

Proposal for

HARDISTY CREEK FISH PASSAGE AND HABITAT ASSESSMENT

Submitted to

TOWN OF HINTON

October 2007

P72-7305

Presented by
Golder Associates Ltd., Edmonton

Golder Associates Ltd.
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October 19, 2007

P72-7305

Town of Hinton
Planning and Development Services
2nd Floor, 131 Civic Centre Road
Hinton, Alberta T7V 2E5

Attention: Jean Anne Fraser, Director

RE: Hardisty Creek Fish Passage and Habitat Assessment Near Thompson Lake

Please find enclosed our proposal for Fish Passage / Fish Habitat Assessment and Corrective Action Designs for two crossings of Hardisty Creek in the Town of Hinton, Alberta.

We look forward to working with you on this project. Please feel free to contact the undersigned should you have any questions or comments regarding this proposal.

GOLDER ASSOCIATES LTD.

Handwritten signature of Marcel Chichak.

Marcel Chichak, B.Sc., P. Eng.
Senior Water Resources Engineer

Handwritten signature of Nathan Schmidt.

Nathan Schmidt, Ph.D., P. Eng.
Senior Water Resources Engineer, Associate



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Information contained in this proposal is proprietary to Golder Associates Ltd. and is therefore confidential. It is to be used solely for the purpose of evaluating the proposal and, to the extent permitted under law, is not to be disclosed to anyone outside of the evaluation group without written permission from Golder Associates Ltd.

1 INTRODUCTION

The Hardisty Creek Restoration Project (HCRP) is a multi-stakeholder initiative with the general mandate to foster increased public awareness of watershed concerns within Alberta and, specifically, to restore the fish, wildlife, vegetation and overall health of the Hardisty Creek watershed. The HCRP is comprised of the Athabasca Bioregional Society, Foothills Model Forest, Town of Hinton, Alberta Sustainable Resource Development, Alberta Infrastructure and Transportation, Fisheries and Oceans Canada, Hinton Fish and Game Association, Weldwood of Canada Ltd. and the public. Other stakeholders, such as Canadian National Railroad, have also pursued initiatives to improve the Hardisty Creek watershed.

The overall objective of the HCRP is to produce a detailed plan to guide the implementation of restoration activities at a number of sites within the Hardisty Creek watershed. When completed, the restored sites will demonstrate practical and proven restoration techniques addressing the range of riparian and fish habitat impacts within the study area. The restored sites will also serve to educate interested parties from around the Province.

The Town of Hinton has invited Golder Associates Ltd. (Golder) to submit a proposal to conduct fish passage and fish habitat assessments and develop corrective action designs for Hardisty Creek within the Town of Hinton, Alberta.

2 APPROACH

Two culvert crossings in the Thompson Lake District have been selected for corrective action as shown in Figure 1. These are:

- #C20245 on Bradwell Street; and
- #C20247 on Brookhart Street



Figure 1 Selected culvert locations on Hardisty Creek

The approach for completing the corrective action designs for the selected crossings consists of the following steps:

- **Step 1:** Identify opportunities for improving fish habitat and fish passage by conducting a detailed fish habitat assessment. Other opportunities may include riparian or instream habitat structures. For example, it may be appropriate to protect the streambank at the outside meander bends near the culverts, or near roadway encroachments. This initial step also includes the field investigation portion of the project, including the culvert and channel surveys necessary to complete a fish passage assessment (see Step 2).
- **Step 2:** Quantify the fish passage issues at the selected culverts and identify feasible alternatives for improving fish passage by conducting a detailed fish passage assessment. The alternatives may include substrate placement or baffles in the culvert barrel, downstream riffles to create backwater through the culvert to correct perching, installation of additional pipes, or structure replacement (i.e., new culvert or bridge).
- **Step 3:** Produce an engineering design suitable for construction of selected alternatives such as culvert backflooding or rock weirs. If it is

determined that culvert replacement is the best alternative, design of the replacement structure would not be included in the scope of work.

An additional step would be to complete a Restoration Plan (Plan) for Hardisty Creek. The Plan would prioritize restoration actions based on both biological and cost factors, compile the results of the fish habitat and fish passage assessments, and compare the alternatives with input from stakeholders.

3 METHODOLOGY

3.1 Fish Habitat Assessment

A fish habitat assessment will be conducted to identify opportunities for improving fish habitat and fish passage along Hardisty Creek. All habitat assessment work will be focused on the target species: rainbow trout, bull trout, brook trout and mountain whitefish.

Primarily, this task will comprise a site visit by a fisheries biologist experienced in both fish habitat mapping and restoration.

Work required to complete the habitat assessment consists of the following specific tasks:

- Review of available information, including:
 - NTS soil and biophysical maps;
 - Current satellite images and historical aerial photography;
 - Development, access management and land use planning documents;
 - Aquatic habitat and fisheries inventory summaries; and
 - Federal, provincial, municipal and third-party (consultant) reports.
- Sediment source survey, to identify major erosional features or unstable stream banks. The survey will be based on the following information sources:
 - National Topographic Series (NTS) soil and biophysical maps;
 - Current satellite images and historical aerial photography; and
 - Development, access management and land use planning documents.
- Culvert surveys to prepare for the fish passage assessment by confirming the available culvert information and by measuring the following:

- Culvert length and slope; and
 - Downstream channel cross-sections where mitigation measures such as riffles might be constructed to create slower water velocities through the culvert barrel.
- Fish habitat mapping, based on the Habitat Classification System (O'Neil and Hildebrand 1986) at sites where potential restoration, rehabilitation or mitigation measures are possible. The fisheries assessment will, at a minimum, extend 50 m upstream and 100 m downstream of each culvert crossing. The selected classification system allows for the identification of the major habitat types (e.g., riffles, runs, pools) into subclasses based on water depth and availability of instream cover. This system has been used extensively on many Alberta streams to assess the availability and quality of habitat for various fish life requisite activities (e.g., spawning, rearing, adult holding areas). In addition to habitat features, the following criteria will also be considered:
 - Overall channel restoration alternatives;
 - Specific fish habitat restoration alternatives;
 - Specific streambank and floodplain vegetation restoration alternatives;
 - Perennial surface flow restoration alternatives;
 - Opportunities for public involvement in restoration activities;
 - Watershed aesthetics; and
 - Flow conveyance requirements.

The result of this fish habitat assessment task will be a report that clearly illustrates the existing habitat, key constraints on local fish populations, and restoration opportunities.

3.2 Fish Passage Assessment

A detailed fish passage assessment will be conducted for the two selected culvert crossings, to quantify the conditions preventing fish passage. The detailed assessment will estimate water velocities through the culvert and tailwater conditions downstream of the culvert. The procedure for completing the fish passage assessment follows:

- Measure and delineate the contributing drainage area for each culvert from available digital topography or LIDAR data, should it become available;
- Calculate the appropriate conveyance and fish passage design discharges for each culvert, based partially on the analysis prepared previously by Golder Associates for Weldwood of Canada Ltd. (Golder 2002);

- Determine appropriate fish passage criteria, in conjunction with Fisheries and Oceans Canada;
- Develop a computer hydraulic model of each culvert configuration based on the survey data collected as part of the fish habitat assessment;
- Evaluate water velocities through each culvert, compared to fisheries criteria;
- Investigate potential alternatives for changing the culvert configuration to create acceptable hydraulic conditions for fish passage, while maintaining flood conveyance capacity. Mitigation measures may include:
 - Maintenance of existing culvert conditions to allow unimpeded fish passage (e.g. removal of physical obstructions such as debris);
 - Installation of hydraulic structures to assist in fish passage (e.g. riffles designed to create backwater pools downstream of culvert outfall);
 - Additional culverts, placed at flood stage; or
 - Replacement or realignment of the existing culverts.
- Estimate planning level costs of feasible alternatives at each culvert.

The result of the fish passage assessment will be a clear comparison of the culverts in terms of the types of measures that are necessary to provide fish passage.

3.3 Engineering Design of Selected Alternatives

Detailed engineering designs of selected crossings will be developed. The detailed designs will include the following:

- Hydraulic design, to satisfy both fish passage and flood conveyance criteria;
- Design of erosion and sediment control measures, stream bank stabilization measures, instream hydraulic structures, or riparian/instream habitat structures; and
- Design drawings, sufficient for field-fit construction implementation.

Replacement of culverts with appropriately sized culverts or bridge structures will be considered in the alternative evaluation; however, design of these structures is not included in the scope of work.

4 DELIVERABLES

Golder will provide, over the course of the project, the following deliverables to the Town of Hinton:

- Attendance at project kickoff meeting in Hinton;
- Digital submission of a draft fish habitat assessment report;
- Presentation of the fish habitat assessment results at a stakeholder meeting;
- Digital submission of a draft fish passage assessment report;
- Digital submission of engineering design drawings; and
- Five colour copies of a report documenting the results of the fish habitat and fish passage assessments, and the engineering designs.

5 SCHEDULE

The proposed project milestone dates are listed below based on a contract award date of November 1, 2007:

Stakeholder meeting #1 in Hinton (project startup)	November 5, 2007
Completion of fish habitat assessment	Spring 2008
Completion of fish passage assessment	Spring 2008
Presentation of assessment results in Hinton	May 2008
Completion of engineering designs	May 2008
Final Deliverables	June 1, 2008

6 BUDGET

The proposed budget is \$23,098 plus \$1,385.88 GST for a total of \$24,483.88, based on the selected two crossings that require corrective action. The costs assume that only one design iteration is required, based on Steering Committee acceptance of the assessment results, and based on discussions between Golder and the Steering Committee about design concepts – prior to the completion of the engineering design. The costs are also based on attendance of a Golder representative at a maximum of two committee meetings in Hinton. The budget breakdown is shown in Table 1.

Table 1 - Budget Breakdown

Hardisty Creek Fish Passage Assessment		Labour							Total Labour Hours	Total Labour Cost	Incidental Expenses % of Professional Fees	Marked-up Disbursements			Sub Total	Total Disbursements	Total Cost	
		Jim O'Neil	Marcel Chichak	Nathan Schmidt	Corey Stetura	unspecified	DRAF	WORD Support Staff				Travel	Accommodation / Food	Field Equipment				
		Level --> P-7	P-6	P-6	P-4	P-2												
Phase No.	Tasks	Rate -->	\$ 200	\$ 185	\$ 185	\$ 145	\$ 105	\$ 92	\$ 65		6%							
1000	Project Management/Start up Meeting			12						12.0	\$ 2,220	\$ 133			\$ -	\$ -	\$ -	\$ 2,353
1100	Health and Safety planning					4				4.0	\$ 580	\$ 35	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 615
1200	Fish Passage Assessment			20	2					22.0	\$ 4,070	\$ 244	\$ 400	\$ 50	\$ 100	\$ 100	\$ 595	\$ 4,909
1300	Habitat assessment			4		24	12			40.0	\$ 5,480	\$ 329	\$ 400	\$ 100	\$ 500	\$ 500	\$ 1,050	\$ 6,859
1400	Stakeholder meeting			12						12.0	\$ 2,220	\$ 133	\$ 400	\$ 50	\$ -	\$ -	\$ 495	\$ 2,848
1500	Design drawings			4				4		8.0	\$ 1,108	\$ 66	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 1,174
2000	Reporting		2	10	2	8		2	2	26.0	\$ 4,094	\$ 246	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 4,340
										0.0	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
										0.0	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
	TOTAL -->		2	62	4	36	12	6	2	124.0	\$19,772	\$1,186	\$1,200	\$200	\$600	\$600	\$2,140	\$23,098

APPENDIX I RESUMES OF PERSONNEL

- Chichak, Marcel
- Schmidt, Nathan
- Stefura, Corey



Marcel Chichak, P.Eng.

- Education** Certificate in Historic Resource Management, University of Calgary 1993
B.Sc. Civil Engineering, University of Alberta 1982
- Affiliations** Association of Professional Engineers, Geologists and Geophysicists of Alberta (APEGGA), Professional Member
Association for Preservation Technology International
Society of Automotive Engineers
- Experience**
- 2007- date **Golder Associates Ltd** **Edmonton, AB**
- Senior Water Resources Engineer*
River engineering specialist responsible for leading assessment, planning and design of water resources infrastructure and river engineering projects.
- 1989-2007 **Government of Alberta, Transportation** **Edmonton, AB**
- Hydrotechnical Specialist*
Department resource for hydrotechnical engineering, including: river training, scour studies, flood data acquisition, functional planning studies, roadway alignment reviews, fish passage evaluations and bridge assessments. Also responsible for developing test and monitoring protocols, best practices, databases and data repositories.
- 1988-89 **Syncrude Canada Ltd.** **Ft. McMurray, AB**
- Geotechnical Consultant*
Embedded within client's on-site offices conducting stability analysis of hydraulic fill tailings dam structures.
- 1986-87 **Thurber Geotechnical Consultants Ltd.** **Edmonton, AB**
- Project Geotechnical Engineer*
Intermediate Engineer responsible for conducting geotechnical tests for foundations, tunnels, water intakes and dams. Managed quality assurance programs for construction of a hydraulic fill structures and building foundations.
- 1983-86 **University of Alberta** **Edmonton, AB**
- Research Associate*
Manager of research lab, designed, constructed and monitored experimental apparatus, managed lab staff, produced research reports and conference papers.



Marcel Chichak, P.Eng.

PROJECT RELATED EXPERIENCE – RIVER ENGINEERING

Turner Valley Gas Plant

Turner Valley, AB

Lead engineer in conceptual planning to protect this significant historic site, including hydrology, hydraulics, river training, air photo interpretation and negotiation with regulatory authorities to allow emergency in-stream activity while containing release of hydrocarbons.

North Saskatchewan River – Highway 22 Crossing

Drayton Valley, AB

Provided engineering expertise for management of this complex site in a highly mobile river environment, including river training, scour studies, geotechnical assessment, air photo interpretation, roadway alignment studies and structure assessment.

Government of Alberta – Navigable Waters Mapping Project Edmonton, AB

Using the Provincial single line stream network data, digital elevation data and satellite imagery, a GIS layer was created representing all navigable streams and lakes in the Province.

Government of Alberta – Scour Programme

Various Locations

Managed multi-year inspection programme encompassing all scour susceptible bridge sites throughout the Province. Prepared annual work plans, selected consultants, reviewed survey results and made recommendations for further study, rehabilitation or replacement of deficient structures. Sites included bridges on:

- Ram River
- Waiparous River
- Red Deer River
- North Saskatchewan River
- Athabasca River
- Pembina River
- Bow River
- Elbow River
- Oldman River
- Willow River
- Redwillow River
- Peace River
- Wapiti River
- Sheep River
- Kakwa River
- Smoky River
- Little Smoky River
- James River

PROJECT RELATED EXPERIENCE – SITE PLANNING

Bridge Planning

Various Locations, AB

As Bridge Planning Engineer was responsible for performing or overseeing preliminary engineering (ie, bridge location, configuration, sizing of hydraulic opening and optimization of overall design), alignment studies and site assessments at hundreds of sites throughout the Province, including:

- Highway 43 twinning from Edmonton to Grande Prairie (Little Smoky, Smoky, Iosegun and Waskahegan Rivers)
- Highway 63 twinning north of Ft. McMurray (Athabasca River)
- Calgary South West Ring Road through Tsuu T'ina Lands (Elbow River and Fish Creek)
- Highway 3 realignment and twinning through Crowsnest Pass (Crowsnest River)
- Proposed North Saskatchewan River crossing, Strathcona County Industrial Heartland



Marcel Chichak, P.Eng.

Involved in design of river protection works (spurs, groynes and guidebanks) throughout the Province including:

Northern Alberta

- Wenzel River, Highway 58
- Redwillow River, Highway 722
- Sheep Creek, Highway 40
- Berland River, Highway 40
- Pembina River, Highway 40, 16A
- Freeman River, Highway 658
- Lobstick River at Niton Junction
- McLeod River, Highway 32
- Smoky River, Highway 40, 43 and 49
- Ksituan River, Highway 727
- Hamelin Creek, Highway 725
- Athabasca River, Highway 63

Central Alberta

- North Saskatchewan River, Highway 22, 11A et al
- Red Deer River, Highway 2 and 21
- Dogpound Creek, Highway 580
- James River, Highway 22
- Brazeau River, Highway 734
- Battle River, Highway 21

Southern Alberta

- Sheep River, Highway 2A, 22 and Turner Valley
- Waiprus River, Highway 40
- Highwood River, Highway 2a and 22
- Fish Creek and Elbow River, Calgary Ring Road
- Pincher Creek, low level crossing
- Oldman River, Highway 785 and 811
- Belly River, Highway 505
- Bow River, Highway 539 et al

Irrigation Canal Reconstruction

Various Locations, AB

As Senior Hydrotechnical Engineer, prepared terms of reference and oversaw design of:

- Winagami/Girouxville Drainage Canal
- McAllister Creek drop structure #2
- Little Bow Canal Reach 3 drop structure

PROJECT RELATED EXPERIENCE – CONTRIBUTION TO KNOWLEDGE

Dedicated to life long learning and mentoring of new engineers, the following contributions to knowledge have been made:

- 2003 Stollery Executive in Residence at University of Alberta
- Frequent lecturer in graduate and undergraduate level Civil Engineering courses
- Numerous papers presented at engineering conferences
- Numerous research reports published

Publications

Chichak, Marcel. F. 1989. The Use of Silicone in Hot Mix Asphalt Concrete. Alberta Transportation and Utilities Research publication, TB- 89/01.

---. Skid Resistant Road Surface Treatments. RR- 89/04, 1989

---. Alberta Special Products Evaluation Listing. RR- 90/07, 1990.

---. National Survey of ACP Cracksealing Practices. RR- 89/05, 1989.

Marcel Chichak, P.Eng.

- . The Use of De-Icing Chemicals on Bridge Decks. RR- 89/03, 1989.
- . Methods of Detecting Moisture Content in Bridge Deck. TM- 90/07, 1990.
- . Fast-Track Bridge Deck Repair Using Pyrament Concrete. PAP 90/03, 1990.
- . Field Evaluation of Husky PMA and Hydrotech 6160-6165 Crack Sealers. RR- 90/16, 1990.
- . Draft Specification for the Supply of Lignosulfonates. RR- 90/13, 1990.
- . Field Evaluation of Corrugated Polyethylene Culvert. RR- 90/15, 1990.
- . Evaluation of Gilsonite Asphalt Additive. TM- 92/06, 1992.
- . Glasphalt Asphalt Concrete Substitute. TM- 92/04, 1992.
- . Rapid Permeability Testing of Concrete. RR- 92/08, 1992.
- . Hot-Applied Polymer-Modified Crack Sealer use in Alberta. RR- 93/10, 1993.
- . Inventory Criteria for Historic Bridges on Alberta's Transportation Network. RR- 93/07, 1993.
- . Entac Dust Suppressant Evaluation. TF- 93/01, 1993.
- . Consequences of Suspended Crack Sealing on Pavement Service Life. RR- 93/11, 1993.
- . Accelerated Testing of Low VOC Paint Systems. PAP 94/02, 1994.

Conference Papers

- Alberta Special Products Evaluation Listing.* Western Association of Canadian Highway Officials Annual Convention, Edmonton, Alberta, 1989.
- Fast Track Bridge Deck Repair using Pyrament Cement.* Transportation Association of Canada Annual Convention, St. John's Newfoundland, 1990.
- Alberta Special Products Evaluation Listing.* Research and Development Annual Conference, Calgary, Alberta, 1991.
- Crack Sealing Cost/Benefit Study and Bridge Deck Membrane Holiday Detection.* Research and Development Annual Conference, Grande Prairie, Alberta, 1992.
- Inventory Criteria for Historic Bridges on Alberta's Transportation Network.* Transportation Association of Canada (TAC) annual conference and exhibition, Ottawa, Ontario, 1993.
- Inventory Criteria for Historic Bridges on Alberta's Transportation Network.* Association for Preservation Technology International (APT) annual conference, Ottawa, Ontario, 1993.
- Accelerated Testing of Low VOC Paint Systems.* 5th World Congress - Coating Systems for Bridges and Steel Structures, St. Louis, Missouri 1997.
- Design Discharge Determination for Alberta Rivers.* 16th Conference of the Hydrotechnical Division of the CSCE, Burlington, Ontario, Canada, 2003.

Contributor to the following publications

- Scott, J.D. and E.A. Richards *Geotextile and Geomembrane International Information Source* Rexdale, Ont. : Canadian Geotechnical Society, 1984. 506 p
- Johnston, T. *Sports Car Road Racing in Western Canada.* Creative Connections Publishers, 2004, 389p
- McDonell, R. *The Speediest Land Traveller: A History of Alberta Auto Racing.* Granville Island Press, 2005, 320p
- Gilpin, J. *Roads to Resources: a History of Transportation in Alberta.* Alberta Roadbuilders and Heavy Construction Association, 2005, 430p.
- Charters, D. *The Chequered Past: Sports Car Racing and Rallying in Canada, 1951 – 1991.* University of Toronto Press, 2007 382p.



Nathan Schmidt

Education: Ph.D., Civil Engineering (Fluid Mechanics), University of Canterbury, 1998
M.Sc., Civil Engineering (Water Resources), University of Alberta, 1992
B.Sc., Civil Engineering (Co-op Program, With Distinction), University of Alberta, 1990
Applied Fluvial Geomorphology, Dave Rosgen/Wildland Hydrology, 2001

Affiliations: Association of Professional Engineers, Geologists and Geophysicists of Alberta (P.Eng. and Environment Committee Chair) • Association of Professional Engineers and Geoscientists of British Columbia • Association of Professional Engineers, Geologists and Geophysicists of Northwest Territories • International Association for Hydraulic Research • Canadian Institute of Mining, Metallurgy and Petroleum (Environment Section) • Canadian Water Resources Association (Alberta Director) • Consulting Engineers of Alberta (Environment Committee Member)

Awards: Commonwealth Postgraduate Scholarship, 1993-1997 • NSERC Post-graduate Scholarship, 1992 • Leonard E. Gads Teaching Assistant Award, 1991 and 1992 • Engineers Collaborative J.R. Ogilvie Memorial Scholarship, 1990 • Walker, Newby & Associates Scholarship in Environmental Engineering, 1990 • Leonard E. Gads Memorial Scholarship, 1989 • Luscar Engineering Limited Bursary in Civil Engineering, 1986

Experience:

2002 - date	Golder Associates Ltd. <i>Associate, Senior Water Resources Engineer</i> Consultant and Project Manager on projects related to river engineering, hydrology, water management, and environmental impact assessment in the mining, water resources, power, forestry, and transportation market sectors.	Edmonton, AB
1997 - 2002	Golder Associates Ltd. <i>Senior Water Resources Engineer</i> Consultant and Project Manager on a variety of projects. Highlights included managing the climate and hydrology component of the Regional Aquatics Monitoring Program for five years, leading the surface water hydrology components of the CNRL Horizon Oil Sands Project EIA and Suncor Firebag In Situ Oil Sands Project EIA, and leading the Functional Design, Hydrology, and Hydraulics components of the Iron Ore Company Wabush Lake Tailings Management Project.	Calgary, AB
1993 - 1997	University of Canterbury <i>Research/Teaching Assistant, Fluid Mechanics</i>	Christchurch, New Zealand
1992 - 1993	Alberta Transportation & Utilities <i>Bridge Planning Engineer</i>	Edmonton, AB
1990 - 1992	University of Alberta <i>Research/Teaching Assistant, Water Resources Engineering</i>	Edmonton, AB
1990	Stanley Associates Engineering Ltd. <i>Hydrotechnical Engineer</i>	Edmonton, AB

Nathan Schmidt

PROJECT RELATED EXPERIENCE – INFRASTRUCTURE

Igloo Building Products

Parkland County, Alberta

Project manager for drainage design of an 80 ha parcel of land in the Acheson Industrial Park. The project included hydrological modeling and grading design to meet Province of Alberta and Parkland County regulations.

Golden West Homes

Parkland County, Alberta

Project manager for stormwater management permitting (Alberta *Water Act*) drainage design of an 11 ha parcel of land in Parkland County. The project included hydrological modeling to meet Province of Alberta and Parkland County regulations.

Cohos Evamy – Arcadia Creek BF 76478

Arcadia, Alberta

Project manager responsible for deriving design water surface elevations and flow velocities, as well as recommending scour protection measures for a replacement bridge on Arcadia Creek at Highway 2. This was an Alberta Infrastructure and Transportation project. Also responsible for coordinating environmental tasks.

CH2M Hill – Poplar Creek BF71019 and BF85038

Breton, Alberta

Project manager responsible for deriving design water surface elevations and flow velocities, as well as recommending scour protection measures for bridge on Poplar Creek and bridge-sized culvert on an adjacent tributary.

Big Island Lake Stabilization

Strathcona County, Alberta

Project manager responsible for establishing the pre-disturbance lake water level regime of a small prairie lake and performing feasibility-level design of a control structure to restore the lake level. The project included field surveys, hydrological and hydraulic modeling, environmental assessment and public consultation.

Synchrude Aurora Clean Groundwater Diversion

Fort McMurray, Alberta

Project manager for assessment of water quality and treatment alternatives for pumped groundwater from the basal aquifer, with the goal of achieving regulatory permitting for release to Stanley Creek or the Muskeg River. The project included sizing of a retention pond, specification of aeration requirements and participating in discussions with Alberta Environment.

Foothills Model Forest – Hardisty Creek Restoration

Hinton, Alberta

Project manager for fisheries and hydrologic assessment and development of remediation measures for stream restoration and fish passage. Responsible for addressing concerns of stakeholders including industry, regulatory agencies, municipalities and environmental groups.

Infrastructure Systems Ltd. – Henderson Creek BF 73982

Bonanza, Alberta

Project manager responsible for deriving design hydrology, water surface elevations and flow velocities, as well as recommending scour protection measures for a replacement bridge on Arcadia Creek at Highway 2. Responsible for checking Design Data drawing. This was an Alberta Infrastructure and Transportation project.

Nathan Schmidt

PROJECT RELATED EXPERIENCE – INFRASTRUCTURE (continued)

Infrastructure Systems Ltd. – Hines Creek Dell Bridge BF 72581 Fairview, Alberta
Project manager responsible for deriving design water surface elevations and flow velocities, as well as recommending scour protection measures for a single-span bridge on Hines Creek.

Infrastructure Systems Ltd. – Highway 28 Culvert BF 73146 Redwater, Alberta
Project manager responsible for deriving design discharge and culvert sizing for replacement of a culvert between two wetlands.

Jivko Engineering – Mackenzie River Bridge Ft. Providence, NWT
Contributed to environmental impact assessment, including study of effects of ferry crossing decommissioning on sediment deposition into the Mackenzie River and effects of bridge pier and approach causeway construction on physical habitat characteristics.

Canadian Natural Resources Ltd. – Tar River Crossings Ft. McMurray, Alberta
Project manager for hydraulic assessment, fish habitat assessment and erosion and sediment control planning for two bridge crossings on the Tar River at the CNRL Horizon Project. The results of the study were used for permit applications with Fisheries and Oceans Canada.

B.C. Rail Emergency Erosion Control Prince George, British Columbia
B.C. Rail retained Golder Associates to provide an emergency assessment of recent Fraser River bank erosion that jeopardized a section of their mainline, north of Prince George. In collaboration with a fisheries biologist, conducted a site visit and prepared a report assessing the likely cause of the erosion, outlining potential remedial measures, assessing such measures by economic, technical and environmental criteria, and discussing ways to incorporate fish habitat compensation measures into remedial measures. The report was used to support an application for an Authorization for Harmful Alteration, Disruption or Destruction (HADD) of fish habitat to Fisheries and Oceans Canada.

Anadarko Petroleum – East Liard Pipeline Fort Liard, Northwest Territories
Project manager for hydrology component of the project. Tasks included a field reconnaissance to identify stream crossing locations, field program to measure geomorphologic data, regional hydrology study and design of pipeline sagbend and burial depths.

Border Paving Ltd. – McLeod River Gravel Pit Edson, Alberta
Responsible for deriving water surface elevations for various flood events to support a regulatory application for gravel pit development to Fisheries and Oceans Canada.

Alberta Transportation BF 73687 and BF76856 Barrhead, Alberta
Project manager for the design of river protection works at two sites. The bridge providing access to Ft. Mackay was subject to pier scour and a remedial design was developed to repair the problem and prevent further damage. The Highway 32 bridge across Groat Creek, south of Whitecourt, was subject to severe upstream bank erosion. A riprap guidebank was designed to repair the channel and enhance bed load passage through the bridge opening. The works required an Authorization from DFO, including fish habitat compensation, and the compensation was negotiated and designed.

Nathan Schmidt

PROJECT RELATED EXPERIENCE – INFRASTRUCTURE (continued)

Canadian Natural Resources Ltd. – Access Road Crossings **Ft. MacKay, Alberta**
Performed hydraulic assessment of bridge crossings of the MacKay and Ells Rivers and Joslyn Creek and four culvert crossings to define flood inundation levels and fish passage velocities. The results of the study were used for permit applications with Fisheries and Oceans Canada.

Transportation Association of Canada **Ottawa, Canada**
Co-authored and compiled TAC's Synthesis of Practice on Transportation Construction and Maintenance and the Protection of Fish Habitat. This document discusses the integration of habitat issues into transportation and stream crossing planning, reviews regulatory approval requirements and presents best management practices for habitat protection, channel design, fish passage and erosion and sediment control.

Alberta Transportation & Utilities **Edmonton, Alberta**
Co-author of the AT&U Fish Habitat Manual: Guidelines and Procedures for Watercourse Crossings in Alberta. Wrote chapter on Erosion and Sediment Control Plan, including sample plans for bridge and culvert construction, and subsequently revised the chapter on Fish Passage. Prepared factsheets describing recommended mitigation procedures.

Alberta Infrastructure RPW Inspections **Edmonton, Alberta**
Undertook Level I hydrotechnical inspections at 28 bridge sites near Cochrane, Canmore, Sundre and the Forestry Trunk Road. Hydrotechnical and geomorphic observations were recorded during site visits. Measurements were supplemented with photographs and video footage. The condition of existing river protection works and the likelihood of lateral channel migration were assessed. Field observations were supplemented by airphoto analysis. Level II hydrotechnical inspections were undertaken at bridge sites on Lee Creek at Cardston and the Belly River near Glenwood. Detailed assessments of river behavior were presented and conceptual designs for river training works were developed. The results of each inspection, assessment and recommendations were presented in report format.

Suncor Firebag Project Access Corridor **Ft. McMurray, Alberta**
The access corridor to the Firebag In-Situ Oilsands Project required the replacement of three bridges and one culvert on Canterra Road and the construction of one bridge over the North Steepbank River. Developed Erosion and Sediment Control Plans for these five crossings to satisfy requirements for federal and provincial permit applications.

North Arm, Fraser River **British Columbia, Canada**
Assessed mechanisms responsible for river bank erosion at a site downstream of the Oak Street bridge in Vancouver. Prepared a feasibility-level report which reviewed options for bank protection and presented a conceptual design which accommodated the construction of a containment system for the contaminated site, which was under a remediation order. Prepared final design drawings and construction specifications for the bank protection works and inspected the work during construction.

Nathan Schmidt

PROJECT RELATED EXPERIENCE – INFRASTRUCTURE (continued)

South Thompson River

British Columbia, Canada

Assessed mechanisms responsible for river bank erosion at the Secwepemc Cultural Education Society site on the Kamloops Indian Reserve. Prepared a report which reviewed options for bank protection and presented a conceptual design which accommodated preservation of the unique cultural and archeological resources of the area. After consultations with the client and DFO, prepared final design drawings and construction specifications.

Sunpine Forest Products

Sundre, Alberta

Participated in the development of a GIS-based system for forestry road stream crossing design. Involved in the development of field data acquisition forms, regional hydrologic analyses for flood and fish passage events, and bridge waterway opening design.

Peterson Creek Park Erosion Control

Kamloops, British Columbia

Developed an erosion and sediment control plan for three eroded streams that were tributary to Peterson Creek. These streams had been subject to increased stormwater runoff due to urbanization of their catchment areas and this had caused streambed erosion of up to four metres. These streams were located in steeply sloped parkland, so erosion control treatments were designed to minimize use of heavy equipment and disturbance of natural areas. Treatments included installation of HDPE pipe with granular fill and construction of timber and rockfill erosion control structures. This project culminated in the production of tender documents, including detailed plans for construction.

Bow River near Canmore

Alberta, Canada

Prepared an Erosion and Sediment Control Plan for a pipeline crossing of the Bow River. This plan was used during open trench construction to minimize effects on fish and fish habitat in the crossing area and included components of fish habitat compensation.

Whispering Pines IR4

British Columbia, Canada

Responsible for writing a construction specification for emergency dyking on the North Thompson River, north of Kamloops. The specification was prepared for Indian and Northern Affairs Canada and the Whispering Pines/Clinton Indian Band to assist the band in raising existing dykes and constructing new dykes in advance of the spring freshet.

Quintette Coal – Babcock Window Haul Road

British Columbia, Canada

Prepared a water management plan for the Babcock Window haul road at Quintette Operating Corporation's mine near Tumbler Ridge. Performed an analysis of available climatic and hydrologic data to determine site runoff and designed a sedimentation pond in accord with provincial guidelines. Prepared quantity and cost estimates for construction.

Special Areas Water Supply Project

Alberta, Canada

Responsible for estimating bridge and culvert costs for 33 crossings of a water supply canal from Nevis to Sounding Creek. This involved performing hydraulic backwater calculations using WSPRO as well as a culvert flow program, sizing of culvert and bridge openings, clearances and gradeline modifications.

Nathan Schmidt

PROJECT RELATED EXPERIENCE – INFRASTRUCTURE (continued)

Various Rivers, Creeks and Canals in Alberta

Alberta, Canada

Performed assessments of 16 major bridge crossings of rivers, creeks and irrigation canals in Alberta as part of a highway bridge maintenance and construction program. Tasks included analysis of site hydrology and hydraulic conditions including backwater calculations, flood frequency determination, flood depth and bridge clearance determination and bank protection design.

Red Deer River near Drumheller

Alberta, Canada

Collected field data to be used in the design of river bank protection works. Relevant data included river stage and channel geometry.

Athabasca River near Fort McMurray

Alberta, Canada

Collected field data to be used in the design of a pipeline crossing. Relevant data included river stage and channel geometry as well as observations of ice scarring.

Nathan Schmidt

PROJECT RELATED EXPERIENCE – EROSION AND SEDIMENT CONTROL

City of Edmonton – Whitemud Creek Erosion Study **Edmonton, Alberta**

Project manager an assessment of existing erosion and evaluation of future erosion potential under urbanized conditions. The project involved intensive data collection for approximately 40 km of stream length on Whitemud and Blackmud Creeks within the City limits. It included assessments of stream hydrology, geomorphology and valley wall instability, with the objective of identifying and prioritizing areas for application of mitigation measures.

CN Rail – Trestle Replacement **Whitcourt, Alberta**

This project involved the emergency construction of an earthfill embankment and culvert to replace a fire-damaged timber railway trestle. Provided advice to site personnel regarding sediment monitoring and specification of Best Management Practices for erosion and sediment control on this project.

City of Edmonton – Clover Bar Creek Restoration **Edmonton, Alberta**

Project manager an assessment of existing erosion and evaluation of future erosion potential under urbanized conditions. Undertook an intensive site reconnaissance on 5 km of stream length, assessed erosion potential and developed recommendations for restoration of existing erosion and treatments to prevent erosion under the future, urbanized flow regime. The project included a comprehensive alternative evaluation and quantity and cost estimates for selected alternatives. Later participated in process to resolve dispute over funding responsibilities between two municipalities.

Various Clients **Various Locations**

Senior review of Erosion and Sediment Control Plans for the following projects:

- John Hart Highway SDMP – Peters Bros. Construction, Dawson Creek, B.C.
- Farrell Creek Road #115 SDMP – Brocor Construction, Hudson's Hope, B.C.
- Lesser Slave River Bridge File 7460 ECO Plan – West Shore Constructors, Slave Lake, Alberta

Regional Municipality of Wood Buffalo **Fort McMurray, Alberta**

Project manager and lead engineer on a project to revitalize the Snye, a waterbody located upstream of the confluence of the Athabasca and Clearwater rivers. The Athabasca end of the Snye was blocked by causeway construction in the late 1960's, resulting in siltation and stagnation. This project included field surveys, a hydrology study and development of a feasibility-level design for hydraulic structures to manage flow through the Snye to enhance water quality and maintain a self-scouring inlet for navigation at the Clearwater entrance.

Alberta Transportation – Red Willow River **Wembley, Alberta**

Project director for river engineering, alternative assessment and environmental work on a reach of the river that was subject to accelerated erosion. Areas of interest included bank erosion downstream of a secondary highway bridge and at the downstream end of a cutoff channel that was constructed in the early 1970's. Undertook a field reconnaissance to kick off the project and provided guidance and review for the duration of the project.

Fisheries and Oceans Canada – Nulahugyuk Creek **Bernard Harbour, Nunavut**

Undertook a field reconnaissance and provided hydrology and geomorphology input to a study of an Arctic stream, to determine reasons why the historic Arctic char spawning run has not occurred in recent years and to develop remedial measures.

Nathan Schmidt

Transportation Association of Canada

Ottawa, Canada

Primary author and project manager for development of the TAC National Guide to Erosion and Sediment Control on Roadway Projects. This document was developed with the TAC Project Steering Committee, with review by the TAC Environmental Issues Subcommittee, the TAC Environment Council and the TAC Chief Engineer's Council, and it was subject to review and comments by Fisheries and Oceans Canada (DFO) at the regional and national levels. The intent of the document was to address erosion and sediment control regulatory issues, physical theory and risk assessment, as well as provide methods for developing erosion and sediment control plans over the life cycle of a roadway project.

Foothills Model Forest – Hardisty Creek Restoration

Hinton, Alberta

Project manager for fisheries and hydrologic assessment and development of remediation measures for stream restoration and fish passage. Responsible for addressing concerns of stakeholders including industry, regulatory agencies, municipalities and environmental groups. The project included several phases, including assessment and design (2003-4), construction of stream restoration prescriptions (2004) and construction of a 1.8 m high riffle to backflood a culvert for fish passage (2005).

Alberta Transportation

Barrhead, Alberta

Project manager for the design of river protection works at two sites. The bridge providing access to Ft. Mackay was subject to pier scour and a remedial design was developed to repair the problem and prevent further damage. The Highway 32 bridge across Groat Creek, south of Whitecourt, was subject to severe upstream bank erosion. A riprap guidebank was designed to repair the channel and enhance bed load passage through the bridge opening. The works required an Authorization from DFO, including fish habitat compensation, and the compensation was negotiated and designed.

Talisman Resources Pipeline Crossing

Little Sundance Creek, Alberta

Analyzed hydrologic and geomorphic data for a proposed pipeline crossing. Used the data to complete a sagbend and burial depth design for a directionally drilled crossing. Wrote the engineering sections of an Alberta *Water Act* Code of Practice report for the pipeline crossing.

EOG Resources Pipeline Crossing

Christmas Creek, Alberta

Performed a site reconnaissance to collect stream geomorphology data at a proposed pipeline crossing. Used the data to complete a sagbend and burial depth design for a directionally drilled crossing. When site conditions prevented use of directional drill method, the crossing method was changed to an aerial crossing and a Navigable Waters Protection Act application drawing was prepared.

Peterson Creek Park Erosion Control

Kamloops, British Columbia

Developed an erosion and sediment control plan for three eroded streams that were tributary to Peterson Creek. These streams had been subject to increased stormwater runoff due to urbanization of their catchment areas and this had caused streambed erosion of up to four metres. These streams were located in steeply sloped parkland, so erosion control treatments were designed to minimize use of heavy equipment and disturbance of natural areas. Treatments included installation of HDPE pipe with granular fill and construction of timber and rockfill erosion control structures. This project culminated in the production of tender documents, including detailed plans for construction.

Sunpine Forest Products

Sundre, Alberta

Participated in the development of a GIS-based system for forestry road stream crossing design. Involved in the development of field data acquisition forms, regional hydrologic analyses for flood and fish passage events, and bridge waterway opening design.

Nathan Schmidt

Whispering Pines IR4

British Columbia, Canada

Responsible for writing a construction specification for emergency dyking on the North Thompson River, north of Kamloops. The specification was prepared for Indian and Northern Affairs Canada and the Whispering Pines/Clinton Indian Band to assist the band in raising existing dykes and constructing new dykes in advance of the spring freshet.

Transportation Association of Canada

Ottawa, Canada

Contributed to, and compiled, TAC's Synthesis of Practice for the Protection of Fish Habitat. This document discusses the integration of habitat issues into transportation and stream crossing planning, reviews regulatory approval requirements and presents best management practices for habitat protection, channel design, fish passage and erosion and sediment control.

Alberta Transportation & Utilities

Edmonton, Alberta

Involved in the preparation of the AT&U Fish Habitat Manual: Guidelines and Procedures for Watercourse Crossings in Alberta. Wrote chapter on Erosion and Sediment Control Plan, including sample plans for bridge and culvert construction and gravel mining. Prepared factsheets describing recommended mitigation procedures.

Quintette Coal – Babcock Window Pit

British Columbia, Canada

Prepared water management plans for the Babcock Window pit and haul road at Quintette Operating Corporation's mine near Tumbler Ridge. Performed an analysis of available climatic and hydrologic data to determine site runoff and designed a sedimentation pond in accord with Provincial guidelines. Prepared quantity and cost estimates for construction.

Bow River near Canmore

Alberta, Canada

Prepared an Erosion and Sediment Control Plan for a pipeline crossing of the Bow River. This plan was used during open trench construction to minimize effects on fish and fish habitat in the crossing area and included components of fish habitat compensation.

North Arm, Fraser River

British Columbia, Canada

Assessed mechanisms responsible for river bank erosion at a site downstream of the Oak Street bridge in Vancouver. Prepared a feasibility-level report which reviewed options for bank protection and presented a conceptual design which accommodated the construction of a containment system for the contaminated site, which was under a remediation order. Prepared final design drawings and construction specifications for the bank protection works and inspected the work during construction.

South Thompson River

British Columbia, Canada

Assessed mechanisms responsible for river bank erosion at the Secwepemc Cultural Education Society site on the Kamloops Indian Reserve. Prepared a report which reviewed options for bank protection and presented a conceptual design which accommodated preservation of the unique cultural and archeological resources of the area. After consultations with the client and DFO, prepared final design drawings and construction specifications.

Nathan Schmidt

PROJECT RELATED EXPERIENCE - HYDROLOGIC ANALYSIS

Prairie Farm Rehabilitation Administration

Barrhead, Alberta

Golder was a subconsultant to Urban Systems Limited on this water supply study for Barrhead County, and was responsible for the surface water hydrology, hydrogeology and geographic information systems components of the project. Served as the Golder project manager and was responsible for the hydrology analysis. Long-term hydrometric data were used to determine water supply availability under mean and 10-year dry conditions, including an allowance for Instream Flow Needs. The GIS component included analysis of groundwater and surface water supply as well as the results of a public consultation.

Miramar Doris Hinge Fish Habitat Compensation

Nunavut, Canada

Using hydrologic data collected during the project baseline study and long-term regional climatic data, a model was developed to predict lake discharges based on long-term records of rainfall and runoff. The results of the analysis were used as the basis for the feasibility-level design of fish habitat structures at Roberts Lake outlet, which were a key component of the fisheries *No Net Loss* plan. Recommendations were presented for future hydrologic monitoring to verify the results of the analysis and refine the habitat structure designs.

Oil Sands Regional Hydrologic Modeling

Ft. McMurray, Alberta

Project manager for development of a regional hydrologic (HSPF) model of the oil sands region. This model has subsequently been used as the basis for several environmental impact assessment baseline reports. The model was also used as the basis for development of design runoff curves for mine operational water management.

Quintette Coal – Tumbler Ridge

British Columbia, Canada

Analysed available climatic and hydrologic data to prepare water management plans for pit development and closure planning for three open pits. Performed rainfall-runoff modelling for sedimentation pond sizing. Reviewed client's hydrologic studies, including derivation of design discharges.

Diavik Diamonds – Lac de Gras

Northwest Territories, Canada

Developed a water balance model, incorporating changes to site hydrologic conditions, to quantify the hydrologic impacts of the Diavik Diamond Mine project on Lac de Gras. Analysed snow survey and local stream gauging data to determine snowmelt and seasonal runoff coefficients for selected representative catchments in the Lac de Gras basin.

Oil Sands Climatic & Hydrologic Monitoring 1998 - 2002

Alberta, Canada

Managed the climate and hydrology component of the Regional Aquatics Monitoring Program. This ongoing study of various streams and lakes in the oil sands area which spans from Janvier in the south to the Firebag River in the north. It includes the Athabasca River, Muskeg River and tributaries, Birch Mountains drainages, Poplar Creek, Kearl, McClelland and Isadore's Lakes. Responsible for the collection of data from climatic monitoring stations in the area and for undertaking snow surveys in various study areas. Analysis included processing stream discharge and water level data, preparing stage-discharge rating curves and synthesizing hydrographs. All available local and regional data were compiled in a database for easy reference. Provided data support to RAMP funders and to authorized third parties, including regulatory agencies, consultants and contractors.

Nathan Schmidt

PROJECT RELATED EXPERIENCE - HYDROLOGIC ANALYSIS (continued)

Sunpine Forest Products

Sundre, Alberta

Performed regional hydrologic analyses of mountain and foothill areas comprising Sunpine's Forest Management Area for flood and fish passage events. These were used for bridge and culvert waterway opening design.

Fraser and Thompson Rivers

British Columbia, Canada

Analysed historical streamflow data from Water Survey of Canada gauging stations on the Fraser, North Thompson and South Thompson Rivers to derive discharges incorporated in the design criteria for river bank protection works at sites in Vancouver and Kamloops.

Iron Ore Company of Canada – Wabush Lake

Labrador, Canada

Responsible for the installation of flow monitoring stations on three tributaries to Wabush Lake. Tasks included siting and installation of stations, training of IOC staff in gauging techniques, developing stage-discharge rating curves and synthesizing hydrographs from continuous water level data.

Paramount Pipeline

High Level, Alberta

Performed a regional hydrologic analysis of Water Survey of Canada stream gauging data to derive design discharges for crossings of several ungauged streams in northwest Alberta.

Syncrude Canada Ltd. - Mildred Lake

Ft. McMurray, Alberta

Performed a regional hydrologic analysis of Environment Canada–Atmospheric Environment Service precipitation and evaporation data to derive inflows to approximately 70 lakes in the region. This information was used in an environmental impact study of airborne emissions on lake water quality.

Nathan Schmidt

PUBLICATIONS AND PRESENTATIONS

- Schmidt, N., ed. 2005. Proceedings of the 17th Canadian Hydrotechnical Conference. Edmonton, Alberta, August 17-19, 2005, 1016 p.
- Schmidt, N.P., G.R. Ash, H. Wilson and C. Duane. 2004. Climate and Hydrology Data Collection for Northern Mine Development. Canadian Institute of Mining, Metallurgy and Petroleum Mining North, Edmonton, 9-12 May, 2004, 8 p.
- Biftu, G., N.P. Schmidt, A. Beersing and L.F. Sawatsky. 2004. Consideration of Potential Effects of Climate Change and Resulting Hydrologic Impacts on Mine Developments. Canadian Institute of Mining, Metallurgy and Petroleum Mining North, Edmonton, 9-12 May, 2004, 8 p.
- Schmidt, N.P., A. Beersing, G. Biftu and F. Ade. 2004. Application of the Hydrological Simulation Program FORTRAN (HSPF) Model to Two Large Scale Environmental Impact Assessments in Northeastern Alberta (Abstract and Presentation Only). 24th Annual Conference of the International Association for Impact Assessment, Vancouver, 25-29 April, 2004.
- Doram, D., S. Tuttle, N. Schmidt, P.Keele, K. Mackenzie and C. Duane. 2004. The Canadian Natural Horizon Mine Closure and Reclamation Plan. Society for Ecological Restoration and Canadian Land Reclamation Association, SER2004 - 16th annual World Conference on Ecological Restoration, Victoria, August 24-26, 2004 (Abstract and Presentation Only).
- den Dulk, J. and N. Schmidt. 2004. The Hardisty Creek Restoration Project. Pages 63-64 in G.J. Scrimgeour, G. Eisler, B. McCulloch, U. Silins and M. Monita. Editors. Forest Land-Fish Conference II – Ecosystem Stewardship through Collaboration. Proc. Forest-Land-Fish Conf. II, April 26-28, 2004, Edmonton, Alberta (Extended abstract and presentation).
- Mackenzie, I.B., G. Herasymuik, N. Schmidt, Z. Kovats and K. Clipperton. 2004. Environmental Impact Assessments in the Alberta Oil Sands Area. Western Canada Oil Sands Summit, Calgary, Alberta, 29-30 January 2004, 25 p.
- Schmidt, N.P. and R.H. Spigel. 2000. Second Mode Internal Solitary Waves I – Integral Properties. Fifth International Symposium on Stratified Flows, Vancouver, 10-13 July, 2000, 6 p.
- Schmidt, N.P. and R.H. Spigel. 2000. Second Mode Internal Solitary Waves II – Internal Circulation. Fifth International Symposium on Stratified Flows, Vancouver, 10-13 July, 2000, 6 p.
- Metikosh, S. and N. Schmidt. 2000. Developing and Implementing Effective Compensation Measures. Presented to Synergy for Prosperity: Consulting Engineers of Alberta, Alberta Transportation and Alberta Roadbuilders and Heavy Construction Association Annual Conference, Edmonton, March, 2000 (Presentation only).
- Bender, M., S. Metikosh, L. Sawatsky and N. Schmidt. 1999. Transportation Construction and Maintenance and the Protection of Fish Habitat, Transportation Association of Canada, Synthesis of Practice No. 5, Ottawa, 56 p + app.

Nathan Schmidt

- Bender, M., S. Metikosh, L. Sawatsky, N. Schmidt and D. Snider. 1999. Mitigation Strategies for Watercourse Habitats at New Road Crossings: Alberta Transportation and Utilities Fish Habitat Manual, Canadian Society for Civil Engineering Conference, Regina, SK, 10p.
- Alberta Transportation and Utilities 1999. Fish Habitat Manual: Guidelines and Procedures for Watercourse Crossings in Alberta. Co-author responsible for writing Chapter 9 – Erosion and Sediment Control Plans; Appendix I – Fish Habitat Mitigation Technique Factsheets; Appendix VII – Example Erosion and Sediment Control Plans; 2nd edition revision of Chapter 7 – Culvert Fish Facility Design, Edmonton, AB.
- Schmidt, N. 1997. Generation, Propagation and Dissipation of Second-Mode Internal Solitary Waves, Ph.D. Thesis presented to the University of Canterbury, Department of Civil Engineering, 400 p.
- Schmidt, N. 1992. Flow in Ice Covered Channels, M.Sc. Thesis presented to the University of Alberta, Department of Civil Engineering, 200 p.
- Schmidt, N., and R.H. Spiegel. 1997. Advanced Flow Visualisation Techniques Used in Fluids Research, UC Research, University of Canterbury Research Committee, July 1997, pp 48-49.



Corey Stefura

- Education** Envi. Sci. Dipl., Fish and Wildlife Major, Lakeland Community College, 1989
B.Sc., Biology, University of Lethbridge, 1993
- Affiliations** Alberta Society of Professional Biologists; Alberta Roadbuilders & Heavy Construction Association – Environment Committee; Ducks Unlimited Canada; Trout Unlimited Canada
- Experience**
- 1999 to date **Golder Associates Ltd./RL&L Environmental** **Edmonton, Alberta**
Fisheries Biologist
Aquatic resources biologist involved with fisheries research and aquatic environmental assessments of water resource, oil and gas, and linear development projects. Conduct fish mortality investigations for power generating facility. Services provided include study design and management, collection and reporting of field investigations, permit applications to regulatory authorities, preparation of environmental monitoring plans, development of mitigation and fish habitat compensation programs. Prepared training workshops on white sturgeon sampling techniques for First Nations Groups, presentations and posters for international conferences.
- 1994 to 1999 **RL&L Environmental Services Ltd.** **Edmonton, Alberta**
Fisheries Technician
Participated in habitat inventories, white sturgeon research, pipeline crossing assessments and population estimates. Responsible for field programs, logistics, data collection, verification, analysis and presentation, and map drafting, interpretation and analysis. Experience in jet boat operation, fish surgery, radio telemetry, surveying, fish ageing, and operation and maintenance of water quality meters.
- 1994 **Alberta Environmental Protection** **Edmonton, Alberta**
Fisheries Technician
Implemented Instream Flow Methodologies on the Battle, Sturgeon and Vermilion rivers. Included preliminary data entry and analysis using PHABSIM. Worked in conjunction with Golder Associates performing mountain whitefish and walleye observations on the Red Deer River.
- 1993 **University of Lethbridge** **Lethbridge, Alberta**
Research Assistant
Implemented experiments on riparian poplars (optimal and maximal poplar seedling growth, effects of water table decline on poplars). Used piezometric wells to study water table fluctuations during spill events.
- 1992 to 1993 **University of Lethbridge** **Lethbridge, Alberta**
Research Assistant
Captured, marked, and cared for wild and captive Richardson's ground squirrels, performed daily censuses, recorded badger activity. Employed radio telemetry to locate hibernacula. Data entry and presentation.

Corey Stefura

PROJECT RELATED EXPERIENCE – FISHERIES INVESTIGATIONS

Lower Bow River Fish Population Estimates

Calgary, Alberta

Multiple pass mark-recapture study was conducted to generate population estimates of mountain whitefish, brown trout, and rainbow trout were conducted on the lower Bow River near Calgary. These estimates were used to assist with management of the fisheries resource.

Fraser River White Sturgeon Monitoring

British Columbia

A large-scale, five-year program to investigate the status of white sturgeon in the Fraser River drainage in British Columbia. Work was completed for BC Fisheries and BC Ministry of Environment, Lands and Parks. Annual reports were prepared along with a final comprehensive report summarizing the findings of the five year study. Results the studies were presented at the 4th International Sturgeon Symposium, with current research being applied to recovery efforts for white sturgeon in the Nechako River watershed.

Fish Mortality Investigations

Wabamun, Alberta

A number of fish were encountered in the screen house of the inlet canal at TransAlta's Lake Wabamun power plant. Causes for the mortalities were investigated, including metal toxicity. A tagging and salvage program was initiated.

Fish Salvage Operation

Wabamun, Alberta

Fish mortalities were encountered in the outlet canal downstream of the exclusion fence. The possible causes of the mortalities were investigated. Fish were rescued from the canal and returned to the main portion of the lake.

Wabamun Lake Whitefish Spawning Study

Wabamun, Alberta

Study to evaluate the effects of the increased thermal regime caused by the Wabamun Lake Power Plant facility on lake whitefish spawning. An in situ egg incubation study was implemented to determine egg survival/mortality in the study and control areas.

Fisheries and Fish Habitat Inventories of the South

Saskatchewan River Basin

Alberta

Participated in study to determine the status of fish populations in the lower Bow, lower Oldman, and South Saskatchewan rivers and identify factors that may limit fish production. Fish species composition and relative abundance were determined through an intensive sampling program that utilized electrofishing, seining, and set lines. Meso-habitat characteristics were recorded, mapped and correlated with fish capture data to provide an index of relative use by fish species. Radio transmitters were implanted in selected sportfish species (walleye, sauger, goldeye) to determine the extent of overwintering and spawning migrations.

Study of Lake Sturgeon Movements

Alberta/Saskatchewan

Lake sturgeon distribution in Alberta is confined to the North and South Saskatchewan river drainages. This study was initiated in 1996 to provide further information to aid in management of the species in the South Saskatchewan River. Critical habitats (spawning and overwintering) were identified as a result of the telemetry program.

Fisheries Inventory of Swan Hills –

Whitecourt Integrated Resource Plan Area

Alberta

This study was undertaken to collect detailed fisheries inventory information to assist resource managers in formulating an integrated resource management plan for the Swan Hills – Whitecourt region.

Corey Stefura

PROJECT RELATED EXPERIENCE – FISHERIES INVESTIGATIONS

(continued)

Fisheries Investigations of the Smoky River

Grande Prairie, Alberta

A fisheries investigation was conducted on the Smoky River near a proposed gas pipeline crossing. Emphasis was placed on mountain whitefish spawning potential. Description of potential effects on fisheries resources and evaluation of mitigation and construction activities.

Fish Overwintering Use of the Lower Athabasca River

Fort McMurray, Alberta

Research was conducted for the Instream Flow Needs (IFN) Sub-Group of the Water Working Group of the Cumulative Effects Management Association (CEMA) to determine use of the Lower Athabasca River (LAR) for overwintering by key fish species. The characteristics of key overwintering areas were identified. The study was conducted to develop or adapt models to assess cumulative effects of water withdrawals on aquatic biota and water quality and for use in determination of instream flow needs for fish and other users in the LAR.

Fish Stocking and Aeration Study – Muir Lake

Alberta, Canada

Evaluated growth and overall health condition of stocked rainbow trout population. Deployed a fyke net to capture fish, then removed ageing structures and assessed sexual maturity of fish.

Corey Stefura

PROJECT EXPERIENCE – TRANSPORTATION & INFRASTRUCTURE

Anthony Henday Extension Project

Edmonton, Alberta

As part of the Anthony Henday Extension Project, a fish and fish habitat assessment was conducted on the North Saskatchewan River for a proposed bridge crossing. Sampling methods included electrofishing, beach seining, and kick netting. Recommendations were made regarding mitigation and compensation options due to the potential for mountain whitefish spawning during the proposed construction schedule.

Temporary Shoring of Mackay River Bridge

Fort McMurray, Alberta

Upgrades were proposed for a bridge crossing the MacKay River, to transport Petro Canada's SAGD equipment. A fish and fish habitat assessment was conducted and follow-up sediment monitoring was conducted during the installation of the pilings to ensure compliance with both the CCME guidelines and the Alberta Water Act.

Redwillow River

Beaverlodge, Alberta

Erosion issues were noted near a bridge crossing the Redwillow River. As part of a potential rehabilitation strategy, a fish and fish habitat assessment was conducted near the proposed works. The investigation was conducted according to the specifications outlined under the Alberta Water Act Codes of Practice for Watercourse Crossings.

Lesser Slave River Bridge Replacement

Slave Lake, Alberta

The Highway 88 bridge crossing the Lesser Slave River was replaced. Services provided included the preparation of an Environmental Construction Operations Plan (ECO Plan), a fish and fish habitat assessment, and eggs and/or larval fish sampling. Hydroacoustic and sediment monitoring was also conducted during the installation of the pilings to ensure regulatory compliance.

QAES Assessment of Five Streams

Swan Hills, Alberta

Fish and fish habitat assessments were conducted on five streams near Slave Lake and Swan Hills. The crossings at these locations were scheduled for either maintenance or replacement. Fish sampling methods included minnow trapping, backpack electrofishing, and angling. Habitat compensation and mitigation recommendations were provided with reference to provincial and federal legislation.

Monitoring During Installation of a Temporary Water Intake

Fort Mackay, Alberta

Suspended sediment monitoring was conducted during the installation of a temporary water intake structure on the Athabasca River. Water samples were collected through the ice and analyzed for total suspended solids to ensure compliance with the CCME guidelines, the Alberta Water Act, and the Federal Fisheries Act.

Monitoring During Emergency Replacement of a Trestle Bridge

Whitecourt, Alberta

A railway trestle bridge damaged by fire was replaced by two culverts. During the culvert installations, suspended sediment monitoring was conducted. A fish and fish habitat assessment was also completed near the proposed crossing. Fish sampling methods included backpack electrofishing, gill nets, and minnow traps. Sediment and erosion control measures were recommended and Best Management Practices were applied. Stream reclamation at the inlet and outlet of the culverts were co-ordinated.

Corey Stefura

PROJECT RELATED EXPERIENCE – IMPACT ASSESSMENTS

Rat Creek Combined Sewer Overflow:

Benthic Assessment Study

Edmonton, Alberta

Seasonal benthic macroinvertebrate and water quality monitoring/assessments in the North Saskatchewan River as related to municipal discharges (combination of surface runoff and sanitary effluents) was conducted.

Load/Flow Shaping: A Review of Environmental Effects

Castlegar, BC

Participated in a study which provided a review of the environmental effects of hydroelectric powerplant operations on biological communities. Emphasis was placed on species in the Columbia River below Keenleyside Dam to the Canada-U.S. border. The information was used to predict the impacts of several hydroelectric projects and to assist in developing mitigation and compensation programs to reduce the impacts of existing and planned developments on the lower Columbia River basin.

Gulf Surmont In-Situ Oil Sands Project

Fort McMurray, Alberta

Collected seasonal fisheries information for inclusion in baseline studies and an environmental impact assessment for the Gulf Surmont Project. The project used Steam Assisted Gravity Drainage (SAGD) technology to recover bitumen from the Tar Sands of Alberta.

Grizzly Extension Pipeline Project

Tumbler Ridge, BC

Completed seasonal baseline studies of aquatic resources within watercourses potentially affected by the pipelined development. Contributed to sections of a Comprehensive Study Report (CSR) prepared for the National Energy Board (NEB) and assisted in the preparation of an application to DFO for authorization of works and undertakings affecting fish habitat.

Fish Overwintering Use of the Lower Athabasca River

Fort McMurray, Alberta

Research was conducted for the Instream Flow Needs (IFN) Sub-Group of the Water Working Group of the Cumulative Effects Management Association (CEMA) to determine use of the Lower Athabasca River (LAR) for overwintering by key fish species. The characteristics of key overwintering areas were identified. The study was conducted to develop or adapt models to assess cumulative effects of water withdrawals on aquatic biota and water quality and for use in determination of instream flow needs for fish and other users in the LAR.

Mackenzie Valley Gas Project

NWT, Canada

Summer field work for detailed surveys of streams along the identified pipeline corridor including hydrology, fisheries and water quality assessments as part of the environmental impact assessment for the Mackenzie Valley Gas Project. Survey transects, discharge measurements, fish sampling and physical measurements of fish habitat components were conducted. *In situ* water quality parameters were recorded and water and sediment samples collected for further analysis.

Corey Stefura

PROJECT RELATED EXPERIENCE – AQUATIC BIOLOGY & RESEARCH

Lower Bow River Fish Population Estimates **Calgary, Alberta**

Multiple pass mark-recapture study was conducted to generate population estimates of mountain whitefish, brown trout, and rainbow trout were conducted on the lower Bow River near Calgary. These estimates were used to assist with management of the fisheries resource.

Fraser River White Sturgeon Monitoring **British Columbia**

A large-scale, five-year program to investigate the status of white sturgeon in the Fraser River drainage in British Columbia. Work was completed for BC Fisheries and BC Ministry of Environment, Lands and Parks. Annual reports were prepared along with a final comprehensive report summarizing the findings of the five year study. Results the studies were presented at the 4th International Sturgeon Symposium, with current research being applied to recovery efforts for white sturgeon in the Nechako River watershed.

Study of Lake Sturgeon Movements **Alberta/Saskatchewan**

Lake sturgeon distribution in Alberta is confined to the North and South Saskatchewan river drainages. This study was initiated in 1996 to provide further information to aid in management of the species in the South Saskatchewan River. Critical habitats (spawning and overwintering) were identified as a result of the telemetry program.

Nechako River White Sturgeon Tagging Project **Prince George, BC**

Conducted follow-up studies from the 5-year study, including internal radio tag implants, to determine white sturgeon spawning locations and success.

Fish Overwintering Use of the Lower Athabasca River **Fort McMurray, Alberta**

Research was conducted for the Instream Flow Needs (IFN) Sub-Group of the Water Working Group of the Cumulative Effects Management Association (CEMA) to determine use of the Lower Athabasca River (LAR) for overwintering by key fish species. The characteristics of key overwintering areas were identified. The study was conducted to develop or adapt models to assess cumulative effects of water withdrawals on aquatic biota and water quality and for use in determination of instream flow needs for fish and other users in the LAR.

Wabamun Lake Whitefish Spawning Study **Wabamun, Alberta**

Study to evaluate the effects of the increased thermal regime caused by the Wabamun Lake Power Plant facility on lake whitefish spawning. An egg study was implemented to determine egg survival/mortality in the study and control area.

2000 - 2001 Priest Rapids and Wanapum

White Sturgeon Studies **Washington, U.S.A.**

Spawning areas below Rock Island and Wanapum Dam on the Columbia River were sampled using substrate mats to determine time and location of white sturgeon spawning. Tracking using sonar devices were employed to monitor movements.

Rat Creek Combined Sewer Overflow:

Benthic Assessment Study **Edmonton, Alberta**

Seasonal benthic macroinvertebrate and water quality monitoring/assessments in the North Saskatchewan River as related to municipal discharges (combination of surface runoff and sanitary effluents) was conducted.

Corey Stefura

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- Stefura, C. 2004. Fisheries Assessment of the Redwillow River near Highway 722 – Bridge File Number 08036 (Revised) – Letter Report to Alberta Transportation – Peace Region. Report No. 04-1326-020: 15 p.
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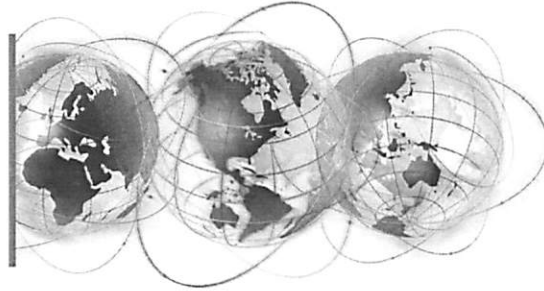
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APPENDIX II PROJECT PROFILE



CLOVER BAR CREEK EROSION CONTROL STUDY

Location

- Clover Bar Creek, AB

Key Services

- Fluvial Geomorphology
- Hydrological Analysis
- Erosion Control
- Dispute Resolution

Key Features

- Cost: \$23,000
- Year: 2004

Key Personnel

- Nathan Schmidt, Ph.D.,
P.Eng.

This project involved an assessment of existing erosion and evaluation of the future erosion potential for Clover Bar Creek under urbanized conditions.



The project included a review of existing studies and development designs for the creek watershed, followed by a field reconnaissance to survey the creek profile and cross-sections and to identify existing erosional features. Over 5 km of channel was examined and divided

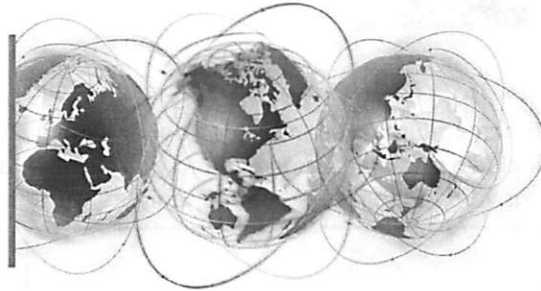
into geomorphically homogeneous sub-reaches for further analysis.

Each reach was characterized and assessed for erosion potential. Recommendations for restoration of existing erosion and treatments to prevent erosion under the future, urbanized flow regime were developed. The project included a comprehensive alternative evaluation and quantity and cost estimates for selected alternatives.

The project included provision of expert opinion in a dispute over funding responsibilities between two municipalities. The dispute was settled prior to a scheduled hearing before the Urban Municipalities Board.



CITY OF EDMONTON, 2005



COSTS AND BENEFITS OF NATURAL WETLANDS

Location

- Edmonton, AB

Key Services

- Evaluation of Mitigation Measures
- Economic Assessment

Key Features

- Cost: \$5,000
- Duration: 1 month

Key Personnel

- Kevin Frankowski, M.A.Sc.
- Nathan Schmidt, Ph.D., P.Eng.

In response to a technical question from City Council, the City of Edmonton Drainage Services Department retained Golder to provide a conceptual-level analysis of the benefits provided to the City by natural wetlands used for stormwater management.

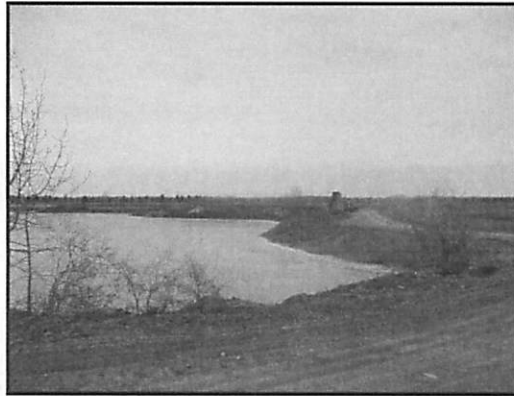
The project included an evaluation of the approximate relative economic benefits associated with using existing natural wetlands, compared to using purpose-built constructed treatment wetlands or "pipe infrastructure" systems (e.g., conventional engineered "hard" structures such as grit separators) for stormwater management. The evaluation was not applied to any particular facility or location, but was conducted for general application to areas within the City of Edmonton. The functionality that Golder was asked to evaluate in this comparison was limited to the management of stormwater quality and quantity. Functionality such as habitat, public green space, and aesthetics, while acknowledged as being important, were requested to be excluded from the scope of the assessment.



The study concluded that constructed wetlands can be designed to mimic specific functions performed by natural wetlands, including water treatment. During the design process, the design objectives or priorities need to be selected and the trade-offs assessed. Depending upon the design objectives, constructed wetlands can be designed to maximize treatment performance, habitat quality, or some middle-ground hybrid.



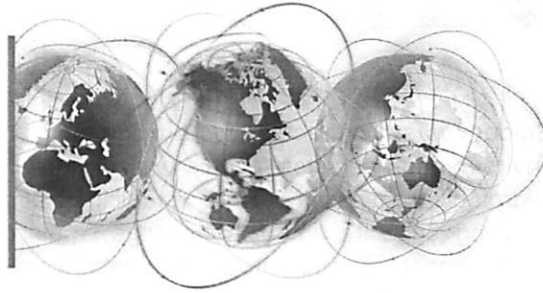
Since natural wetlands provide an intertwined collection of functions, including habitat, aesthetic and greenspace, and water treatment values, converting them to serve primarily as water treatment facilities will result in a loss of value or quality of the other functions.



The study also recognized that the water treatment functions of natural wetlands can be accessed and harnessed for stormwater management, as long as the appropriate assessments and planning are done beforehand to determine whether the

planned stormwater inputs are within the assimilative capacity of the natural wetland and will not result in an unacceptable effect on the natural wetland. Depending on site-specific conditions, the costs to conduct these assessments plus the physical modifications needed to direct stormwater into the natural wetland may be comparable to the costs for designing and constructing a purpose-built treatment wetland. As a result of fundamentally different capabilities, cost comparisons between conventional stormwater treatment technologies and constructed wetlands are very situation-specific, and are strongly influenced by the specific design objectives.

FOOTHILLS MODEL FOREST, 2003



HYDROLOGY AND FISHERIES HABITAT ASSESSMENT AND STREAM RESTORATION PRESCRIPTIONS AT HARDISTY CREEK

Location

- Hinton, AB

Key Services

- Evaluation of Mitigation Measures
- Economic Assessment

Key Personnel

- Nathan Schmidt, Ph.D., P.Eng.
- Jan den Dulk, P.Biol.

The Hardisty Creek Restoration Project (HCRP) is a multi-stakeholder initiative with the general mandate to foster increased public awareness of watershed concerns within Alberta and, specifically, to restore the fish, wildlife, vegetation and overall health of the Hardisty Creek watershed, Hinton, Alberta. The HCRP is comprised of the Athabasca Bioregional Society, Foothills Model Forest, Town of Hinton, Alberta Sustainable Resource Development, Alberta Transportation, Fisheries and Oceans Canada, Hinton Fish and Game Association, Weldwood of Canada Ltd. and the public. Other stakeholders, such as Canadian National Railroad, are also pursuing initiatives that improve the quality of the Hardisty Creek watershed.

The overall objective of this project is to produce a detailed plan to guide the implementation of restoration activities at a number of sites within the Hardisty Creek watershed. These sites include the reach of Hardisty Creek within Kinsmen Park and in the vicinity of three selected road crossings. When completed, the restored sites will demonstrate practical and proven restoration techniques addressing the range of riparian and fish habitat impacts within the study area. The restored sites will also serve to educate interested parties from around the province.

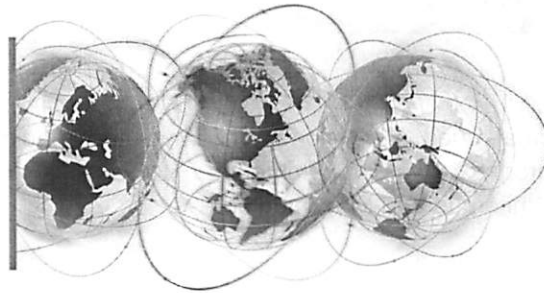




Golder was contracted to provide a range of engineering and environmental services for this project, including field data collection, a hydrological assessment to establish design flows for watercourse crossing capacity and fish passage, a fish habitat assessment, and development of alternatives for enhancing fish passage. Detailed engineering of culvert crossings and prescription of remedial measures for stream restoration were also included in the scope of work. Cost estimates for construction were provided, and Golder was subsequently asked to supervise construction of the project.



CITY OF EDMONTON, 2005



WHITEMUD CREEK EROSION STUDY

Location

- Edmonton, AB

Key Services

- Geomorphic Analysis
- Risk Assessment
- Erosion mitigation design

Key Features

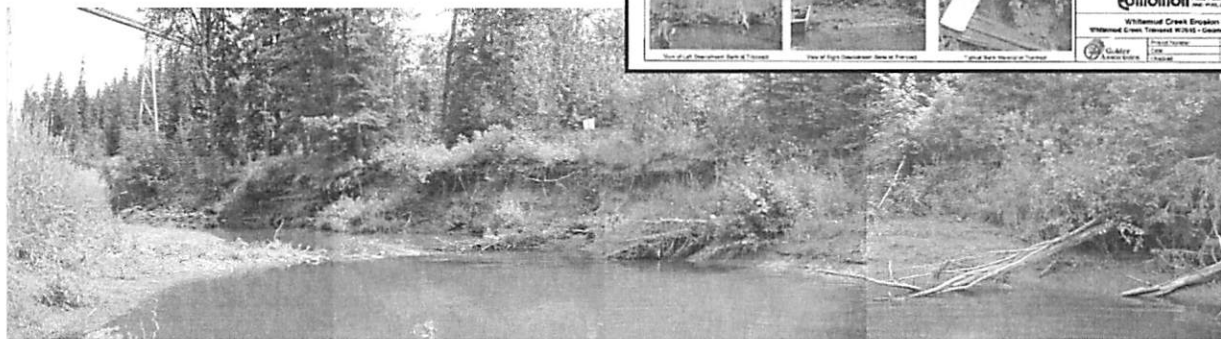
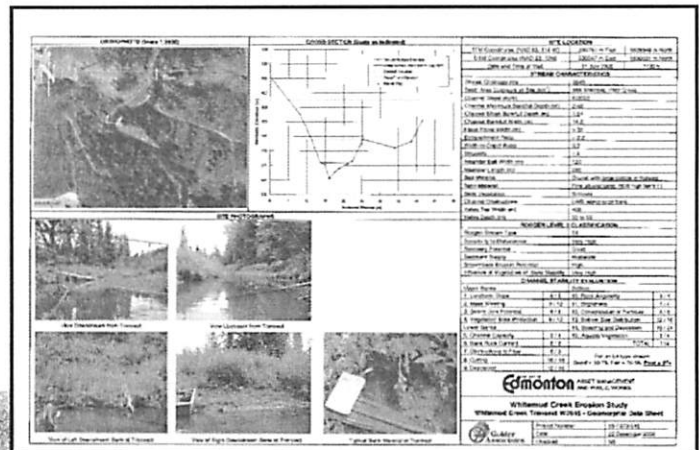
- Cost: \$70,000
- Duration: 6 months

Key Personnel

- Nathan Schmidt, Ph.D., P.Eng.
- Bernard Trevor, M.Eng., E.I.T.

Golder Associates was selected by the City of Edmonton Drainage Planning Department to assess the hydrologic, geomorphic and erosional characteristics of Whitemud and Blackmud creeks. The assessment included a review of available data, field data collection over approximately 50 km of creek channel, risk assessment of creek bank and valley wall stability, and the conceptual design of erosion control measures.

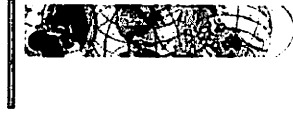
The project compiled and reviewed existing hydrologic, geomorphic, geotechnical and erosional data for the Whitemud Creek basin. This compilation formed the background for a two week field survey of the creek mainstems. The survey extended from the southern city limits to the North Saskatchewan River.



Mitigation procedures specific for the type of erosion were prescribed for each site. Feasibility-level cost estimates were prepared for the



WHITEMUD CREEK EROSION STUDY



catalogued sites along Whitemud and Blackmud creeks. A monitoring program was recommended to assess the potential changes to Whitemud and Blackmud creeks.