September 26, 2014

Mr. Jeffrey Woolston
Town Manager
17 Highland Avenue
Winthrop, ME 04364

Proposal for Engineering Services (4145001.00)
Maranacook Lake Hydrologic Modeling Services

Dear Mr. Woolston:

Kleinschmidt Associates (Kleinschmidt) is pleased to provide this cost proposal for engineering services for the Maranacook Lake Watershed Hydrologic Study as outlined in the Towns of Winthrop and Readfield (Towns) request for proposal (RFP) dated September 12, 2014.

PROJECT UNDERSTANDING

The primary goal of the study is to investigate the hydrology of the watershed in order to regulate the water level in Maranacook Lake better. Over the last decade, Maranacook Lake water levels have surpassed the prescribed maximum levels more frequently and for a longer duration than desired. The Maranacook Lake outlet dam is managed by the Dam Committee consisting of representatives from both Towns and the Cobbosee Watershed District. A hydrologic model is requested to assess the inflows to Maranacook Lake in combination with the operation of the dam's outlet structure. Being able to predict the watershed's response to precipitation is essential for evaluating the need for dam structure or operation modifications and for enabling the Dam Committee to operate the dam proactively before extreme events occur to keep the water level within the desired range.

The Towns are looking for a reliable, calibrated modeling tool to aid in making decisions about altering the structure and/or operations of the dam. Kleinschmidt will collaborate with the Towns and other stakeholders to ensure that the model is a useful tool for managing the lake level. The model will allow the Dam Committee to determine the additional discharge capacity needed and to examine various outlet configurations over a range of storms. The model will also aid the Dam Committee in determining seasonal target water levels that can reduce the likelihood of exceeding the maximum water level. Developing seasonal targets (i.e., a reservoir rule curve) will allow the Dam Committee to make proactive decisions rather than having to react to storms.

SCOPE OF WORK

TASK 1: PROJECT COORDINATION

Kleinschmidt has budgeted time for two meetings over the course of the project: a kick-off meeting, and a meeting to present the hydrologic model to the Towns. The cost for this task includes time to prepare for the meetings, mileage, and time for phone conversations with the Towns' personnel and other stakeholders.

TASK 2: MODEL DEVELOPMENT

Kleinschmidt believes that the U.S. Army Corps of Engineers Hydrologic Engineering Center's Hydrologic Modeling System (HEC-HMS) with its ArcMap geographical information system (GIS) extension HEC-GeoHMS is the most appropriate model to simulate the hydrology of the Maranacook Lake watershed. The HEC-HMS software is free, available without a license, and is widely used in the industry. The model is capable of simulating discrete events and seasonal or annual patterns. We plan to use the model in its event-based mode to predict watershed response to return-period storms (i.e., 1-, 2-, 5-, 10-, 25-, 50-, and 100-year return periods).

The modeling process will begin with reviewing available data for the site. The watershed will be delineated and characterized (e.g., channel slopes, land use, and soil types) using HEC-GeoHMS and the GIS. Using the watershed geometry and routing scheme, the runoff parameters will be determined and other inputs coded.

The model will be developed using multiple data sources:

- climatological data (primarily hourly and daily precipitation) from the National Oceanic and Atmospheric Administration (NOAA) and the Northeast Regional Climate Center (NRCC);
- spatial data, such as terrain, land use, and soil data from the U.S. Geologic Survey (USGS) and the Natural Resource Conservation Service (NRCS);
- information about Maranacook Lake water levels, historical dam operations, and precipitation data provided by the Dam Committee;
- information about Torsey Pond water levels and historical dam operations provided by the Dam Committee; and
- dimensional data including elevations for both the Maranacook Lake and Torsey Pond outlet dams provided by the Dam Committee.

Historical precipitation, dam operations, and lake level data will be used to calibrate the model. The model will be calibrated to three different precipitation events with adequate data, one in the spring, summer, and fall. The calibrated model will be validated using three additional storms, one each in the spring, summer, and fall. Once the model is satisfactorily calibrated, it will be used to analyze desired scenarios.

Kleinschmidt will simulate the return-period storms (1-, 2-, 5-, 10-, 25-, 50-, and 100-year) with the current dam configuration. Ideally, this will result in a reservoir rule curve that will mitigate the lake level problems without the need for dam modifications. As an example, the model will be used to evaluate the changes in lake level in response to a typical spring runoff to determine target winter drawdown levels to avoid exceeding the maximum desired level in Maranacook Lake. If a rule curve is determined to be insufficient for managing water levels, Kleinschmidt will investigate potential dam modifications, such as increasing the spillway capacity or modifying the gates.

TASK 3: REPORT

Kleinschmidt will provide a concise report describing the model that includes the following elements:

- process and methods for developing the model;
- all assumptions involved in developing the model;

- results of the calibration;
- simulation results for the existing dam;
- simulation results for a modified dam;
- recommendations for the Dam Committee to manage Maranacook Lake levels; and
- instructions for using the model for future simulations.

Kleinschmidt will provide hard copies of the report based on our publication rates (Attachment A). Digital copies of the report will be provided in portable document format at no charge. Kleinschmidt also will provide all the digital model files. Kleinschmidt uses a ShareFile Web site to deliver large electronic files easily without clogging e-mail boxes.

SCHEDULE

The deliverables for this project are due by December 31, 2014. Assuming that we receive a notice to proceed by October 13, 2014 with adequate data to calibrate the model, we will meet the prescribed project deadline.

QUALIFICATIONS

Kleinschmidt is an employee-owned, Maine corporation with offices across the country and in Canada. Kleinschmidt will be servicing this project from our corporate headquarters in Pittsfield, ME. Kleinschmidt has specialized in hydrologic and hydraulic engineering since 1966. Please see the project data sheets in Attachment B for a few examples of our hydrologic modeling experience.

The Kleinschmidt team will consist of following personnel:

- Bjorn Lake, PhD, P.E. – Project Manager
- Michael Schimpff, P.E., P.H. – Senior Technical Advisor
- Bruce Halverson, P.E., P.H., C.F.M. – QA/QC Engineer
- Michael Hross – Staff Engineer

All personnel designated for this project except for Bruce Halverson are based in our Pittsfield, ME office. Please see résumés for the members of the proposed project team in Attachment C.

Kleinschmidt's principals are Paul Cyr, Paul Williams, David Nash, Michael Schimpff, Gary Liimatainen, Thomas Kahl, Jon Christensen, Scott Ault, Timothy Oakes, Henry Mealing, Kelly Schaeffer, Michael Hreben, Jeremiah Maher, and Alan Haberstock. Kleinschmidt has prepared this proposal without any connection with any other Proposer making any proposal for the same services. No person acting for or employed by either Town is directly or indirectly interested in this Proposal or any agreement which may be entered into to which the Proposal relates or in any portion of the profits therefrom.

FEE ESTIMATE

Based on this scope of services, we propose to complete this scope of work for **$13,000**. This fee is an estimate; however, we will not exceed this amount without written approval from the Towns. This estimate includes all labor hours based on our 2014 standard rates for each employee, a 3 percent communication fee, and mileage for two round trips from Pittsfield to Winthrop. The following table shows the fee estimates by major task.

TABLE 1 ITEMIZED FEE ESTIMATE

Task	Cost
Project Coordination	$1,500
Model Development	$9,000
Report	$2,500
Total	**$13,000**

TERMS AND CONDITIONS

The proposed scope of work will be performed according to the Towns' Services Agreement, and work will be performed on a lump sum basis (Attachment D). An invoice will be submitted monthly for work completed the previous month.

We look forward to the opportunity to be of service. If this proposal is acceptable to you, please initiate the proper paperwork for us to proceed. Please contact us if you have any questions regarding this proposal. We appreciate your confidence in Kleinschmidt and look forward to working with you.

Sincerely,

KLEINSCHMIDT ASSOCIATES

Bjorn Lake, Ph.D., P.E.
Project Manager

Scott R. Ault
Senior Vice President

BAL:SDM
Attachments:
A –Publication Rates
B – Project Data Sheets
C – Résumés
D – Method of Payment
cc: Proposal Distribution

ATTACHMENT A

PUBLICATION RATES

Publications Supplies, Copying, and Laminating Rates

8.5″ x 11″ Publications Supplies

Cover Sets (Covers, Plastic & Binders)	$3.00
Report Backs	$0.50
Report Covers	$0.50
Report Plastic	$0.60
Spiral Binders	$0.50
1″ White 3-Ring Binder	$4.99
1 1/2″ White 3-Ring Binder	$6.99
2″ White 3-Ring Binder	$7.50
3″ White 3-Ring Binder	$9.00
4″ White 3-Ring Binder	$17.99
Index Report Tabs (White & Mylar Coated)	$0.39
Rite in the Rain Paper (per page plus cost of copying)	$0.14

11″ x 17″ Publication Supplies

1″ Black 3-Ring Binder	$15.00
2″ Black 3-Ring Binder	$21.00
3″ Black 3-Ring Binder	$23.00
Box Mailers	$2.50
Flat Mailers	$2.00

Other Publications Supplies

CD Burning	$2.00
CD Mailers	$1.40

Copying Rates (per page)

8.5″ x 11″ B/W Copies	$0.10
11″ x 17″ B/W Copies	$0.10
8.5″ x 11″ Color Copies	$0.80
11″ x 17″ Color Copies	$1.20
Folding Pages (Pittsfield ONLY)	$0.04

Oversized Drawing Copy Rates (B/W Only) (per page)

18″ x 24″	$1.00
22″ x 34″	$2.00
24″ x 36″	$2.00
28″ x 40″	$2.00
36″ x 48″	$3.00

Laminating Rates

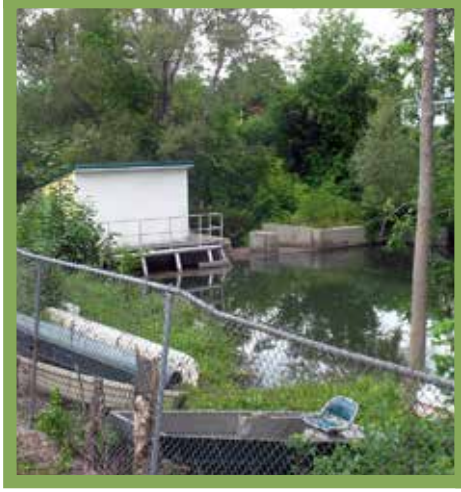
8.5″ x 11″	$0.55
11″ x 17″	$0.65
Business Card	$0.20
Badge Size w/Clips	$0.38

ATTACHMENT B

PROJECT DATA SHEETS

China Lake Feasibility Study

Watershed management and lake restoration



Client: **Kennebec Water District**

Project Location: **East Vassalboro, ME**

Project Size: **3,845 acres**

Services Provided:

- **Water Quality Assessment**
- **Hydrologic and Hydraulic Analysis**

Project Timeframe: **2012**

Relationship with Client: **Since 1970's**

Client Needs:
China Lake is a 303(d) listed impaired water body due to poor water quality and annual nuisance algal blooms. The Kennebec Water District wanted to evaluate possible in-lake restoration methods to improve the water quality in their drinking water source because watershed-based methods have not mitigated the problem over the last few decades.

Kleinschmidt Solution:
Kleinschmidt investigated three potential in-lake restoration techniques to address the poor water quality issue: hypolimnetic withdrawal, alum treatment, and controlled drawdown. Kleinschmidt concluded that hypolimnetic withdrawal would be ineffective, the current lake level order may be altered to optimize nutrient export from the system, and alum treatment, although expensive, would likely be the most effective restoration method.

Client Benefits:
Kleinschmidt provided a detailed feasibility study that clearly identified the costs and benefits of three in-lake restoration techniques allowing the Kennebec Water District to make an educated decision on the best path forward to improve the water quality of China Lake.

Kleinschmidt

Long Creek Modeling Services

Hydrologic and hydraulic engineering analysis for restoration support

Client: **Long Creek Watershed Management District**

Project Location: **Portland, South Portland, Westbrook, and Scarborough**

Services Provided:

- **Watershed Management and Basin Planning**
- **Stormwater Management**
- **Hydrologic & Hydraulic Engineering**

Project Timeframe: **2013 - ongoing**

Relationship with Client: **Started 2013**

Client Needs:
The Long Creek Management District requested that a hydrologic and hydraulic model be developed for the Long Creek watershed to evaluate the implementation of the Long Creek Restoration plan. The District required the development of a defensible, comprehensive model that could efficiently gauge the effectiveness of separate stormwater retrofits and in-stream restoration projects.

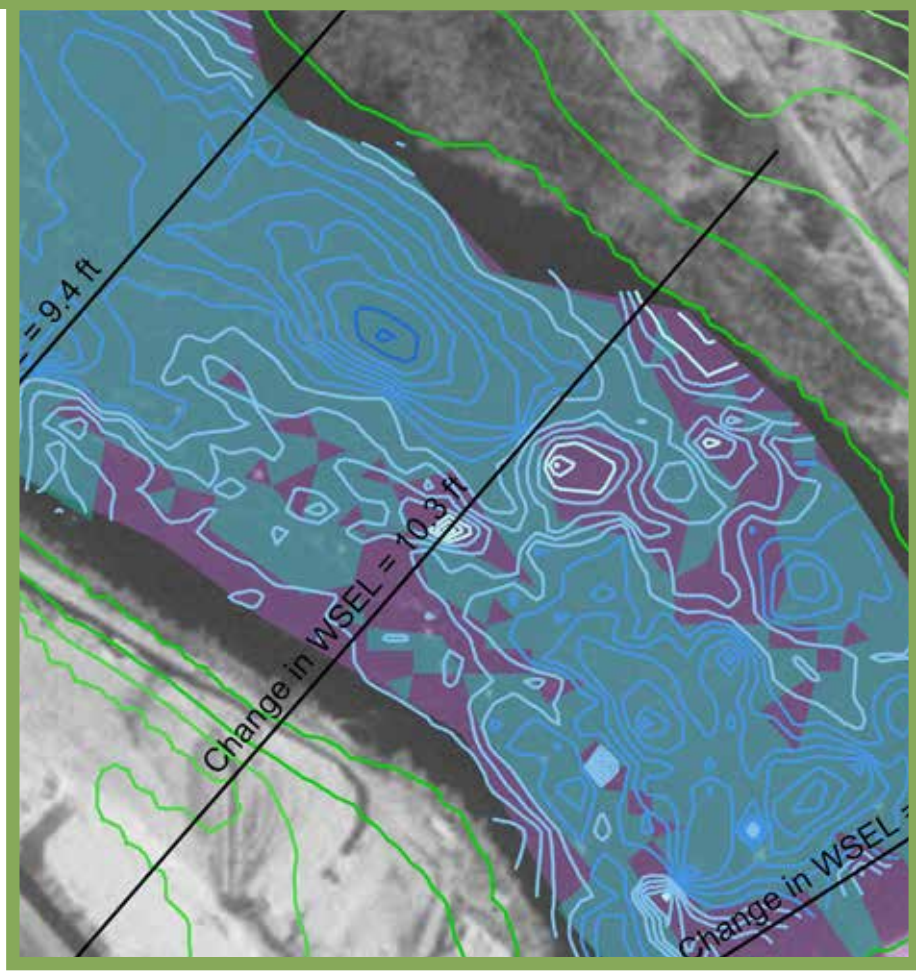
Kleinschmidt Solution:
Kleinschmidt developed a coupled HEC-HMS and HEC-RAS model that can readily be manipulated to evaluate watershed management plan implementation. The model can adaptively address the changes in hydrologic and hydraulic conditions in the watershed from existing to proposed conditions.

Client Benefits:
Kleinschmidt was able to deliver a working model of the entire watershed that provided the Long Creek Watershed Management District with a tool to analyze stormwater retrofits, best management practice implementation, and in-stream modifications proposed in the watershed management plan and yet to be developed for the stream restoration. As the District strives to reach reclassification of the urban impaired stream, the built model will be able to predict effectiveness of proposed projects, thereby avoiding potential costly missteps in the restoration process. During the process, Kleinschmidt helped identify alterations to the monitoring plan that will benefit future work on Long Creek.

Kleinschmidt

Penobscot River Restoration Project

Hydrologic and hydraulic analysis to assess dam removals



Client: **Penobscot River Restoration Trust**

Project Location: **Veazie and Old Town, ME**

Services Provided:

- **Hydrologic and hydraulic analysis and modeling**
- **Aquatic habitat assessment**
- **GIS database development and spatial analysis**

Project Timeframe: **2006 - 2008**

Relationship with Client: **Since 2006**

Client Needs:
The Penobscot River Restoration Project is a large, innovative restoration project on New England's second largest river. The Penobscot River drains 8,570 square miles or about one-third of Maine. The project to remove two dams and install fish passage at a third was initiated by the Penobscot River Restoration Trust - a non-profit composed of several conservation groups and the Penobscot Indian Nation. The restoration project will restore 11 species of sea-run fish to the Penobscot River and reestablish the river's historic connection to the ocean, dramatically improving access to nearly 1,000 miles of river habitat.

Kleinschmidt Solution:
Among the services provided by Kleinschmidt during inital stages of the Penobscot River Restoration Project has been to perform hydrologic and hydraulic analysis. Our engineers determined changes in river flows that would occur due to decommissioning and removal of the Veazie and Great Works dams. Our hydrologists derived peak annual flows from historic stream gage data, and determined flood flows with recurrence intervals ranging from 1.5 to 100 years for each site using Log-Pearson III statistical analysis. To calibrate the hydraulic model, hydrologists determined peak historic flood flows in combination with published peak water levels for the flood event. Each of the calculated flows were used as input in HEC-RAS to determine changes that would occur in parameters such as river velocity, depth, cross sectional flow area, and top width.

Client Benefits:
Kleinschmidt's results were used to assess how the dam removals would affect water levels in the river during extreme flood events, sediment transport, fish passage, recreation opportunities, and wildlife habitat.

Kleinschmidt

ATTACHMENT C

RÉSUMÉS

BJORN A. LAKE, PH.D., P.E.

ENVIRONMENTAL ENGINEER

Bjorn Lake specializes in solving water resource problems using his diverse educational background and expertise. He manages restoration projects and water quality studies related to rivers, lakes, and streams including assessing water quality parameters such as dissolved oxygen, temperature, and inorganic and organic pollutants. He studies possible effects to water quality of sediment transport related to proposed dam removals including estimated total volume, particle distribution, and contaminant levels and need for sediment management plans post dam removal. Bjorn also manages and performs fish passage feasibility studies and designs including hydrologic and hydraulic calculations, public outreach, field measurements, site layout, and permitting coordination.

Key Expertise

- Water/Sediment Quality
- Fish Passage Feasibility Studies
- Hydrologic & Hydraulic Analysis
- Dam Removal
- Habitat Improvement & Restoration
- Fish Passage Design
- Study Scoping & Plan Development

Professional Registration
Professional Engineer, ME

Professional Affiliations
Society for Ecological Restoration

Sebasticook Regional Land Trust

Water Resources Committee of the Maine Water Utilities Association

Education
Ph.D. Civil and Environmental Engineering, University of Maine, 2009

M.S. Ecology and Environmental Science, University of Maine, 2003

B.A. Biochemistry, College of Wooster, 1997

Years of Experience
With Kleinschmidt: 4
Total: 14

Hydrologic and Hydraulic Modeling Study, Long Creek
Long Creek Watershed Management District, Portland, ME
Managed a team of hydrologic and hydraulic engineers to develop a coupled HEC-GeoHMS and HEC-GeoRAS model for an urban-impaired stream watershed in southern Maine. The model will be used in future watershed restoration projects, culvert replacements, and evaluation of stormwater retrofits.

Breach Analysis, Gambo Dam
SAPPI Fine Paper , Westbrook, ME
Built a HEC-RAS v4.1 model of a reach in the Presumpscot River to investigate dam breach and flood flow scenarios. Wrote a memorandum to FERC to maintain the low hazard classification of the dam.

Feasibility Study, Hawkes' Mill Dam
Atlantic Salmon Federation, Albion, ME
Managed the feasibility study investigating fish passage alternatives at an old mill dam. Performed the hydrology calculations and hydraulic modeling. Organized meetings and project partner engagement.

Fish Bypass Final Design, Howland Dam
Penobscot River Restoration Trust, Howland, ME
Managed a multi-firm team designing a bypass around the decommissioned Howland Dam as part of one of the largest river restoration efforts in the United States. The fish bypass will be approximately 1000 feet long with an operating range spanning a few hundred to many thousands cubic feet per second of flow. Design includes hydraulic gate retrofits, improvements to downstream passage at the dam, electrical work, powerhouse demolition, and development of a complex blasting plan to satisfy resource agency requirements.

Breach Analysis, Saccarrapa Dam
SAPPI Fine Paper , Westbrook, ME
Built a HEC-RAS v4.1 model of a reach in the Presumpscot River to investigate dam breach and flood flow scenarios. Wrote a memorandum to FERC to maintain the low hazard classification of the dam.

Water Quality, Beneficial Reuse of Water Treatment Residuals
Kennebec Water District, East Vassalboro, ME
Managed and performed a study to examine re-use applications for the alum-based water treatment residuals produced at the water treatment plant involving complete physical and chemical characterization. Project included laboratory-scale experiments investigating contaminant leaching and immobilization as well as design and optimization of Best Management Practices. Participated in permitting discussions with Maine Department of Environmental Protection to alleviate concerns over high arsenic levels in the water treatment residuals for an application at the Maine Lakes Resource Center in Belgrade, Maine.

Final Dam Remediation/Removal Study, Hawkinsville Dam
Hudson River–Black River Regulating District, Boonville, NY
Managed the final study of two alternatives to bring a dam in upstate New York into compliance with regulations. Study covered the full suite of possible effects of both alternatives including cultural resources, natural resources, and socioeconomic factors. Study involved the development of conceptual designs and opinions of probable cost. Construction on the dam is slated for 2015 after completion of the final design for the preferred alternative.

Statewide Dam Survey, Maine
National Oceanic and Atmospheric Administration, Various Locations, ME
Assisted in writing a public outreach brochure and booklet involving improved fish passage and dam removal. Performed physical surveys of dams in Maine.

Relicensing Project, Vanceboro Dam
Woodland Pulp, LLC, Baileyville, ME
Assisted in scoping water quality studies related to the State of Maine trophic indices including the determination of the appropriateness of agency- proposed water quality sampling plans. Provided guidance on mercury fate and transport in impoundments.

Fishway Final Design, Grist Mill Road
Atlantic Salmon Federation, Carmel, ME
Managed the final design of an Alaskan steeppass fishway at a ledge outcrop underneath a Maine Department of Transportation bridge. The project included public outreach, civil site layout, construction sequencing, opinion of probable construction cost, agency consultation, and hydrologic and hydraulic calculations.

Water Quality Drawdown Study, China Lake
Kennebec Water District, Vassalboro, ME
Managed and conducted a study investigating the optimization of the China Lake water level plan to improve the water quality within the lake. Study included a feasibility study for installing hypolimnetic withdrawal and dosing with alum.

Habitat Improvement Projects, Lake St. Lawrence
New York Power Authority, Massena, NY
Evaluated engineering and permitting feasibility for Common Tern habitat creation and improvement on Lake St. Lawrence. Developed opinions of probable construction cost. Assisted in the design of shoreline stabilization measures on Nichols Island dikes.

Dam Removal Study, Pembroke Dam
Algonquin Power Company, Pembroke, NH
Managed preliminary study. Investigated possible effects to water quality of sediment transport in the Suncook River after a proposed dam removal. Sediment characterization included estimated total volume, particle distribution, and contaminant levels. Determined the extent and necessity of a sediment management plan post removal of the dam.

Habitat Improvement Projects, Niagara River
New York Power Authority, Buffalo, NY
Prepared a construction bid document for Osprey nesting habitat improvement; reviewed Frog Island designs; presented Motor Island design concepts at a shoreline stabilization conference in Augusta, Maine.

Water Quality, Holtwood Redevelopment Project
PPL Corporation, Holtwood, PA
Reviewed water quality data collected from a flooded excavation work site and compared those results with natural bacteria levels of the Susquehanna River. Provided guidance on worker safety relating to fecal coli form contamination at the construction site following Hurricane Irene.

Dam Removal Feasibility Study, Great Dam
VHB Inc., Exeter, NH
Managed Kleinschmidt's scope of work investigating dam rehabilitation scenarios for a feasibility study for the Great Dam in Exeter, New Hampshire. Coordinated with New Hampshire Department of Environmental Services dam safety officials to bring the deteriorating dam into compliance as requested by the Town. Also, executed the U.S. Army Corps of Engineers (USACE) CRREL methodology for evaluating dam removal on an ice-effected river as part of the Great Dam removal feasibility study.

MICHAEL C. SCHIMPFF, P.E., P.F., P.H.

SENIOR HYDROLOGIST

Mike Schimpff specializes in hydrologic and hydraulic analysis including hydropower feasibility studies, Probable Maximum Flood (PMF) analyses, dam breach studies, energy analyses and modeling, watershed modeling, reservoir management, and backwater and transient analyses. He manages and performs statistical analyses on hydrologic data including flow duration analyses and flow frequency analyses using models including HEC-RAS, HEC-HMS, HEC –RES SIM, and WRC Flood Frequency Analyses. Mike routinely provides quality control and project oversight and is called upon to provide professional testimony as an expert witness in the area of hydrology, open channel hydraulics, and headwater benefits analyses.

Key Expertise

- Hydrologic & Hydraulic Analysis
- FEMA Flood Studies
- Hydro Feasibility Study
- Dam Breach Studies
- PMF Determination
- Dam Removal
- Gates & Water Control
- Hydro Due Diligence

Professional Registration

Professional Engineer - ME, CO, NY, and NE
Professional Forester - ME
Professional Hydrologist
Natural Resources Conservation Service Technical Service Provider, ME

Professional Affiliations

American Society of Dam Safety Officials

Society of American Foresters

American Water Resources Association

National Hydropower Association

Education

M.S. Forest Resources with specialty in Forest Hydrology, University of New Hampshire, 1977

B.A. Biology, Drake University, 1973

Years of Experience

With Kleinschmidt: 34
Total: 38

Hydrology and Hydraulic Analysis, West Grand and East Grand Lakes, ME
Various Clients, Numerous Locations
Completed hydrology and hydraulic analysis of these substantial watersheds to support reservoir management planning. West Grand Lake is estimated at 14,000 acres, while East Grand is approximately 16,000 acres.

Hydrology and Hydraulic Analysis, Hadlock Pond Restoration
New York Department of Environmental Protection, Fort Ann, NY
Completed hydrology and hydraulic analysis of the watershed and pond to support the design and replacement of a water control structure on this 194-acre pond.

Rehabilitation Feasiblity Study, Moosehead Hydroelectric Dam
Town of Dover Foxcroft, Dover Foxcroft, ME
Completed hydrology and hydraulic analysis and energy analysis for rehabilitation of small hydroelectric station. Completed feasibility assessment including turbine selection for report of rehabilitation options.

Dam Removal Feasibility Study, Hawkes' Mill Dam
Maine Council of Atlantic Salmon Federation, Albion, ME
Project Manager for feasibility study investigating fish passage alternatives at an old mill dam including performance of hydrology calculations and hydraulic modeling, stakeholder outreach, and agency consultation.

Dam Removal, Sandy River
Madison Electric Works, Madison, ME
Project Manager for dam removal design including use of bathymetric data for hydraulic modeling. Field studies and dam removal analyses included wetlands, bank erosion, fisheries habitat, and ice jam potential.

Hydro Feasibility Study, Penobscot River Basin
Great Northern Paper, Millinocket, ME
Project Engineer for a reconnaissance level analysis of the technical and economical feasibility of hydropower generation at numerous sites within the Penobscot River Basin. Assessed the energy capacity, environmental, and regulatory implications associated with hydroelectric development and generation at each site. Kleinschmidt's final analysis provided detailed benefit cost assessments, conceptual project layouts, and recommendations regarding which of the projects warranted further investigation.

Micro-hydro Feasibility Study, Bass Mill Building
Bass/Wilson Properties, LLC, Wilton, ME
Senior engineer for feasibility study at renovated Bass shoe mill that once housed a small hydro mechanical/electrical system. Conducted an initial assessment to determine the generating potential of the site, conceptual layout and determine if there are any major impediments to developing the site. Applied basic values regarding development costs to initial estimates of project generation to provide an initial assessment as to the project's economic and technical feasibility.

Hydropower Redevelopment, Freedom Falls
Freedom Mill, LLC, Freedom, ME
Conducted feasibility study at old gristmill site to assess possible redevelopment options including performing hydraulic analysis to determine estimate of the annual generation using typical values for a run of river facility in Maine. Derived a conceptual level opinion of cost and prepared a benefit-cost ratio for several development options. Prepared final design plans and specifications for a 50 kw installation including dam rehabilitation work and the associated FERC application for license exemption. Also provided construction monitoring during the construction phase.

Hydro Feasibility Study, Curtis Station
International Paper Company, Corinth, NY
Conducted hydrologic, hydraulic, and energy analyses as part of feasibility analysis to evaluate considerations that would be pertinent to redevelopment of site.

Hydroelectric Project Redevelopment, Troy Hydroelectric Project
Falling Waters Hydropower, Inc., Troy, VT
Conducted hydrologic, hydraulic, and energy analyses as part of feasibility analysis to evaluate considerations that would be pertinent to redevelopment of site including constructing new powerhouse.

Hydroelectric Redevelopment Design, St. George Project
J. D. Irving Limited, Saint John, NB, Canada
Conducted hydrologic, hydraulic, and energy analyses as part of feasibility analysis to evaluate considerations that would be pertinent to redevelopment of site including constructing new powerhouse.

Hydro Feasibility Study, Lyons Falls Project
Kruger Energy, Lyons Falls, NY
Performed multiple feasibility and energy studies including developing flow duration curves as well as headpond and tailwater rating curves.

Hydro Feasibility Study, Higley Redevelopment Project
Orion Power, Edwards, NY
Conducted hydrologic, hydraulic, and energy analyses as part of feasibility analysis to evaluate considerations that would be pertinent to redevelopment of site including constructing new powerhouse.

Dam Breach Analyses, Several Projects along Oswegatchie River
Brookfield Renewable Power, Oswegatchie River, NY
Performed series of dam breach analyses and Inflow Design Flood determinations for several projects on the Oswegatchie River.

Hydro Feasibility Study, North Unit Diversion Dam
Portland General Electric and North Unit Irrigation District, Bend, OR
Project Manager for performing an assessment of the feasibility of developing the hydroelectric generating potential at the North Unit Diversion Dam. Included in the work was a review of hydrology and hydraulics of the site, and a conceptual plan for development was prepared. This data was the basis for preparing a conceptual opinion of cost and estimate of the annual generation for the project.

Hydro Feasibility Study, Prineville Reservoir at Bowman Dam
Portland General Electric, Prineville, OR
Project Manager for feasibility assessment of developing hydroelectric generating potential at the U.S. Bureau of Land Management's Bowman Dam. Included in the work was a review of water allocations, reservoir operations, hydrology, and development of the appropriate design flow. A detailed review and development of the water allocation models were done to review potential changes to the current reservoir operating rules. This data was the basis for preparing a conceptual plan for development, a conceptual opinion of cost, and an estimate of the annual generation for the project. Also reviewed and updated previous feasibility studies to assess project potential in light of previous study assumptions and energy sales conditions.

BRUCE E. HALVERSON, P.E., C.F.M. SENIOR ENGINEERING CONSULTANT

Bruce Halverson specializes in analyses of extreme hydrologic events and the quantification of their effects, risk analyses and the development of hydrologic and hydraulic designs, use of modeling systems, and computer programming related to hydraulic modeling. He performs distributed-parameter hydrologic modeling, sediment delivery and transport studies, probable maximum flood studies, floodplain determinations, reservoir flood routing and hydropower studies, and riverine biological habitat studies. Bruce conducts hydrologic alteration analyses using statistical methods and designs and analyzes hydraulic structures and physical model studies. He uses modeling systems developed by the U.S. Army Corps of Engineers, the Danish Hydraulic Institute, the National Weather Service, the U.S. Department of Agriculture, the U.S. Environmental Protection Agency, and the Natural Resources Conservation Service. He also uses integrated geographic information system-based model systems such as HEC-GeoRAS, HEC-GeoHMS, and Watershed Management System.

Key Expertise

- Hydrologic & Hydraulic Analysis
- Forensic Flood Event Analysis
- Flood Damage Risk Analysis
- Dam & Spillway Engineering
- Dam Breach Studies
- Gates & Water Control Design
- Fish Passage Hydraulic Design

Professional Registration
Professional Engineer, IL and WI

Certification/Training
Certified Floodplain Manager

Professional Affiliations
Society of American Military Engineers

Association of State Floodplain Managers

Education
M.S. Civil Engineering, Louisiana State University, 1988

B.S. Agricultural Engineering, University of Wisconsin-Madison, 1981

Years of Experience
With Kleinschmidt: 3
Total: 32

Penstock Transient Analysis, Solomon Gulch Hydroelectric Project
Cooper Valley Electric Association, Glennallen, AK
Performed transient analysis of 3,800 foot penstock, as part of Part 12 Inspection of Solomon Gulch Hydroelectric Project. Analysis included use of numerical model (Bentley HAMMER) to analyze risk of failure due to high pressure and collapsing due to negative pressures arising from sudden flow changes.

Dam Failure Analysis and Inundation Mapping, Marshfield Dam
Green Mt. Power, Marshfield, VT
Performed simulation of breach floodwave due to failure of Marshfield Dam, down the Winooski River from the dam to Montpelier, Vermont. Used HEC-RAS to simulate flooding, develop mapping of inundated areas downstream, and determine rate of flood wave to be used by emergency services as part of warning system for approximately 33 miles of the Winooski River

Dam Failure Analysis and Inundation Mapping, Connecticut River
TransCanada, Connecticut River in VT, NH, and MA
Performed simulations of breach floodwaves and prepared inundation mapping to update Emergency Action Plans for Moore and Comerford Dams on the Connecticut River. The modeling and mapping extended from Moore Dam to Holyoke Dam in Massachusetts. Used HEC-RAS to simulate flooding, develop mapping of inundated areas downstream, and determine rate of flood wave to be used by emergency services as part of warning system for approximately 194 miles of the Connecticut River. The project deliverables also included an interactive GIS-based mapping application to view inundation zones for user-chosen scenarios and timeframes.

Hydropower Feasibility and Preliminary Design, Brandon and Dresden Island Dams
Northern Illinois Hydro, Joliet, IL
Performed hydraulic modeling of the Illinois Waterway and preliminary hydraulic analysis/design of proposed hydroelectric projects on existing dams.

Wetland Restoration/Mitigation, World Dairy Center
Wisconsin Department of Transportation, Madison, WI
Performed analysis and modeling of 200 acre site in southeast Madison to determine suitability of site for restoration and use for wetland mitigation. The project included the development and calibration of a shallow groundwater model (DRAINMOD), which was used to simulate the groundwater fluctuations for the current drained conditions and future undrained conditions.

Fish Passage Hydraulic Design, Orono Mill Project
Black Bear Hydro Partners, LLC, Orono, ME
Provided oversight and quality control review of hydraulic design of downstream fish passage components of proposed modifications to Orono Mill Project. The design constraints of structures included both performance and regulatory aspects of optimal flow velocities.

Fish Passage Preliminary Design, Prairie du Sac
Alliant Energy, Prairie du Sac, WI
Performed preliminary design of upstream and downstream fish passage structures. Design considerations include a variety of constructability constraints as well as regulatory considerations. Project feature designs included upstream and downstream passage structures and various features used to develop attraction velocities in the headwater and tailwater areas.

Probable Maximum Flood and Snowmelt Analysis, Hebgen Reservoir
PPL Montana, Galatin County, WY and MT
Performed analyses of rainfall and snowmelt events and developed the Probable Maximum Flood for a 930-square mile watershed in Wyoming and Montana. The project included calibrating hydrologic models (HEC-HMS) for snowmelt and rainfall/runoff processes, which were necessitated due to the relatively low percentage of rainfall and snowmelt received by the downstream reservoir. The Probable Maximum Precipitation was developed using methods in HMR55A. The hydrologic modeling was performed to develop a range of expected reservoir inflows due to extreme snowpack conditions during spring snowmelt.

Independent External Peer Review
Lake Michigan Diversion Accounting, Chicago, IL
Was selected as H&H Modeling Expert for a three-member technical review committee. Primary responsibility was to review procedures and models used to develop flow diversion quantities from Lake Michigan. Technical standards for methodologies used for this process are mandated by the U.S. Supreme Court, and resulting flow estimates are reviewed by the International Joint Commission, a bi-national organization, established by the U.S. and Canada. This process is renewed on a five to seven year cycle, and the current committee is referred as the Seventh Technical Committee.

Due Diligence of Hydroelectric Projects
Confidential Client
Performed analysis of existing operations of hydroelectric facilities, hydrologic analysis of river flows, and statistical analysis of potential plant upgrades for use with economic value analysis.

Previous Project Experience

Flood Event Analysis / Expert Witness, Hackensack River
NY and NJ
Responsible for developing integrated hydrologic and hydraulic models to simulate the flooding that occurred after a Nor'easter produced more than 10 inches of rain over the Hackensack River basin in New York and New Jersey in 2007. The models were used to accurately hindcast the flooding and the impact of reservoir operations on the river flows and flood stages. The models were developed using GIS techniques to quantify the relevant hydrologic parameters.

Probable Maximum Flood Analysis, DeForest Lake Reservoir
United Water, Rockland County, NY
Responsible for developing a Probable Maximum Flood estimate for the DeForest Lake Reservoir using HEC-HMS software. The project objective was to develop a revised Probable Maximum Flood using two different Probable Maximum Storm scenarios: one scenario involved using the customary HMR51/52 method and the other involved using a site-specific Probable Maximum Storm. The models were developed using GIS techniques to quantify the relevant hydrologic parameters.

MICHAEL P. HROSS

CIVIL/ENVIRONMENTAL ENGINEER

Mike Hross specializes in hydrologic and hydraulic analysis including hydropower feasibility studies, dam breach studies, energy analyses and modeling, watershed modeling, reservoir management, and transient analyses using models including HEC-RAS, HEC-HMS, HEC-RES SIM, and HAMMER V8i. Mike performs statistical analyses on hydrologic data including flow duration analyses and flow frequency analyses.

Key Expertise

- Hydrologic & Hydraulic Analysis
- Hydro Energy Analysis
- GIS Spatial Analysis
- Dam Breach Studies
- Hydro Due Diligence

Education

M.S. Civil and Environmental Engineering, Northeastern University, 2012

B.S. Ecology and Environmental Sciences, University of Maine, 2010

Years of Experience

With Kleinschmidt: 2
Total: 2

Hydraulic Modeling, Hiram Dam Spillway and Gates
Brookfield Renewable Energy Group, Hiram, ME
Developed a comprehensive headpond elevation versus discharge rating curve for all spillways and gate structures for the Hiram dam. The rating curve was developed to aid dam operators with headpond regulation.

Hydraulic Modeling, Minimum Flow Unit Energy Analysisat Graham Lake
Black Bear Hydro Partners, LLC, Milford, ME
Used Graham Lake historical reservoir rule curve and historical discharge data to perform an energy analysis on a minimum flow hydroelectric unit. The analysis examined multiple operating scenarios and also different sized unit to determine the maximum annual generation that could be obtained.

Hydraulic Modeling, Box Mill Dam Fish Passage Feasibility Study
China Region Lakes Alliance, China, ME
Performed a site visit to the Box Mill Dam and assisted in collecting dimensions and elevations of the dam. Performed a hydrologic analysis of the dam's watershed using GIS and USGS regression equations for ungaged watersheds. Estimated required rock volumes and performed quality control/quality assurance checks of hydraulic calculations for a proposed fish passage rock ramp for the dam. Assisted in drafting a feasibility report of the proposed rock ramp.

Hydraulic Analysis, Orono Mill Project Downstream Fish Passage
Black Bear Hydro Partners, LLC, Milford, ME
Determined the necessary height of a weir in order to pass sufficient flow into a downstream fish passage structure. Determined velocities and depths of water in the structure. Also, determined the necessary length and slope for a fish return pipe to ensure the minimum depth of water and maximum exit velocities were satisfied.

Hydraulic Modeling, Hawkinsville Dam Rehabilitation or Removal Analysis
Hudson River-Black River Regulating District, Hawkinsville, NY
Used the HEC-RAS hydraulic modeling software, in conjunction with ESRI's ArcGIS, to develop a model of the Hawkinsville dam and the Black River. Used the model to show that the dam's hazard classification was too strict, and performed a dam breach analysis that led to a lowering of the hazard class by New York DEC. Used the model to evaluate different rehabilitation and removal alternatives. Drafted a dam breach report and assisted in the drafting of a feasibility report regarding rehabilitation and removal alternatives. Also, developed an opinion of probable cost for dam removal versus rehabilitation.

Hydraulic Modeling, Scotland Minimum Flow TurbineFirst Light Power Resource Services, LLC, Norwich, CT
Developed a daily energy model for the Scotland hydroelectric facility that evaluated six different turbine options. The model included estimated head losses, USGS flow data, efficiency curves, and headpond and tailwater rating curves. The model's results were used to help the client decide the most economic option for a new minimum flow turbine.

Hydraulic Modeling, Dwight Station Penstock Replacement
Essential Power, LLC, West Springfield, MA
Performed detailed head loss calculations for the Dwight Station penstocks. Existing conditions were compared with various options for penstock replacement or lining and the incremental change in head loss between each option was compared.

Hydraulic Modeling, Menominee Dam Entrainment and Energy Assessment
North American Hydro, Neshkoro, WI
Calculated head losses for an existing trash rack structure and several proposed trash rack configurations for the Menominee project. Compared the incremental change in head loss between each option modeled.

Hydraulic Analysis, Solomon Gulch Project Minimum Flow Diversion
Copper Valley Electric Association, Glenmallen, AK
Determined the required dimensions for a v-notch weir to accommodate a seepage flow without overtopping. Performed a head loss analysis for a minimum flow pipe to determine the required diameter of the pipe to meet the minimum flow requirement.

Hydraulic Modeling, West Point Micro Hydro Engineering
Select Engineering Services, Layton, UT
Used a GIS to delineate the watersheds of three dams at West Point in New York. Estimated hydrology for the sites by finding nearby, comparable USGS gaged watersheds and prorating the flows to the dams. Developed an energy model using the synthesized hydrology for the three dams.

Hydraulic Analysis, Hebgen Dam Spillway Replacement Engineering
PPL Montana, LLC, Butte, MT
Developed a headpond versus discharge rating tool to evaluate the differences between various spillway designs. The spreadsheet was designed such that spillway parameters could be changed and the discharge capacity based upon the new design easily checked.

Hydraulic Modeling, Twin Falls Fixed Crest Analysis and Design
Idaho Power Company, Boise, ID
Used the HEC-RAS hydraulic modeling software to determine the tailwater elevation at the base of an arch spillway for a stability analysis.

Hydraulic Analysis, Tomahawk and Grandfathers Falls Hydroelectric Projects Fish Protection Evaluation, Wisconsin Public Service Corporation, Green Bay, WI
Developed annual and monthly flow duration curves for the Tomahawk and Grandfathers Falls projects for a fish protection evaluation. Generated monthly statistics, such as mean, median, and maximum flows, based upon the flow duration curves.

Hydraulic Analysis, Fairfax Falls and Clark Falls Penstock Inspection – Internal Vacuum Pressures, Green Mountain Power, Colchester, VT
Performed hydraulic analyses of air vents for the Fairfax Falls and Clark Falls projects to determine the minimum internal pressures that would be experienced within the projects' penstocks when the penstocks were being drained.

Hydraulic Modeling, Vermont Tissue Hydro
Carbon Zero, LLC, North Bennington, VT
Used the HEC-RAS hydraulic modeling software to model the tailrace of the Vermont Tissue Hydro development. The model was used to determine the required elevation in the tailrace to minimize head losses in the tailrace at the tailrace design flow. Drafted a memo summarizing the methods and results for the client.

Hydraulic Analysis, Proctor Station Minimum Flow Gate
Green Mountain Power, Colchester, VT
Performed hydraulic analysis to determine the elevation required for the minimum flow gate to pass the minimum flow when the headpond was lowered.

Hydrologic & Breach Analysis, Mendums Pond Dam
New Hampshire Department of Environmental Services, Concord, NH
Completed a hydrologic and hydraulic analysis for the Mendums Pond Dam, located on the Little River in New Hampshire. Used HEC-HMS to determine the 2.5x100-Year inflow for use in the breach analysis. Developed a HEC-RAS model to determine the potential downstream impacts from a breach.

ATTACHMENT D

METHOD OF PAYMENT (LUMP SUM BASIS)

METHOD OF PAYMENT
(LUMP SUM BASIS)

1. Definitions

    a. Kleinschmidt - Kleinschmidt Associates.

    b. Basic Services - Services to be performed for or furnished to Owner as described in the Scope of Work in the Proposal.

    c. Additional Services - Services to be performed for or furnished to Owner that are not included under Basic Services. Additional services may be defined in the Proposal or agreed to by Owner anytime during the Project.

    d. Kleinschmidt's Consultants - a person or entity having a contract with Kleinschmidt to provide services or supplies as an independent associate or consultant engaged directly on the Project.

2. Owner agrees to pay Kleinschmidt for Basic Services a lump sum fee quoted in the Proposal which include services of Kleinschmidt's Consultants, if any. Unless otherwise agreed upon, monthly invoicing for lump sum work will be based on the percent of work completed.

3. For any Additional Services Owner may pay Kleinschmidt either on a negotiated Lump Sum basis or Hourly Rate basis, as mutually agreed by the Owner and Kleinschmidt in writing.