis of Hinesburg Neighborhood to assist with stormwater design and planning. Prepared Quality Assurance Project Plan (QAPP) for project and project maps. Identified and evaluated alternatives for stormwater treatment within neighborhood. Project will be used as a demonstration site for the Ahead of the Storm program.

Wainwright Mill Dam Removal, Salisbury, VT
Completed assessment and design work associated with proposed dam removal on Tributary #10 to Halnon Brook. Performed wetland delineation and hydraulic modeling of site. Identified and evaluated alternatives for dam removal. Calculated sediment volumes and potential sediment export for alternatives. Prepared design plans for dam removal.

Lake Iroquois-Patrick Brook Watershed Action Plan, Hinesburg, Richmond, St. George & Williston, VT
Prepared Quality Assurance Project Plan (QAPP) for project. Conduct stream and road assessments to identify potential sources of sediment and phosphorus to surface waters within watershed. Identify potential projects to improve water quality, flood resiliency, and overall health of the lake and watershed and prepare concept designs for highest priority projects. Estimate phosphorus loads to the lake from roads, streams, and shorelands. Prepare report summarizing findings and actionable projects and strategies within the watershed.

Instream Habitat Flow Study, Stowe, VT
Assisted with design of instream habitat flow study of the Little River. Collected instream flow measurements and prepared flow estimates in proposed hydroelectric bypass reach. Compared flow gauging data with nearby USGS gauge. Used water depth and velocity and streambed substrate to calculate habitat usability at study transects for varying flow conditions for several species and life stages of aquatic organisms. Prepared report summarizing findings and recommendations.

Memberships and Affiliations

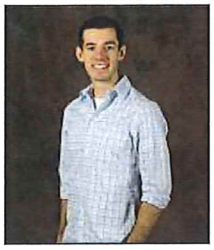
- Association of State Floodplain Managers
- Vermont Association of Wetland Science
- Women in GIS Northeast Chapter

Additional Training

- Natural Shoreline Erosion Control Certification
- Wetland Delineation Training Certification

Ethan Ely, PE

Associate Water Resources Engineer | Waterbury, VT



Ethan Ely is an Associate Water Resources Engineer who has worked on an assortment of projects involving flooding mitigation and analysis, stream restoration, culvert design, and stormwater management. His experience includes analyzing waterways and stream crossings using hydraulic and hydrologic modeling software.

Years of Experience

6 years with the firm | 3 years with other firms

Professional Registrations

- Professional Engineer - NY
- Remote Pilot License

Education

- MS, Civil Engineering with Concentration in Water Resources, University of New Hampshire
- BS, Environmental Engineering, University of New Hampshire

Project Experience

Resilient New York Flood Resiliency On-Call, State of New York
Project Engineer for the Resilient New York Program, in which flood studies are being conducted across Eastern New York, resulting in the development of flood and ice jam hazard mitigation alternatives to help guide implementation of mitigation projects. Flood assessments have been completed in numerous watersheds and communities located in the eastern portion of the state.

Furnace Pond Dam Breach Analysis, Union Vale, NY
Developed a hydrologic model for Furnace Pond Dam along Fishkill Creek. The flood hydrographs from the model were then used as input to a hydraulic model, which was used to perform a dam breach analysis and assess the extend and severity of flooding downstream. Advised the Town of Union Vale on the state of the dam, impact of a dam breach, and what steps should be taken to bring the dam into compliance with NYSDEC requirements.

River Street Dam Emergency Action Plan, Acton, MA
Performed a dam breach analysis for the River Street Dam along Fort Pond Brook and used the results of the analysis to develop flood inundation maps for impacted areas downstream. Developed an emergency action plan (EAP) to help advise emergency personal on what actions to take should a dam breach occur.

Jenney (Arms House) Pond Dam and Store Pond Dam Emergency Action Plans, Plymouth, MA
Performed dam breach analyses for both Jenney (Arms House) Pond Dam and Store Pond Dam and used the results of the analysis to develop flood inundation maps for impacted areas downstream. Developed emergency action plans (EAPs) to help advise the town and emergency personnel on what actions to take in the event of a dam breach.

Stamford Local Flood Analysis (LFA), Stamford, NY
Developed a hydrologic model for the Rexmere Lakes Dams and used the model to perform a dam breach analysis. The resulting flood hydrographs were then used as input to a hydraulic model to determine the extent and severity of flooding downstream. Evaluated flood mitigation alternatives for the village.

East and West Branches of the Neversink River UAS Survey, Neversink, NY
Utilized UAS technology to perform photogrammetric survey of streambank erosion and hillslope failures along the East and West Branches of the Neversink River.

Margaretville Flood Analysis, Margaretville, NY
Developed a 2D hydraulic model to analyze flooding in the Village of Margaretville. Used measured water surface elevations and time-stamped photographs from the Hurricane Irene flood to calibrate the model. Results of the assessment will be used to develop flood mitigation strategies for the village.

Olive Culvert Replacement, Olive, NY
Examined stream hydrology and used hydraulic modeling software to size stream crossings in order to reduce flooding and improve aquatic organism passage.

Manor Kill Floodplain Restoration and Bank Stabilization, Conesville, NY
Conducted field work and gathered information to characterize bank and channel conditions. Evaluated various restoration design options using a 1D hydraulic model. Developed the design plans for a floodplain and streambank rehabilitation project. Performed onsite inspection during the construction.

Hunter Local Flood Analysis, Hunter, NY
Participated in stakeholder meetings, conducted hydraulic modeling of bridges and floodplains, and evaluated flood mitigation alternatives to support analysis of flood mitigation recommendations.

Bushkill Stream & Streambank Rehabilitation Project, Olive, NY
Conducted field assessment and assisted in the development of hydraulic modeling and engineering design plans for improvements to the Bushkill channel and protection of a bridge and roadway. Used UAS technology to document changes in stream morphology.

Bellinger Brook, Herkimer, NY
Assisted with planning and engineering analysis along Bellinger Brook in the town and village of Herkimer. Duties included analysis of hydrologic conditions for the purpose of evaluating the impact of impervious surfaces and potential for detention in the watershed, and evaluation of hydraulic conditions along an unnamed tributary to assess likely causes of flooding.

Salmon Creek Flood Assessment, Hilton, NY
Conducted field measurements, developed hydraulic model and conducted hydraulic evaluations as part of a study to evaluate flooding along Salmon Creek in the Village of Hilton. Project components included geomorphic assessment, hydraulic modeling, and evaluation of flood hazard mitigation scenarios.

Stony Clove Stream Feature Inventory, Chichester, NY
Collaborated with NYC's Department of Environmental Protection on an erosion monitoring study. Worked in the field to gather sediment information and conducted Bank Erosion Hazard Index (BEHI) assessments at bank failure sites.

Paulins Kill River System Flood Modeling, Warren & Sussex Counties, NJ
Conducted hydrologic and hydraulic evaluations as part of a study to evaluate impacts of various stream corridor alterations on flooding along the Paulins Kill. Project components included geomorphic assessment, hydraulic and hydrologic modeling, sediment transport analysis, and evaluation of flood hazard mitigation scenarios, including floodplain restoration.

Additional Training

- 2D Hydraulic Modeling
- Ecological Restoration

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ADDRESS
2276 Wheelock Road
Sutton, VT 05867

EVAN CARLSON

EXPERIENCE

Director, Product & Business Development - Whiteout Solutions

August 2021 - Present
- Driving product vision for workflow automation applications
- Developing key relationships with partners, clients and other stakeholders
- Working directly with CEO to develop organizational strategy

Co-Founder - Entrepreneur-in-Residence - Do North Coworking

September 2018 - July 2021
- Strategy & oversight of all aspects of the coworking space
- Development of programming & resources to supports local entrepreneurs
- Develop business model for long term sustainability of entrepreneurship center & coworking space in Lyndon & other rural Vermont communities

Consultant, UX, Design & Product Development - Hjalmar Carlson

June 2015 - Present
- Working with media companies, small businesses & non-profits to develop & ship new digital products
- Providing product strategy to align with business goals, including product roadmaps, technical architecture diagrams and user experience auditing
- Creative technology ideation & research for agencies & marketing teams

Product Manager, Emerging Platforms & Mobile - Complex Media

May 2013 - August 2015
- Built business cases for new products & pitch to executive teams
- Conceived & launched multiple core products, including React video comments, cover story platform & a real-time trending dashboard
- Technical creative direction on interactive stories & branded content
- Managed entire product lifecycle from wireframing, KPI reporting & product iteration through sunsetting of products

Senior Mobile Developer - Complex Media

May 2012 - May 2013
- Developed mobile sites for Complex & all owned & operated properties
- Built & managed mobile team of three to support the platform growth
- Managed mobile advertising guidelines & develop proprietary tools to display, track & report on ad campaigns across 120 publisher sites

Co-Founder - SquaQr

June 2011 - December 2012
- Design & development of SquaQR, a mobile feedback platform
- Managed client acquisition in Colorado

EDUCATION

The New England Institute of Art, Brookline, MA
BS, Interactive Media Design, Graduated Dec 2006

Matthew Clark

Danville, Vermont, United States

mclark@whiteoutsolutions.com

linkedin.com/in/matthew-clark-baa66319

Summary

As an entrepreneur, Matthew Clark has been involved in many different industries, from VoIP NG-911, real-estate development, and most recently the founder and co-owner of Whiteout Solutions LLC, an Environmental Mapping software development start-up company. Matthew is an experienced Chief Technology Officer with a demonstrated history of working in the computer software industry. Strong information technology professional skilled in Session Initiation Protocol (SIP), Communication, Visio, Troubleshooting, and Wireless Technologies. 20+ years of leading teams, designing and developing software and working in all aspects of growing and building companies.

Matthew has many years of working with technology. His specific skill sets include GIS, Mapping, 911, e911, NG-911. ROS, Embedded Systems Development, C++, C# Java, unity, point cloud, las/laz, Photogrammetry, UAV development, Remote Sensing Technologies, Hardware Integration. Matthew is a Certified Private Pilot and a FAA Part 107 Certified Remote Pilot.

Experience

Co-Founder @ Whiteout Solutions, LLC
Whiteout Solutions
Feb 2016 - Present (6 years 11 months +)
https://whiteoutsolutions.com

Senior Director of Development
TeleCommunication Systems, Inc.
Jul 2012 - Oct 2015 (3 years 4 months)
microDATA a TCS Company.

Director of Software Development
microDATA GIS Inc.
Mar 2011 - Jul 2012 (1 year 5 months)

Programming Manager
microDATA GIS Inc.
Dec 2005 - Sep 2011 (5 years 10 months)

GIS Manager
Town of Oro Valley
Nov 2004 - Dec 2005 (1 year 2 months)

Natalie Vogel

Montpelier, Vermont | Cell (847) 373-6282 | vogeln97@gmail.com
https://www.linkedin.com/in/natalie-vogel-0096111a7/

Education

- Bachelor of Science in Natural Resource Management, Colorado State University, Fort Collins CO, 2020
- Minor in Geographic Information Systems (GIS)

Certifications

- Federal Aviation Administration Remote Pilot Certification, *Number 4396521*, Earned June 16th, 2020.
- Completed FAA Part 107 Recurrent Course, Renewed April 12th, 2023.
- American Management Association 2 day course, Management Skills for New Managers, *Number 1294UOG2SC,* Earned April 28th, 2023

Geospatial Experience

Whiteout Solutions LLC

GIS Team Lead & UAV Operations Specialist | May 2023 – Present | St. Johnsbury, VT

- Manage a GIS team of 2.
- Streamline weekly meetings with each individual & team meetings.
- Own all deliverables going to clients. Spearhead mapping of the Connecticut saltmarsh monitoring project. Lead all post-processing of topobathymetric LiDAR & hyperspectral datasets. Lead analyst for creating vegetation indices, change detection and reports to Connecticut Department of Energy & Environmental Protection.
- Lead analyst for 18,000 acres of collected data in Connecticut saltmarsh.

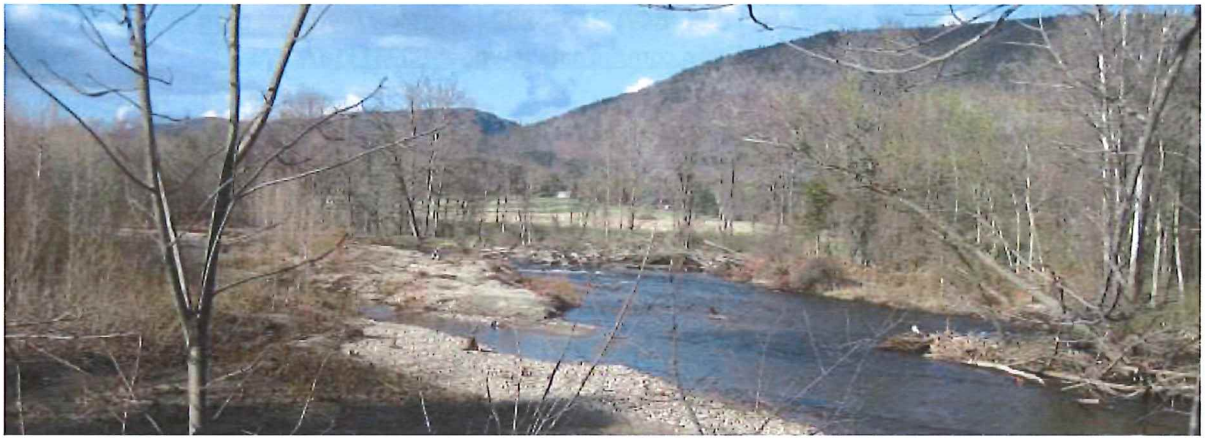
GIS Analyst & UAV Operations Specialist | Oct. 2022 – May 2023 | St. Johnsbury, VT

- Streamline all workflows for field collection, post-processing and analysis for all geospatial data.
- Create efficient automation for post-processing and analysis of LiDAR data using LasTools.
- Team lead for establishing standard operating procedures for all GIS workflows and assist in all quality assurance project plans for the company.
- Supervise two tech interns for company and provide daily workloads and training.
- Designated drone pilot for company and responsible for field data collection of LiDAR & multispectral data, post-processing in Inertial Explorer and ScanLook.
- Provide visual analysis and narrative for clientele to ensure the data is valuable.

CES Cultural Group | Tetra Tech, Inc.

GIS Cultural Specialist II | Dec. 2020 – Present | Golden, CO

- Oversee data management, database creation and management, and advanced spatial analysis and research.
- Oversee QA/QC of all cartographic and data analysis deliverables for leading sustainable energy companies (e.g. Xcel Energy, Avangrid, Idaho Power) and government agencies across 20 states (e.g. BLM USGS, SHPOs, BOR, FWS)
- Create efficient project automation tools in Python and web apps for Field Maps.
- Conduct cultural pedestrian survey on commercial renewable energy projects and design GPS field data collection tools.
- Project lead/Main GIS Contact for the largest transmission line project (Idaho Power). Implemented efficient automation for clients to view data and oversee and manipulate datasets with over 12 years of data.



Summary of Qualifications

Who We Are

SLR's interdisciplinary team of engineers and scientists allows us to cover the wide range of skills required to properly complete flood risk reduction and restoration design. Our team is led by water resources engineers and scientists that are well versed in floodplain restoration, channel restoration, fluvial geomorphology, hydrology, hydraulic modeling, sediment transport, water quality evaluation, scour analysis, infrastructure vulnerability, cost estimating, permitting, and outreach. This core group is supported by geotechnical engineers, landscape architects, and others. Our team regularly assesses roads and rivers to identify potential projects and follows those projects through the design and permitting process to implementation.

We take great pride in the creative solutions that we have developed, working with our clients, the surrounding communities, and environmental regulators.

Decades of Flood Control Experience

The project team has its roots in flood control, having completed watershedwide and town-wide flood control analyses extensively throughout the Northeast. Team members have experience in analyzing riverine systems using TR-20, HEC-1, HEC-HMS, HEC-2, HEC-RAS, HEC-GeoRAS, HEC-GeoHMS, River2D, RMA-2, HY-8, P-8, and SMS-7.0. Many of our past projects have involved complex hydrologic and hydraulic analysis, structural analysis, and regulatory permitting.

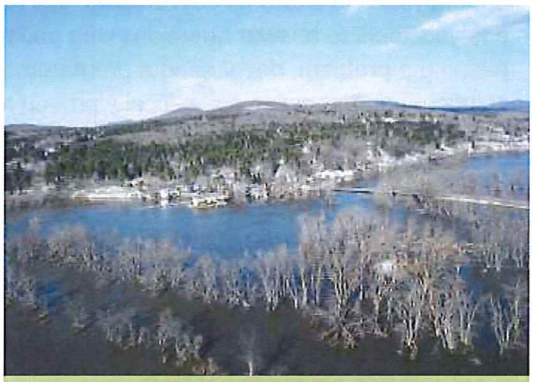
Dog River, Northfield, VT

Flood Analysis

An important element of flood mitigation analysis is a strong understanding of engineering design and construction principals. Our team has designed and overseen construction on many dozens of flood control projects. In the early planning and assessment phases, we are able to vet the cost, constructability, and likelihood of permitting associated with mitigation strategies to identify feasible measures with a high degree of efficacy. Our analysis of river systems uses a combination of naturalistic and theoretical techniques ranging from the use of healthy upstream and downstream reference reaches and regional hydraulic geometry relations to advanced computer modeling techniques. In addition to providing the basis for design, our models are developed to meet the technical standards and permitting requirements necessary to comply with FEMA as well as other state and federal agencies.

Flood Studies, Hydrologic/Hydraulic Studies

SLR is a leader in the field for conducting hydrologic and hydraulic studies of both upland and tidal systems. The staff at SLR have designed many drainage and flood control projects including open channels, culverts, bridges, dams, detention basins, storm drains, erosion control programs, and created or restored wetlands. Many of our past projects have involved extensive hydrologic and hydraulic analysis, structural analysis, and regulatory permitting. A majority of these projects have focused on drainage systems that are designed to simulate natural conditions and the restoration of degraded channels and wetlands.



Lamoille River, Lamoille & Franklin County, VT

The firm has experience using both one- (1D) and two- (2D) dimensional hydrodynamic models to simulate unsteady flow and bidirectional flow. Among the models the firm uses are Branch, HEC-RAS (unsteady version), RMA-2, Fastabs, FESWMS, and SMS. Our river hydraulic projects have included channels, culverts, dam removal, constriction removal/modification, fish ladders, and bridges.

Special concerns with hydraulic projects include fish passage, impact on habitat, impact on natural vegetation, potential flooding of adjacent properties, and scour.

Flood Mitigation

The staff at SLR has conducted many drainage and flood mitigation projects and studies including open channel, culverts, bridges, dams, detention basins, and structural alterations of buildings. We are also well versed in the FEMA review process, as well as projects managed and/or funded by state agencies, complying with their technical standards, administrative procedures, environmental concerns, and permit requirements. We have completed flood mitigation studies in many communities across Vermont with recent examples in Jeffersonville, East Middlebury, Bennington. The projects included intensive field investigation effort, survey, HEC-RAS hydraulic modeling, analysis of flood hazard mitigation measures, and extensive public outreach.

About Whiteout Solutions

Our Background:

Whiteout Solutions is a geospatial technology company based in Northern Vermont. From our start in 2016, we have been developing remote sensing hardware and software systems, specializing in high precision LiDAR with spatial accuracies in the >2cm range. Utilizing our collection systems, proprietary processing applications and our decades of geospatial analysis experience, we work to generate high value datasets to help solve the biggest environmental challenges that face our world today.

Why Whiteout Solution:

With a collective 50 years of experience, we bring a deep knowledge and modern technology to efficiently deliver answers and insights to our partners. Data collection can be expensive, so we aim to maximize the value of data and to provide our customers with the ability to collaborate with teams on analysis and share all deliverables. We have built thousands of proprietary processes and analysis tools to answer questions with geospatial data. Our products have been developed by defining a problem, developing a programmatic solution, evaluating results, continually refining the solutions, and applying scientifically proven methodology to geospatial data analysis. These tools are used in forestry management, environmental sciences, municipal asset inventories and more.

A few notable & proprietary tools developed by Whiteout Solutions include:

- Tree species identification
- Tree stem detection
- Forestry biomass analysis
- Utility vegetation encroachment analysis
- Lithologic surface analysis
- Coastal sediment elevation models

All the tools listed above are available through our automated workflow application known as **geoSAP** which chains together commonly used spatial analysis processes to produce complex industry specific deliverables. In addition to the tools highlighted above, geoSAP allows users to conduct feature extraction on point clouds and imagery, process photogrammetry, analyze multispectral imagery and more. geoSAP is a cloud hosted application, leveraging compute node that accelerates data processing to get deliverables to users faster. All deliverables processed through geoSAP can be viewed and shared with other stakeholders or downloaded in a variety of standard formats. The application can be accessed through standard SaaS subscriptions or on-premises through an enterprise licensing agreement.

PROJECT PROFILE

Jeffersonville Flood Study & Hazard Mitigation

CAMBRIDGE, VT

CLIENT

Lamoille County Planning Commission

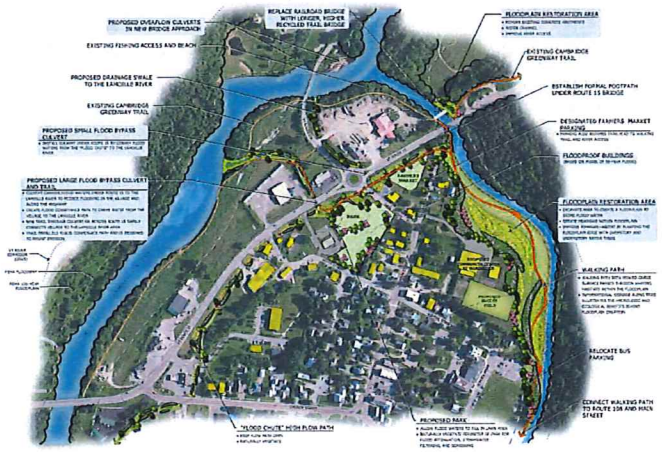
SERVICES

- Survey
- River Channel Assessment
- Hydrologic & Hydraulic Analysis
- Engineering Design
- Hazard Mitigation Planning
- Public Outreach
- Permitting
- Cost Estimating
- Construction Oversight

The Village of Jeffersonville is located at the confluence of the Brewster River and the Lamoille River. This low-lying village center is prone to flooding and repeat flood damages. The Lamoille County Planning Commission, in conjunction with the Jeffersonville Board of Trustees, retained SLR to conduct a hydraulic study to perform an alternatives analysis for flood mitigation. The results of this project were incorporated into the Jeffersonville Village Hazard Mitigation Plan and the highest priority projects have been designed and constructed.

A combination of alternatives was recommended including replacement of an undersized rail trail bridge, increasing the size of the culverts under the road embankment to increase flow out, restoration of a floodplain to decrease local flood levels and velocities, and increased conveyance under a downstream bridge with overflow culverts. Public outreach documents were created, including a master plan and renderings.

The design and construction were completed for the two highest priority projects. The Cambridge Greenway Trail / Railroad Bridge was replaced, incorporating a restored floodplain and wider, higher resilient trail bridge. A large flood relief culvert was designed and installed under Route 15 to allow flood water to safely leave the village.



PROJECT PROFILE

Route 15 Flood Bypass Culverts

JEFFERSONVILLE, VT

CLIENT

Lamoille County Planning Commission

SERVICES

- Flood Mitigation
- Hydraulic Modeling & Hydrologic Analysis
- Culvert Structural Design
- Permitting
- FEMA Benefit-Cost Analysis
- Bid & Construction Phase Services

SLR completed engineering design for flood bypass culverts. A 20-foot-wide, 4-foot-tall, 54-foot-long pre-cast concrete flood bypass culvert was installed under Route 15 to allow flood waters to more rapidly reach the Lamoille River reducing flooding in the Village. This flood mitigation project is the second of four recommended alternatives identified in a 2014 Flood Hazard Engineering Study and a 2017 Flood Mitigation Master Plan. SLR led collaboration with interested stakeholders to investigate the flood patterns in the Village, select preferred alternatives, and explore implementation. Artistic renderings were created to assist the community in visualizing projects and to support grant funding applications.

The project design required the disciplines of river science, hydraulic engineering, structural engineering, geotechnical engineering, water supply engineering, and traffic engineering.

A FEMA Benefit-Cost Analysis was completed for the project and illustrated that the project benefits (i.e., reduced flood damages) outweighed the project costs for design and implementation. The main project benefits are the increase in public safety and reduced risk to infrastructure and private property in the Village. Project co-benefits included improvements to the local drainage swales leading to the Lamoille River; increased traffic safety due to guiderails along the highway and parking area; better local habitat and stormwater filtering due to revegetation; more appealing aesthetics due to revegetation; and upgrades to the local water system due to installation of shutoff valves when a section of the water main was moved.

PROJECT PROFILE

Barnes Camp / Stowe Mountain Resort Garage

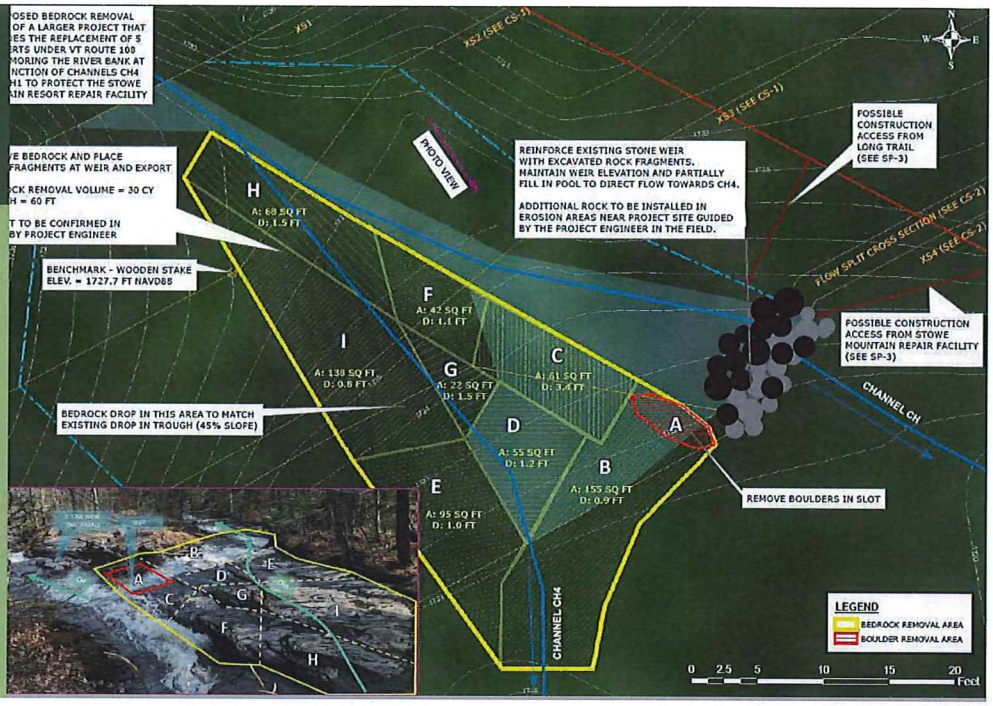
STOWE, VT

CLIENT

Lamoille County Planning Commission

SERVICES

- Survey
- River Channel Assessment
- Hydraulic & Hydrologic Analysis
- Engineering
- Hazard Mitigation Planning
- Public Outreach



SLR worked with the Lamoille County Planning Commission (LCPC) to mitigate flood and erosion risks on Vermont Route 108 at Barnes Camp and at the Stowe Mountain Resort maintenance garage. We evaluated drainage patterns, evaluated culverts, performed an alternatives analysis, estimated the cost for implementation, and performed a FEMA benefit-cost analysis.

We coordinated with LCPC; the Vermont Department of Transportation (VTrans); and the Vermont Department of Forests, Parks, and Recreation to select the preferred alternative and implement the design. The project included river assessment of the steep drainages flowing off of Mount Mansfield, survey, and design.

This project balances infrastructure protection, water quality protection, drainage improvements, and continuity of positive aesthetics in Smugglers' Notch State Park.

PROJECT PROFILE

East Burke Dam Removal

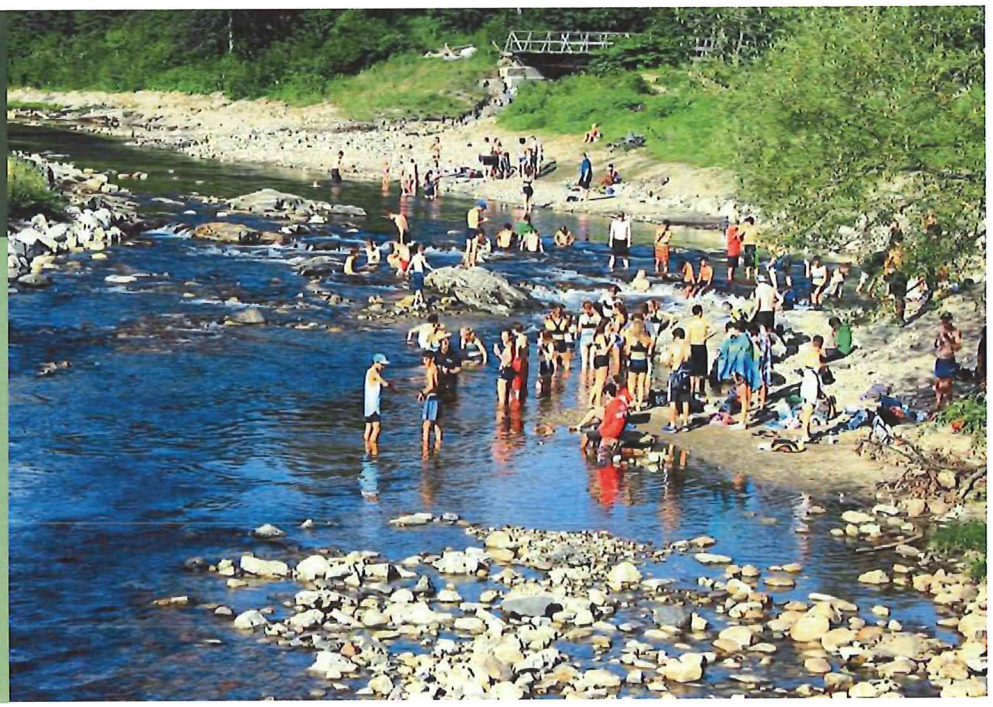
EAST BURKE, VT

CLIENT

Connecticut River Conservancy

SERVICES

- Geomorphic Assessment
- Hydraulic Analysis
- Sediment Management
- Dam Removal Design
- Permitting
- Public Outreach
- Photo-Simulations



The Connecticut Conservancy retained the services of SLR to design, permit, and oversee the removal of the East Burke Dam on the East Branch of the Passumpsic River in East Burke, Vermont.

The dam was obsolete, breached, holding back 5 years of sediment, creating a fish barrier, and increasing flood levels.

The project began with a geomorphic assessment of the channel. A preferred alternative was designed to restore the channel, stabilize local erosion, reduce the risk of long-term sedimentation, and control project costs.

Photo-simulations were prepared to illustrate what the river would look like following dam removal. The simulations were used during public outreach and permitting. Local, state, and federal permits were obtained for the project. While the project was built, SLR performed construction oversight to help implement the design and to track permit compliance.

PROJECT PROFILE

Melrose Terrace Floodplain Restoration

BRATTLEBORO, VT

CLIENT

Brattleboro Housing Authority

SERVICES

- Hydraulic Analysis
- Flood Mitigation Planning & Design
- Floodplain Restoration
- Cost Estimating
- Permitting
- Public Outreach
- Construction Oversight

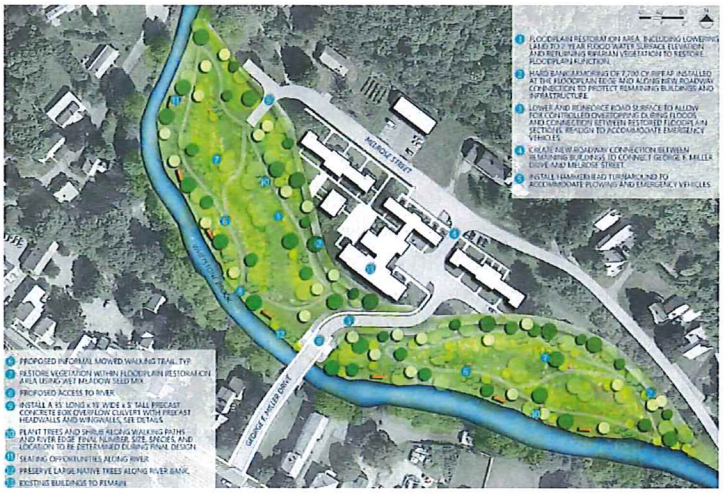
The project restored a section of floodplain along Whetstone Brook where multiple properties have historically flooded. Multiple alternatives were evaluated before a combination of alternatives was chosen based on hydraulic modeling to reduce flood risk improve river function. The work included removing 11 residential buildings and infrastructure from the floodplain, removal of fill, and increasing capacity of the roadway connection at George F. Miller Drive by adding an overflow culvert and lowering the road surface. In combination, this project reduced flood risk for remaining properties and restored natural function to 4.2-acres of floodplain.

Our team worked with the housing partnership and community to choose alternatives with the largest positive benefits. A FEMA Benefit-Cost Analysis was completed to show that the project benefits outweigh the costs. Renderings were completed to help with public outreach.

All stages of design were completed, with input from partners on the design throughout the process. Sewer, drinking water, stormwater, and road network improvements are included in the design to increase resiliency and move significant portions of the infrastructure out of the floodplain and still serve the remaining buildings.

Permitting was completed including a FEMA CLOMR to support floodplain permitting. Engineers assisted with bidding and construction oversight.

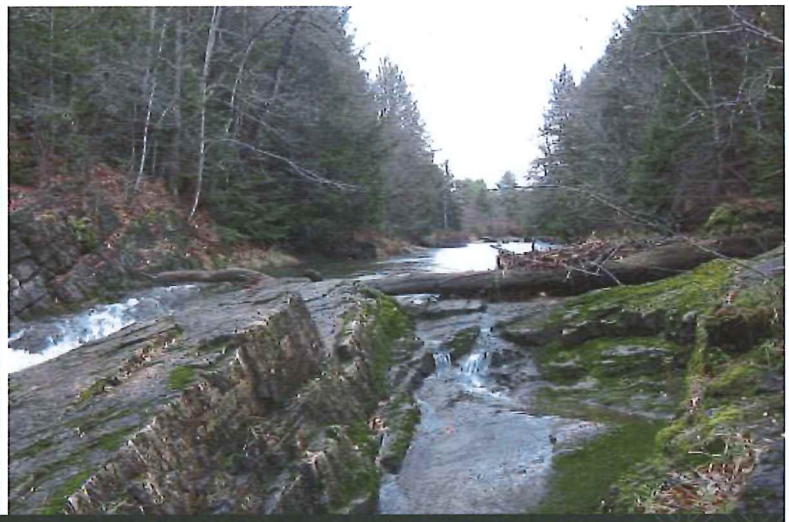
The Melrose Terrace Floodplain Restoration project received the 2024 Merit Award from ACEC Vermont.



PROJECT PROFILE

Lewis Creek Habitat & Geomorphic Assessment

ADDISON COUNTY, VT



CLIENT

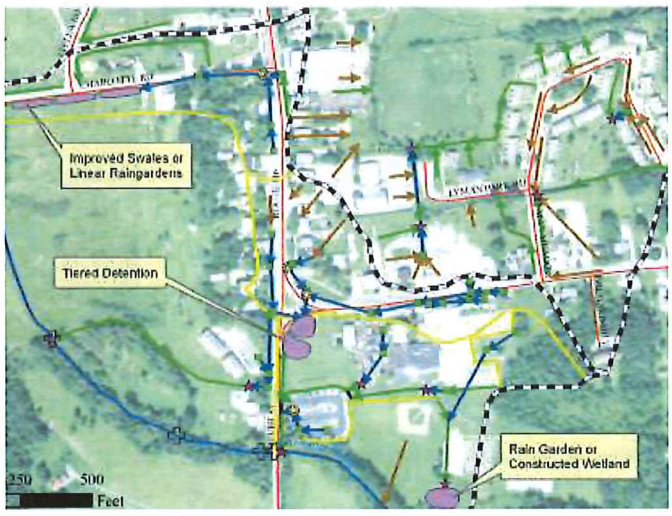
Lewis Creek Association

SERVICES

- Geomorphic Assessment
- Stream Habitat Assessment

SLR was retained by the Lewis Creek Association to assess stream habitat and geomorphic condition on selected reaches along the mainstem and tributaries of Lewis Creek in Addison County, Vermont. The work utilized the newly developed Vermont reach habitat assessment protocol developed by SLR. Stream condition was used to establish recommendations for channel protection and management strategies.

The assessment covered the forested headwaters of Lewis Creek downstream to the flatter reaches where agriculture is abundant in adjacent to the channel. Bridges and culvert were assessed throughout the study area. A final report was provided that summarized geomorphic condition and provided recommendations for future restoration projects.



PROJECT PROFILE

McCabe's Brook Stream & Wetland Restoration

SHELBURNE, VT

CLIENT

Lewis Creek Association

SERVICES

- Wetland Restoration Design
- Wetland Delineation
- Site Assessment
- Alternatives Analysis
- Engineering Design
- Permitting

SLR is working with the Lewis Creek Association on stream and wetland restoration design for a site on McCabe's Brook in Shelburne, Vermont. SLR previously completed a watershed assessment and identified numerous potential projects, including this restoration project, for water quality, habitat, and flood resiliency improvement in the watershed. The site has been historically managed for agriculture and parts of it were active pasture until very recently. SLR completed site assessment, conducted an alternatives analysis, prepared a 30% design, and worked with regulators to determine permitting needs. The restoration design includes restoring a more natural hydrology to disconnected floodplain wetlands through targeted earth work and instream wood structures to raise the streambed. Restoration of the plant community is an important component, with extensive proposed plantings at the site coupled with non-native invasive plant species management. The project also features a variety of wood additions to improve instream habitat for aquatic organisms. The project site is located downstream of a large beaver meadow with evidence of an active beaver population. The restoration design includes beaver dam analogs (BDAs) to promote the recolonization of the project site with beavers.

PROJECT PROFILE

Hollow Brook Refugia Restoration

STARKSBORO, VT

CLIENT

Lewis Creek Association

SERVICES

- Flood Mitigation
- River and Sediment Management
- Riverbank Stabilization
- Instream Habitat Restoration
- Engineering Design

View of old bridge abutments and concrete blocks from downstream (December 6, 2020)

SLR assisted the Lewis Creek Association (LCA) with water quality improvement, habitat restoration and flood mitigation along the Hollow Brook in Starksboro, Vermont. The upper reaches of Hollow Brook were identified to be important areas for restoration to create brook trout refugia (Increasing Aquatic Habitat Knowledge and Stewardship in the Lewis Creek Watershed, SLR, January 2020). The project site has a double perched culvert, abandoned bridge, and a lack of riparian vegetation. The Lazy Brook Mobile Home park has experienced flood damages and remains vulnerable to future flooding. This project includes multiple elements that will reduce flood risk to the Mobile Home park.

The concept design includes culvert replacement, removal of a constriction at abandoned bridge, and riparian and instream channel restoration. The project will improve the geomorphic compatibility of the river, the water quality, and fish passage by removing the unnatural restriction of the culvert, planting the riparian buffer, and designing a fix for the upstream gully.

SLR is working with Canonica Landworks in a design-build capacity with Addison County Regional Planning Commission to finalize permitting, design, and remove the abandoned bridge abutments. This project will reduce flood risk and improve instream habitat.

Yellow arrow shows where water has exited the channel upstream of old bridge abutments and concrete blocks (October 10, 2020)

PROJECT PROFILE

Winooski River Flood Study

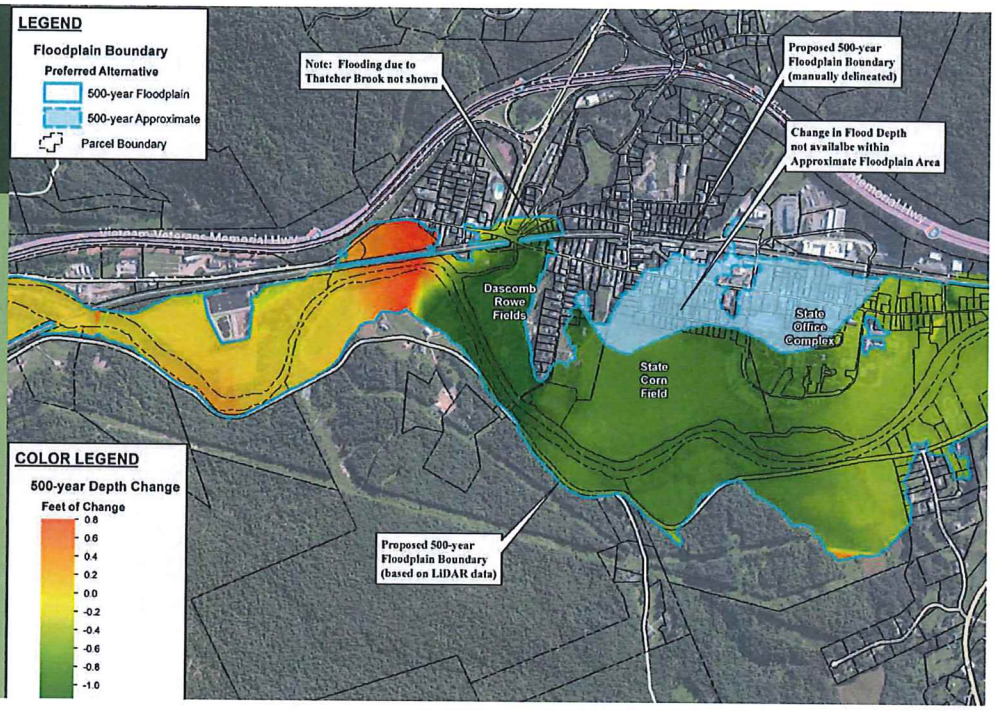
WATERBURY, VT

CLIENT

Town of Waterbury, VT

SERVICES

- Survey
- Engineering
- Hydrologic & Hydraulic Analysis



The Town of Waterbury engaged SLR to perform a flood study of the Winooski River following extensive damages to the Village during Tropical Storm Irene. The Town is located in a floodplain setting that has been subjected to several large floods in the past century. The goal of the project was to identify flood reduction alternatives and to create conceptual designs for future implementation.

The project was performed in three phases. An initial hydraulic sensitivity analysis was completed to investigate nearly 30 alternatives, which included various combinations of floodplain reconnection, changes at the bridges, and changes to the Bolton Fall Dam. The alternatives consider the flood history and redevelopment plans at the State Complex in Waterbury.

Survey was performed to confirm the findings of the initial modeling that suggested that some areas of floodplain reconnection in undeveloped areas may lower flood levels in the developed Village Center. Conceptual design was also performed.

PROJECT PROFILE

Middlebury River Flood Mitigation Study

EAST MIDDLEBURY, VT

CLIENT

Town of Middlebury VT

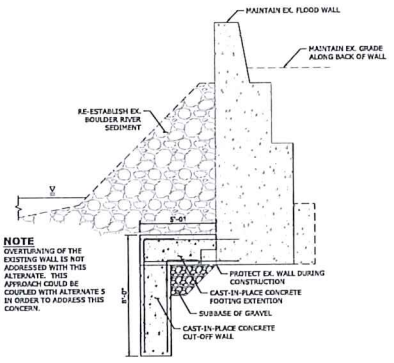
SERVICES

- Survey
- Water Resources Engineering
- Hydrologic & Hydraulic Analysis

SLR assisted the Town of Middlebury with a flood mitigation study to reduce flood and erosion hazards in the Village of East Middlebury. The area is prone to recurring flood damages where buildings, roads, bridges, culverts, and utilities are impacted. The project included survey, hydrology and hydraulic modeling, flood mitigation alternatives analysis, and conceptual design. Final design of repairs and extension of a flood wall that was undermined during Irene was also completed as part of this project.

A host of alternatives were evaluated particularly to reduce flooding associated with sedimentation. The project site is located at the base of a mountain where the river flows over an historic alluvial fan. Now confined by buildings and infrastructure, the river gets clogged during flooding and overflows. A series of alternatives were evaluated with sediment transport modeling. The preferred alternative is floodplain restoration to allow the river the space it needs to store and transport sediment, debris, and water during flood. This alternative resulted in lower flood levels and less damage.

The project received FEMA funding to complete the highest priority projects. Flood mitigation projects were implemented to reconnect floodplain, repair berm, and repair a flood wall.



SCOUR MITIGATION UTILIZING A CONCRETE CUTOFF WALL

PROJECT PROFILE

North Washington Street Bridge Two Dimensional Modeling

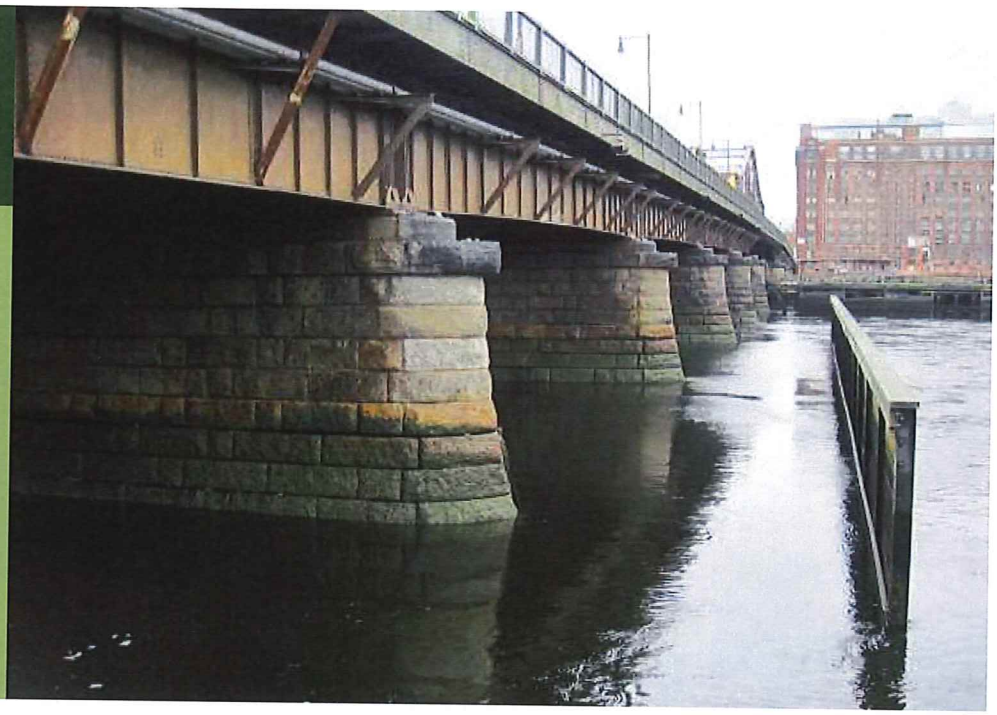
BOSTON, MA

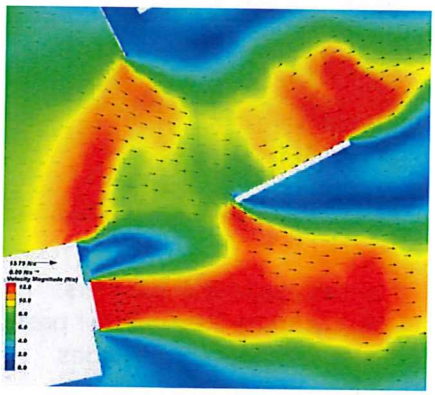
CLIENT

Benesch
(formerly Purcell Associates)

SERVICES

- Engineering
- Scour Analysis
- Hydrological & 2-D Hydraulic Analysis





The North Washington Street Bridge over the Charles River is deteriorated and proposed to be replaced. SLR's services were retained to perform hydraulic modeling, scour analysis, and to provide recommendations for scour countermeasures for the proposed structure. The work was performed on behalf of the City of Boston and in cooperation with MassDOT and MassDCR.

The North Washington Street Bridge is located just downstream of the New Charles River Dam that establishes complex flood-driven hydraulics at the project site where the Boston Inner Harbor meets the Charles River basin. The site experiences a tide range of 10-feet and freshwater discharge from a 311-square mile watershed. Further complicating the location is a flood control pump station discharge a short distance upstream of the structure. A two-dimensional hydrodynamic hydraulic model has been created in the vicinity of the bridge to investigate water depth and velocity for several high flow scenarios.

The flood control operation is a priority to the Commonwealth of Massachusetts, the City of Boston, and upstream communities to protect substantial permanent and costly infrastructure along the Charles River. Changes to these typical operating procedures are not likely, and thus the discharge characteristics of the hydraulic structures describe the upstream boundary condition rather than a typical flood hydrograph from an unregulated system.

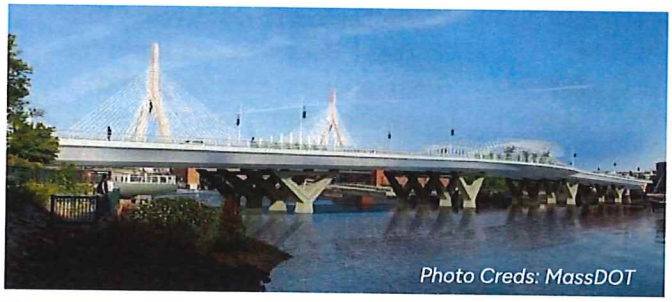


Photo Creds: MassDOT

PROJECT PROFILE

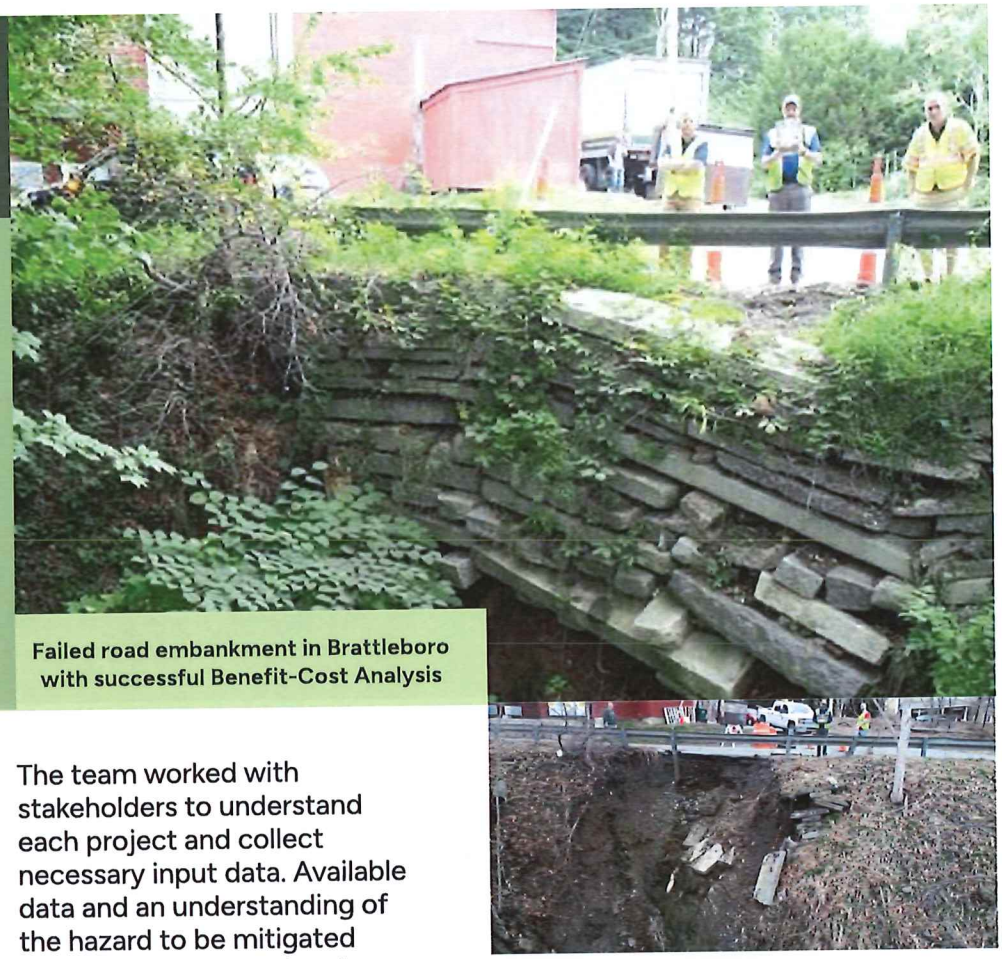
FEMA Benefit-Cost Analysis for Vermont Emergency Management

CLIENT

Vermont Emergency Management

SERVICES

- FEMA Benefit-Cost Analysis
- Hydrologic Analysis
- Flood Mitigation Planning



Failed road embankment in Brattleboro with successful Benefit-Cost Analysis

Our team worked with Vermont Emergency Management to complete multiple FEMA Cost-Benefit Analysis to show that the project benefits outweigh the costs for projects submitted under the Hazard Mitigation Program. Successful BCAs were completed for projects addressing hazards from landslide, erosion, flooding, and loss of power. Culvert replacements, erosion and gully stabilization, retaining wall replacement, floodproofing of a historic building, and generators for critical utilities were found to be cost effective.

The team worked with stakeholders to understand each project and collect necessary input data. Available data and an understanding of the hazard to be mitigated were used to determine the most practical approach to a BCA. FEMA methodologies were followed for data input, documentation, and for standard values where appropriate. Data was input into the FEMA toolkit and multiple configurations and approaches were tested to determine the highest Benefit-Cost Ratio for each project. Site visits and meetings with stakeholders were conducted as necessary to understand the project and assess potential benefits. Recurrence intervals for past and anticipated damages were determined using a variety of methods. BCAs were documented and backup data organized for submission with HMGP applications.

References

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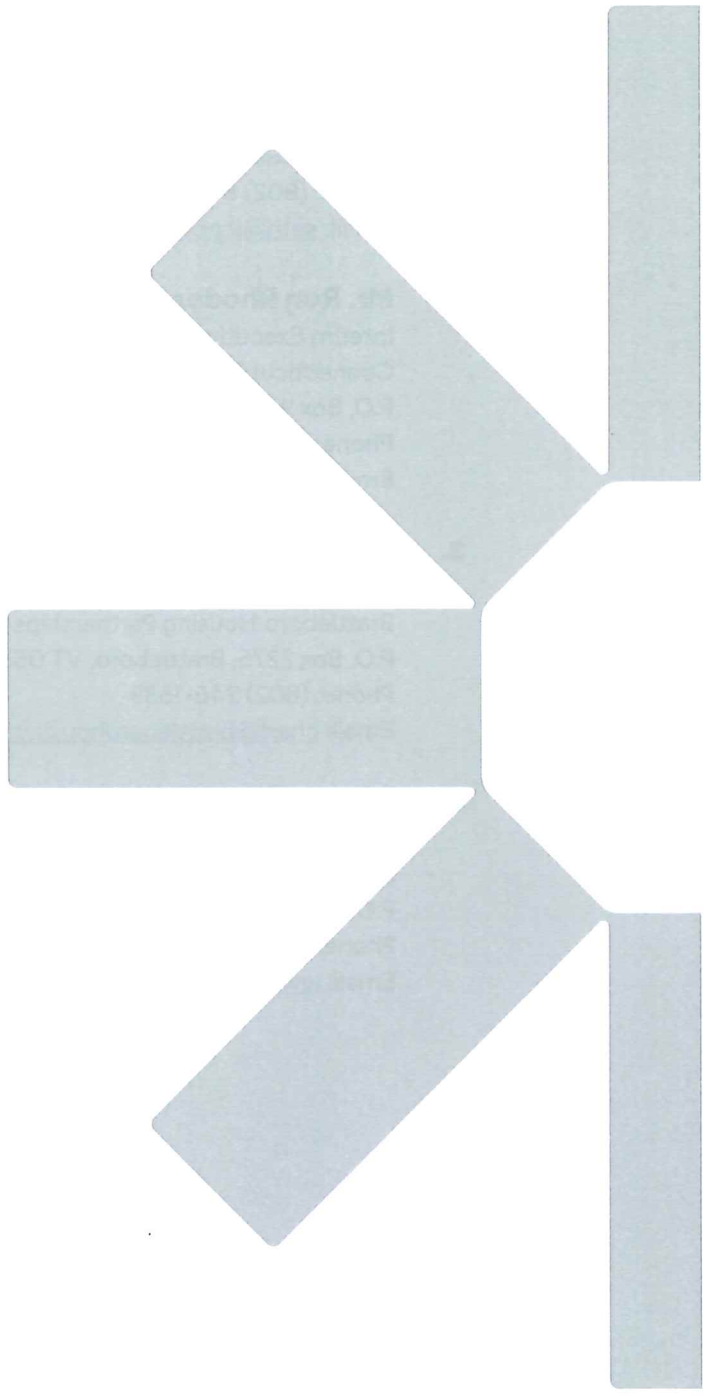
SLR



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