



# Highway 101 Twinning and Avon River Aboiteau and Causeway

Project Update for Community Liaison Committee  
November 27, 2019

# Overview

1. General Update – Timelines
2. Highway 101 Twinning Construction Update
3. Archaeological Program Update
4. Update on the Design of the Avon River Aboiteau and Causeway Upgrading
  - Aboiteau Design – Location Chosen
  - Causeway Alignment and Profile
  - Windsor Marsh Infilling
5. Habitat Offsetting Project for Windsor Marsh Infilling
6. Questions / Discussion

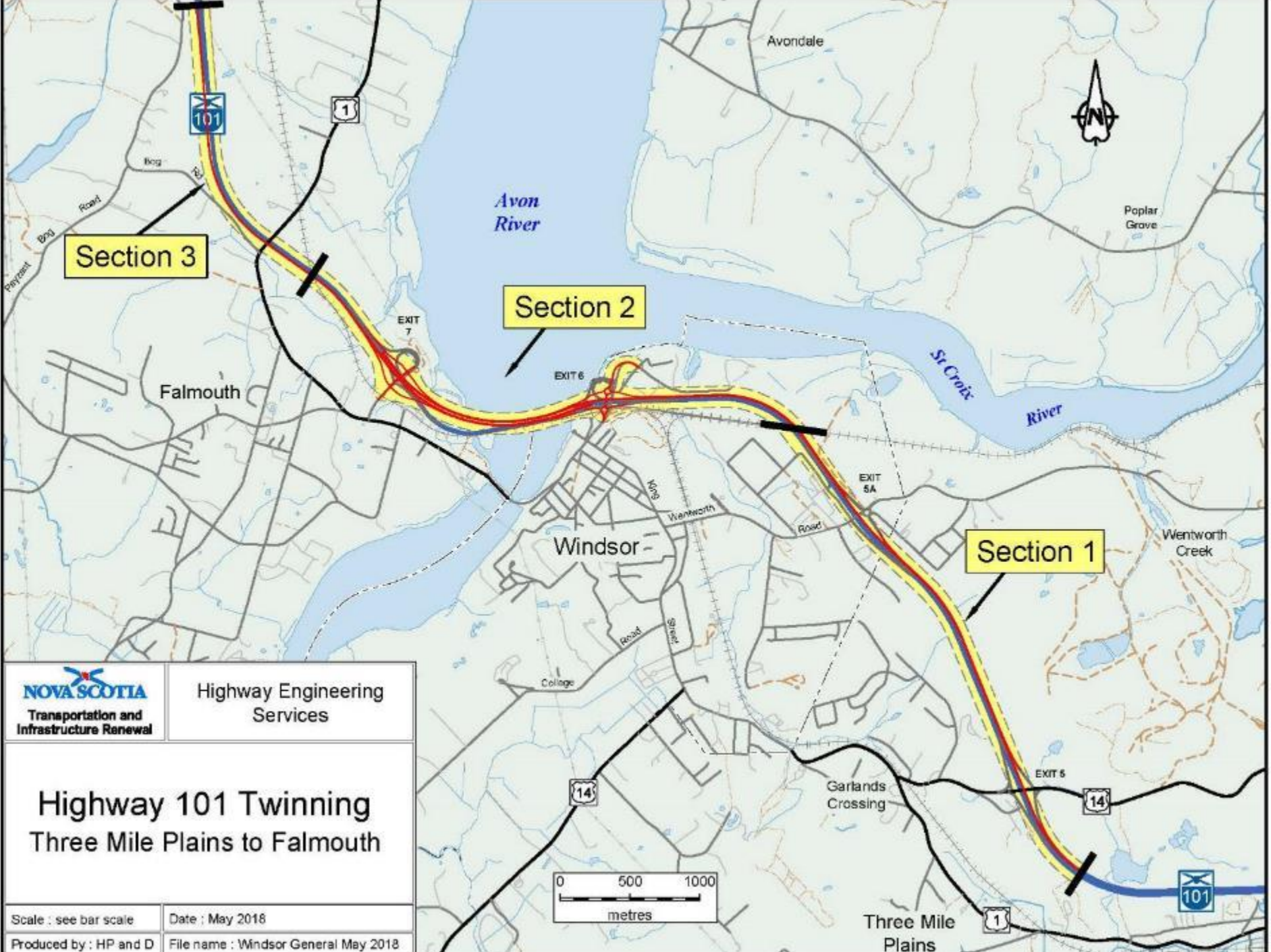
# General Project Update

# General Project Update

## **Project Timelines:**

- **On track for a 5-year project-completion – Fall 2022.**
- **Highway between the Windsor and Falmouth railway crossings (Section 2) will be constructed in 2020-2022 including the Avon River aboiteau, causeway, and Exits 6 and 7.**
- **Partial infilling for widening of the causeway is planned to begin in January as it will require time for consolidation (settlement) due to the soft sediments in the Avon Estuary/River.**

# Highway 101 Twinning Construction Update



**NOVA SCOTIA**  
Transportation and  
Infrastructure Renewal

Highway Engineering  
Services

# Highway 101 Twinning Three Mile Plains to Falmouth

Scale : see bar scale

Date : May 2018

Produced by : HP and D

File name : Windsor General May 2018



# Highway 101 Twinning Update

## Work Completed to Date:

- **Subgrade** for Section 1: Highway 101 westbound lanes, from Trunk 14 (Exit 5) to the Windsor Railway Overpass – 3.4 km



# Highway 101 Twinning Update

## Work Completed to Date:

- **Structures** at Exit 5 (Trunk 14) and Exit 5A (Wentworth Road) for new westbound lanes





# Highway 101 Twinning Update

## Work Completed to Date:

- **Subgrade** for Section 3: Highway 101 eastbound lanes, from Falmouth Twinning to Station 12+400 – 2.4 km



# Highway 101 Twinning Update

## Work Completed to Date:

- **Bridge Structures** at Trunk 1 O/P and Falmouth Railway O/P for new eastbound lanes
  - Abutments, girders, deck, barrier walls





# Highway 101 Twinning Update

## Work Scheduled for 2019/2020:

- **Bridge Structures** at Trunk 1 and Falmouth Railway Overpasses
  - Bridge deck, barrier walls, approach slabs, approach gravels, final site stabilization & securement.
- **Paving** for Phase 1: Highway 101 westbound lanes, from, Trunk 14 (Exit 5) to Windsor Railway Overpass
  - Base gravels, asphalt paving, signage, pavement markings, streetlighting, ramp construction, guardrail final site clean-up and opening to traffic.
- **Bridge Structure** at Windsor Railway Overpass
  - Bridge foundation, structural plate tunnel, approach gravels, final site stabilization & securement.

# Highway 101 Twinning Update

## Future Contracts:

- Initial Causeway Widening
  - Infilling/surcharging for new westbound lanes along causeway and dyke system.
- Section 2 Paving
  - Completion of gravels, paving, signage, guardrail, etc.
- Phase 1 Eastbound Subgrade
  - Widening of existing lanes, gravelling, replacement of existing Trunk 14 and Wentworth Road Overpass Structures.



# Archaeological Program Update

# Figure 1 – Additional Archaeology Investigation



**NSTIR engaged Davis MacIntyre & Associates**



## Figure 2 – Geotech Drilling Along Marsh



**Testing enables detailed design of upgraded road and dyke systems.**



**Figure 3 – Geotech drilling and monitoring  
conducted in late April through June 2019  
on dykelands and along the Marsh**





**40 cm x 40 cm shovel test pits; 1.2 m deep with additional four-corner, hand-augering to a maximum 2.05 m depth in silty-clay sediments.**

**No  
artifacts  
found  
(& 'land' not  
habitable)**

**Geotech drilling indicated silty-clay deposits up to 6 m thick overlying fine sands, silts and gravel of an ancient river bed.**

*Plate 2: Shovel test N0 E90, showing water inundation before augering.*

# Figure 5 – Pre-Contact History of Mi'kmaq

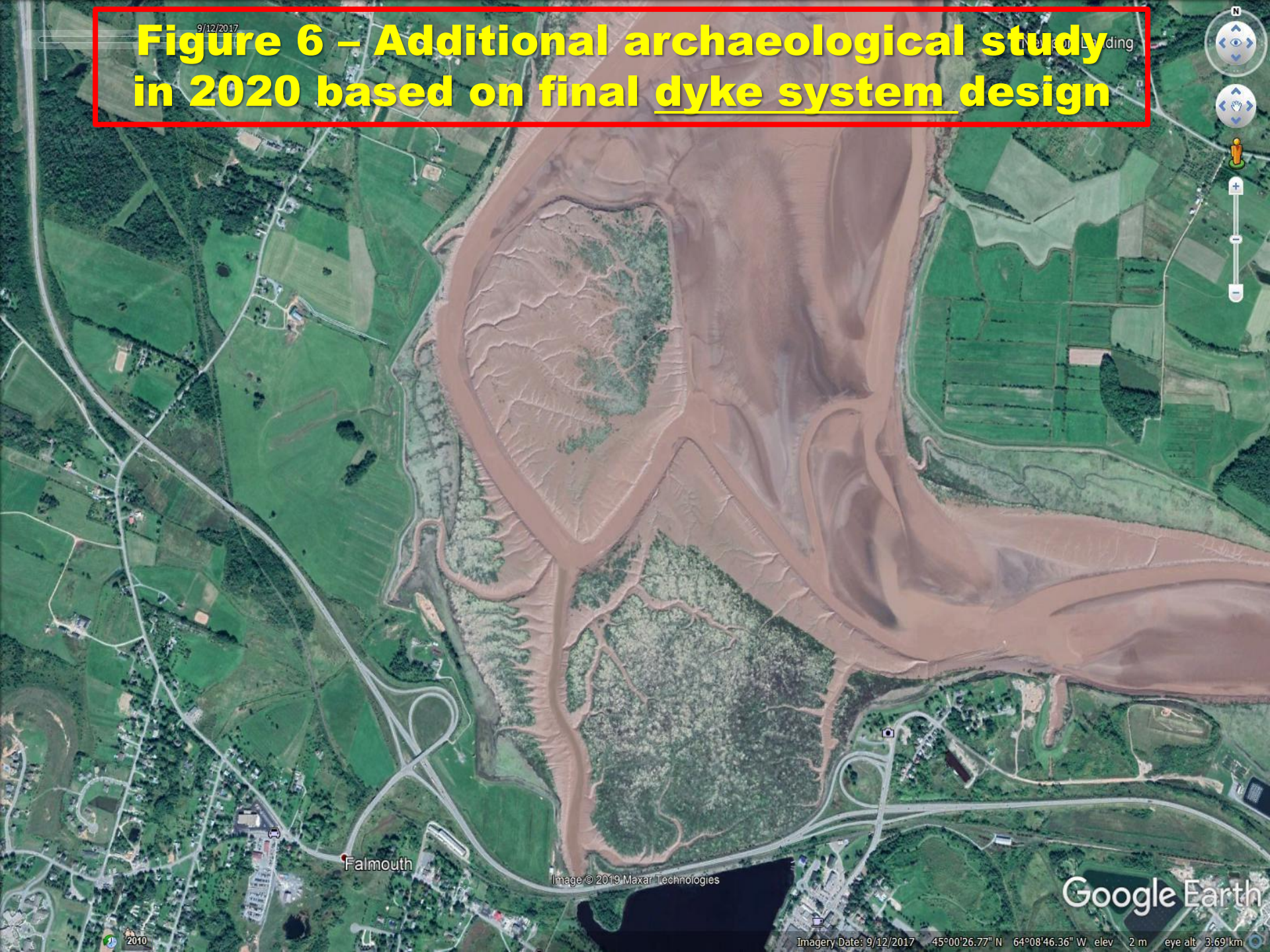
*Table 1: Mi'kmaw/Archaeological Cultural Periods*

Mi'kmaw Period	Archaeological Period	Years
Sa'qiwe'k L'nu'k (the Ancient People)	Paleo-Indian	11,500 – 9,000 BP <b>End of glacial period</b>
Mu Awsami Kejikawe'k L'nu'k (the Not so Recent People)	Archaic	9,000 –3,000 BP <b>Minas Basin forms</b>
Kejikawe'k L'nu'k (the Recent People)	Woodland/Ceramic Period	3,000 –500 BP
Kiskukewe'k L'nu'k (Today's People)	Contact	500 BP – present

**Archaeology studies indicate sediments below 30 cm were undisturbed glacial till and deposited more than 20,000 years BP. Entire impact area on Falmouth side deemed low potential for archaeology resources.**



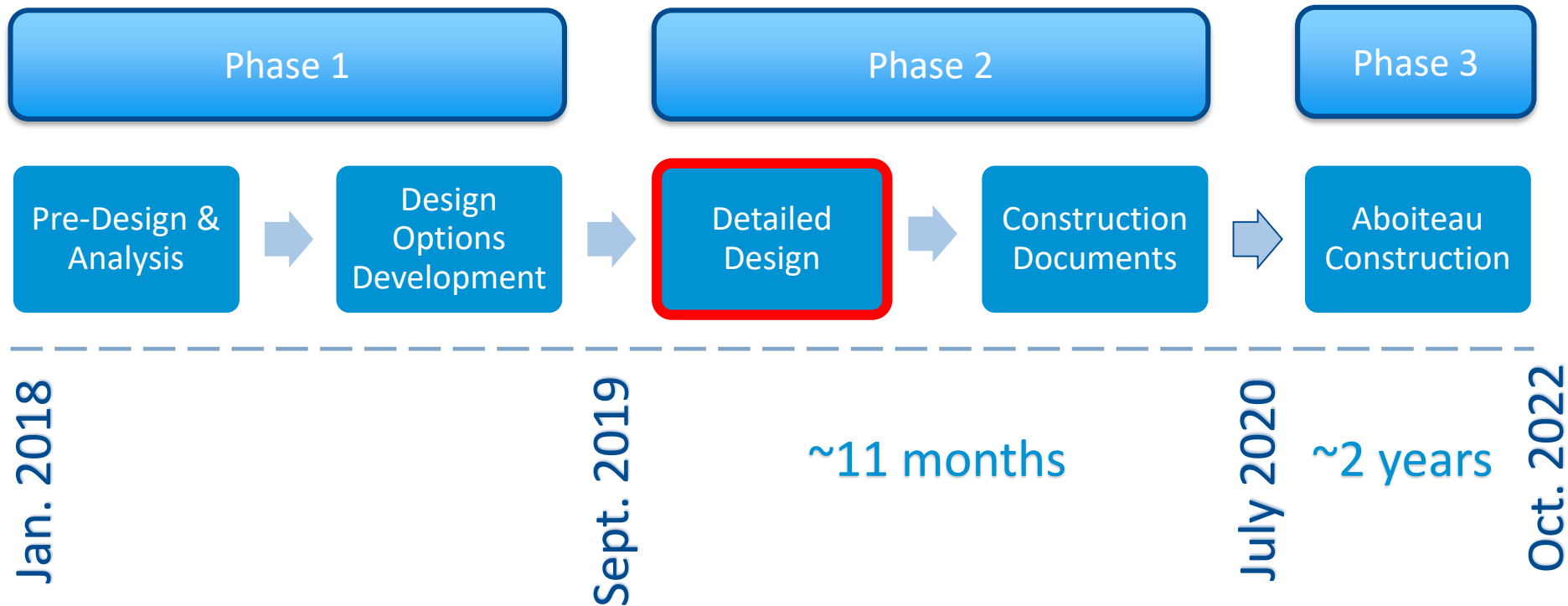
9/12/2017  
**Figure 6 – Additional archaeological study  
in 2020 based on final dyke system design**



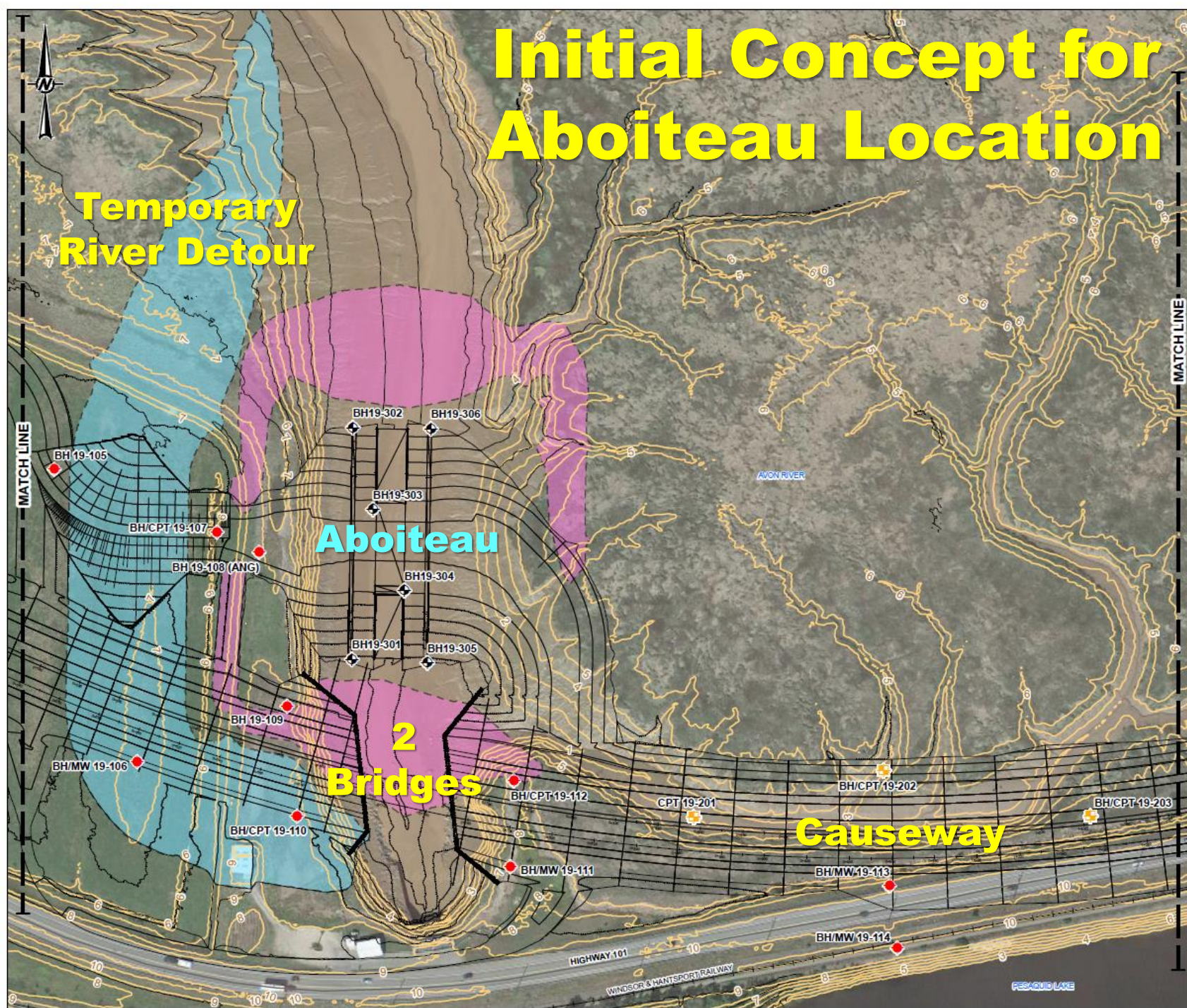
# Avon River Aboiteau and Causeway Upgrading Design Update



# Aboiteau Design Timelines

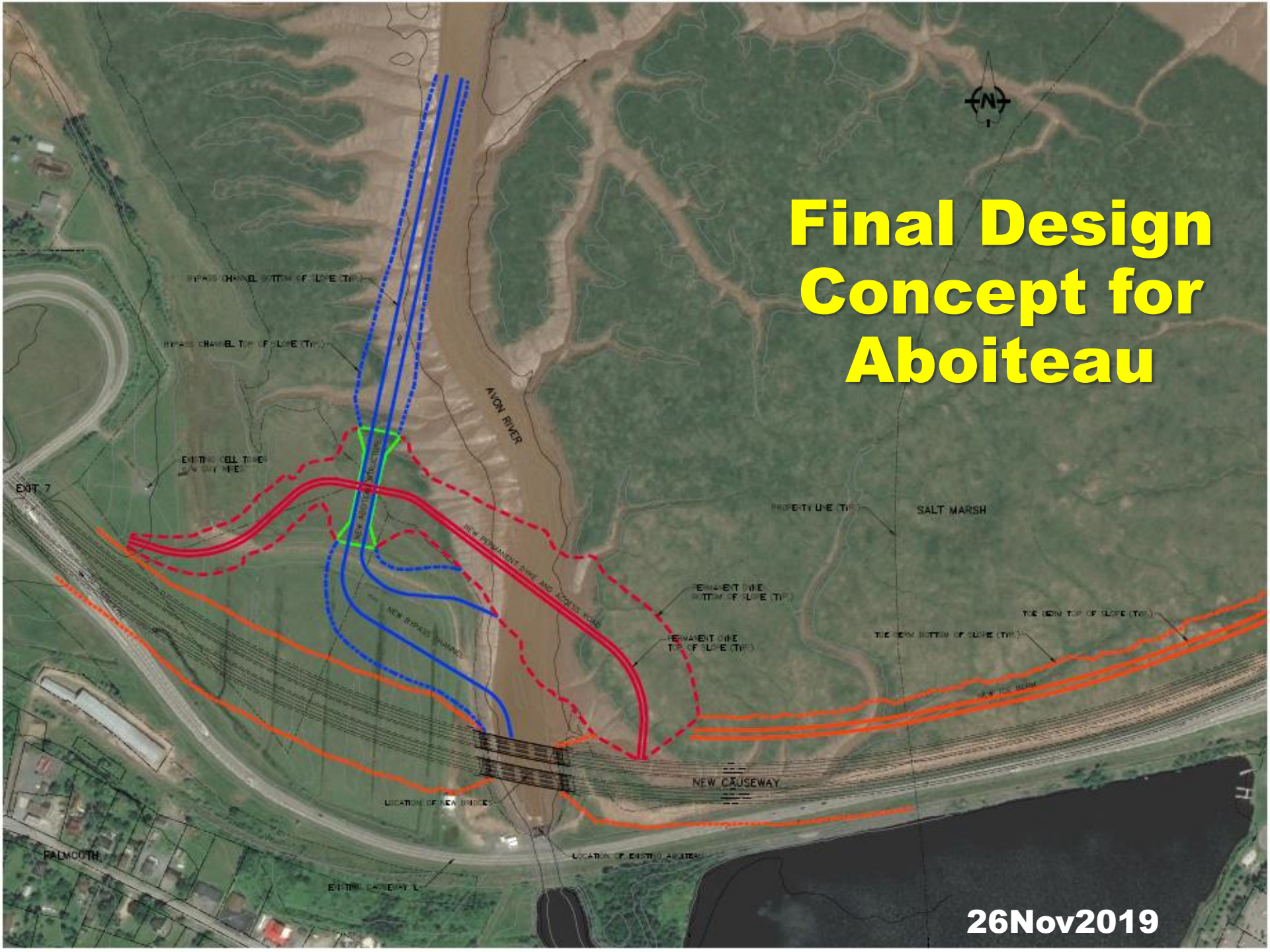


# Initial Concept for Aboiteau Location





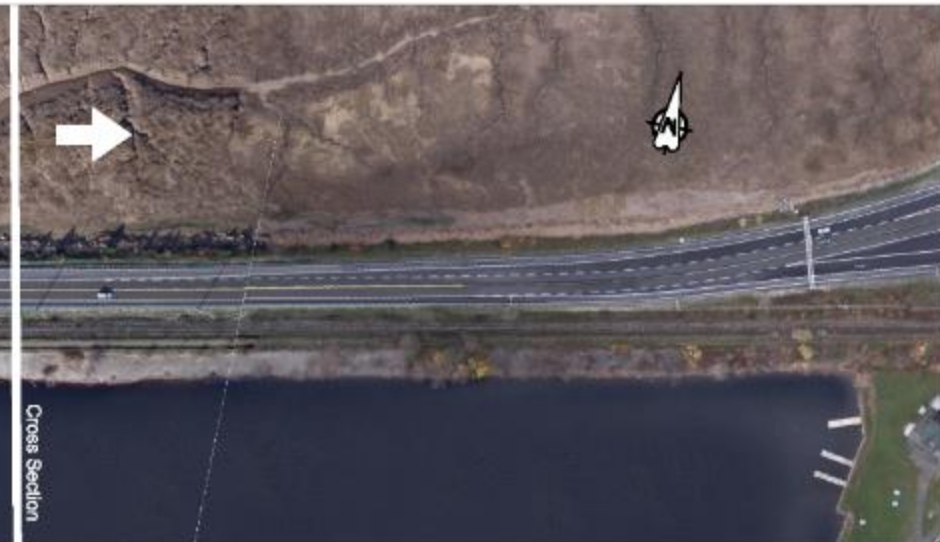
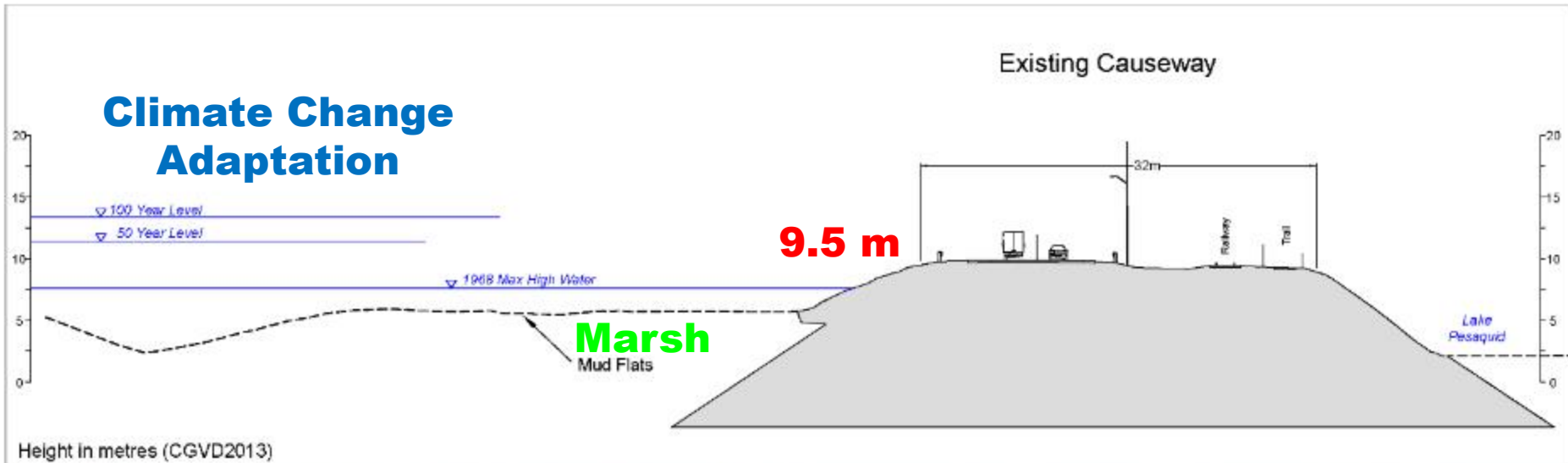
# Final Design Concept for Aboiteau



26Nov2019



# Avon River Causeway - Today



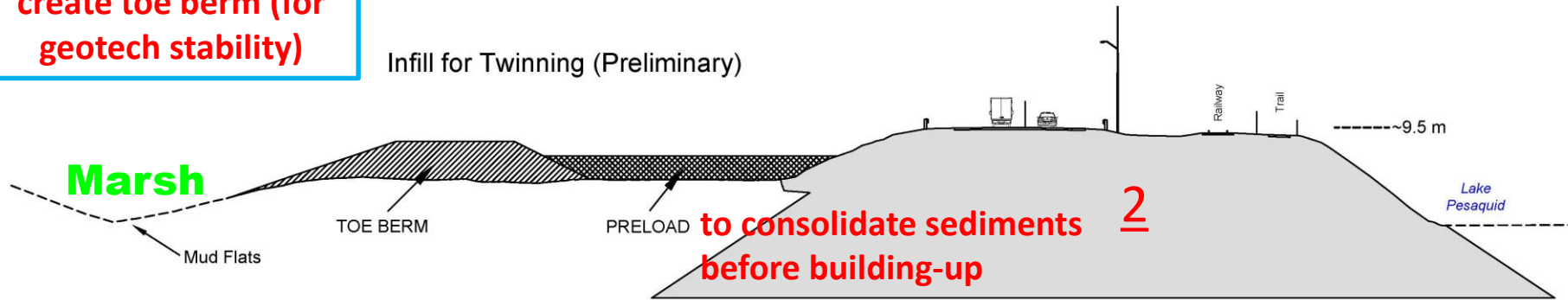
# Initial Stage of Causeway Construction (Winter 2020)

**Marsh excavation and  
armourstone infill to  
create toe berm (for  
geotech stability)**

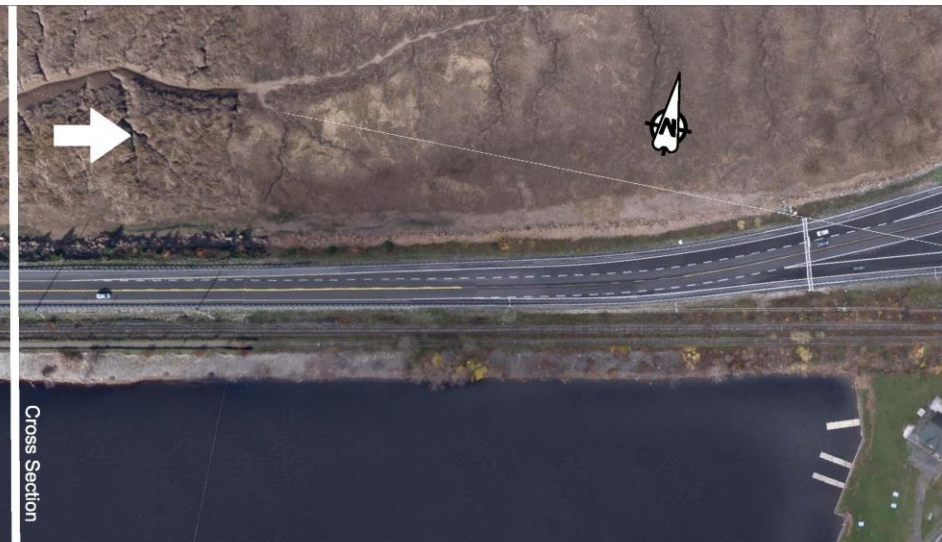
**1**

Infill for Twinning (Preliminary)

Existing Causeway



Height in metres (CGVD2013)



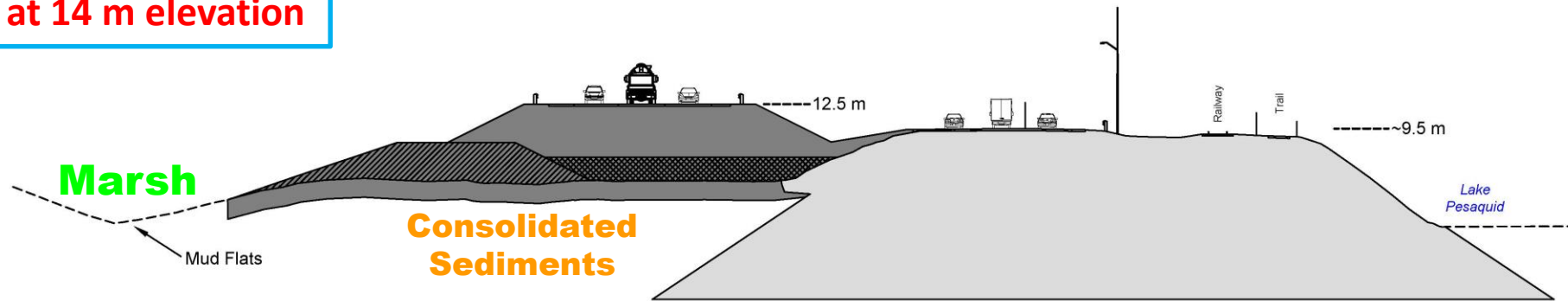


# Causeway Built to 12.5 m (50+ year design)

**Resilient Design;  
100-year design  
at 14 m elevation**

Twinned Causeway

Existing Causeway



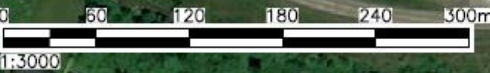
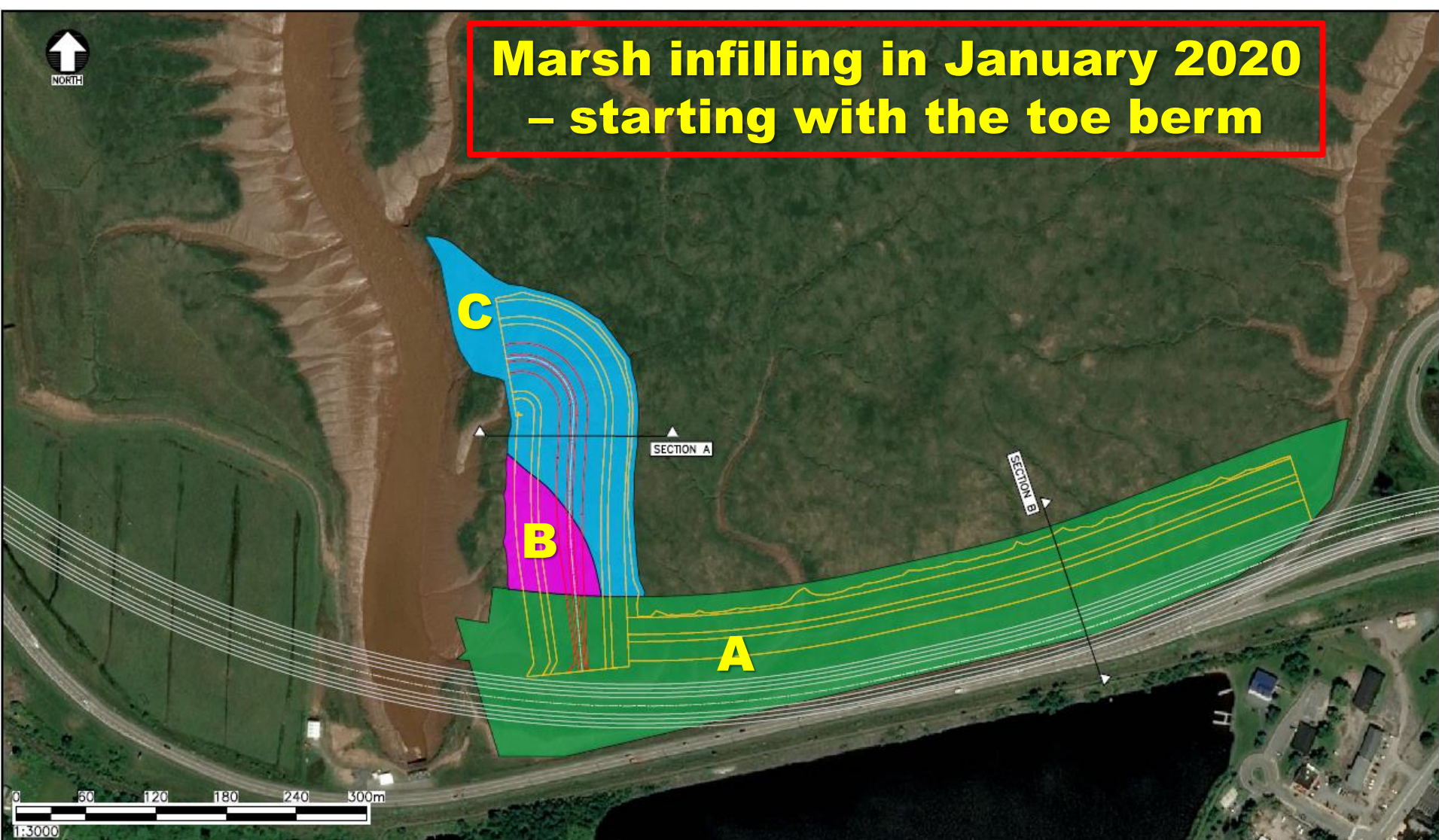
Height in metres (CGVD2013)







# Marsh infilling in January 2020 – starting with the toe berm



- DYKE
- TOE BERMS
- CENTERLINE
- PROPOSED HIGHWAY 101 LANES
- WETLAND IMPACT AREA — A
- WETLAND IMPACT AREA — B
- WETLAND IMPACT AREA — C

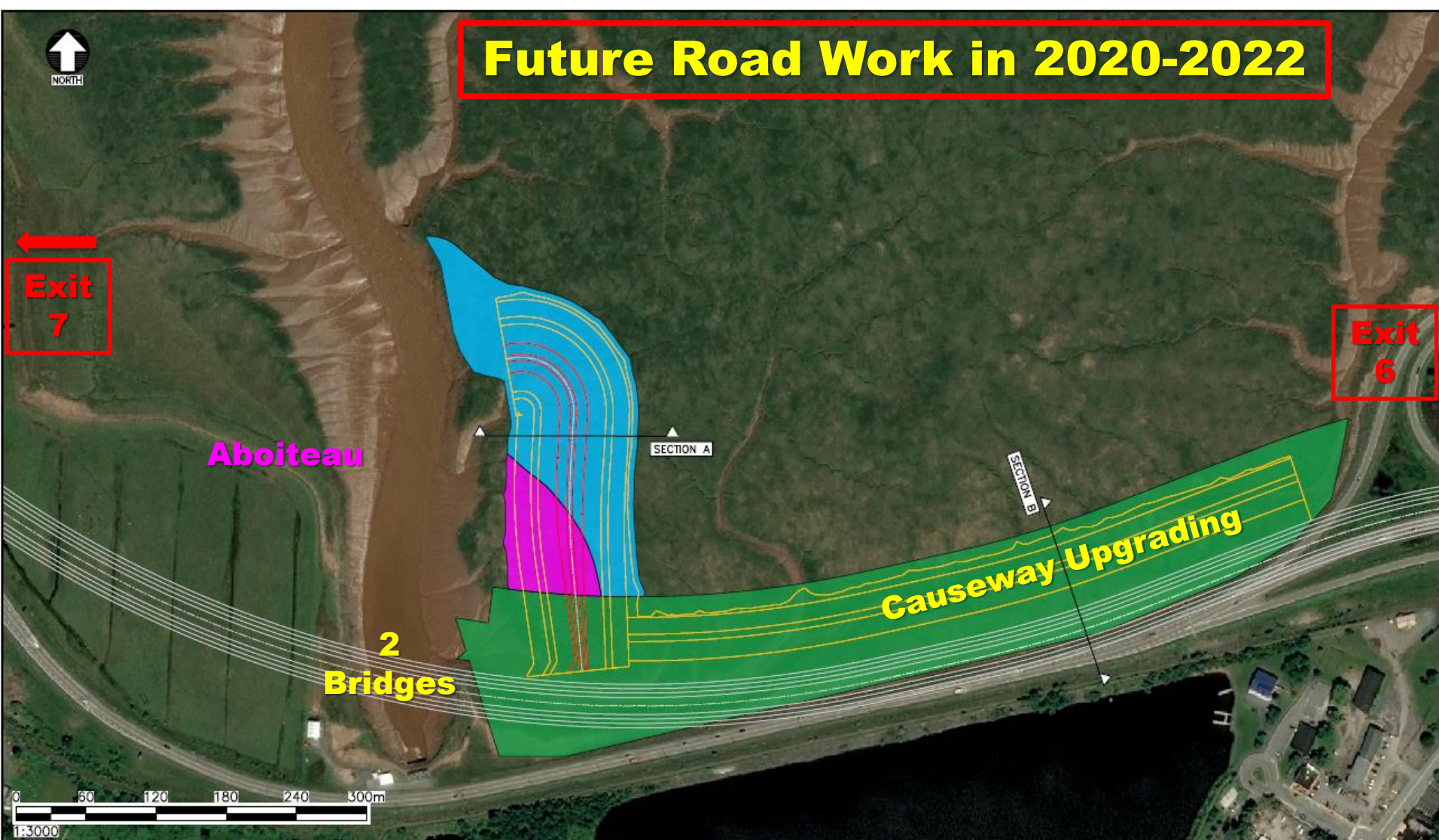
#### NOTES:

- AREA A + B = MIN. ANTICIPATED WETLAND IMPACT AREA
- AREA A + B + C = MAX. ANTICIPATED WETLAND IMPACT AREA

Date	Scale	Designed	Drawn	Checked	Approved	CBCL No.	Contract
NOV 2019	1:3000	LM	RM	LM	IB	171046.00	—
AVON RIVER ABOITEAU						Drawing	
DYKE AND HIGHWAY EMBANKMENT SITE PLAN						1	



# Future Road Work in 2020-2022



- DYKE
- TOE BERMS
- CENTERLINE
- PROPOSED HIGHWAY 101 LANES
- WETLAND IMPACT AREA — A
- WETLAND IMPACT AREA — B
- WETLAND IMPACT AREA — C

**NOTES:**

- AREA A + B = MIN. ANTICIPATED WETLAND IMPACT AREA
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Date NOV 2019	Scale 1:3000	Designed LM	Drawn RM	Checked LM	Approved IB	CBCL No. 171046.00	Contract —
<b>CBCL</b> <b>CBCL LIMITED</b> Consulting Engineers							Drawing
<b>AVON RIVER ABOITEAU</b>  DYKE AND HIGHWAY EMBANKMENT SITE PLAN							1

# Habitat offsetting project for partial loss of Windsor Marsh: Truro-Onslow Salt Marsh Restoration Project



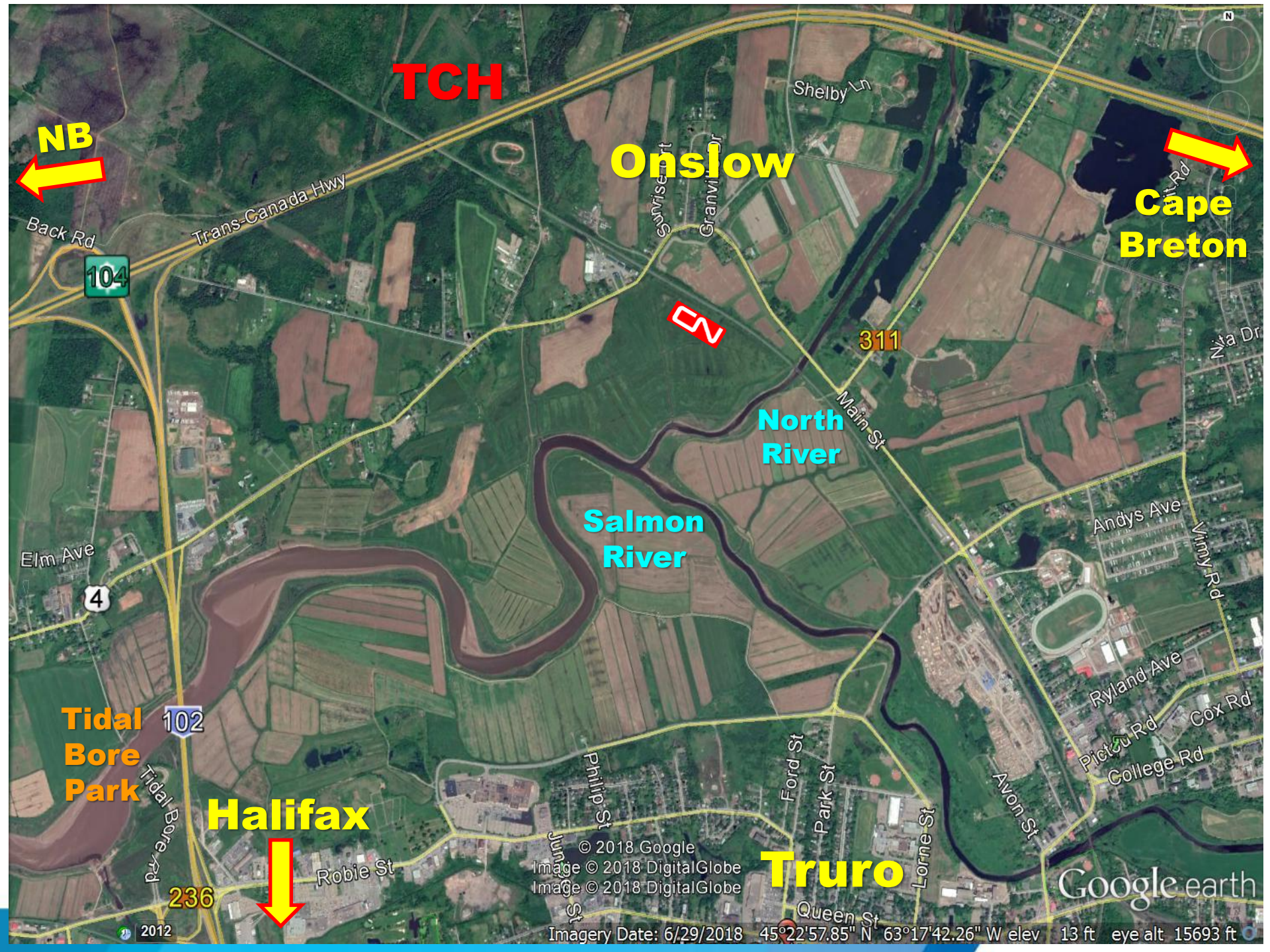
**NSTIR and a diverse group of partners are nearly ready to complete the restoration of over 90 ha of salt marsh near Truro in the Upper Bay of Fundy (Cobequid Bay).**

**The project began 4 years ago as a climate-change adaptation initiative of NSE to develop climate change champions across gov't departments.**

**NSTIR in cooperation with NS Agriculture, Environment and Municipal Relations anticipated multiple goals and adaptation co-benefits from dyke realignment.**

- **Climate Change Adaptation Champions**
  - **Infrastructure protection/resilience**
    - **Bank of habitat offset credits**
      - **Reduced dyke maintenance**
        - **Flood risk reduction**
  - **Restoration of provincially-significant wetland habitat (salt marsh; >80% loss)**
- **Social validation of nature-based solutions (aka natural/green infrastructure)**





**TCH**

**NB**

**Onslow**

**Cape Breton**

**104**

**311**

**North River**

**Salmon River**

**4**

**Tidal Bore Park**

**102**

**Halifax**

**236**

**Truro**

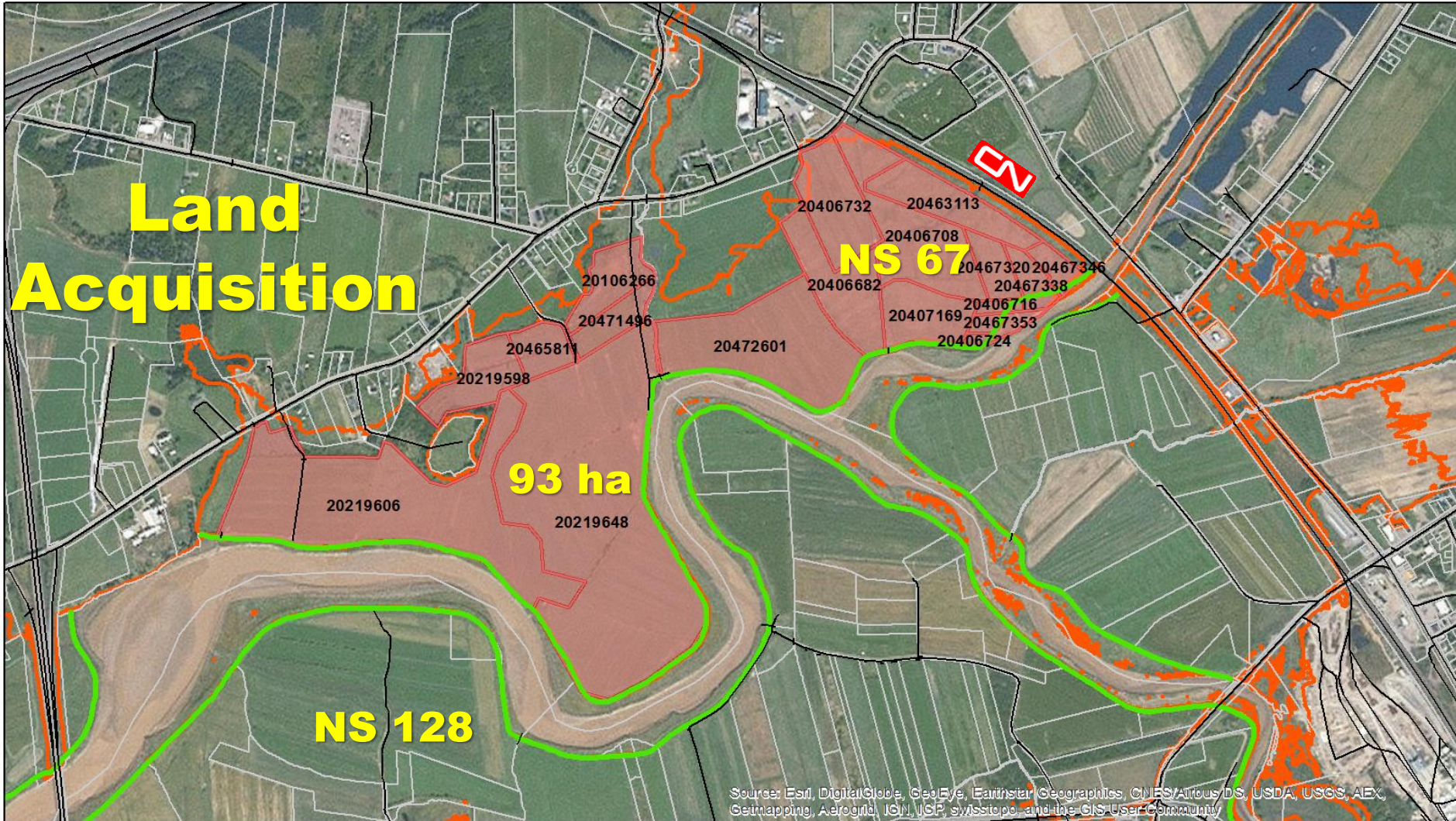
Google earth

© 2018 Google  
Image © 2018 DigitalGlobe  
Image © 2018 DigitalGlobe

Imagery Date: 6/29/2018 45°22'57.85" N 63°17'42.26" W elev 13 ft eye alt 15693 ft



# Land Acquisition



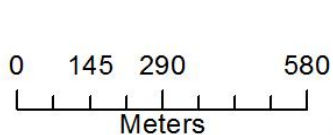
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

— Roads    — Dyke    BryantProperty    Property    Elevation 10m

## Local Marsh Body Opportunity

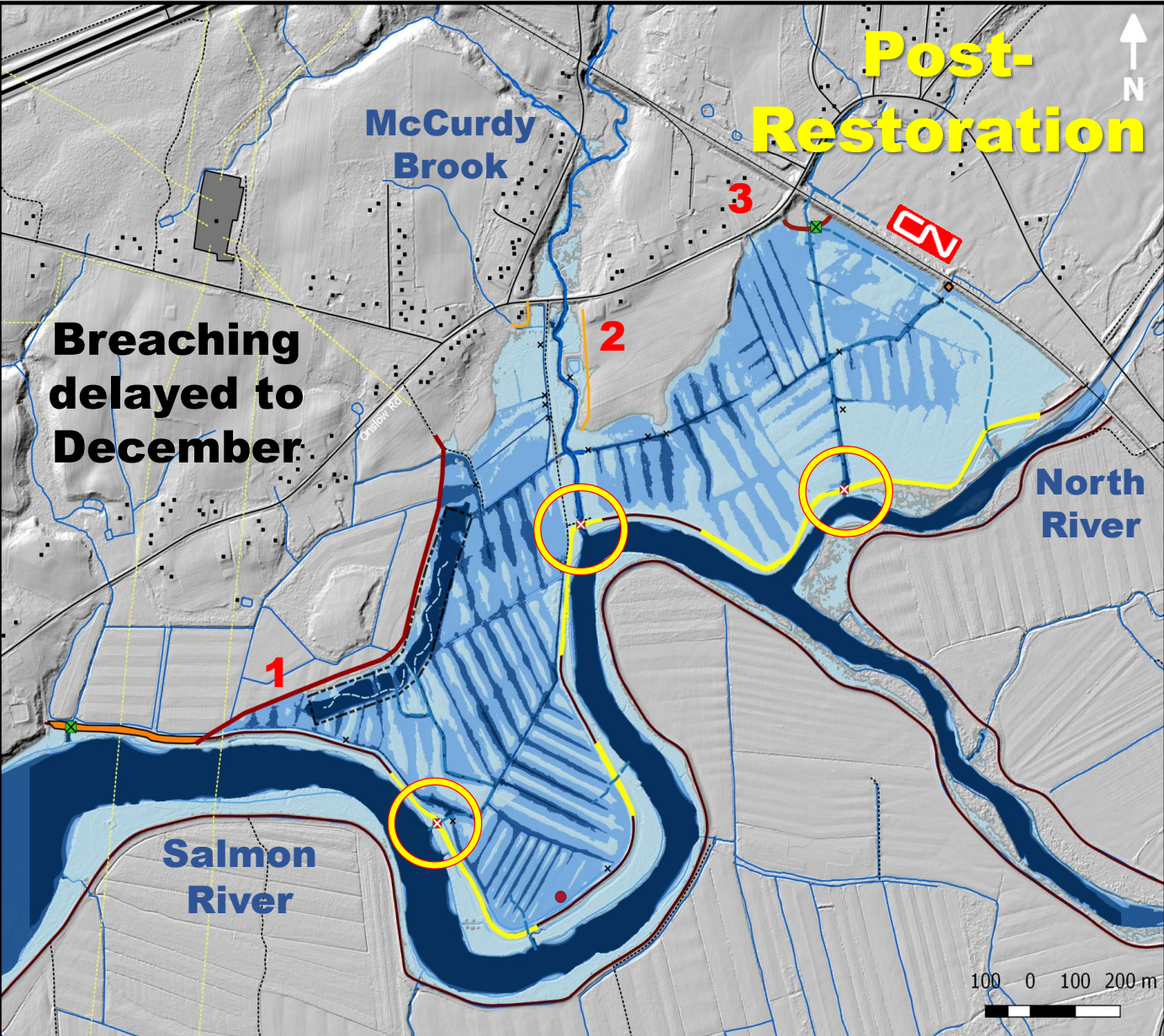
Author: Daniel Bryce  
Coastal GIS Coordinator  
Nova Scotia  
Department of Agriculture  
Coordinate System:  
NAD 1983 CSRS UTM Zone 20N  
Projection: Transverse Mercator  
Units: Meter  
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**Truro - Onslow**  
Potential Dyke Realignment



**NOVA SCOTIA**  
**NOUVELLE-ÉCOSSE**





# Post-Restoration

**Breaching delayed to December**



- Building
- ✕ Eliminate Aboiteau
- ✕ Aboiteau
- ◆ Install Gate
- ✕ Remove
- New Realigned Dyke
- Current Dyke Centerline
- Lot Scale Protection
- Utility Line
- Waterway
- Excavated Channel
- Natural channel (self-organized)
- Roadway
- Highway
- Divided Highway
- Railroad Track (Active)
- Trail or track
- Borrow Pit
- Raise Dyke Height (Top)
- Dyke Breaches (minimum)
- Substation
- High Water Line (HWL) - 9.5 m; 92 ha
- 50% Marsh Flooded - 8.6 m; 46 ha
- 25% Rec. High Tides (Quart.3) - 8.2 m; 13 ha
- Rec. Mean High Water (MHW) - 7.9 m; 5 ha

NOTES: Concept Design. Features not to construction specifications. Borrow Pit and Western dyke delineated from SMU/CBWES Drone imagery, May 2018.



## Onslow North River Dyke Realignment and Salt Marsh Restoration

### + Monitoring

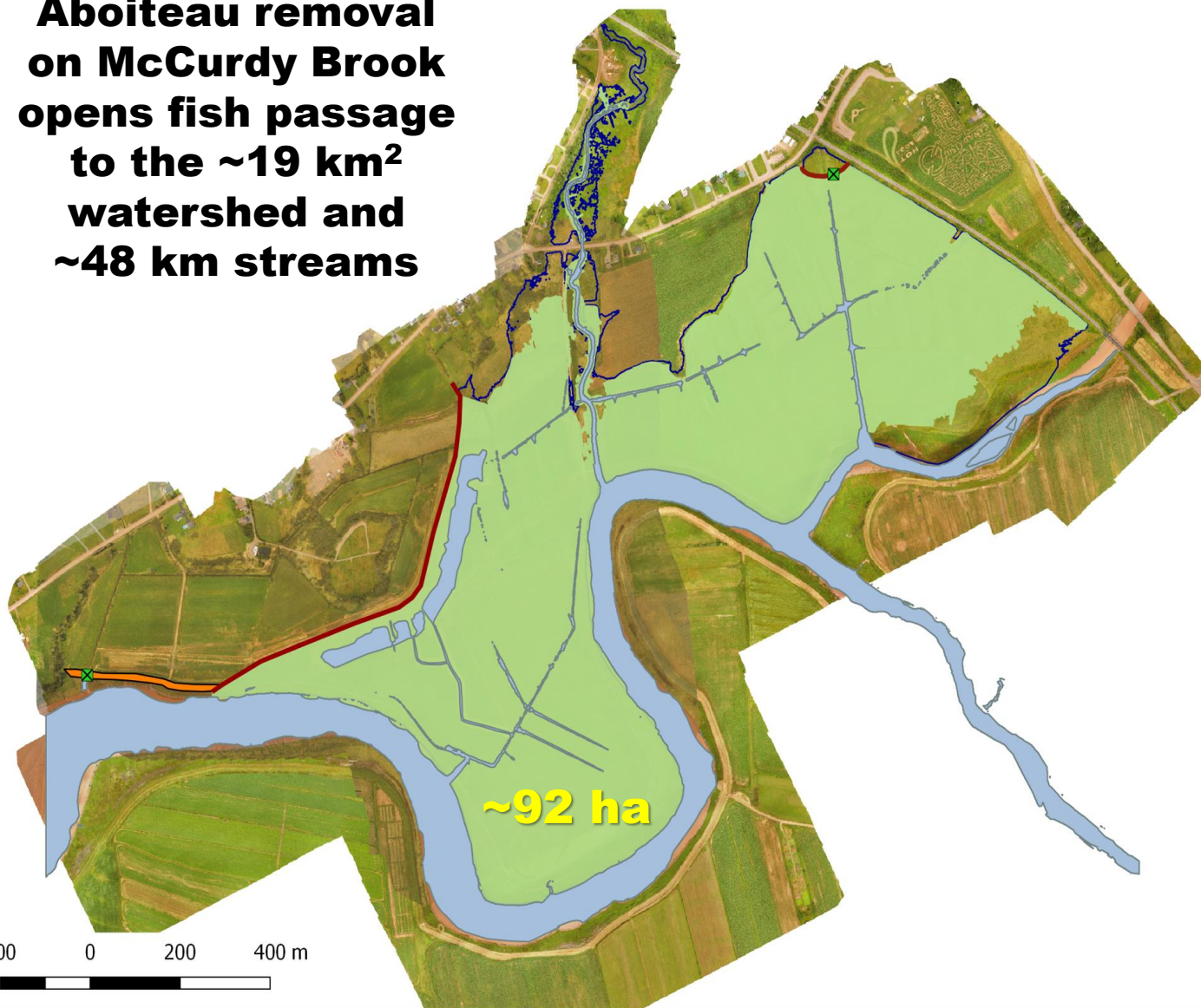
Datum: NAD83 (CSRS98), UTM Zone 20N, CGVD28  
 Date: 07/14/19 Author: Jennie Graham  
 Data: DEM Province of Nova Scotia 2013/CBCL 2014. Dykeland features DDST 2017. Topographic and infrastructure data NSTB 1:10000 2017. Tide Gauges CBCL 2014/CBWES 2017  
 Revisions: 2



# Restoration Outcomes

- 1. Increased ecosystem productivity**  
(past dyking eliminated most of the active floodplain and severely restricted export of food to downstream\* and upstream habitats).
- 2. Protection of up-gradient infrastructure and reduced maintenance costs.**
- 3. Carbon sequestration into marsh soil.**
- 4. Room for storage of flood waters and ice.**
- 5. Research and education opportunities.**
- 6. New bank of habitat credits (~92 ha).**

**Aboiteau removal  
on McCurdy Brook  
opens fish passage  
to the ~19 km<sup>2</sup>  
watershed and  
~48 km streams**



**Legend**

- Aboiteau
- New Dyke
- Old dyke (Topped)
- Restored Area - 92 ha
- Recorded HWL - 9.6 m; 100 ha
- Rec. Mean High Tide (MHT) - 7.9 m; 5 ha

**We know SM  
restoration  
works based  
on 15 years of  
experience  
and >400 ha  
restored.**



# Hwy101 Twinning / Next Steps

- **Detailed planning for the aboiteau and dyke structures as well as gate operations are continuing through the winter months.**
- **Partial infilling of the Marsh is starting soon to allow for sediment consolidation (settlement) in advance of causeway construction.**
- **Regulatory applications for the aboiteau-dyke structures and gate operations will be completed in the Spring once further modelling and detailed design are completed.**
- **Fisheries and marsh monitoring are also continuing to meet the terms and conditions of federal & provincial regulatory approvals.**

## Questions / Discussion



