



COMPANY PROFILE

Highland Consulting Ltd is an engineering and development consultancy located in Nelson, British Columbia (2008), which provides a wide range of engineering services for clients in diverse sectors including transportation, project management, environment, water and waste water. An established consultant firm consisting of key personnel, Paul Kernan, P.Eng, Highland Consulting Ltd's involvement in every aspect of the work is geared to consistently designing and delivering appropriate, cost-effective and professional engineering solutions for every project. The company's success in this role is underpinned by appropriate design skills, attention to detail and willingness to 'go the extra mile' in order to get the job done. Highland Consulting predominately specializes in the Water and Wastewater industry and with the increasing demand for sustainable design is able to 'think outside the box' and provide innovative sustainable design to clients whilst meeting or exceeding government legislation.

SERVICES

- **Waste Water Treatment Plant Design and Discharge-**
Tertiary treatment, seepage bed, sand mound, mechanical treatment systems, pressure distribution, Solar Aquatic Systems, innovative systems, IHA and MWR Design;
- **Water Treatment Plant Design-**
Feasibility reports, hydraulic design, process design, construction permit application, Certificate of Public Convenience and Necessity (CPCN) application, O&M manuals;
- **Small Water User Systems (Review/Design)-**
Design, financial modeling, implementation of system, hydraulic profiles, retro fitting existing infrastructure, Cross Contamination Control (CCC) Reports;
- **Storm Water Management-**
Hydraulic calculations, Storm Water Management Plans, decentralized systems, rain garden and bioswale design, outfall design;
- **Municipal Engineering**
Storm Water/Water Management Plans, highway design, water network design/modeling, lift station design, process design, construction supervision, tender document preparation;
- **Sustainable Civil Design-**
Bioswale storm systems, rain water harvesting, re-claimed water use, LEED consulting, water efficient design;
- **Project Management-**
Project Scheduling, Permit Planning, Design - Build Contracts, Contract Administration.
- **Land Development-**
Preliminary Layout Approval (PLA) applications, subdivision design, regional zoning, public presentations, highway design, septic assessments, services design;

PROFESSIONAL AFFILIATIONS

- Engineers and Geoscientists of BC (EGBC);
- British Columbia Water & Wastewater Association (BCWWA);
- Western Canada Onsite Wastewater Management Association (WCOWMA);
- American Water and Wastewater Association (AWWA);
- Small Waters Users Association of BC;
- Environment & Science Engineering;



RECENT EXPERIENCE

Waste Water Treatment Plant (WWTP) Design and Discharge

- New Denver & Area Housing Society- Septic System design and approvals. Type 3- ISF;
- Lower Kootenay Band – Seven Nations Soaring Eagles Healing Centre – Septic Design;
- Yaqan Nukiy Health + Administration Building– Type 2 ISF WWTP Design/Permits;
- CMH Heli Ski – WWTP design and approvals for IHA and MoE systems (Several Lodges);
- Red Mountain Ski Resort-Septic design for (i)Paradise Lodge and (ii) Club House/Cabins;
- Queens Bay Resort - WWTP design for 90 Lots. IHA/MoE Registration;
- Ainsworth Hot Springs. MoE WWTP upgrade. Outfall upgrades. MBR Treatment (120m³/day);
- Slocan Community Hospital. Design of septic field & permits. Construction Administration;
- Osprey Heights Subdivision-Community septic system design and approvals (22m³/day);
- SD#8 Blewett Elementary School – Repair/Refiling, ISF,Flow Monitoring, IHA;
- Nelson Cohousing Community-ISF sand filter w/ partial drip irrigation re-use (22m³/day);
- Rosedale Elementary School – LEED certified sewage system (37m³/day), Design Build Contract
- Yarrow Elementary School – Tertiary Treatment, Design Build Contract, Construction Admin.
- Whittewater Ski Resort - Glory Chair Septic System, Peat Moss filter, Flow Monitoring;
- Christina Lake Living Arts Centre –Solar Aquatics System (SAS) Design (22m³/day) w/ ISF;
- Shambhala Music Festival – Waste Water Management Plan, Design, Implementation, Permits
- Hidden Valley Estates - Centralized System for 12 homes, STEP collection system;
- Galena Bay Developments-Existing field system failure, alternative outfall design and upgrades;
- Village of Salmo – WWTP Report, Feasibility Study, Financial Assurance, Technical Review;
- Mountain Shores Resort – Rotating Biological Contactor (RBC) review (164m³/day); Reports;
- Crawford Bay Elementary Secondary School – LEED, Sub-surface Tertiary Wetland Design;

Water Treatment Plant (WTP) Design

- Red Mountain Resort – WTP Design Construction Permits;
- CMH – Cariboo Lodge – WTP Design Construction Permits/Water Storage/Water Distribution;
- CMH – Galena Lodge - Water Storage Design and Distribution line;
- Nelson Cohousing Community- Design & Construction Permits for WTP/Reservoir/Network;
- Crawford Bay RV Resort- Design & Construction Permits for WTP/Network. Planning;
- Balfour Resort and Marina- Design & Construction Permits for WTP/Network. Planning;
- Village of Salmo – Universal Water Meter Study, Distribution Network Upgrade, Design;
- Balfour-Planning, Cost Estimates, Phasing of Upgrades, Public Presentations, Feasibility Report;
- Nicks Island Water District-Initial Well Report, Planning, Cost Estimates;
- Crawford Bay Elementary Secondary School – WTP Design, rain water harvesting;

Watershed Management and Source Protection

- 6 Mile Water Users Group/NLG - Combined Water System - Feasibility study, Financial details;
- Bourke Creek Water Study – Small Water Users Group Feasibility Study, Design, Financial Study, Phased approach, grant funding options, source recommendations;
- Sandy Creek Water Study – Small Water Users Group Review

Storm Water Management

- Knee Deep Development- Master Drainage Plan, Hydraulic Analysis, Design (Current);
- Nelson Cohousing Community- Master Drainage Plan, Hydraulic Analysis, Design;



- Riondel Drainage Upgrade (RDCK) – Design, Contract Administration, Planning, Permits
- Christina Lake Living Arts Centre –Bioswale design/Master Drainage Plan
- Wing Creek Resort – Storm Water Report, Hydraulic Calculations, Design, LEED;

Water Conservation, Reuse and Sustainable Civil Design

- Christina Lake Living Arts Centre – Solar Aquatics Phase 1 Design;
- Nelson Cohousing Community- Drip Irrigation Reuse, Water Conservation, Sustainable Design;
- Village of Salmo – Universal Water Meter Study, Distribution Network Upgrade, Design
- Crawford Bay Elementary Secondary School – Tertiary Wetland Design, Rain water harvesting

Construction Management

- Rosedale/Yarrow School, Christina Lake SAS, Sanca Creek WWTP,

REFERENCES

Peter Muirhead (former Provincial Approving officer MoT)
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NELSON COHOUSING COMMUNITY, NELSON, B.C

SERVICES PROVIDED

Complete Civil Engineering of project including - Sustainable Civil Design, Grading Plan, Water Source Investigation, Water Treatment Selection, Water Network Hydraulic Design, Reservoir Design, Associated Construction Permit Applications (IHA), Tertiary Waste Water Treatment Design under Interior Health Jurisdiction, Storm Water Management, Coordination of other consultants, Construction Supervision;

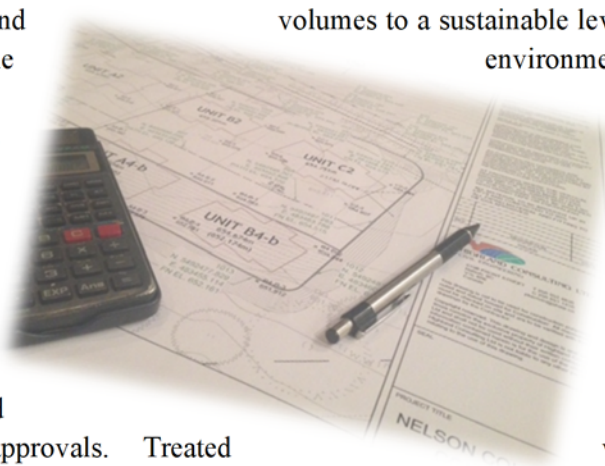
PROJECT DESCRIPTION

The Nelson Cohousing Community development consists of 24 homes and a Common building located approximately 13km from Nelson, BC. The group members share a common vision "The purpose of our coming together in land ownership is to engage in and enjoy the mutual support and joy of community living. Our community will be shaped by the principles of embracing diversity, mindful communication, an environmental ethic of living lightly, and within a sustainable land use design. We aim to build resilience in our community by cultivating food and land based skills, and exchanging those skills with the broader community around us."



Highland Consulting Ltd was responsible for the civil design of the 25 unit village infrastructure. The development waste water is designed to treat 22m³/day of sewage generated to type 2 standards using a timed dosed Intermittent Sand Filter (ISF) with direct discharge to the ground. Approximately 10% of total flow has the option to be further treated for use as drip irrigation to perennial vegetation and can be winterized as required. Sewage collection is by means of individual Septic Tank Effluent Gravity (STEG) tanks to a common low pressure main consisting of 50mm-75mm HDPE pipe network. Water Conservation measures were used to reduce the maximum daily demand volumes to a sustainable level which in turn reduced the effluent loading to the environment.

The water source was investigated to tie into existing neighbors community system and 6MWUG independent community water well on the subject property. The latter option was selected namely due to financial implications. A Water Treatment Plant (WTP) was selected to treat raw water to Interior Health Standards and obtaining the necessary Construction Permits and approvals. Treated water is then transported



via 50mm HDPE pipe to a Cast-in-Place reinforced concrete storage tank with sufficient head to provide operating pressures at the dwellings. The 150m³ storage tank and the 150mm HDPE force main would also provide for necessary fire volumes and emergency storage.

The storm water component of the design included a series of biofiltration swales around the site containing a soil mixed design for slow percolation and vegetation which remove TSS from the impervious run off areas. Provisions were made for overflow pipes connected to culverts for additional retention time during peak storms.



KNEE DEEP DEVELOPMENTS, NELSON, B.C

SERVICES PROVIDED

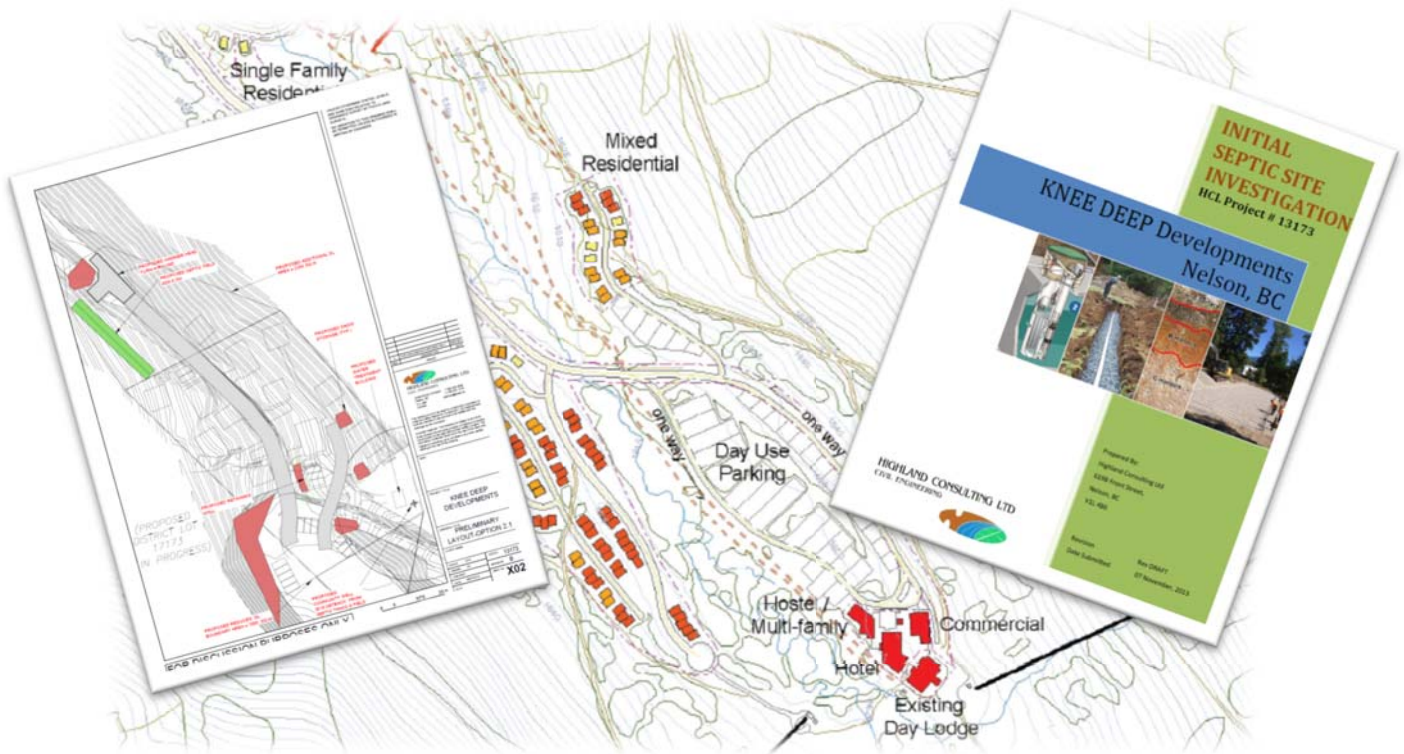
Feasibility Infrastructure Report, Design, Cost Estimates, Septic Site Investigation, Water Table Mounding Calculations. Septic Design, Water Treatment, Drainage Plan and Road Design.

PROJECT DESCRIPTION

A Development Master Plan was submitted by Brent Harley and Associates Inc in 2010 highlighting potential expansion to White Water Ski Resort located in Nelson, BC. The document recommended a phased approach with the intent to upgrade the skiing experience with gradual development of new lifts and trails, the addition of a village component and possible resort accommodation.

Highland Consulting Ltd was responsible for the Initial Civil Infrastructure Feasibility Study for the first phase of accommodations proposed in the Nordic Ski area. Working within a multi-discipline team including Architect, Structural Engineer, Geotechnical Engineer, Avalanche Specialist and the Project Manager, a concept layout plan was produced. The conceptual design included (i) road layout with software modeling for emergency vehicle access, gradients and snow storage capacity, (ii) Onsite septic site investigation with pilot modeling of 'full scale modeling' with water table mounding calculations to establish the septic effluent capacity of the development, sustainable to the environment; (iii) Development types to minimize impact to the environment, (iv) Conceptual Drainage Plan and (v) Initial water source investigation.

It is anticipated that HCL will be responsible for the detailed design of the Infrastructure in Early 2014.





RESIDENTIAL SEPTIC SYSTEMS, NELSON, B.C

SERVICES PROVIDED

HCL specializes in planning and design of on-site septic systems varying in size from residential homes to commercial schools. We provide a cost effect solution considering factors such as: appropriateness of technology (including simplicity, reliability and cost), operation and maintenance cost projections, source control policy/potential source modification/flow reductions, efficiency, sustainability and ecological impact.

SITE INVESTIGATION

Compile comprehensive field analysis soil profiles and hydraulic loading tests in the field with documentation of critical setbacks, design rational, detailed design and recommendations.

DETAILED DESIGN

- Design suitable septic system for site restraints including Type 1, (Primary treatment i.e. Septic tank); Type 2 (Secondary treatment to 45mg/L BoD/TSS standards) and Type 3 (Tertiary treatment to 10 mg/L Bod/TSS standards).
- A typical WWTP would comprise of mechanical system which may include (but limited to) technology such as; (i) Activated sludge, (ii) Rotating Biological Contactor (RBC), (iii) Sequencing Batch Reactor (SBR) and (iv) Membrane Filtration. •A biological treatment system would include (i) Sand filtration, (ii) Combined ground disposal and Treatment, (iii) Constructed Wetland Treatment and (iv) Solar Aquatic Treatment System (Living Machine).
- Disposal system design includes gravity effluent dispersal, pressurized equal distribution, sub-surface wetland, non-pumped pressurized systems and drip irrigation disposal.

FILING WITH HEALTH AUTHORITY

Submission of Record of Sewage System with legal documents, design drawings and supporting documents in order to assist in obtaining building permit from building authority and to allow construction of proposed system.

CONSTRUCTION ADMINISTRATION (IF REQUIRED)

Administer routine construction site inspection (when required) and produce AS CONSTRUCTED drawings for final submission to Health Authority. Help assist in contractor selection.

FINAL APPROVAL/LETTER OF CERTIFICATION

Submission of final documentation including; Letter of Certification, Construction Record Drawing and Operation & Maintenance Manual.





ROSEDALE ELEMENTARY SCHOOL, CHILLIWACK, B.C

SERVICES PROVIDED

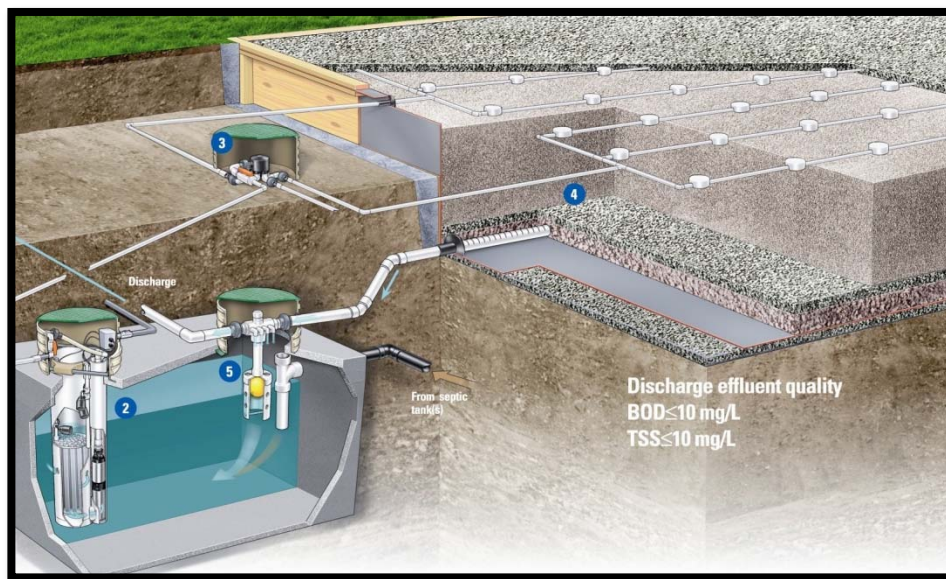
Sustainable Civil Design, Tertiary Waste Water Treatment Design, Ministry of Environment Registration, Responsible for Design-Build Contract, Payment Draws, Project Management, Construction Supervision, Commissioning, Hand Over.

PROJECT DESCRIPTION

Rosedale Elementary School is to be demolished and replaced by a LEED certified Gold school with the capacity of 750 students. The approximate budget of the school is estimated to be \$30M. Highland Consulting Ltd was responsible for Design, Permit Process and Construction of the LEED certified tertiary Waste Water Treatment Plant for 36.9 m³/day discharge onsite. The waste water produced from the Rosedale School building will be treated to reclaimed standards using a Recirculating Sand Filter before being discharged to various sand lined septic fields.

Highland Consulting's was not only responsible as the Consulting engineer, but also as the Contractor under a design-builder fixed-fee contract.

A Recirculating Sand Filter (RSF), will be used to reduce BOD₅ and TSS concentrations to less than 10 mg/L (typically 5 mg/L with 60% nutrient removal). Recirculating sand filters are an aerobic system. In addition to physically filtering the water, they perform as a biological filter. Micro organisms, highly adapted to decomposing wastewater, live on the sand grains. These organisms convert carbon or organic matter in the wastewater to carbon dioxide (CO₂). They also convert ammonia (NH₃) and organic N to nitrate (NO₃-). When the filter recirculates, then the nitrate will pass from the sand filter into an anaerobic or oxygen deplete environment in the recirculation tank. This allows de-nitrification, or the transformation from nitrate (NO₃) to nitrogen gas (N₂(g)). Nitrate may be reduced partially to nitrite or completely to nitrogen gas. Complete reduction requires an organic carbon source, which is usually abundant in the septic tank effluent. Following RSF treatment, the high quality secondary effluent will be discharged to ground via sand lined seepage beds.



Other aspects of the works included; installing tanks with high ground water table, scheduling works to be implemented with conflicting trade works, consultant meetings, meeting stringent MoE regulations construction supervision/inspection and liaising with local authorities.



CHRISTINA LAKE LIVING ARTS CENTER, CHRISTINA LAKE, B.C

SERVICES PROVIDED

Sustainable Civil Design, Tertiary Waste Water Treatment Design, Bioswale/Raingarden Design, Construction Supervision, Storm Water Management Plan, LEED Administration.

Solar Aquatic System (aka 'Living Machine®') with 'cat walk' bridge for educational purposes.



PROJECT DESCRIPTION

Working with in a multi-disciplined design team, Highland Consulting Ltd was responsible for the civil works for a proposed new community welcome center that will serve as an interpretive centre for the region with tourist attractions that will showcase the regions vibrant arts and cultural life, and in particular will serve as an educational experience for environmental sustainability. The waste water produced from the CLAC building will be treated to reclaimed standards using a Recirculating Sand Filter, Solar Aquatics System (SAS) and Ultra Violet Disinfection before being discharged to various sustainable infiltration areas including, sub-surface wetland, reed bed, sand beds and drip irrigation.

In general, SAS duplicates the natural water purification processes of freshwater wetlands. Wastewater is circulated inside the greenhouse through a series of above ground tanks, each with its own aquatic ecosystem, and marshes. The treatment process allows sunlight, oxygen, bacteria, algae, plants, snails and fish to work together to purify the waste water.

Although Solar Aquatics Systems are in use throughout the world, particularly in warmer climates, the CLAC waste water system will be the first of its kind in the Kootenays with an anticipated LEED Gold certification. The Christina Lake SAS waste water treatment system is not only intended to treat sewage and meet legislation, but also be used as a attractive super-cleaning and publicly viewable wastewater system with the capacity for public tours and educational purposes.

Other Civil works included; Storm water management using bio-swales and associated overflow piping, car park design, consultant meetings, construction supervision/inspection and liaising with local authorities.



BALFOUR IMPROVEMENT DISTRICT WATER TREATMENT PLANT, BALFOUR, B.C

SERVICES PROVIDED

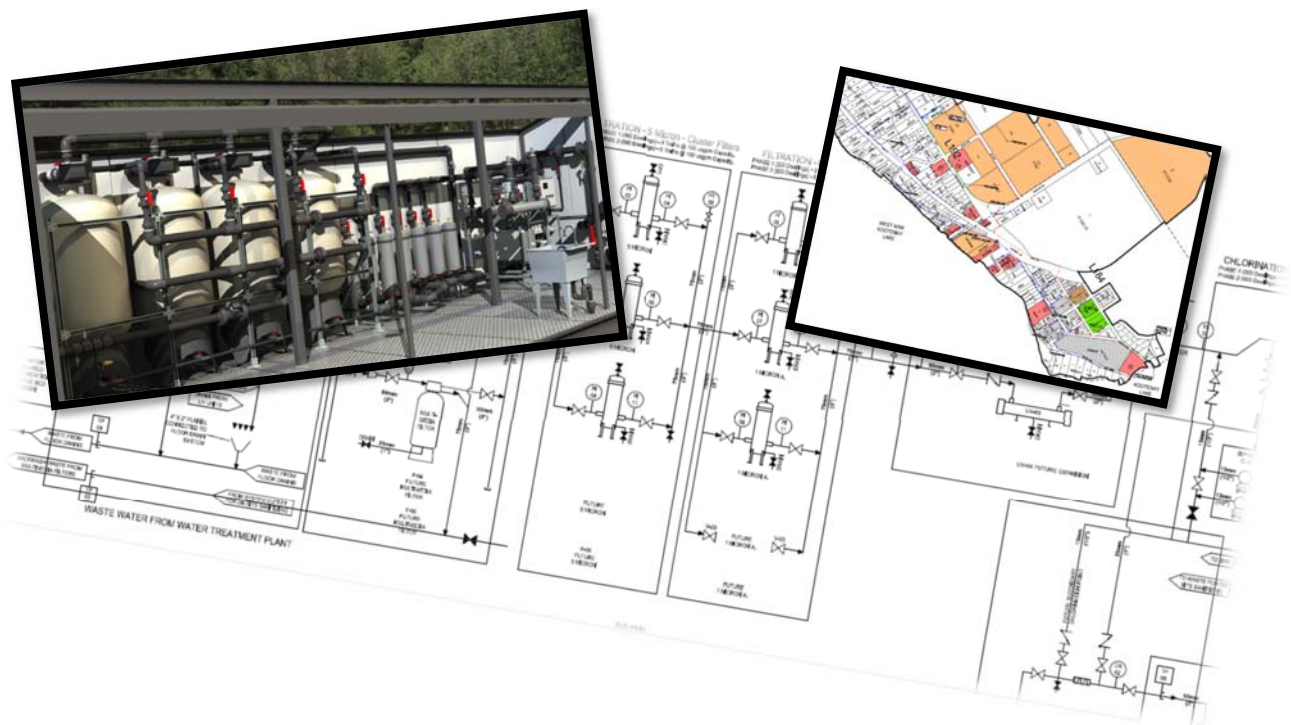
Water Treatment Plant Planning, Cost Estimates, Process Design, Hydraulic Profiles, Phasing of Upgrades, Public Presentations, Feasibility Report, LEED Administration.

PROJECT DESCRIPTION

The Balfour Irrigation District proposes to upgrade the current water system which supplies water to approximately 255 connections (with anticipated growth to 500 connections in the next 5 – 10 years) on a ‘Boil Advisory’ notice, to meet current government agency standards. Working with Financial Advisor, Highland Consulting was initially responsible for conceptual design of Water Treatment Plant (WTP) upgrade to accommodate anticipated population growth and produced Cost Estimates to Classification C level under Public Works Canada.

Public Consultation and submission of Feasibility Report and Cost Estimate to the client and Regional District of Central Kootenays (RDCK), concluded that Balfour Improvement District would implement a Water Treatment Plant (WTP) with associated infrastructure upgrades and allow RDCK to operate and maintain the water system. The WTP was designed to Interior Health Agency 4-3-2-1-0 objectives and RDCK design standards which consists of Multimedia Filters, Cluster Filters, UV and Chlorination treatment. In addition sustainable design was implemented for LEED certification including, Variable Frequency Drive (VFD), increased insulation factor for utility building, efficient lighting, Erosion and Sedimentation Control Plan, Bio Swale, increased water efficiency and reduced site disturbance.

Civil Work also involved: design of force main, retro fitting of existing distribution network system, pump upgrades, hydraulic profiles and associated drawings and submissions.





CRAWFORD BAY ELEMENTARY SECONDARY SCHOOL, CRAWFORD BAY, B.C



SERVICES PROVIDED

**Rendering Drawing Courtesy of KMBR Architects*

Sustainable Civil Design, Tertiary Waste Water Treatment Design, Rain Water Harvesting, Bioswale/Rain-garden Design, Construction Supervision, Storm Water Management Plan, Potable Water Design, Construction Permit application.

PROJECT DESCRIPTION

A 200 student elementary-secondary school with a \$13.7m budget in Crawford Bay, is the first school in the area to achieve LEED certification GOLD, a testament to environmentally and socially responsible design. Working within a multi-disciplinary design team, including Electrical, Mechanical, Structural Engineer, and Architect, I (with Pennco Engineering) was responsible for the civil design of the school infrastructure. The school waste water is treated to tertiary standards with 80-90% nutrient removal using an Intermittent Sand Filter (ISF) with UV provision and sub surface wetland using peat moss and aquatic vegetation. The storm water component of the design included a series of biofiltration swales around the site containing a soil mixed design for slow percolation and vegetation which remove TSS from the impervious run off areas. Provisions were made for overflow pipes connected to dry wells for additional retention time during peak storms.

The rainwater collection tank was sized accordingly to provide sufficient supply for the drip irrigation system and associated Rain Water Leader pipes hydraulically designed. In addition to the civil sustainable designs, fly ash aggregate was used in the concrete for fire, irrigation and septic tanks, reducing CO2 omissions by upto 20%.



Subsurface Wetland Design using
Peat moss and Aquatic Plants.



SKI / CAT / HELI OPERATIONS

SERVICES PROVIDED

HCL specializes in planning and design of civil infrastructure related to winter operations. Comprising of services such as: (i) Septic design/planning, (ii) Water design/approvals, (iii) Drainage design, (iv) Road design to MOT Standards and (v) Development services. We provide a practical solution considering operation factors and cost benefits whilst meeting or exceeding government compliance. In addition we understand the ski industry operations and aim to prioritize approval process from government agencies including MoE, IHA, MoT, DFO, First nations, Lands and Local Building Authorities

RECENT EXPERIENCE

Waste Water Treatment Plant (WWTP) Design and Discharge

- Whitewater Ski Resort – Repair/Refiling; Flow Monitoring, IHA, Pump design, controls;
- Knee Deep Development (Whitewater) - Septic design and approvals for 16 unit development and Lodge;.
- Whitewater Ski Resort - Glory Chair Septic System, Peat Moss filter, Flow Monitoring;
- Eagle Pass Heli Ski - WWTP Report, Feasibility Study, Approvals;
- CMH – WWTP Design, Annual Reports for WWTP submitted to Ministry of Environment;
- Baldface – Feasibility Study, Cost Estimate, obtaining building permits;
- Retallack – Hot tub Design Review and IHA compliance;

Water Treatment Plant (WTP) Design

- Whitewater Ski Resort - Design & Construction Permits for Network/Infiltration Gallery;
- Knee Deep Development – Feasibility Study; Water design for 16 unit development;.
- CMH – Review of infiltration gallery and improved design;

Development

- Knee Deep Development- Master Drainage Plan, Hydraulic Analysis, Design (Current);
- Knee Deep Development - Road design for 16 unit development

TESTIMONIALS

<i>Jeff Pensiero, Baldface, Owner/Manager “</i>	<i>“Working with Paul Kernan at Highland Consulting helped us to build Baldface lodge in a very challenging location, under tight timelines. Paul’s understanding of the scope of the entire project was critical to our success in our latest expansion. We didn’t miss a day!”</i>
<i>Scott Newsome, Eagle Pass, Manager</i>	<i>“Paul is professional and efficient and is willing go the extra mile to complete work with in our schedule and obtain the necessary permits”</i>
<i>Kirk Jensen, Whitewater Ski Resort, General Manager</i>	<i>“Paul Kernan at Highland Consulting has been easy to work with on several projects. Paul has an open mind approach and works with us to find solutions using the latest in technology all while being environmentally conscious. I would personally recommend Highland Consulting for any project you may have, big or small”</i>
<i>Andrew Kyle, Knee Deep Developments</i>	<i>“As HCL is located in Nelson, BC, the company knows the community and is willing to think ‘outside the box’ to achieve sustainable civil design that is in the environments best interest whilst meeting government requirements”</i>