



McElhanney

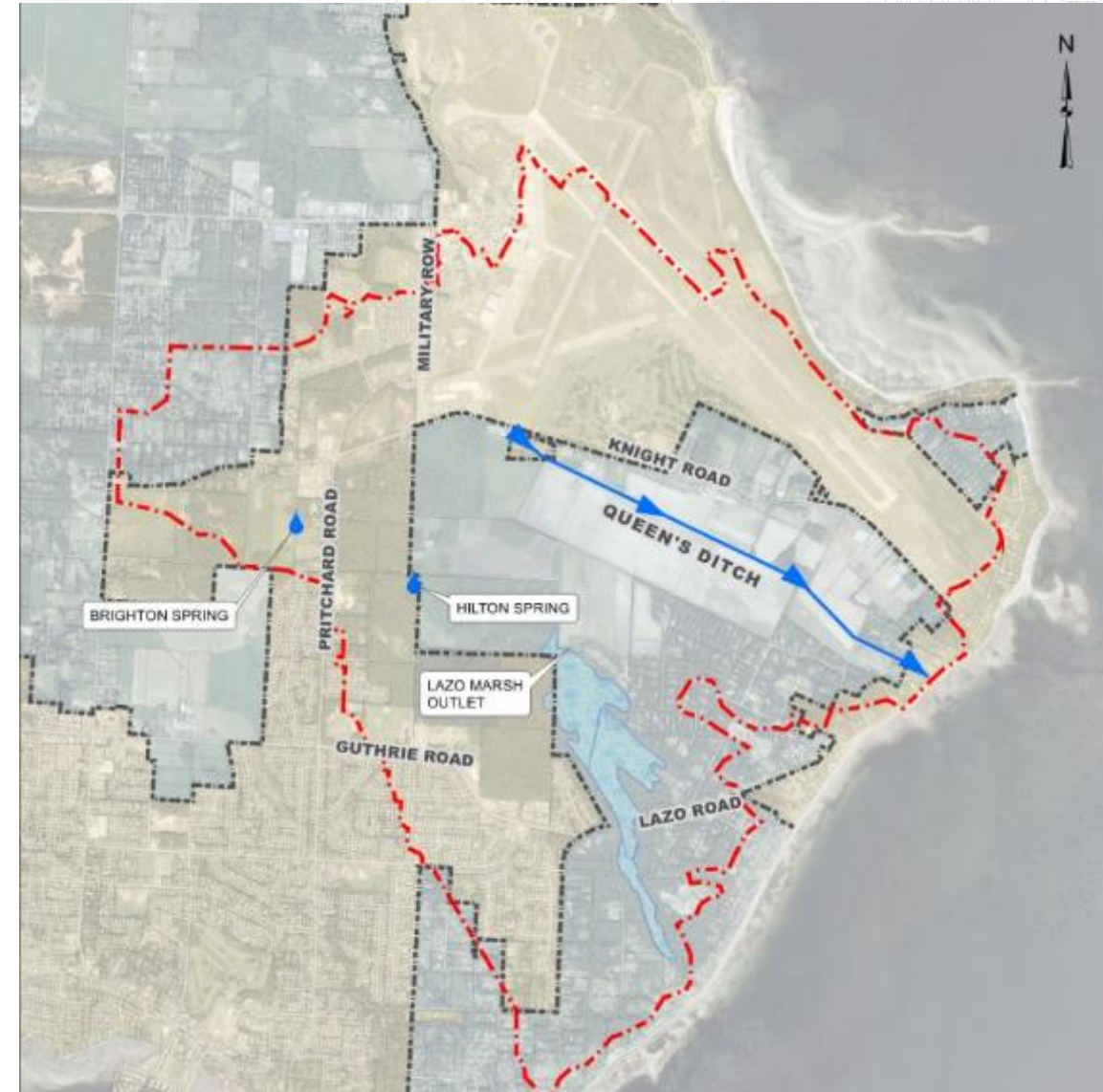
Queen's Ditch Drainage Improvements Options Analysis, Phase 2a

Summary of Methods & Results

Presentation to the Comox Valley Regional District Electoral Area Service
Committee
May 2019

Background - History of Flooding

- A quick history...
 - The Queen's Ditch was initially constructed as a sewage outfall.
 - It formalized Lazo Creek into a drainage channel.
 - Over time, the Lazo wetland was slowly filled to allow it to be farmed.
 - Land owners have manipulated drainage to suit agricultural needs.
 - Phase 1 study reviewed options for managing flood waters within the Queen's Ditch basin.
 - "Managed retreat" was selected as the preferred option to move forward to Phase 2.



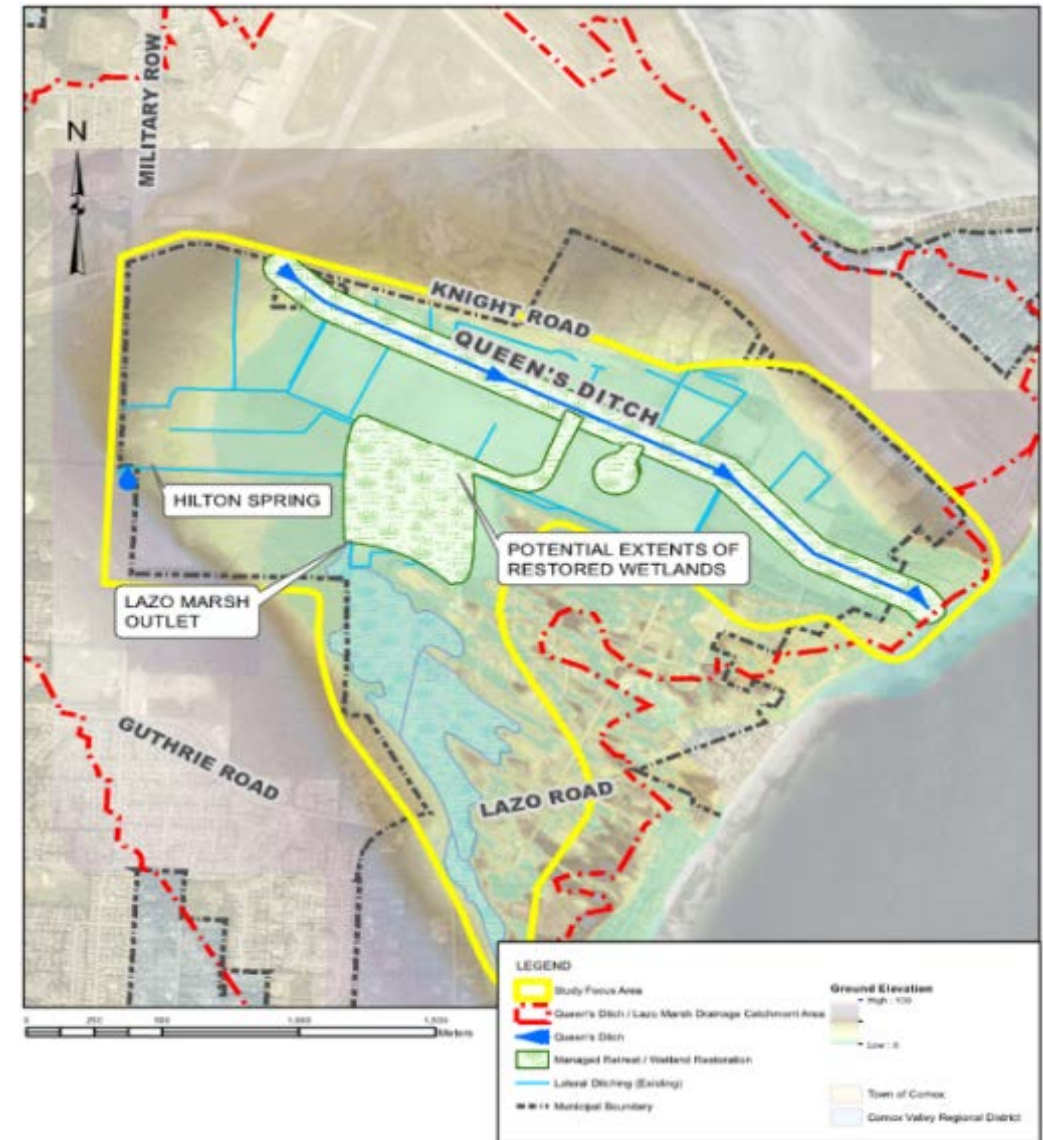
Managed Retreat –Wetland Restoration Option

Current work: Phase 2A

- Detailed hydraulic modeling.
- Preliminary conceptual design work to evaluate options.
- Review required environmental/regulatory approvals

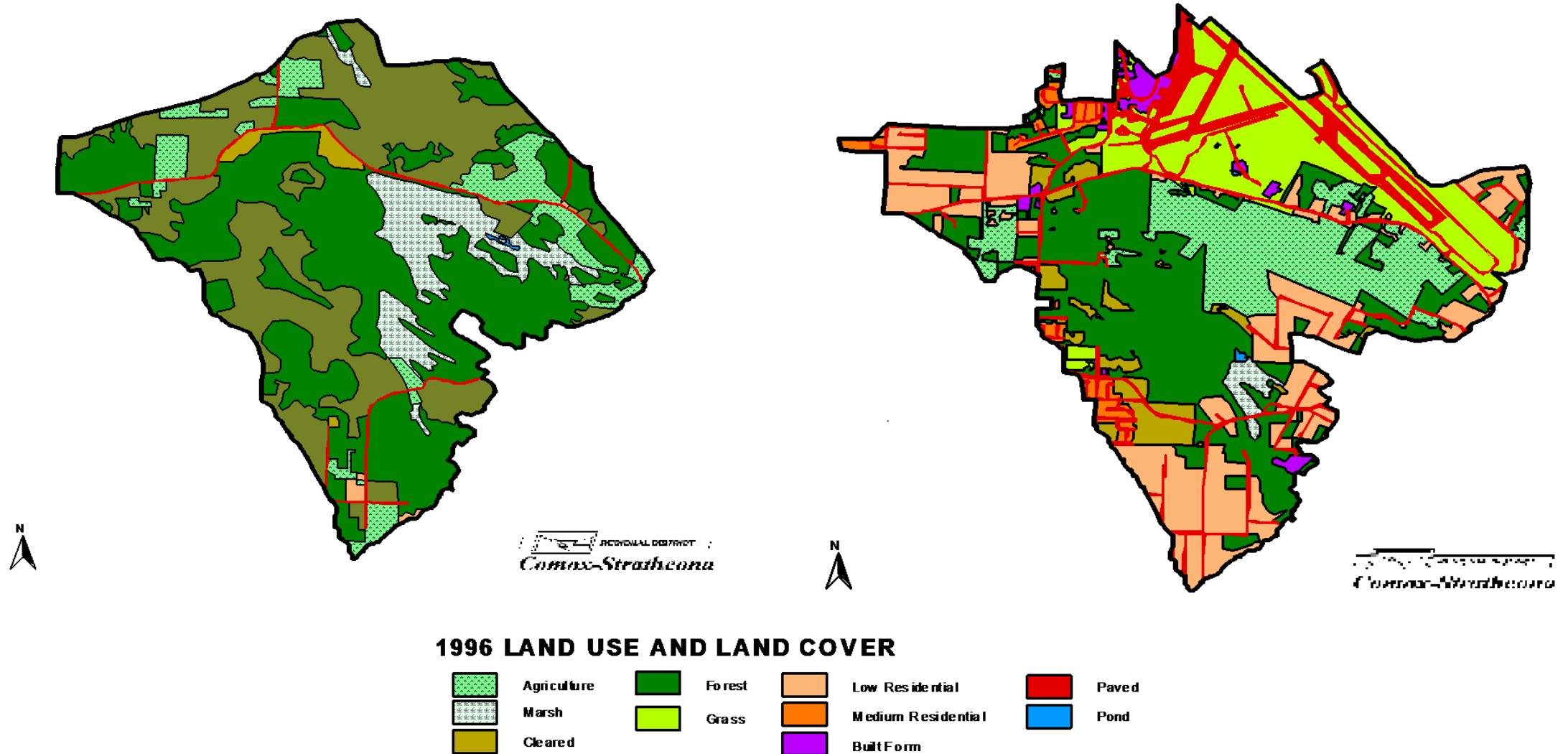
Deferred work: Phase 2B

- Biologist, Agrologist and Hydrogeologist review and input
- Evaluate partnership opportunities.
- Cost estimation
- Evaluation of options
- Local Service Area (LSA) boundary



Land Use – 1931 vs 1996

"Towards a Management Plan for the Lazo Watershed and Queen's Ditch", prepared by William Marsh



Hydraulic Modelling

Design Events / Criteria:

- **Rainfall:** 1:10-Year, 24 Hour Rainfall Event (i.e. a large storm event with a 10% chance of occurring in any given year, lasting 24 hours).
- **Agricultural Drainage Criteria:** Minimize total area & depth of inundation; ensure land drains sufficiently quickly.
- **Tides:** “King” Tide = 2.34m Elevation.
- Plus Climate Change effects.

Software Utilized: HEC-RAS



Climate Change

- Increased Rainfall (and Flows) within Queen's Ditch = +10% rainfall.
- Tide Level = +1.0m due to Sea Level Rise (SLR).
- (King Tide + SLR = 3.34m Elevation).



Scope of Analysis

Detailed Hydraulic Modelling for Four Options (including Base Conditions as Option 0:

1. Increase Drainage Conveyance Capacity (*for the Queen's Ditch as well as connecting ditches*).
2. Reinstatement of Wetlands in Existing Low-lying Areas.
3. Reinstatement of Wetlands, within one property.

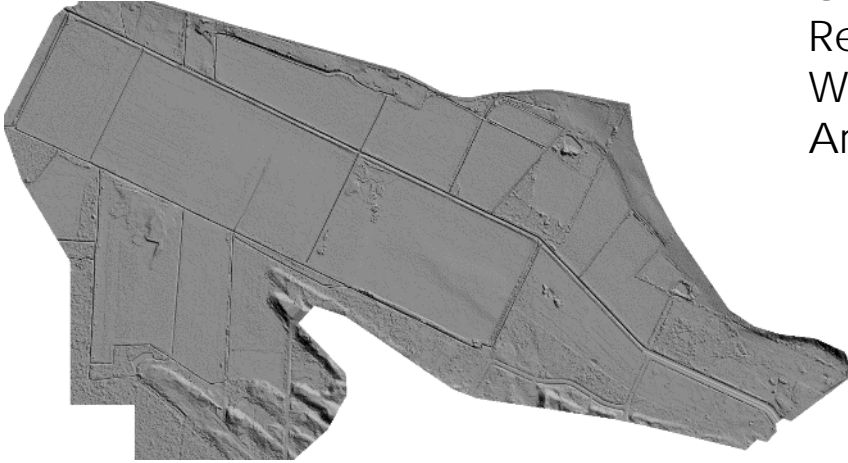
Upgrade Parameters:

- 10m bottom width.
- 4:1 side slopes.
- Channel invert at 2.20m elevation or above.
- All culverts removed, assumed replacement with small clear-span bridges or upgraded culverts.
- All side-ditches cleared/grubbed/re-graded.



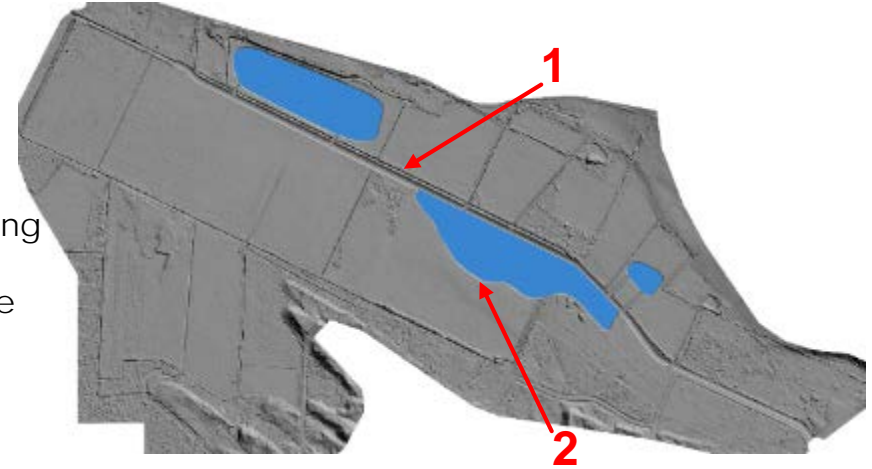
Model Scenarios

Existing Conditions

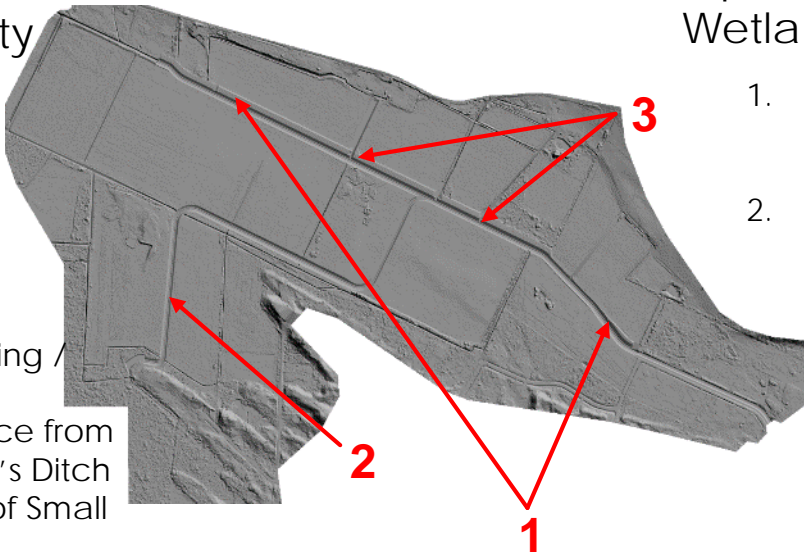


Option 2 – Reinstatement of Wetlands in Low Lying Areas

1. Queen's Ditch Widening / Deepening
2. Excavation of Low-lying Areas to Create Ponds / Storage for Runoff (blue areas)

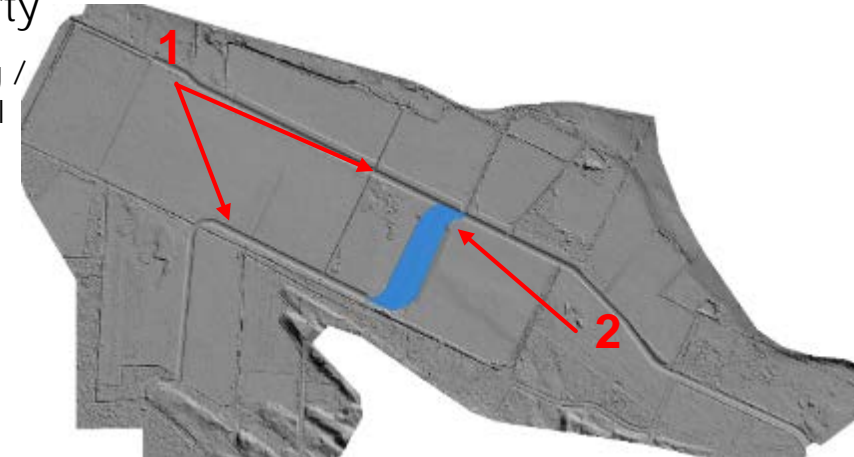


Option 1 – Increased Conveyance Capacity



Option 3 – Reinstatement of Wetlands on Single Property

1. Queen's Ditch Widening / Deepening, including all the way to Lazo Marsh
2. Excavation of Low-lying Area to Create Pond / Storage for Runoff



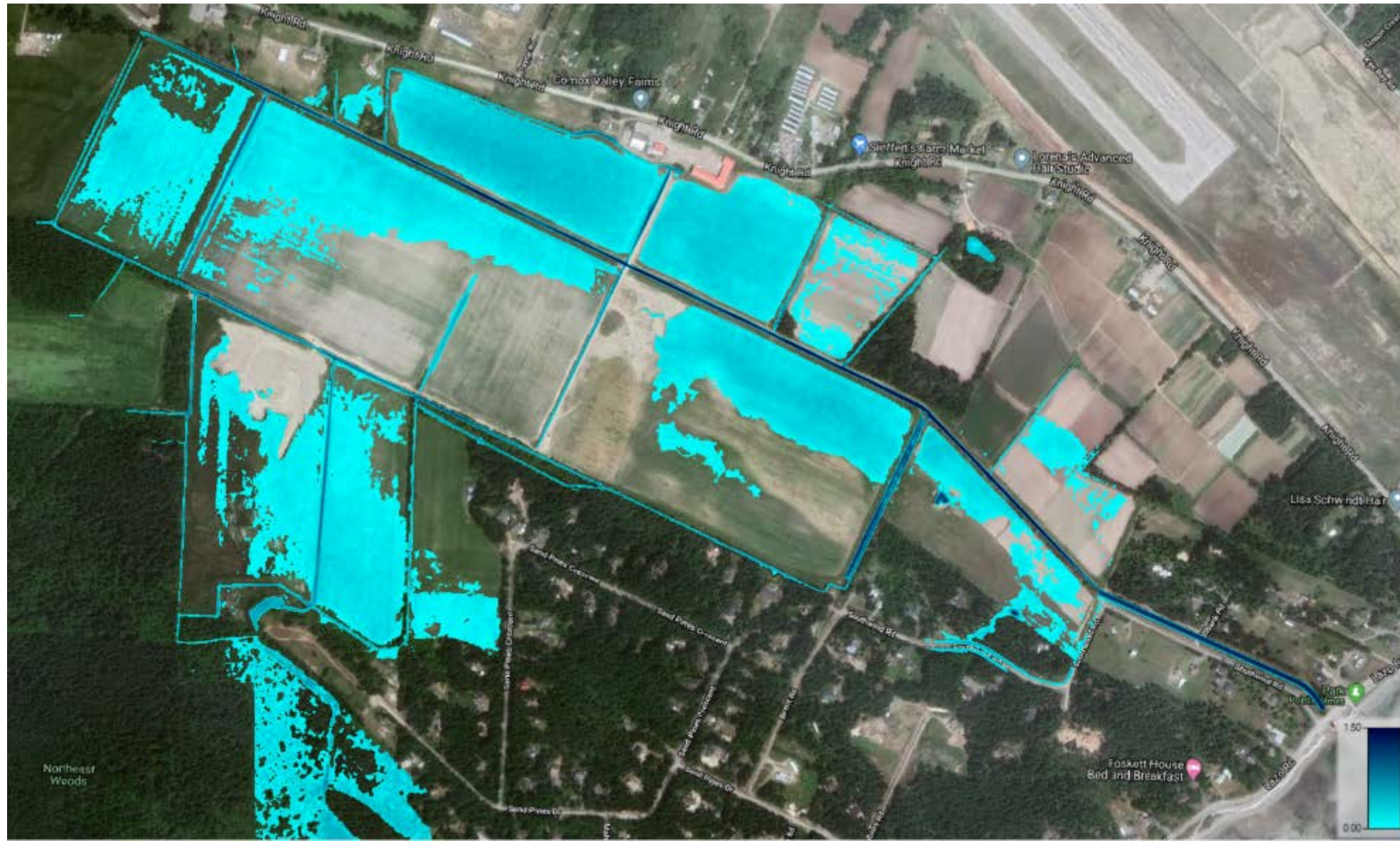
1. Queen's Ditch Widening / Deepening
2. Increased Conveyance from Lazo Marsh to Queen's Ditch
3. Widening / Clearing of Small Side Channels (many locations)



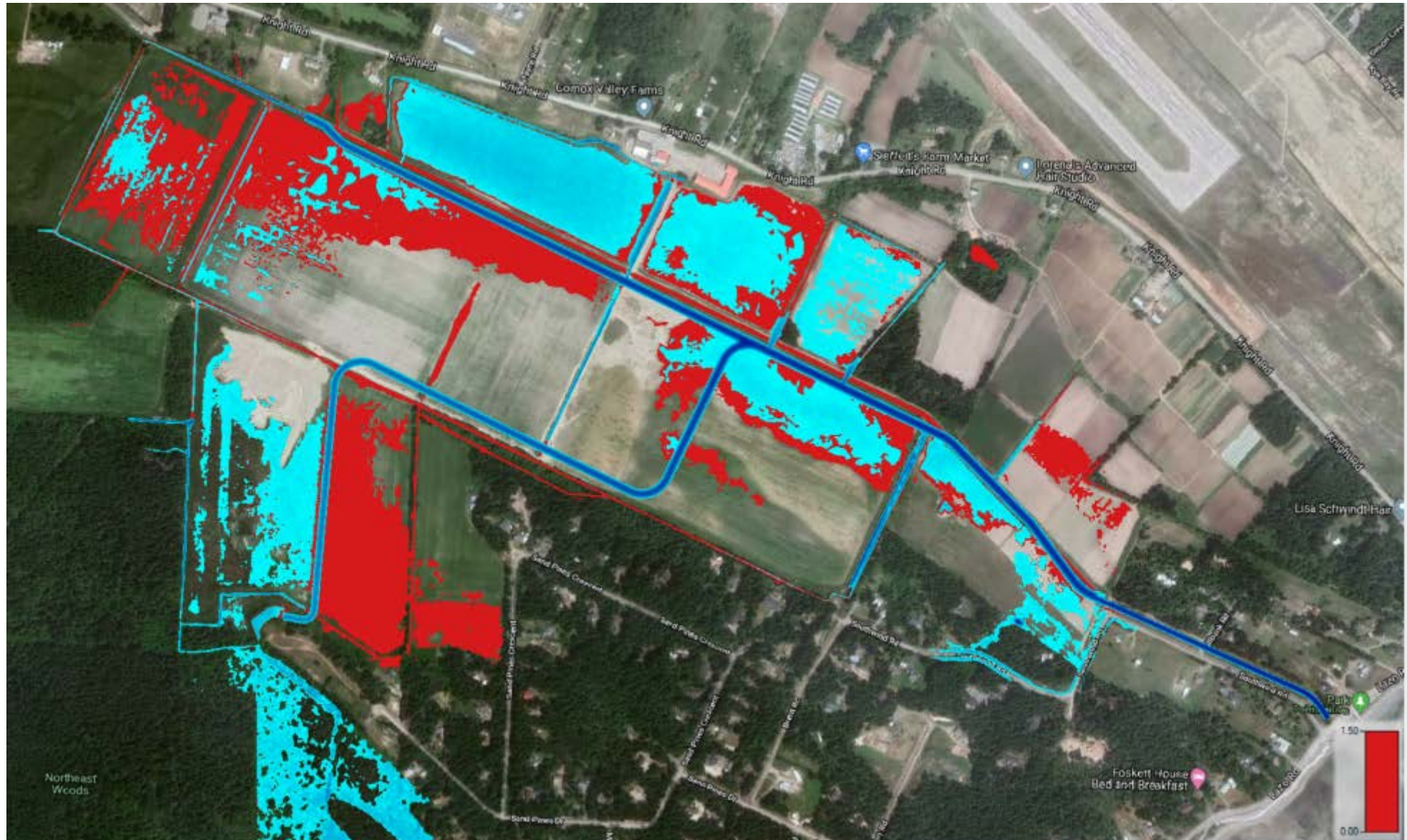
RESULTS – Present Day High Tide (No Runoff)



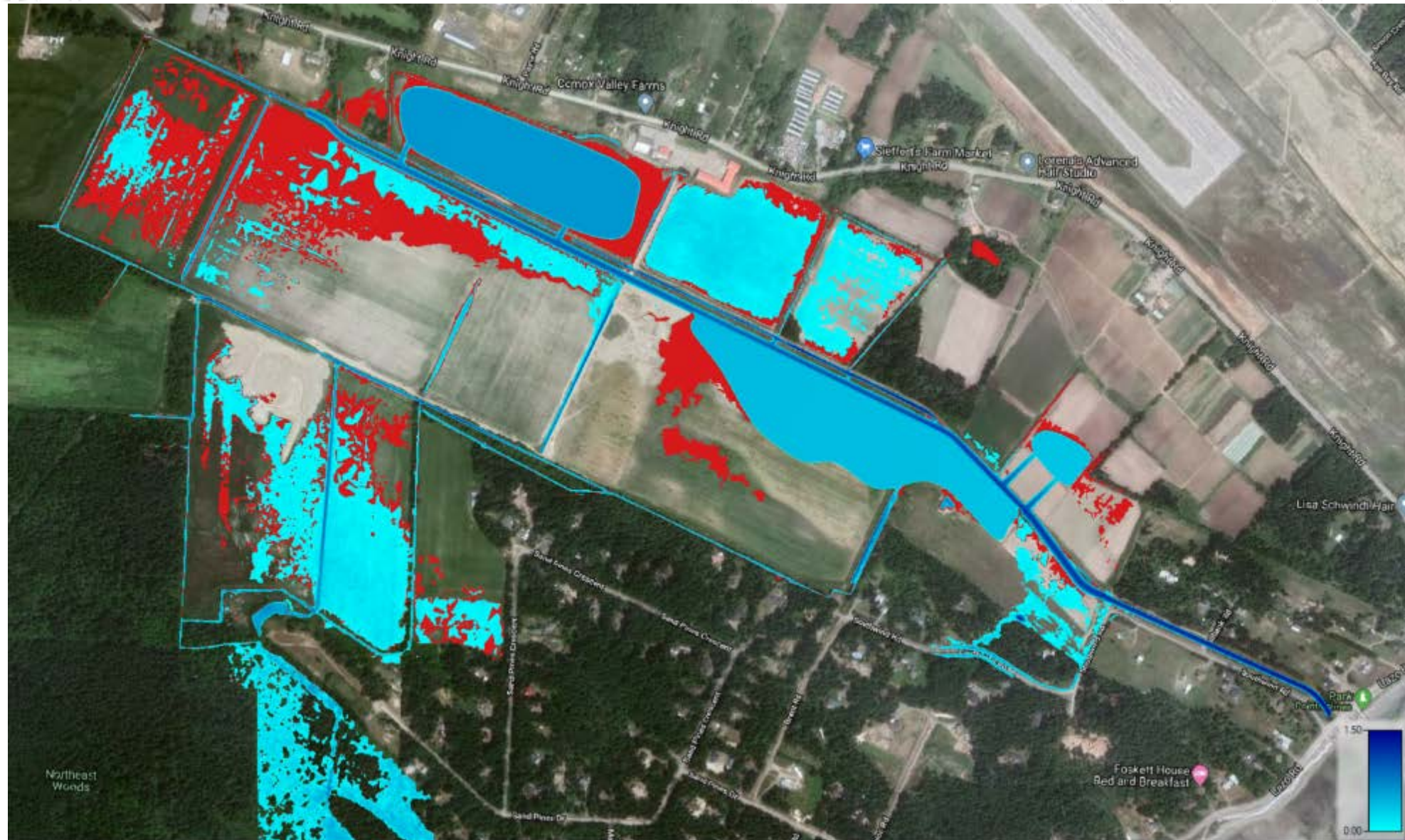
RESULTS – Existing Conditions, High Tide + 10-Year Rainfall



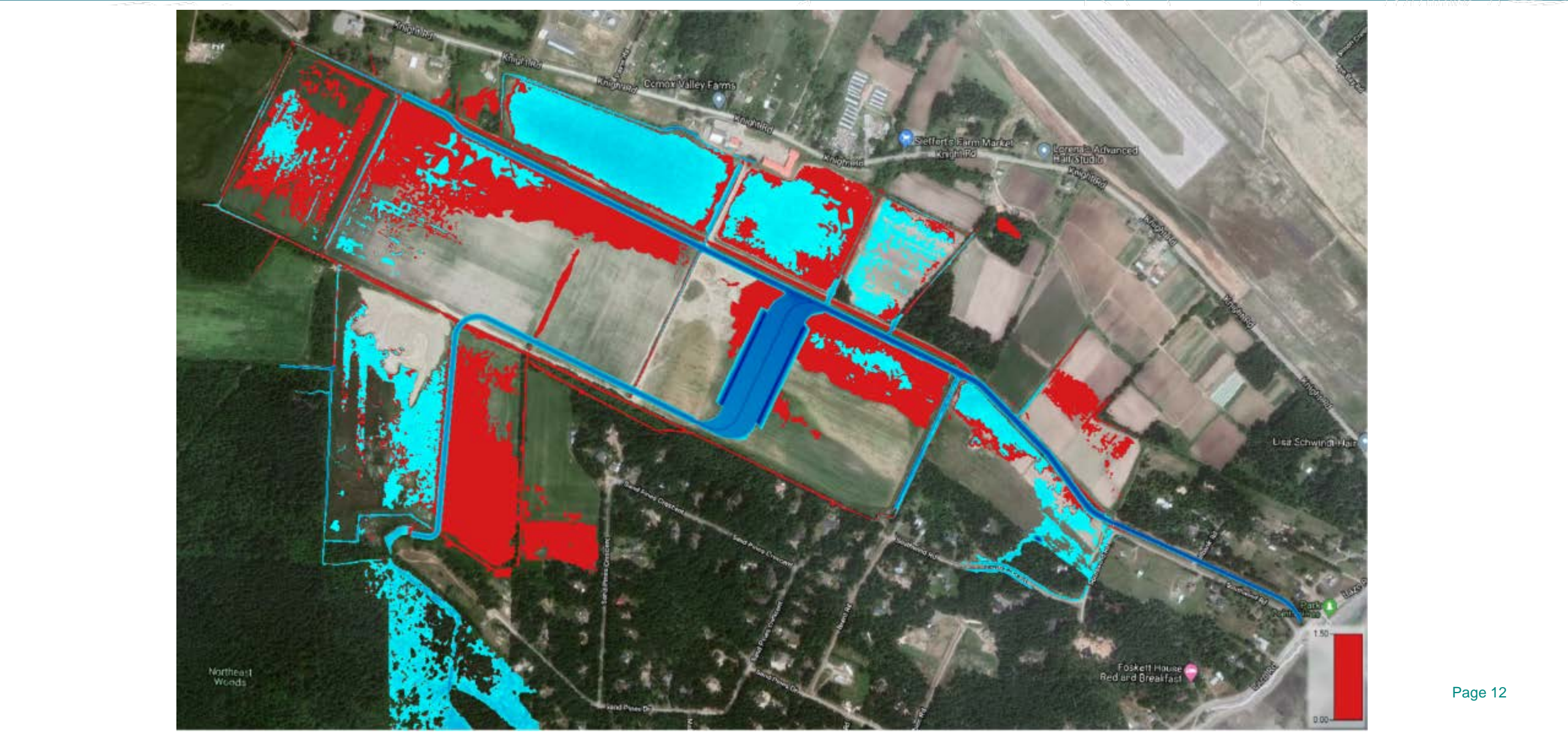
RESULTS – Existing (red) vs. Option 1 (blue) – Present Day Conditions



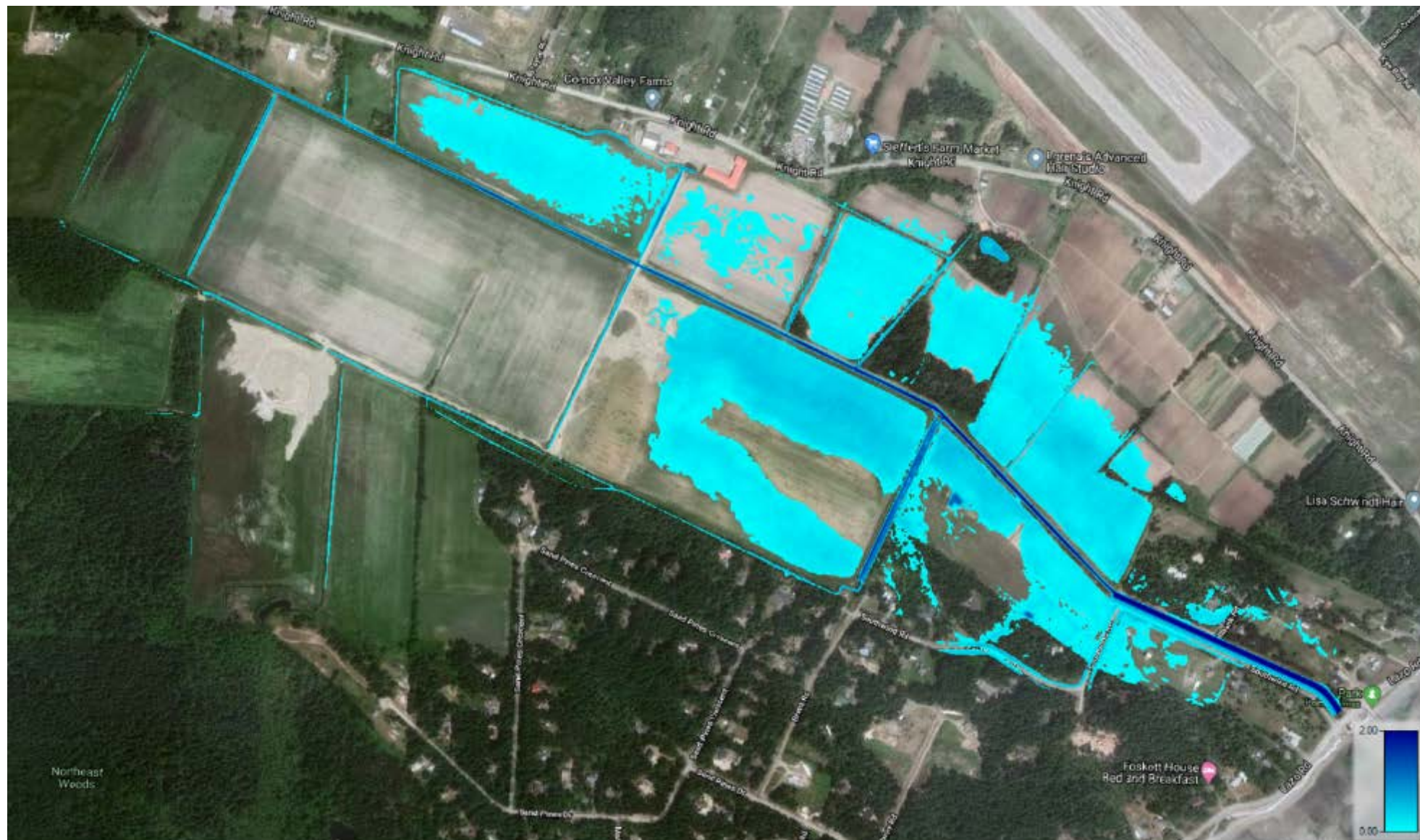
RESULTS – Existing (red) vs. Option 2 (blue) – Present Day Conditions



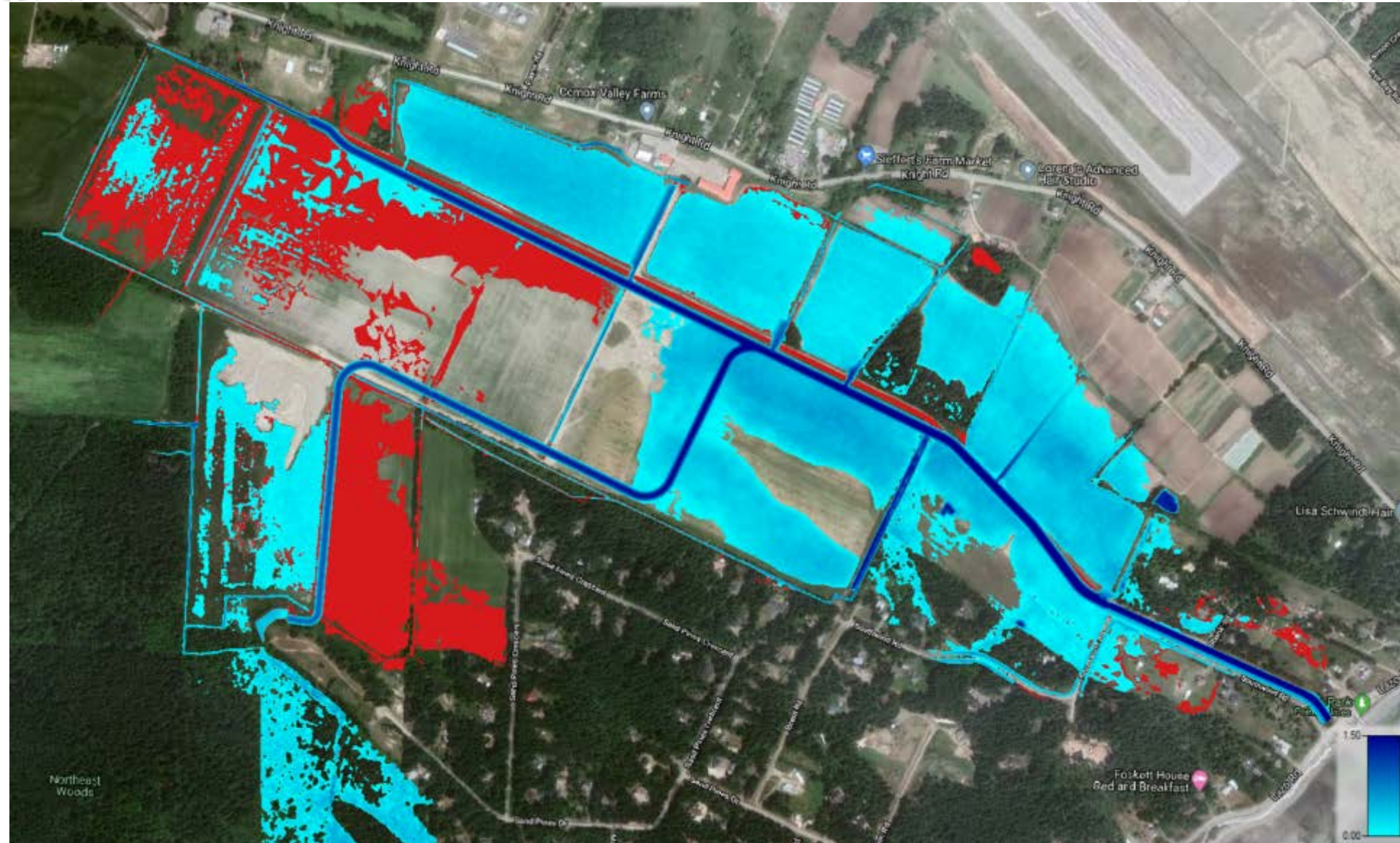
RESULTS – Existing (red) vs. Option 3 (blue) – Present Day Conditions



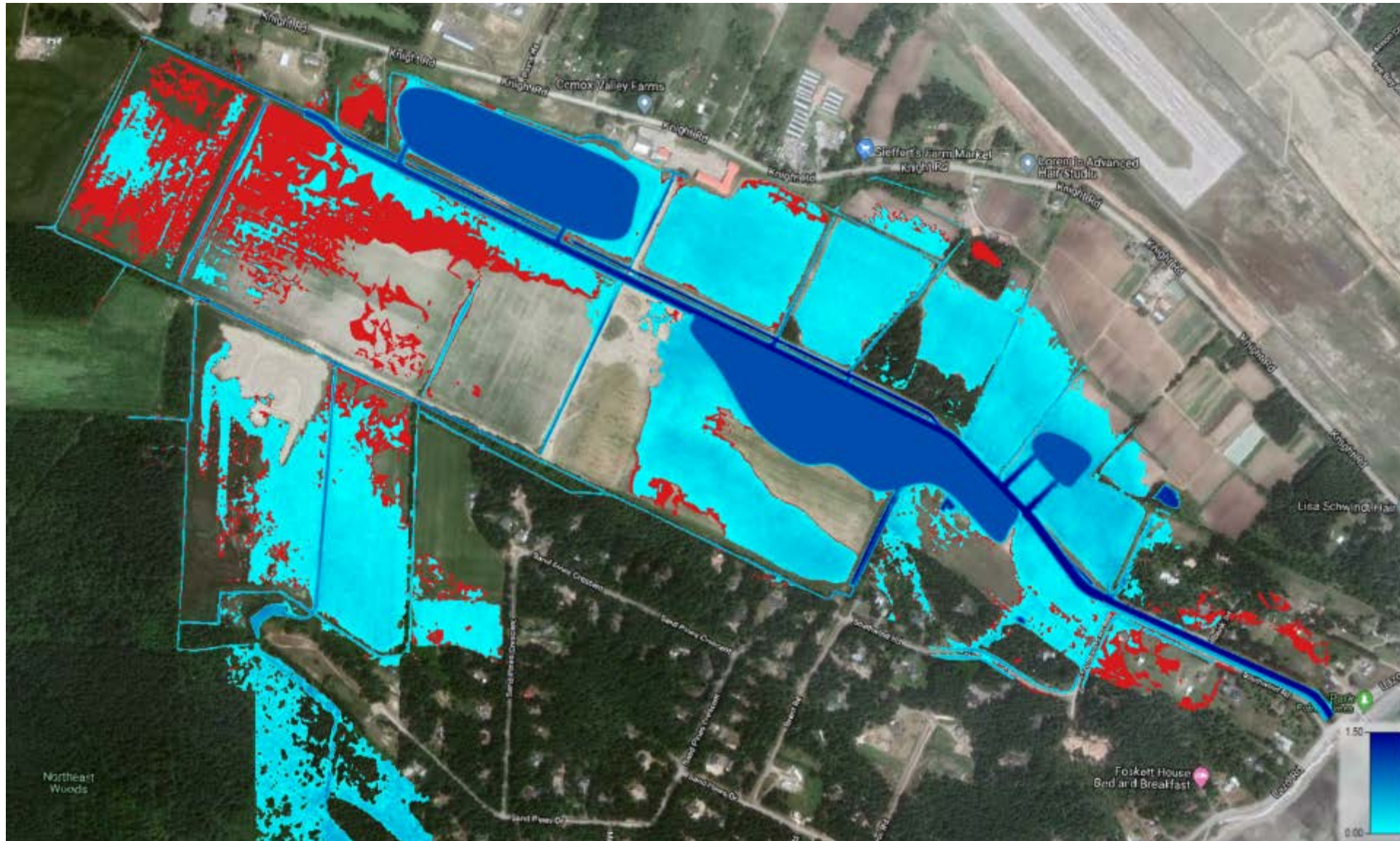
RESULTS – Year 2100 High Tide (No Runoff)



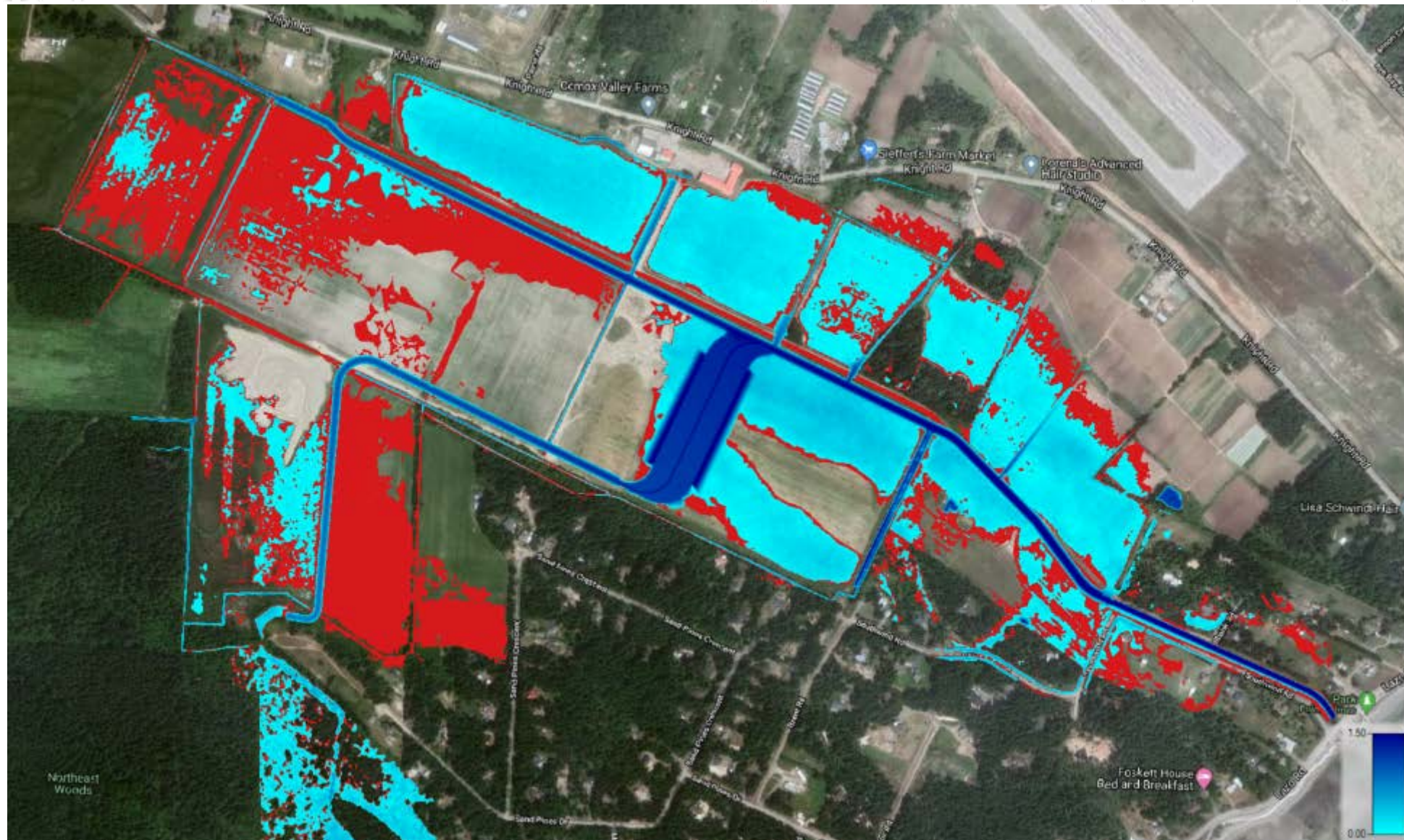
RESULTS – Existing (red) vs. Option 1 (blue) – Year 2100



RESULTS – Existing (red) vs. Option 2 (blue) – Year 2100



RESULTS – Existing (red) vs. Option 3 (blue) – Year 2100



Implementation of Proposed Upgrades – Constraints & Permits

Constraints in Implementing Upgrades:

- Access through Private Properties.
- Control / ownership of lateral connections.
- Non-farm use applications to ALC (see details ->).
- Upgrades bisect farmland, hindering access & operations.
- Riparian planting & spawning gravels will be required to be installed.
- Water Sustainability Act, Section 11 permit required (~3-4 months).
- DFO Project Review required.
- Land Acquisition/SRWs for channel improvements.

General Procedure for Approval of Non Farm Use

- *ALC non-farm use applications is required for each parcel.*
 - *Data needs: Soil test pits to ALC Policy P-10 to inform the application; modeling data for groundwater and 5 & 25 year flood levels (if applicable).*
- *Procedure:*
 - *Field work for affected parcels.*
 - *Land Capability Report (includes statement on improvement to drainage conditions for remainder of lands based on McElhanney modeling and local context).*
 - *Potential application to Municipality for zoning change (depending on bylaw land-use requirements surrounding agricultural zoned land and regional storm water management facilities).*
 - *Application for 'non-farm use' of ALR land, unless there is sufficient evidence from the initial report to demonstrate a local net-benefit to agriculture – in which case, the installation can be framed as 'agricultural improvement' – although ALC approval would be needed for this.*
 - *If it is not deemed a 'farm use', then Section 11 is required, otherwise the Farm Practices Protection Act is in effect. That said, even when FPPA is in effect, the ideal is to have FLNRORD support.*
 - *Planning surrounding prevention of waste discharge (nutrients, sediment, etc.) from Ag lands to the Fish stream.*



Summary of Modelling Results

- Each option provides some limited benefit to the areas near the furthest upstream reaches of Queen's Ditch.
- The increased conveyance capacity connecting to Lazo Marsh in Options 1 & 3 provide benefit to the lands closest to Lazo Marsh.
- All three options drain the fields faster than existing condition, but some areas are limited by tidal inundation.
- Increasing conveyance in Queen's Ditch main channel can only help so much. (Technical explanation- HGL in Queen's Ditch is almost "flat").
- Getting water faster to the Queen's Ditch (for example by way of the increased conveyance from Lazo Marsh), and ensuring the fields shed water effectively to the ditches helps dry them out faster after tidal or storm inundation.

Cost Estimates:

Option 1 = \$16.9M

Option 2 = \$12.3M

Option 3 = \$16.6M





End of Presentation

