The Ecology Action Centre and Nature Nova Scotia Lunch and Learn: Wetlands, Adaptation and Extreme Weather Events.

Date & Time Aug 15, 2023 12:30 PM in Halifax

Description As climate change continues, the severity and frequency of extreme weather in Nova Scotia will grow, as will the need for adaptation. Dr. Danika Van Proosdij, Director of TransCoastal Adaptations Centre for Nature-based Solutions, will be discussing her work on making room for wetlands to adapt to climate change. Dr. David, retired biology professor and active citizen scientist, will share his observations studying the wetlands in the Purcells Cove Backlands in HRM, how they've reacted to extreme weather events, and what this can tell us about planning for the future. Register for the webinar to attend.

Watersheds, Watercourses & *Wetlands* of the Halifax Backlands

David Patriquin

TOPICS

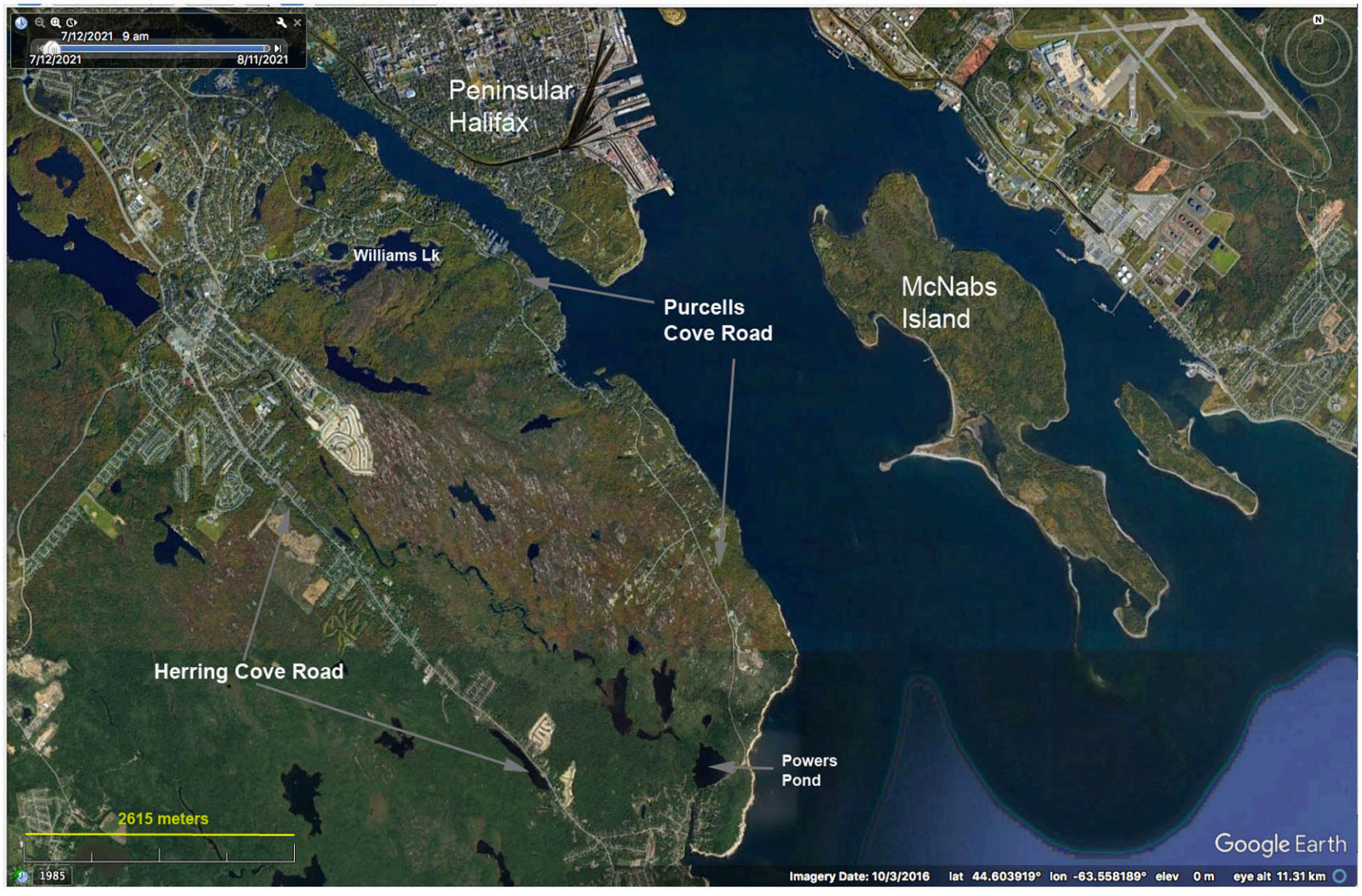
Introduction: The Backlands

Main Topic: Too often overlooked (N Hill, P Manual, DP): The existence and role of Boulder Fields, Washes & "Whaleback Troughs", and Vernal Pools in watercourses

Brief Comment/Photos

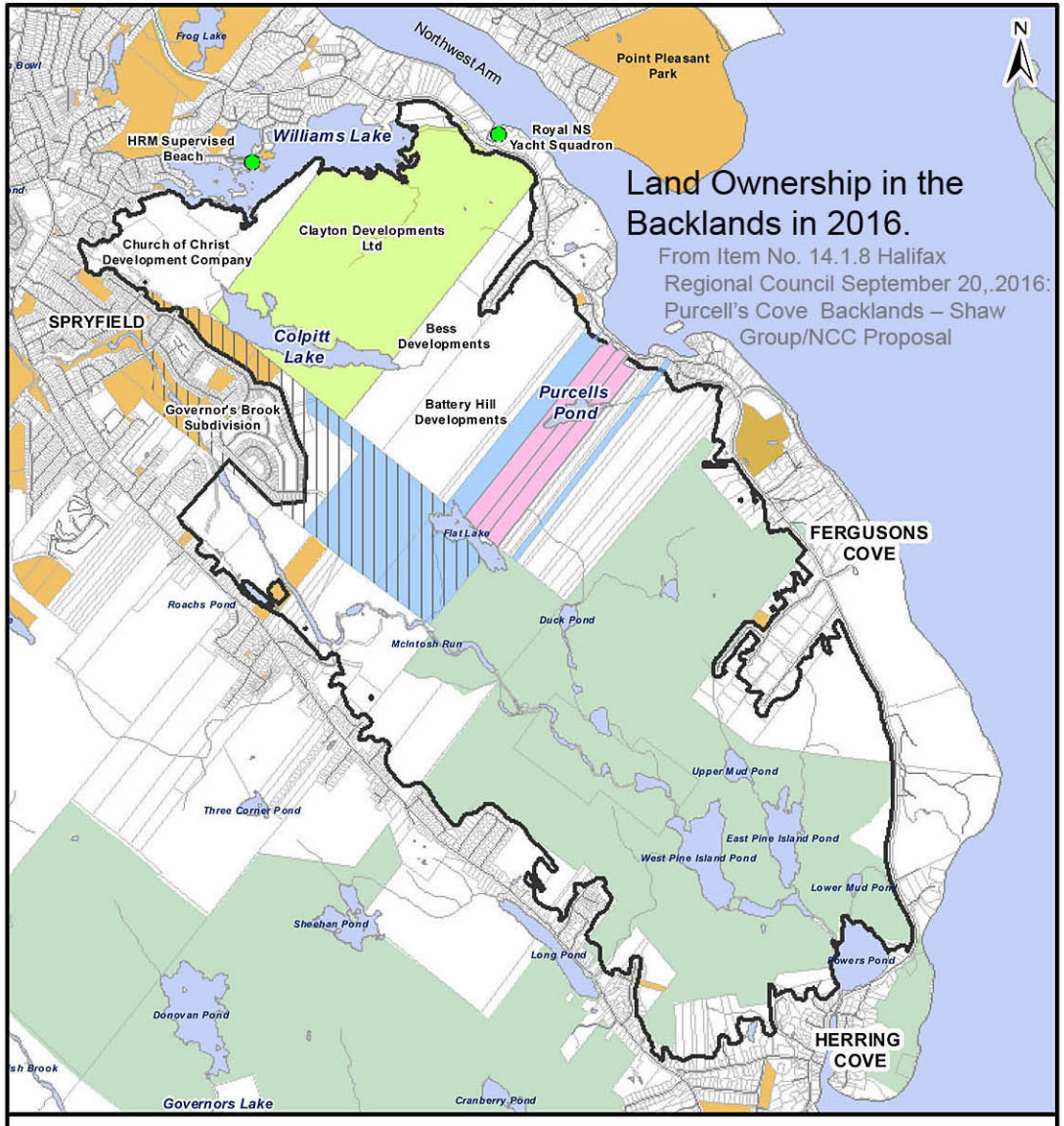
- 2009 Spryfield Fire: Impact On and Of wetlands
- July 2023 Big Precipitation Events: where the water was stored
- Invasive Species in wetlands and watercourses
- Salinization of watercourses receiving urban runoff

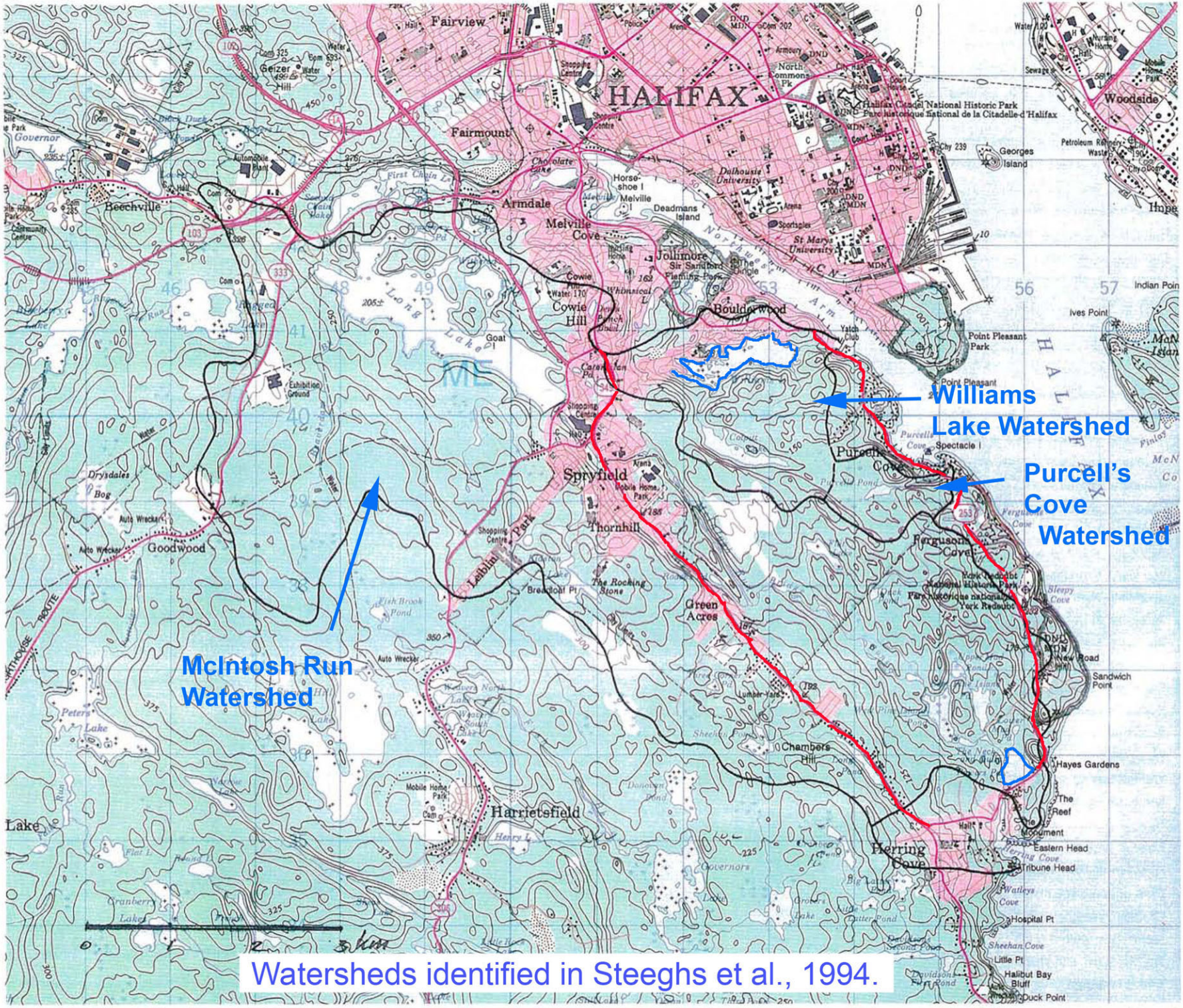
Access slides and notes at
www.backlandscoalition.ca
Go to Current Issues/Wetlands Webinar



The “Backlands” are located only a few kilometers from from peninsular Kjipuktuk (Halifax) in Mi’kma’ki, the ancestral and unceded territory of the Mi’kmaq People.

The Backlands include all of the undeveloped land bounded by Herring Cove and Purcells Cove Roads, and by Williams Lake to the northwest, and Powers Pond to the southeast. It is an area of circa 1350 hectares with nine lakes, hills with spectacular views, globally rare Jack Pine/Broom Crowberry Barrens, Wabanaki forest and dozens of kilometers of informal hiking and biking trails...


Land Ownership in the Backlands in 2016.
From Item No. 14.1.8 Halifax Regional Council September 20,.2016: Purcell's Cove Backlands – Shaw Group/NCC Proposal
N
Northwest Arm
Point Pleasant Park
Royal NS Yacht Squadron
HRM Supervised Beach
Williams Lake
Frog Lake
Clayton Developments Ltd
Church of Christ Development Company
SPRYFIELD
Colpitt Lake
Bess Developments
Battery Hill Developments
Purcells Pond
Governor's Brook Subdivision
Flat Lake
FERGUSONS COVE
Roachs Pond
Duck Pond
McIntosh Run
Upper Mud Pond
Three Corner Pond
East Pine Island Pond
West Pine Island Pond
Lower Mud Pond
Sheehan Pond
Long Pond
Bowers Pond
Donovan Pond
HERRING COVE
Governors Lake
Cranberry Pond
Map 1 - Reference Map
Regional Council Report - Purcell's Cove, Shaw Group / NCC Proposal
Subject Property
HRM Lands Zoned Protected Area
HRM Parkland
HRM Lands Aquired from Governor's Brook Subdivision
Purcell's Cove Backlands Area
Nova Scotia Nature Trust Lands
Crown Lands
Streams
Parcels
Produced by Parks and Recreation Policy and Planning
HALIFAX
0 0.5 1
Kilometers
The accuracy of any representation on this plan is not guaranteed.
30 August 2016
T:\work\iam\Tim\Projects\PCBL\ (HK)


Williams Lake Watershed
Purcell's Cove Watershed
McIntosh Run Watershed
HALIFAX
Fairview
Fairmount
Armdale
Melville Cove
Jollimore
Boulderwood
Cowie Hill
Spryfield
Thornhill
Goodwood
Beechville
Purcells Cove
Ferguson's Cove
Green Acres
Chambers Hill
Harrietsfield
Herring Cove
Woodside
Point Pleasant Park
Sandwich Point
Hayes Gardens
Eastern Head
Tribune Head
Hospital Pt
Duck Point
Halibut Bay
Bluff
Watersheds identified in Steeghs et al., 1994.

Nova Scotia Department of Natural Resources - Mineral Resources Branch

Nova Scotia Department of Natural Resources
Mineral Resources Branch

Open File Map ME 2011-011

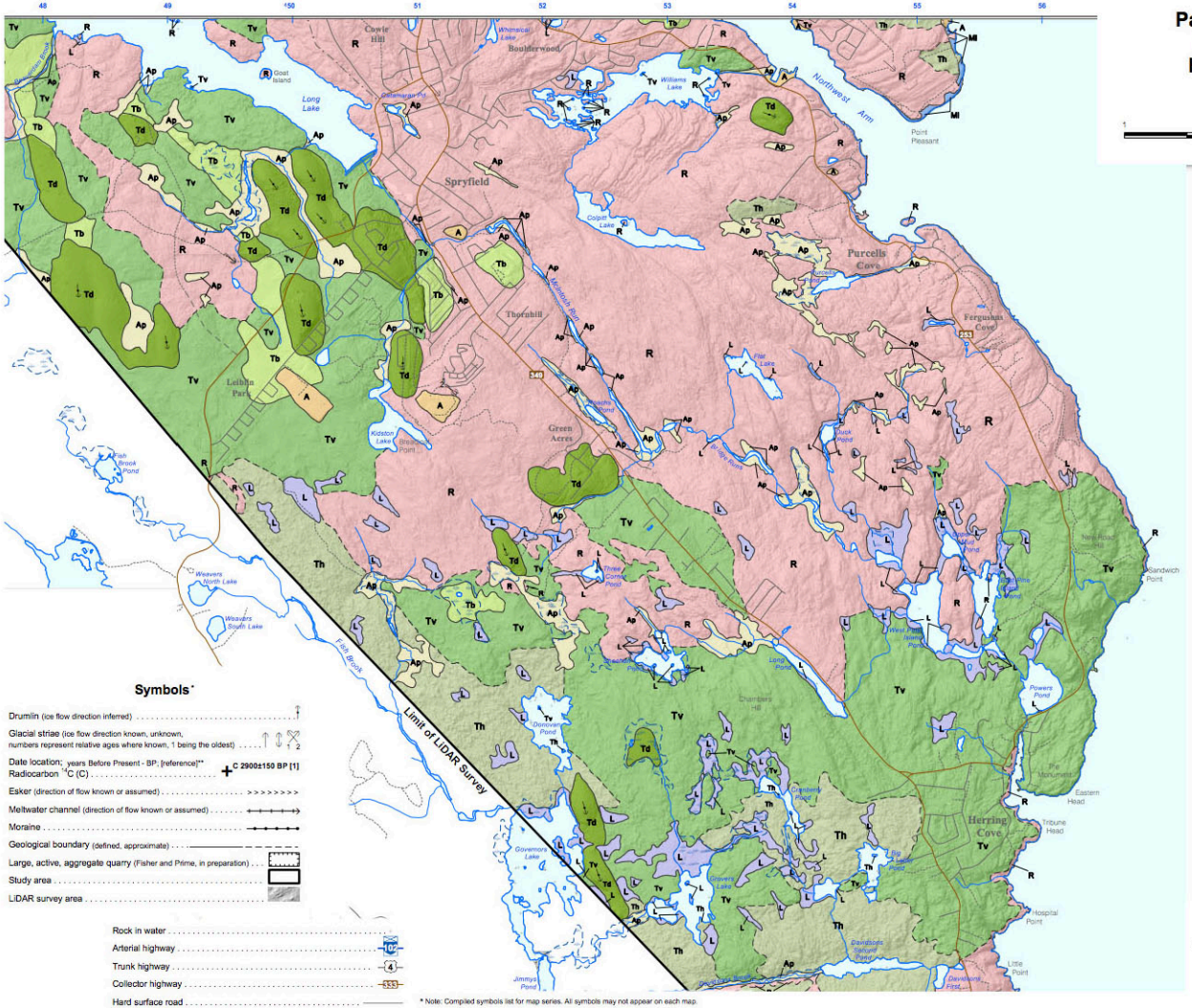
Surficial Geology Map, Part of the Herring Cove Claim Reference Sheet 11D/12A, Halifax County, Nova Scotia

D. J. Utting

Scale 1:25 000

1 0 1 2 km

Halifax, Nova Scotia
2011



Symbols*

- Drumlin (ice flow direction inferred)
- Glacial striae (ice flow direction known, unknown, numbers represent relative ages where known, 1 being the oldest)
- Date location; years Before Present - BP; [reference]** Radiocarbon ^{14}C (C) — C 2900±150 BP [1]
- Esker (direction of flow known or assumed)
- Meltwater channel (direction of flow known or assumed)
- Moraine
- Geological boundary (defined, approximate)
- Large, active, aggregate quarry (Fisher and Prime, in preparation)
- Study area
- LiDAR survey area

- Rock in water
- Arterial highway
- Trunk highway (4)
- Collector highway (333)
- Hard surface road
- Loose surface/resource access road
- Trail, footpath, cart track
- Railway (active, inactive)
- Coastline
- River, stream
- County boundary
- Transmission line (multi, single line)
- Swamp
- Lake, ocean

* Note: Compiled symbols list for map series. All symbols may not appear on each map.

** References for Selected Radiocarbon Dates for Map Series

[1] Boyd, R. and Honig, C. 1992: Estuarine sedimentation on the eastern shore of Nova Scotia; Journal of Sedimentary Petrology, v. 62:4, p. 569-583.

[2] Edgecombe, R.B., Scott, D.B. and Fader, G.B.J. 1999: New data from Halifax Harbour: paleoenvironment and a new Holocene sea-level curve for the inner Scotian Shelf; Canadian Journal of Earth Sciences, v. 36, p. 805-817.

[3] Miller, A.A.L., Mudie, P.J. and Scott, D.B. 1982: Holocene history of Bedford Basin, Nova Scotia: foraminifera, dinoflagellate, and pollen records; Canadian Journal of Earth Sciences, v. 19, p. 2342-2367.

[4] Ogden, J.G., III. 1987: Vegetational and climatic history of Nova Scotia. I. Radiocarbon-dated pollen profiles from Halifax, Nova Scotia; Canadian Journal of Botany, v. 65, p. 1482-1490.

[5] Shaw, J., Taylor, R.B. and Forbes, D.L. 1993: Impact of the Holocene transgression on the Atlantic Coastline of Nova Scotia; Géographie Physique et Quaternaire, v. 47:2, p. 221-238.

QUATERNARY

HOLOCENE (postglacial)

A — ***Anthropogenic***
Artificial or geological material that has been disrupted and redistributed by human activity; texture highly variable. Note that many areas of residential communities and till veneer are mapped as the original material because of the sporadic and shallow nature of the modification.

Ap — ***Alluvial***
Gravel, sand, silt, minor clay and organic deposits. Deposited by active streams and rivers in channels and floodplains. Thickness estimated from 1–10 m.

Ml — ***Marine littoral***
Boulders, cobbles, sand and organic deposits. Coarser material predominant where drumlins form headlands; finer material forms beaches, barrier bars and spits. Sediments deposited or reworked in the littoral zone (i.e. foreshore and backshore) by wave action, longshore drift and eolian processes. Thickness estimated from 1–5 m.

L — ***Lacustrine***
Sand, silt, clay and organic deposits. Sediments deposited from suspension in freshwater lakes, ponds and wetlands; includes shoreline material deposited or reworked by wave action. May be underlain by till or glaciolacustrine material (sand, silt and clay with some dropstones). Thickness estimated from 1–5 m.

PLEISTOCENE (last glaciation)

Th — ***Hummocky till***
Beaver River Till is a diamicton with loose, sandy matrix and locally derived clasts. Surface topography is irregular with small mounds of till deposits. Sediments derived from subglacial erosion and meltout processes. These deposits may represent areas occupied by stagnant ice. Thickness estimated from 1–10 m.

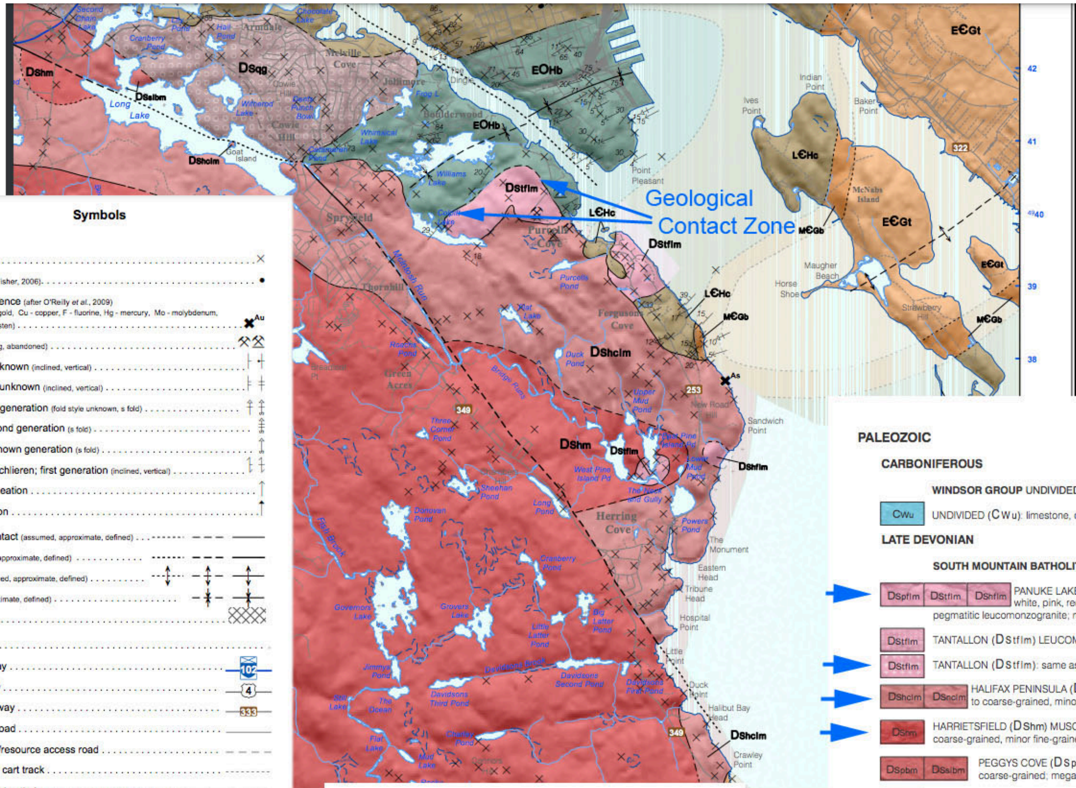
Tb — ***Till blanket***
Beaver River Till is a diamicton with sandy matrix and locally derived clasts. Sediments deposited by ice and derived from subglacial erosion. Thickness estimated from 5–10 m (thick enough to mask irregularities of the underlying bedrock).

* **Tv** — ***Till veneer***
Beaver River Till is a diamicton with sandy matrix and locally derived clasts. Sediments deposited by ice and derived from subglacial erosion. Thickness estimated from 0.5–5 m. Some areas include exposed bedrock and thicker till deposits (>5 m) of locally derived till.

Td — ***Drumlins***
Elongate landforms with long axes parallel to ice flow, composed of up to three tills: a core of Hartlen Till (observed only at coastal sections), overlain by Lawrencetown Till, and in some areas, overlain by Beaver River Till (described above). Hartlen Till is a diamicton with dark grey, compacted, clayey silt matrix, and predominantly locally derived and lesser distally derived clasts. Lawrencetown Till is a diamicton with brownish-red, compacted, clayey silt matrix, and predominantly distally derived clasts. Thicknesses of drumlins are affected by the surface relief of the landforms they are sitting on. In some instances depth to bedrock (determined from water well data, cf. Kennedy *et al.*, 2009) exceeds the surface relief, suggesting material filled a preglacial topographic low or paleovalley. These thicknesses may exceed 30 m.

PALEOZOIC

* **R** — ***Bedrock***
Bedrock exposed at surface or beneath shallow soil. It may include minor fluvial, lacustrine and till deposits. Exposed surface is glacially scoured with ice movement features, such as striae, which are indicated by symbols where identified. Obvious 'strike ridges' seen on the LiDAR hillshade image represent more durable rocks within individual formations.



Symbols

- Outcrop
- Drillhole (after Fisher, 2006)
- Mineral occurrence (after O'Reilly et al., 2009) (As - arsenic, Au - gold, Cu - copper, F - fluorine, Hg - mercury, Mo - molybdenum, Pb - lead, W - tungsten)
- Quarry (operating, abandoned)
- Bedding; tops known (inclined, vertical)
- Bedding; tops unknown (inclined, vertical)
- Fold axis; first generation (fold style unknown, s fold)
- Fold axis; second generation (s fold)
- Fold axis; unknown generation (s fold)
- Cleavage or Schlieren; first generation (inclined, vertical)
- Intersection lineation
- Mineral lineation
- Geological contact (assumed, approximate, defined)
- Fault (assumed, approximate, defined)
- Anticline (assumed, approximate, defined)
- Syncline (approximate, defined)
- Shear zone
- Rock in water
- Arterial highway
- Trunk highway
- Collector highway
- Hard surface road
- Loose surface/resource access road
- Trail, footpath, cart track
- Railway (active, inactive)
- Coastline
- River, stream
- County boundary
- Transmission line (multi, single line)
- Wetlands
- Lake/ocean

Nova Scotia Department of Natural Resources
Geoscience and Mines Branch

Open File Map ME 2014-010

Bedrock Geology Map of the Halifax Area, NTS 11D/12, Halifax County, Nova Scotia

C. E. White, M. A. MacDonald and R. J. Horne

Scale 1:50 000

1 0 1 2 3 4 km

Halifax, Nova Scotia
2014

PALEOZOIC

CARBONIFEROUS

WINDSOR GROUP UNDIVIDED

CWu — UNDIVIDED (CWu): limestone, dolostone, gypsum, sandstone, shale and conglomerate

LATE DEVONIAN

SOUTH MOUNTAIN BATHOLITH (listed in order of increasing mafic mineral content; modified after MacDonald, 1994)

DSpflm, DStflm, DShflm — PANUKE LAKE (DSpflm); TANTALLON (DStflm); HALIFAX PENINSULA (DShflm) LEUCOMONZOGRANITE: buff, orange, white, pink, red; predominantly fine- to medium-grained, minor coarse-grained; variably porphyritic and equigranular, minor pegmatitic leucomonzogranite; metasedimentary xenoliths rare

DStflm — TANTALLON (DStflm) LEUCOMONZOGRANITE: buff, orange, pink, red, white; fine-grained, equigranular or slightly megacrystic

DStflm — TANTALLON (DStflm): same as fine-grained leucomonzogranite with uniform porphyritic texture

DShclm, DSnclm — HALIFAX PENINSULA (DShclm); NEW ROSS (DSnclm) LEUCOMONZOGRANITE: buff, orange, white, pink; predominantly medium- to coarse-grained, minor fine-grained; megacrystic or seriate leucomonzogranite; metasedimentary xenoliths rare

DShm — HARRIETSFIELD (DShm) MUSCOVITE-BIOTITE MONZOGRANITE: light to medium grey, minor buff or orange; predominantly medium- to coarse-grained, minor fine-grained; megacrystic or seriate; metasedimentary xenoliths common

DSpbm, DSslbm — PEGGYS COVE (DSpbm); SANDY LAKE (DSslbm) BIOTITE MONZOGRANITE: light to medium grey; predominantly medium- to coarse-grained; megacrystic or seriate; metasedimentary xenoliths common to abundant

DSqg — QUARRY LAKE GRANODIORITE (DSqg): light grey; medium- to coarse-grained, equigranular or slightly megacrystic texture; metasedimentary xenoliths locally abundant

EARLY CAMBRIAN TO EARLY ORDOVICIAN

HALIFAX GROUP

EOHb — *BLUESTONE FORMATION* (EOHb): light grey to blue-grey slate, rhythmically interlayered with laminated to thin-bedded, fine-grained metasandstone; trace fossils and bioturbated beds common

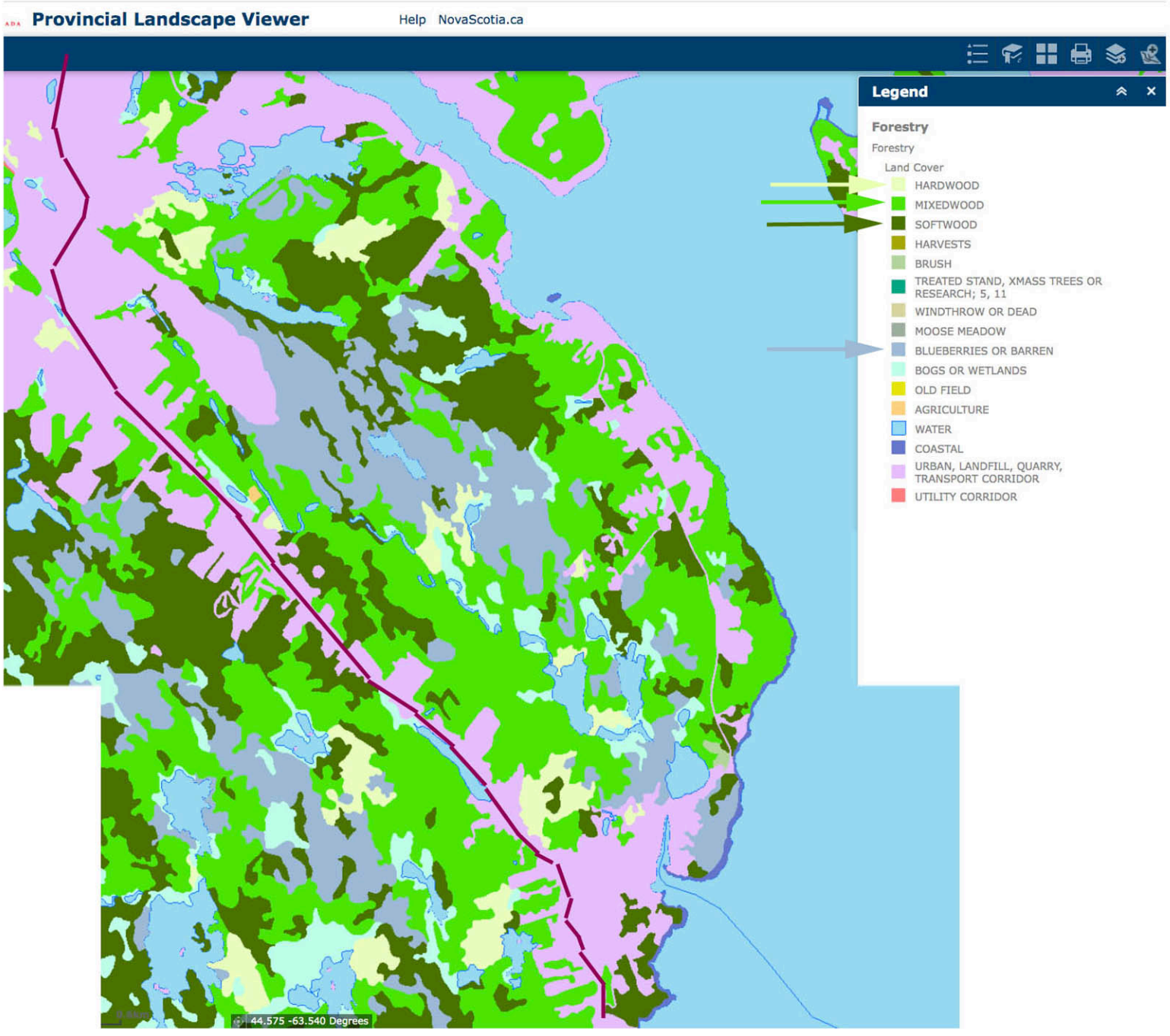
LЄHc — *CUNARD FORMATION* (LЄHc): black to rust-brown slate with thin beds and lenses of minor black metasiltstone; medium-bedded, fine-grained, crosslaminated metasandstone; sulphide minerals common and prone to acid rock drainage (ARD).

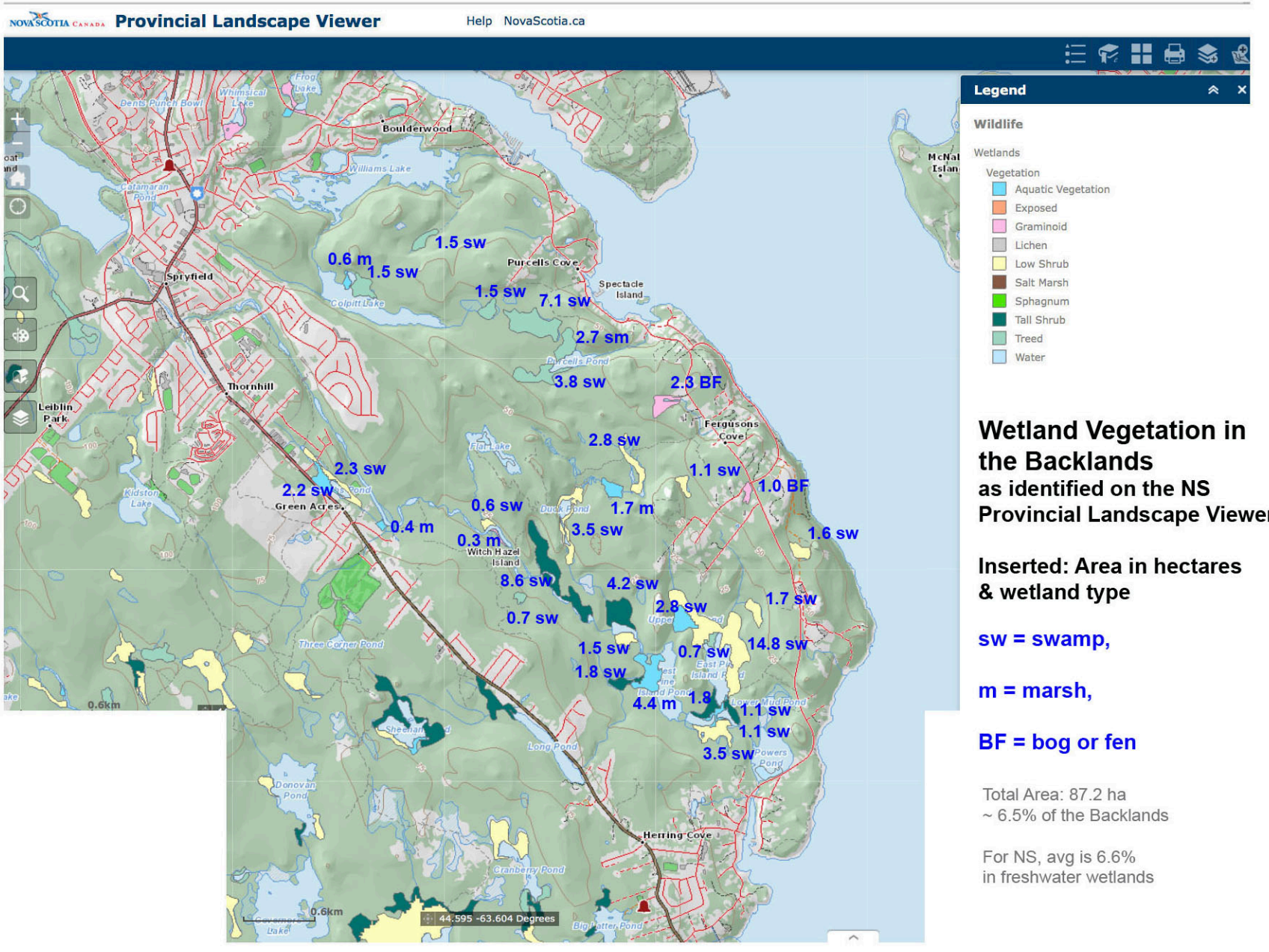
GOLDENVILLE GROUP

MЄGb — *BEAVERBANK FORMATION* (MЄGb): greenish-grey to black, well-laminated metasiltstone to slate; minor, very thin- to thin-bedded, fine-grained metasandstone; abundant manganiferous nodules, laminations and coticules

EЄGt — *TAYLORS HEAD FORMATION* (EЄGt): grey, medium- to thick-bedded, very fine- to medium-grained metasandstone locally interlayered with green, cleaved metasiltstone, and rare black slate; calc-silicate nodules common

LAND COVER


Provincial Landscape Viewer
Help
NovaScotia.ca
Legend
Forestry
Forestry
Land Cover
HARDWOOD
MIXEDWOOD
SOFTWOOD
HARVESTS
BRUSH
TREATED STAND, XMASS TREES OR RESEARCH; 5, 11
WINDTHROW OR DEAD
MOOSE MEADOW
BLUEBERRIES OR BARREN
BOGS OR WETLANDS
OLD FIELD
AGRICULTURE
WATER
COASTAL
URBAN, LANDFILL, QUARRY, TRANSPORT CORRIDOR
UTILITY CORRIDOR
44.575 -63.540 Degrees



Wetland Vegetation in the Backlands

as identified on the NS Provincial Landscape Viewer

Inserted: Area in hectares & wetland type

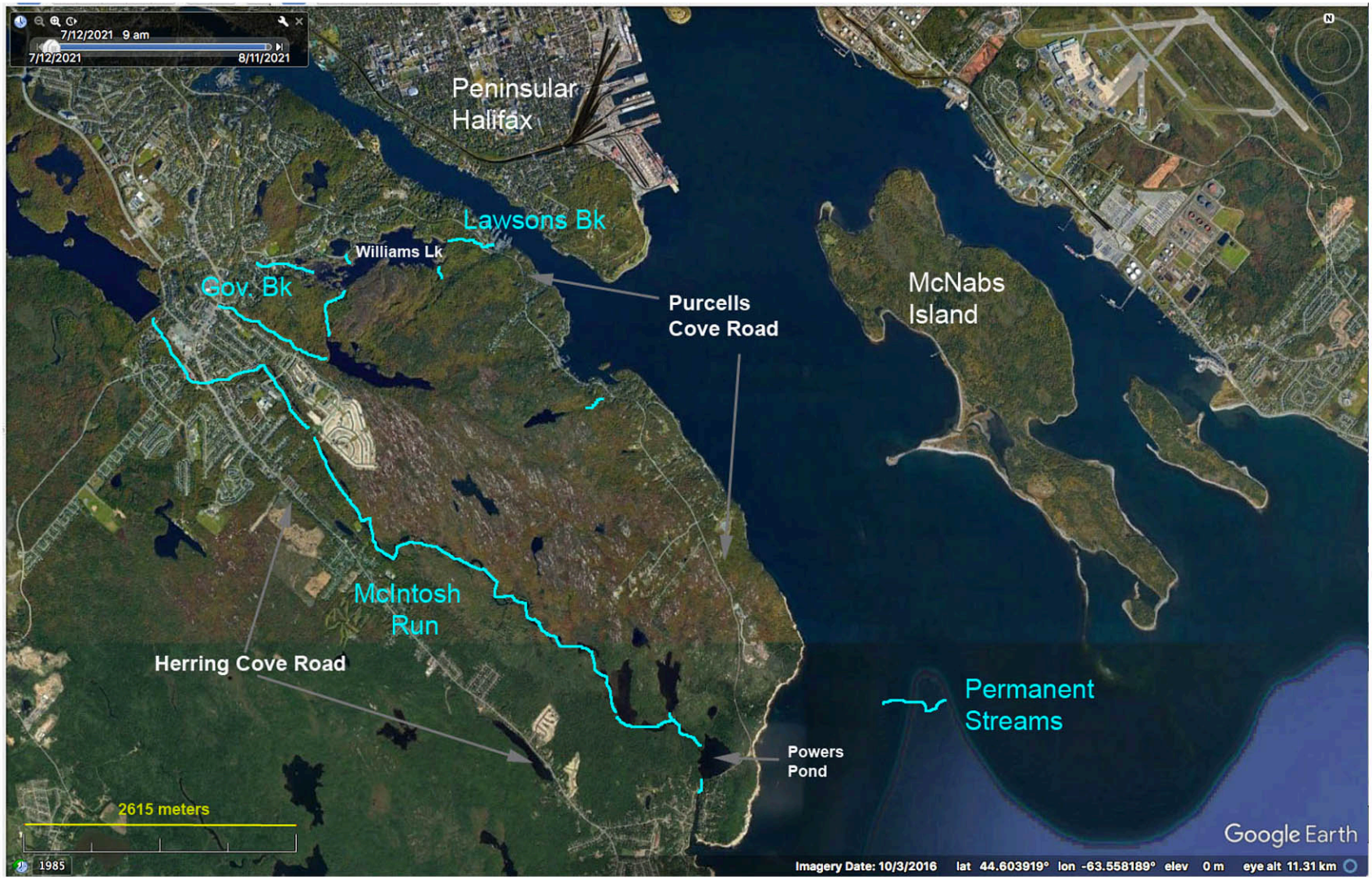
sw = swamp,

m = marsh,

BF = bog or fen

Total Area: 87.2 ha
~ 6.5% of the Backlands

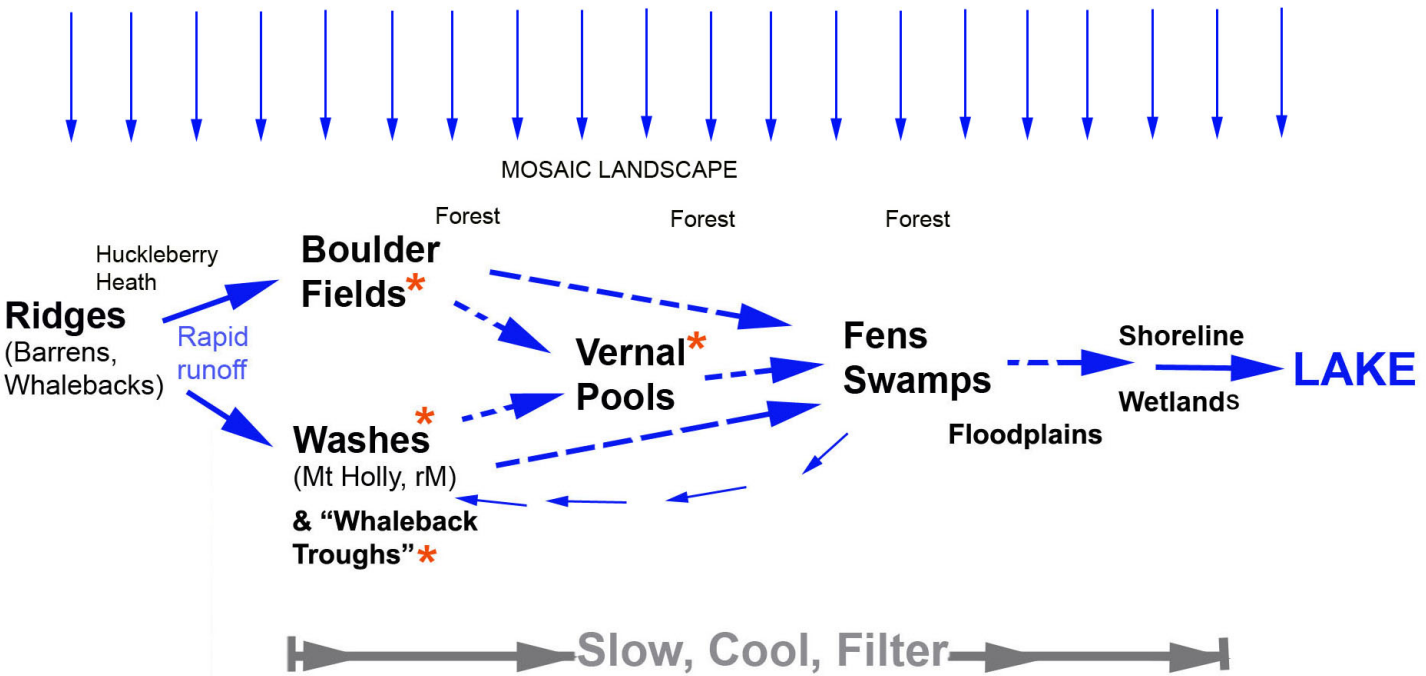
For NS, avg is 6.6%
in freshwater wetlands


7/12/2021 9 am
7/12/2021
8/11/2021
Peninsular Halifax
Lawsons Bk
Williams Lk
Gov. Bk
Purcells Cove Road
McNabs Island
McIntosh Run
Herring Cove Road
Permanent Streams
Powers Pond
2615 meters
1985
Google Earth
Imagery Date: 10/3/2016 lat 44.603919° lon -63.558189° elev 0 m eye alt 11.31 km

Bogs: 3/4 of wetlands in NS at large; <5% in The Backlands

Bogs are the only self-contained wetlands, others are all on watercourses

Water Flow in the Backlands



Broken arrows: Above &/or Belowground movement of water

* Generally not recognized or protected (N. Hill, P. Manual, D.P.)

Water movement in Boulder Fields & Washes is always or mostly below-ground

Vernal Pools are small wetlands; flooded over winter or after intense rainfall, not saturated in summer

After N. Hill in Hill & Patriquin, 2014: Ecological Assessment of the Plant Communities of the Williams Lake Backlands.

Water Flow in the Backlands

MOSAIC LANDSCAPE

Forest Forest Forest

Huckleberry Heath

Ridges (Barrens, Whalebacks)

Rapid runoff

Boulder Fields*

Vernal Pools*

Fens Swamps

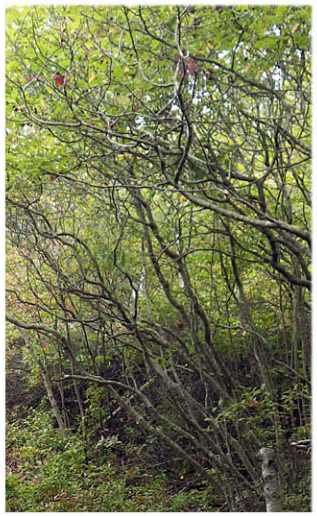
Shoreline Wetlands

LAKE

Washes* (Mt Holly, rM)

& "Whaleback Troughs"

Floodplains



Slow, Cool, Filter

Broken arrows: Above &/or Belowground movement of water

* Generally not recognized or protected (N. Hill, P. Manual, D.P.)

Water movement in Boulder Fields & Washes is always or mostly below-ground

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After N. Hill in Hill & Patriquin, 2014: Ecological Assessment of the Plant Communities of the Williams Lake Backlands.

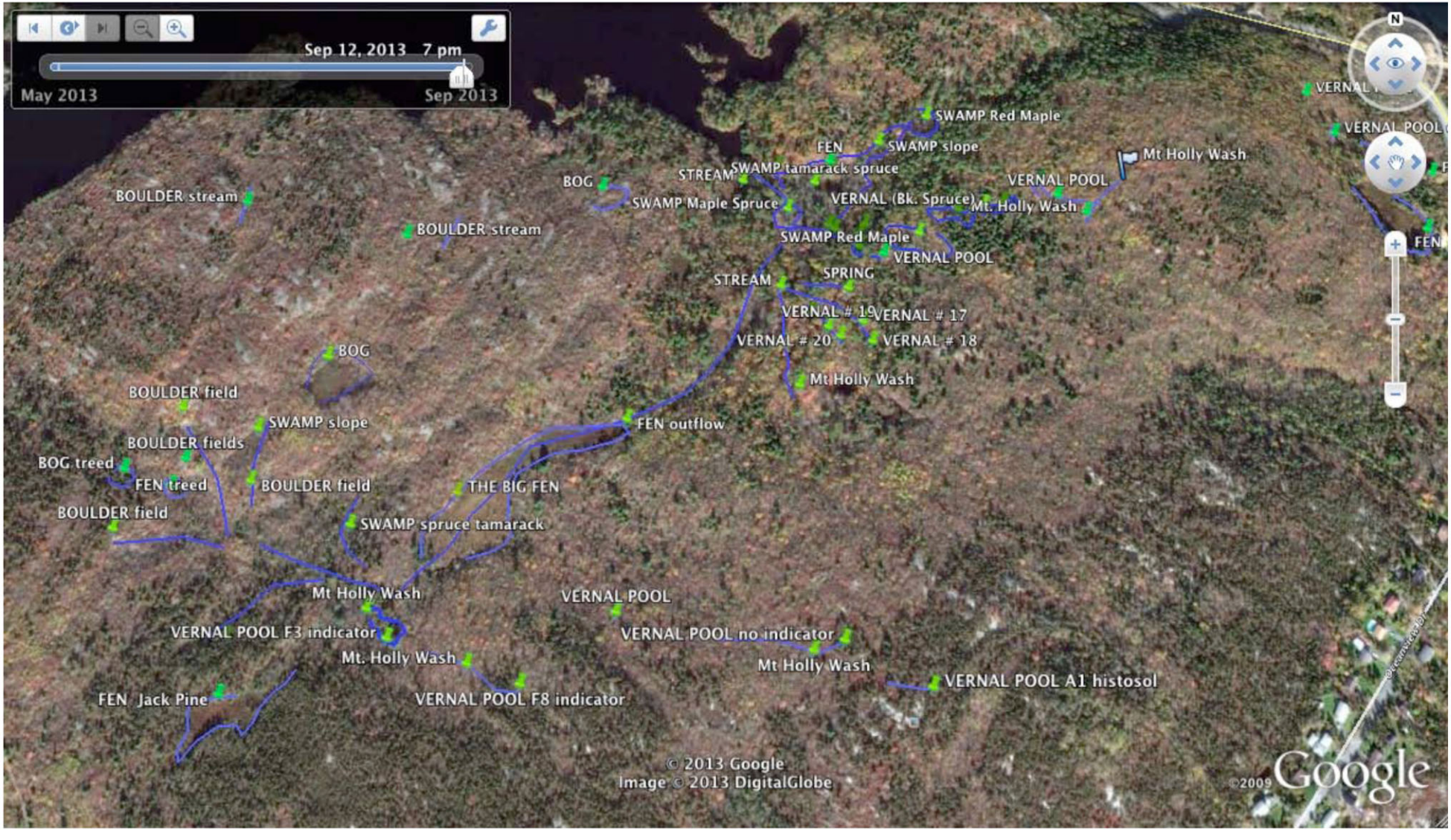
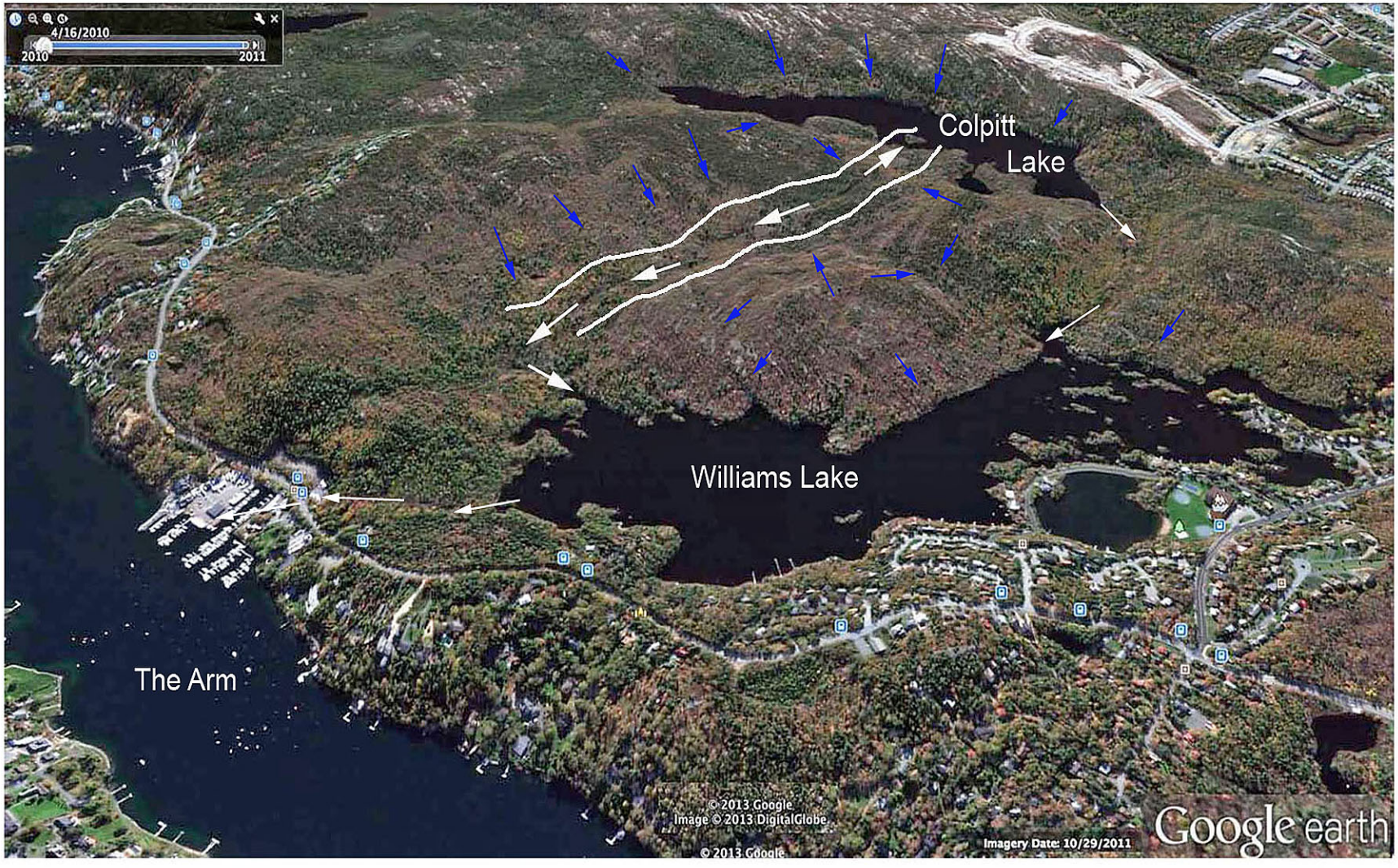


Fig. 7.7 Partial representation of water flows from the barrens into the water course that flows northeast along the contact zone between rocks of the South Mountain Batholith and the Halifax Formation and finally into Williams Lake.



In the Williams Lake Backlands, the larger swamps & fens are located along the Geological Contact Zone

“The WLB present a *mosaic* of landscapes and plant communities associated with high variability on a fairly small scale in the topography, depth of soil/till, drainage and surface water storage and in the ages since disturbance of the associated plant communities.”

RIDGES

Outcrops, Whalebacks,

Run-off from ridge tops and outcrops is immediate. Light rains are absorbed by a crustose & fructicose lichens that had been in a desiccated state of life..often then into dry huckleberry heath on thin soil; these components have very low water-storage capacity

BOULDER FIELDS **"...**visually striking, rather stark appearing boulder fields with large, very angular boulders, mostly free of any vegetation except for a few mosses and lichens" [They are] not wetlands but harbour an underground stream network. Water can be heard gurgling below surface after rainfall and in fall and winter, they may partially fill with water."

Mt Holly Washes





In the WLB, there is a network of **Mountain Holly "Washes",** or infiltration channels that are trough depressions down slopes between the exposed ridge and rocks, and the swamps at lower elevation.

Mountain Holly (*Nemopanthus mucronata*) is the signature species and marker of these washes, often co-occuring with Red Maple

Mountain Holly is cited as a **Facultative Wetland (FAC) species** by NS but is recognized as an **Obligate (OBL) wetland** plant in other listings.

Mountain Holly is a tall shrub with slow twisting growth and red barked roots that go deep to wet sediments in these washes.

The inside wash typically has a shallow peat layer and a mix of sand and fines (silt & clay), the wash channel is lined by a small boulder transition zone outside of which is a **HUCKLEBERRY** (FAC in NS, FACU = Facultative Upland in US) shrub savannah with birch (Paper or Wire) or Jack Pine

Washes can be described as infiltration channels or intermittent streams. **In dryland regions, larger intermittent streams are called arroyos or gullies** and in some US states they are afforded the protection of perennial stream courses, because they account for the **majority (e.g. 80%) of the water flow** channels in these regions

Vernal Pools occur wherever there are **depressions** in the landscape and there are **impermeable soil or rock layers**.... size from less than 5m2 - a pool that might be the pit formed after a tree fall to several hundreds of square meters.

Ecological significance of VPs is often related to diversity (e.g. amphibians or rare plants) in other areas but **in the WLB their major value relates to hydrological function.**

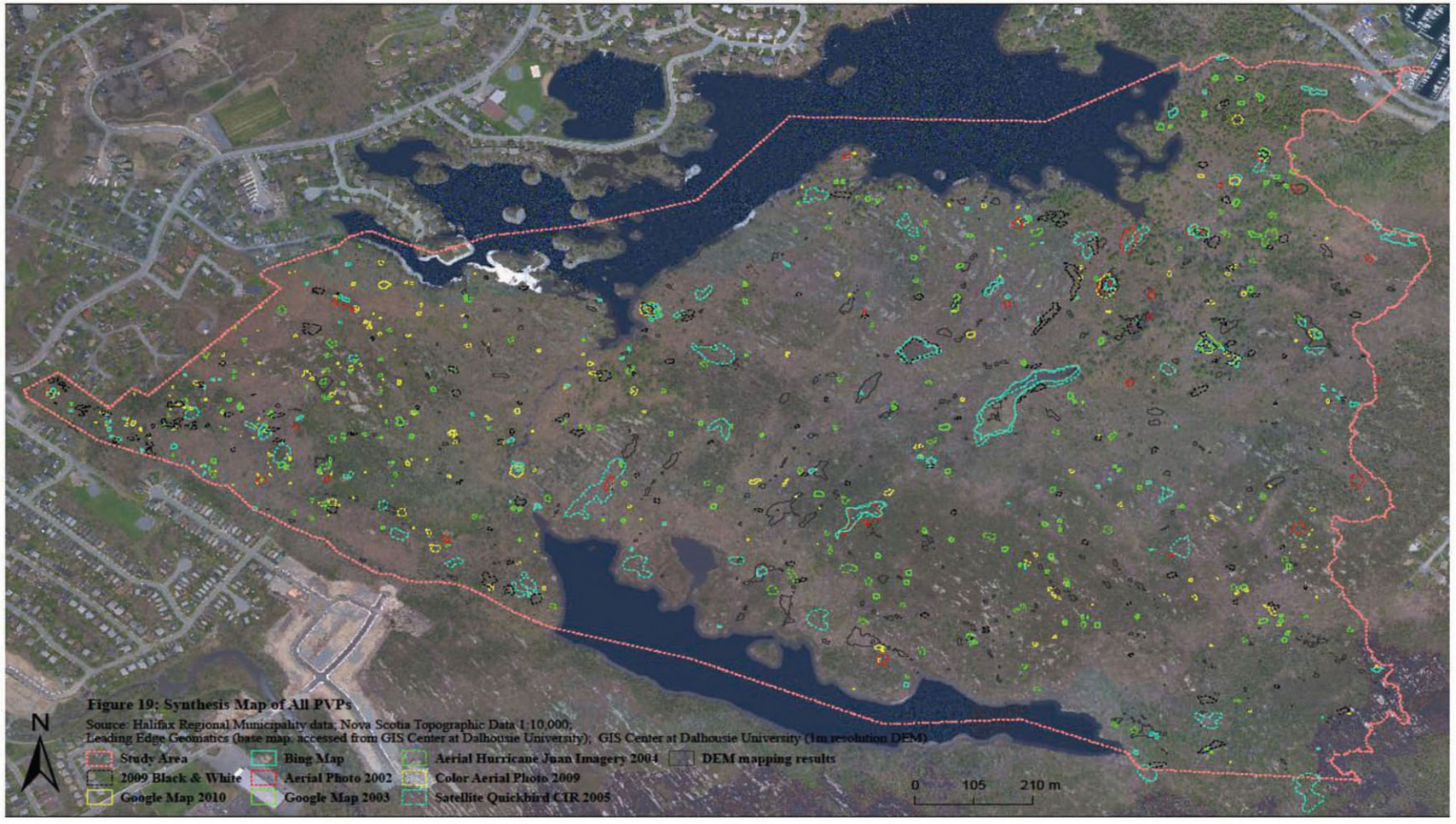
Vernal Pool in WLB on May 14, 2013. At left a spring just above this VP. In a (typically) summer, it appears just as an isolated, open leafy area.

Vernal pools are nodes where the flow pathway levels off.

Vernal pools are wetlands, have dedicated hydric soil indicators, and they recharge groundwater and springs that maintain large organic based wetlands: swamps and fens

Protection: May qualify (>100m2) but often overlooked

"A majority of the vernal pools in the Mountain Holly Washes have Wetland status although none of these appear to have been delineated in the Backlands property while the traditional wetlands (e.g. fens and swamps) were."



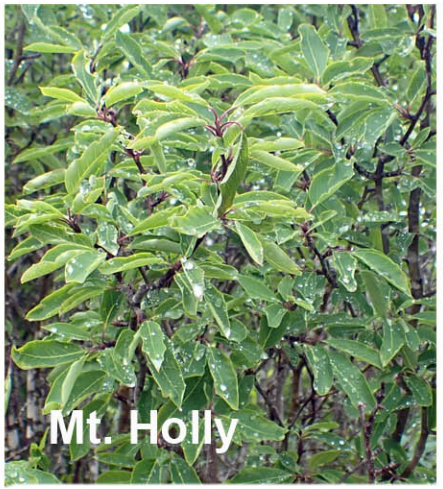
H. Liu's Synthesis Map of All Potential Vernal Ponds

Appendix A Map 4 in *Ecological Assessment of the Plant Communities of the Williams Lake Backlands:* Report by N.Hill and D. Patriquin to the Williams Lake Conservation Co. 2014.Courtesy of Prof. Patricia Manual, Dalhousie School.of Planning

Huan Liu* investigated various remote sensing techniques (aerial photography, satellite photography, and LiDAR - Light Detection and Ranging) and Digital Elevation Modeling for mapping of vernal pools using the undeveloped land in the Williams Lake Watershed as a test case.

*Liu, H 2012. *Vernal Pool Mapping in the Williams Lake Watershed, Halifax supporting small wetland identification in advance of development*. Report in the School of Planning, Dalhousie University, Supervisor: Patricia Manuel.

Whalebacks & Troughs

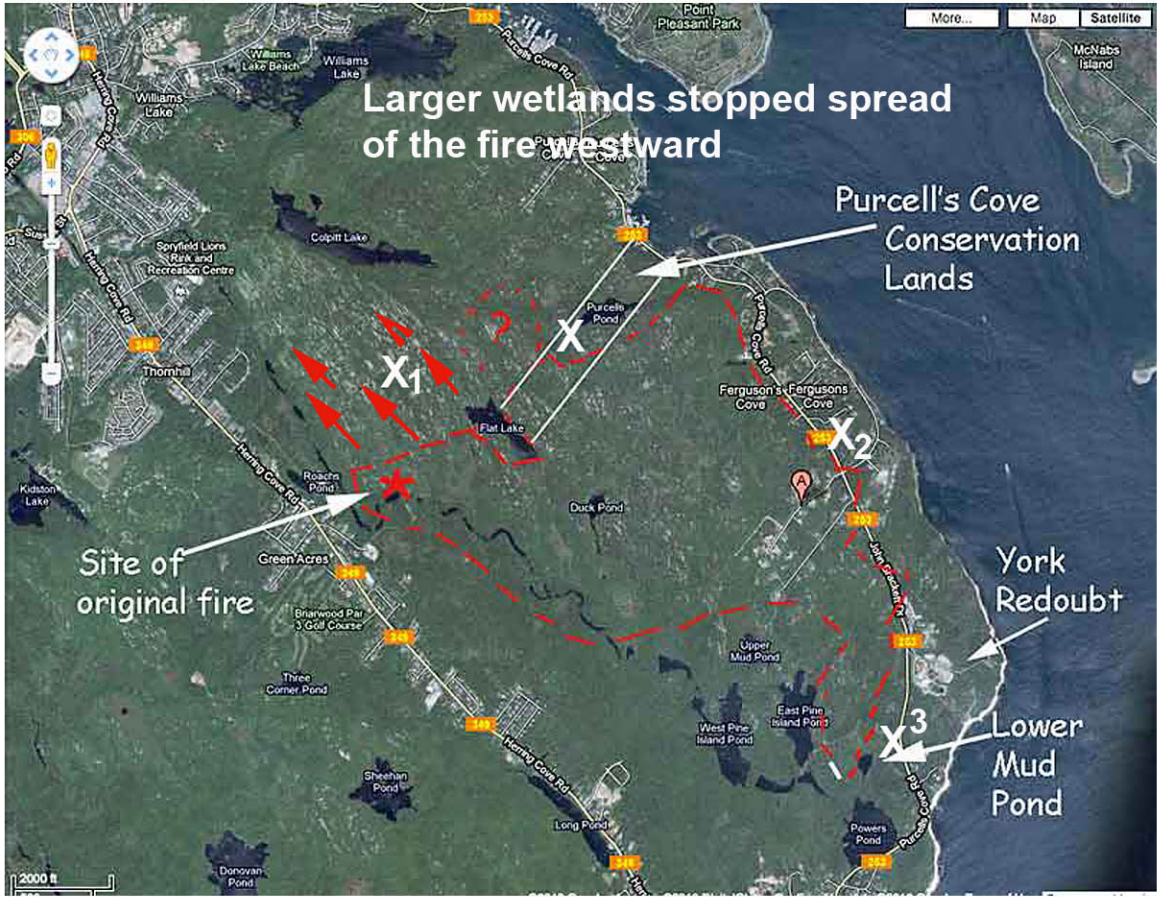


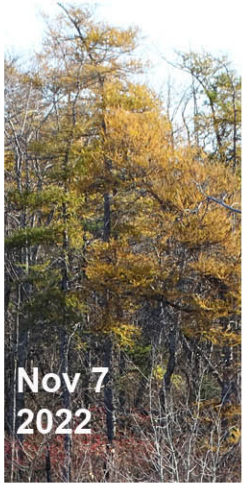
In geology, a whaleback is "**A landform having the form of the back of a whale**." The term is commonly applied to sand dunes but here we have them carved in granite and **oriented NW/SE**, in the direction of movement of glaciers in the last glaciation. In other places, people celebrate even one of these structures, but on the Osprey Trail and environs we have a field of them that extends as far as the eye can see, like a huge pod of whales.

The longitudinal centre of each whaleback is typically bare or lichen-covered; sometimes there are little islands with a Jack Pine or two, but typically the Jack Pines occur towards the edges with Huckleberry below them and Broom Crowberry forming a mat between the huckleberry and the bare rock. In the **depressions (troughs)** between the whalebacks, there can be quite dense, bushy vegetation, with birch, spruce and aspen trees; in the deeper, wetter depressions, there are **aquatic plants** such as leatherleaf and Rhodora; **these troughs are channels of water movement, most often intermittent.**

Swamps & Fens

Fire & Wetlands in the Backlands





Fire & Wetlands in the Backlands

Smaller wetlands burned over but recovered in 3-4 years

49

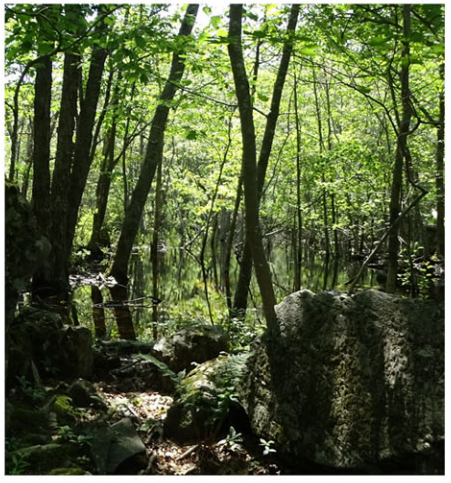
Aug. 27, 2010 in the Lower Mud Pond area

In places on small fire-damaged damaged wetlands, cranberry and hairy cap moss were growing over the still largely dead mats of sphagnum moss; there were a few spots where sphagnum appeared to be regrowing again. (Photo by David Patriquin)

Aug 27, 2010

Where the water was stored during recent intense rainfall events:

Swamps & Fens



Invasive Plants in Wetlands/Watercourses

Salinization of Surface Waters

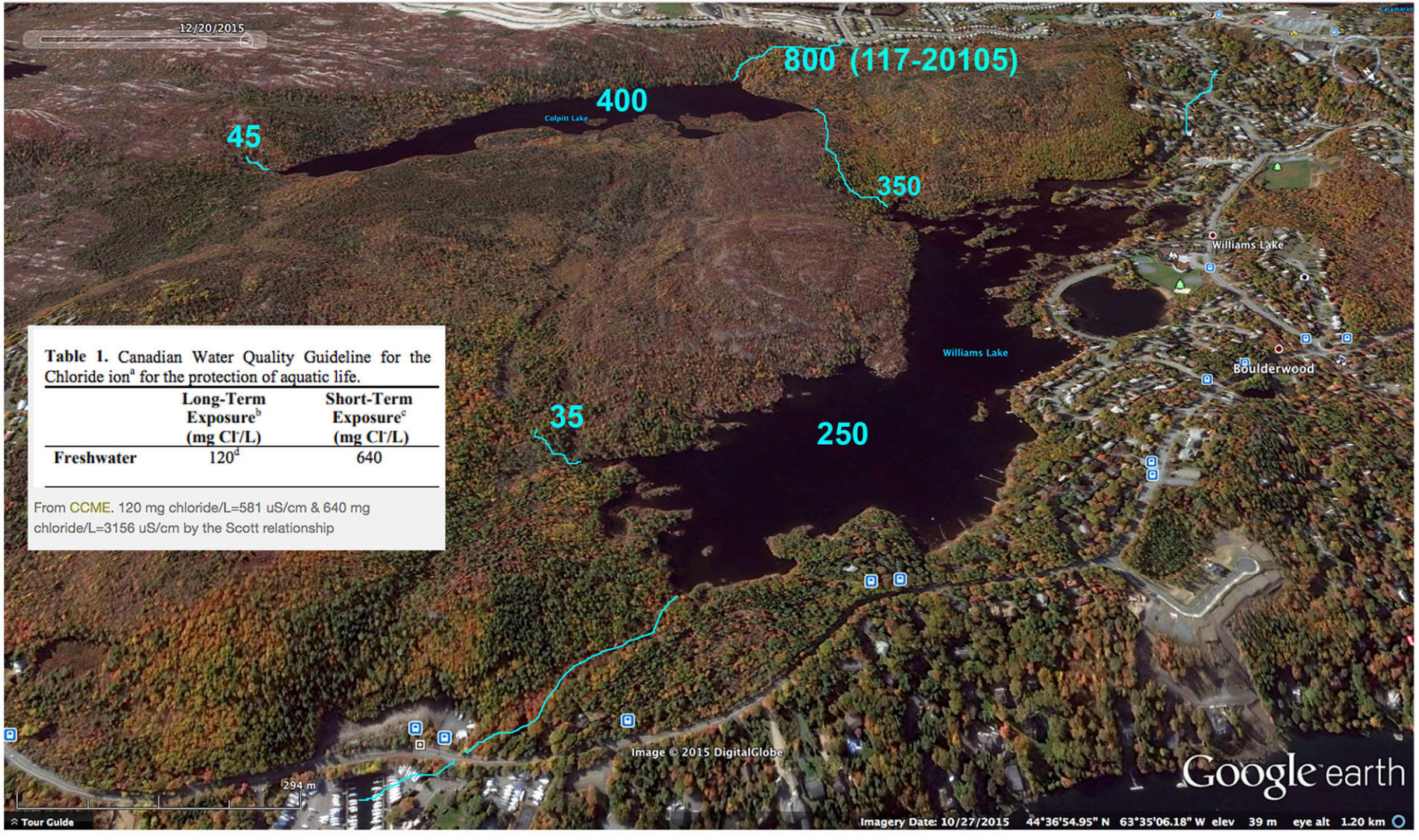


Table 1. Canadian Water Quality Guideline for the Chloride ion[a] for the protection of aquatic life.

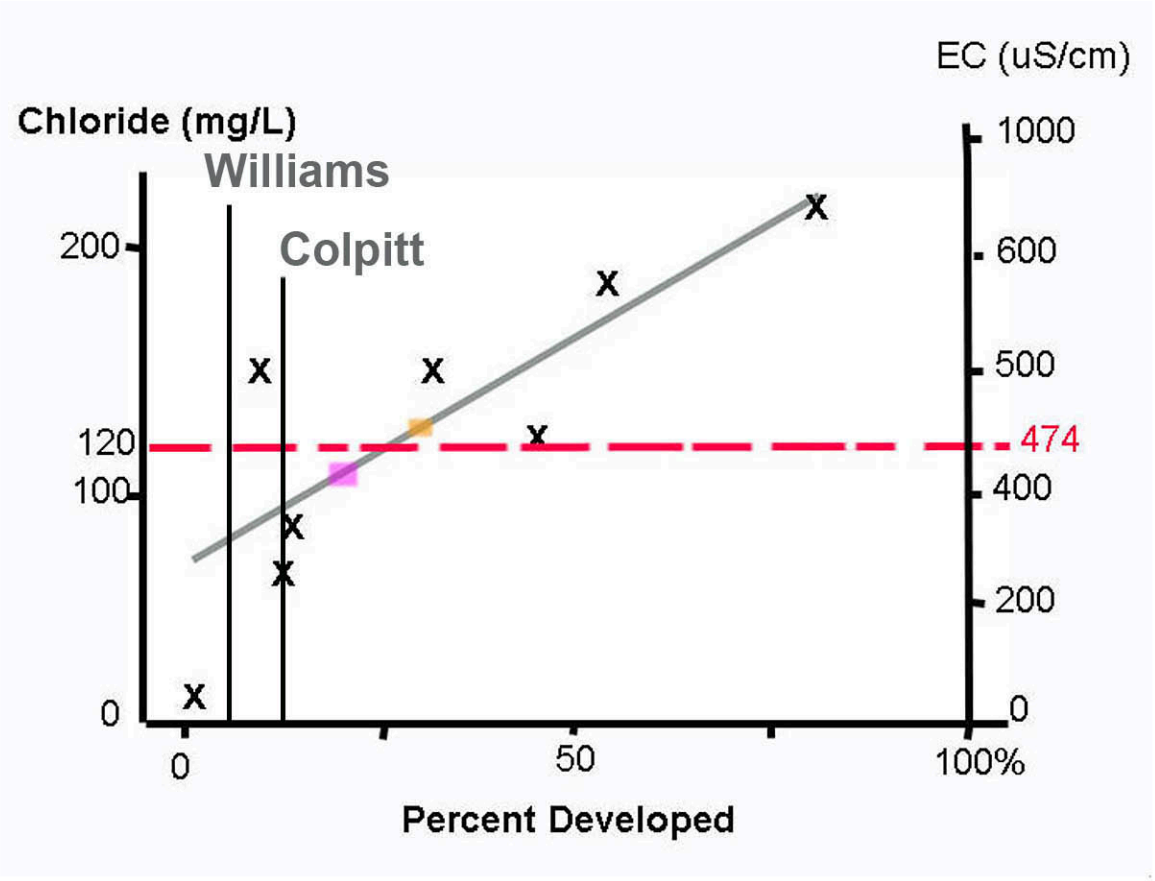
	Long-Term Exposure[b] (mg Cl^-/L)	Short-Term Exposure[c] (mg Cl^-/L)
Freshwater	120[d]	640

From CCME. 120 mg chloride/L=581 uS/cm & 640 mg chloride/L=3156 uS/cm by the Scott relationship

Williams Lake Watershed: Approx. avg, conductivity values of surface waters in 2022 (µS/cm)

Colpitt Lake Watershed, ~24% developed

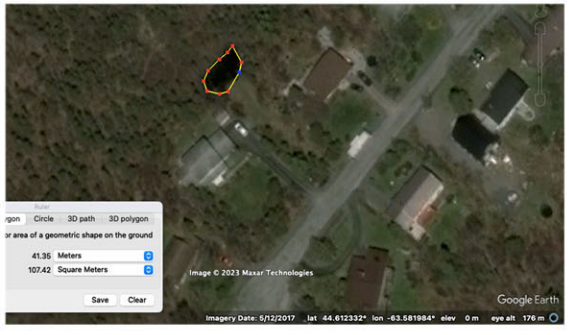
Williams lake ~12.5% developed

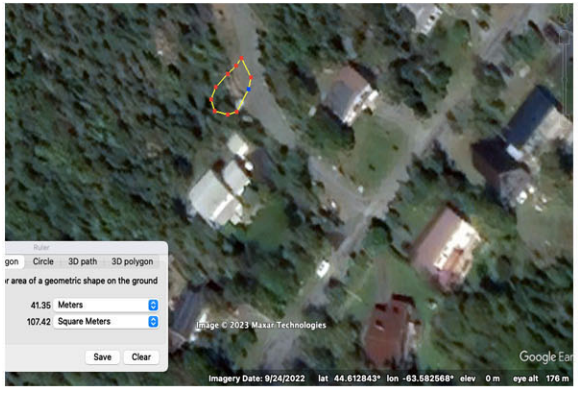


Relationship of Chloride and EC to Percent Land Area Developed.
Graph adapted from Fig 6 in Scott et al., 2019.

The CCME Guideline for long term exposure to chloride is 120 mg/L (the dashed red line).

What's Protected?





- Not small recognized Wetlands
- Not most Vernal Pools (size or not mapped)
- Not Boulder Fields (not rec'd as wetland or w-course)
- Not Mt. Holly Washes (not rec'd as wetland or w-course)
- Not Troughs in Boulder Fields (not rec'd as wetland or w-course)

"The water regime in the WLB has features of dryland systems, with intermittent stream courses probably accounting for a majority of the water flow. Critical components such as Mountain Holly washes, vernal pools and boulder fields are not currently protected under Nova Scotia wetland and stream course regulations but are vital to maintenance of the larger wetlands and water quality of both surface and groundwater in the area."

Not Utilized enough to protect small wetlands (bolded text below)*

"Although government recognizes that many wetlands, such as vernal pools and small urban ponds, that are less than 100 square metres in size may play important roles in the landscape and strongly encourages avoidance of these and all wetlands when siting developments, this policy does not apply unless they are listed as Wetlands of Special Significance .

"**If a wetland is part of a wetland complex (connected by obvious water flows to nearby wetlands), the overall size of the complex will be used to determine if the policy applies.**"

*From the **Nova Scotia Wetlands Conservation Policy** (Oct 2019)

(This text, talked about in the webinar, was added after the webinar,)