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Project Background and Description for Lake St. Martin Outlet Channel

May 9, 2019

Workshop 1: EIS Status

Manitoba Infrastructure

Science | Imagination | Collaboration

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Presentation Outline

1. Project Background (LMB & LSM projects)
2. Lake St. Martin Outlet Channel Project
   - Description
   - Design status
   - Design considerations
   - Associated activities and field investigations

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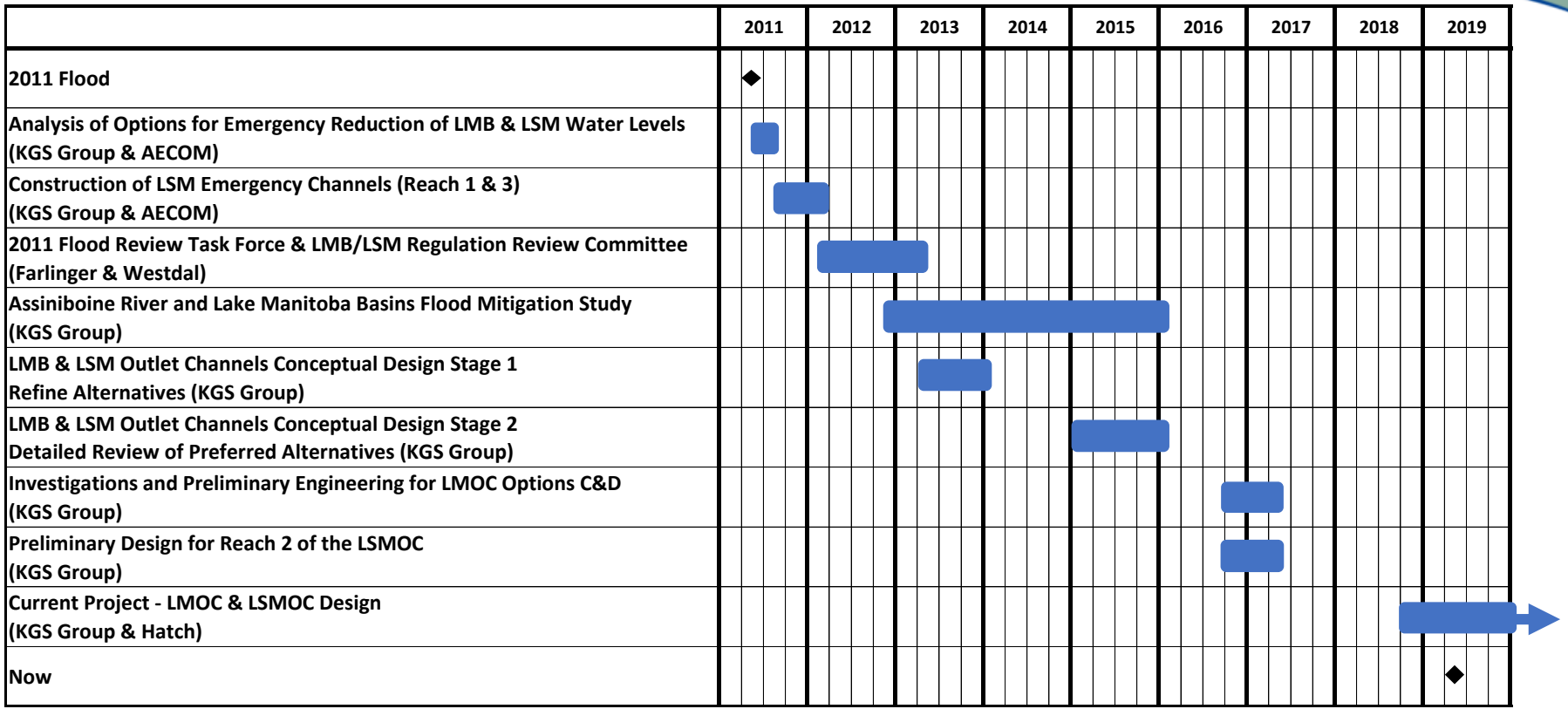
Timeline



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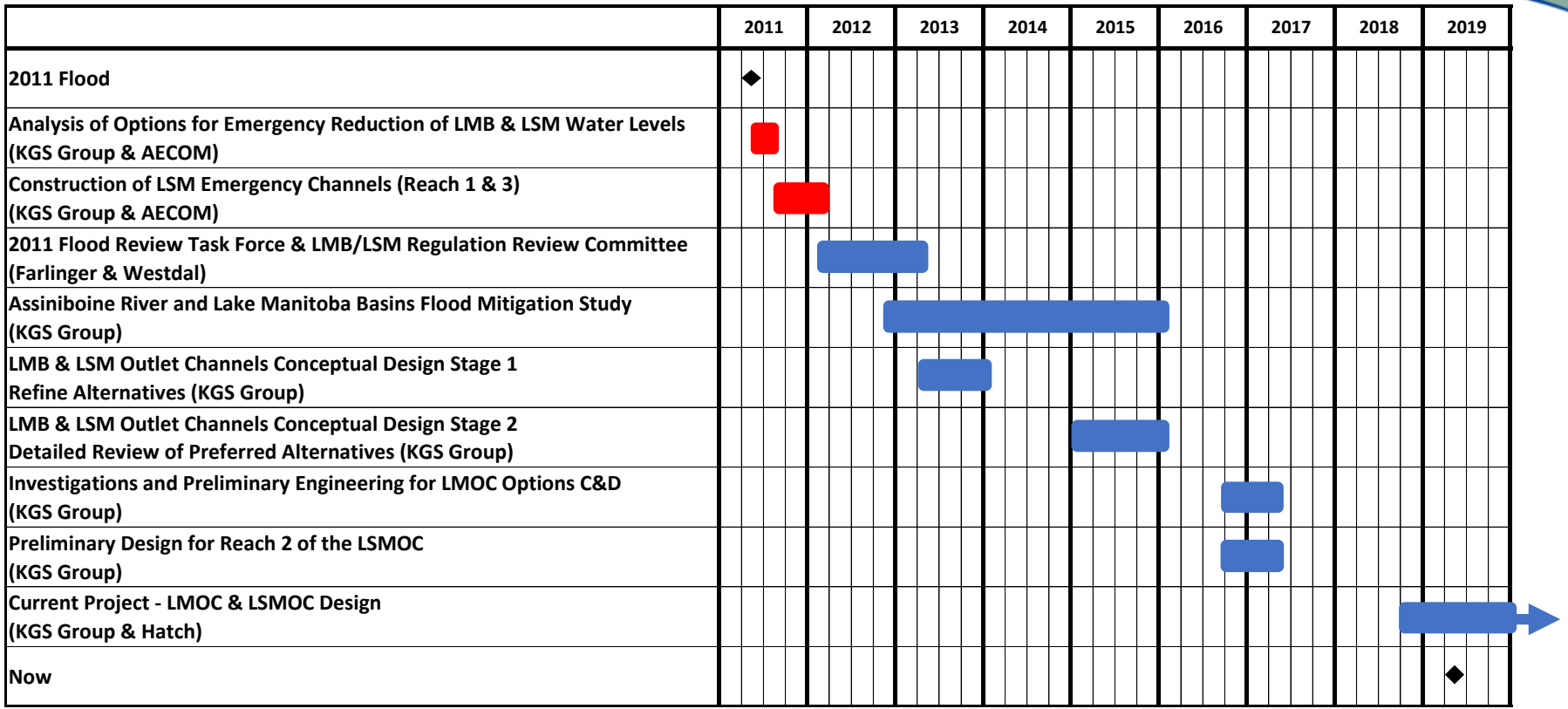
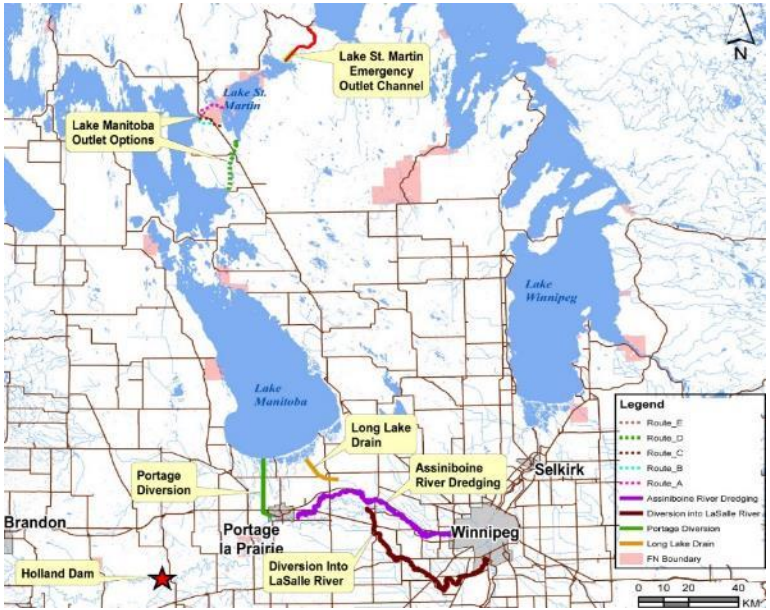
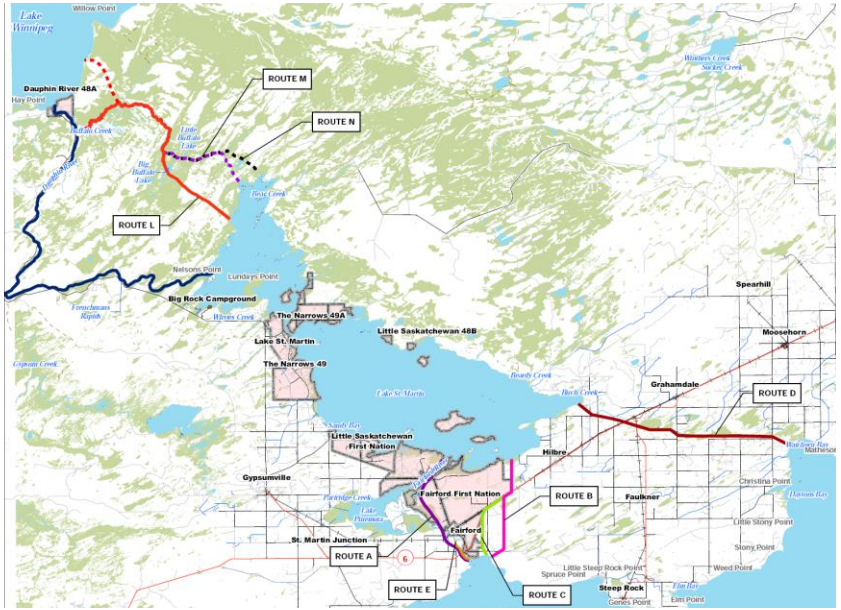
Timeline



Emergency Reduction of LMB/LSM WL

- Range of options and alignments considered
- Construction of LSM Emergency Channel (Reach 1&3)





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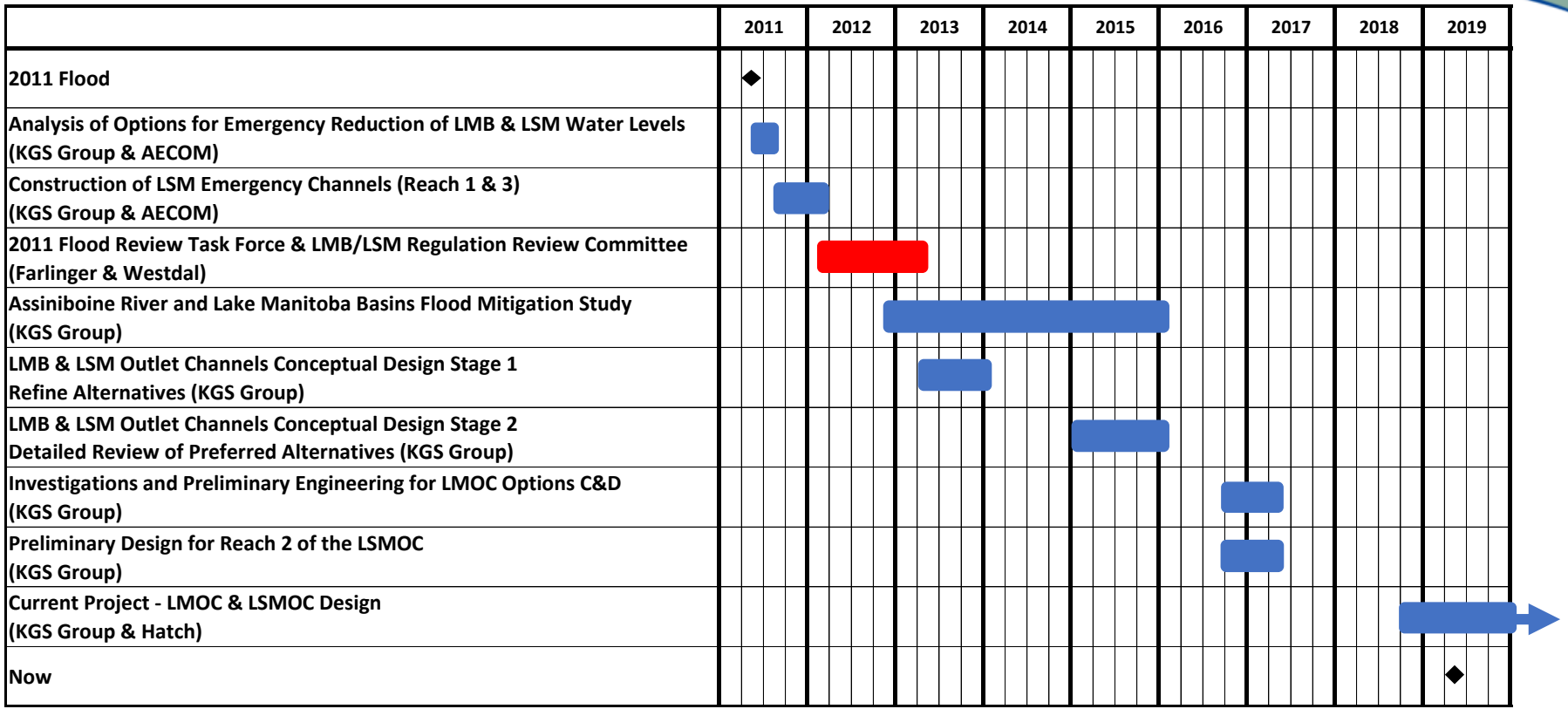

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Post 2011 Flood

- 2011 flood triggered multiple provincial initiatives:
  - 2011 Flood Review Task Force & LMB/LSM Regulation Review Committee
    - Both studies made specific recommendations for permanent additional outlet capacity from LMB/LSM
  - Assiniboine River and Lake Manitoba Basins Flood Mitigation Study

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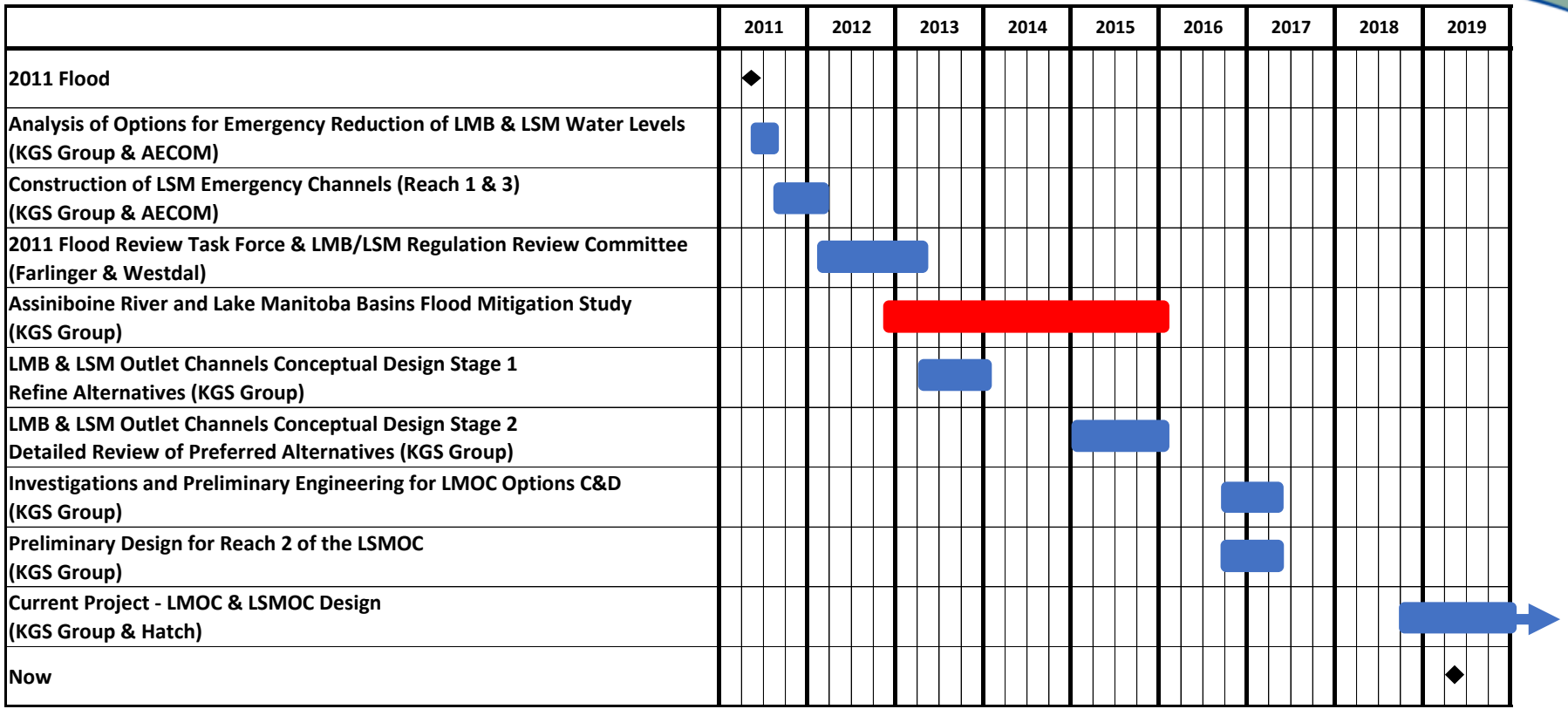
Timeline



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AR and LMB Basins Flood Mitigation Study

- 3-year study which considered entirety of both Lake Manitoba and Assiniboine River basins
- Scope included:
  - Identification of major flood vulnerabilities
  - Hydrologic and hydraulic analyses
  - Development of flood protection measures
  - Cost estimates and economic analyses
  - Environmental & socio-economic considerations (screening)
  - Public open house events in Dauphin, Brandon & Portage la Prairie
    - June 2013 & Dec 2014

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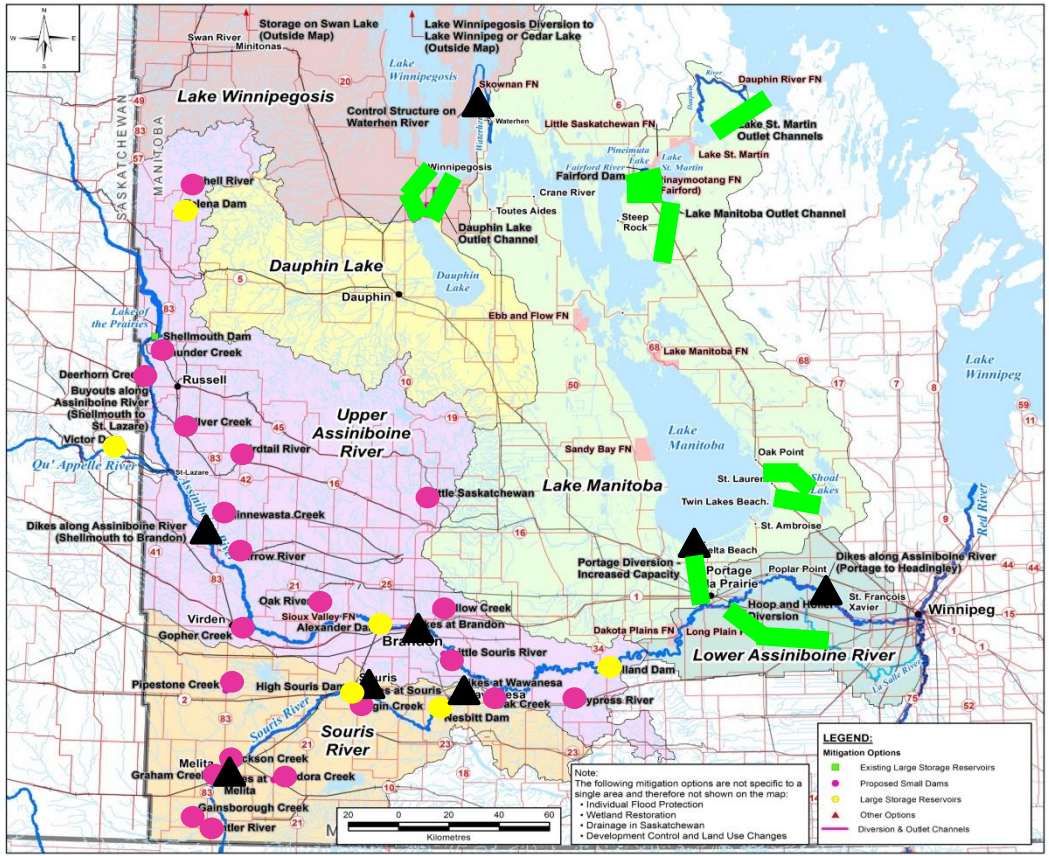
AR and LMB Basins Flood Mitigation Study



Over 70 potential options considered

- Large Dams
- Small Dams
- Diversion Outlet Channels
- Others (e.g. Dikes, Control Structures, Individual flood proofing…)

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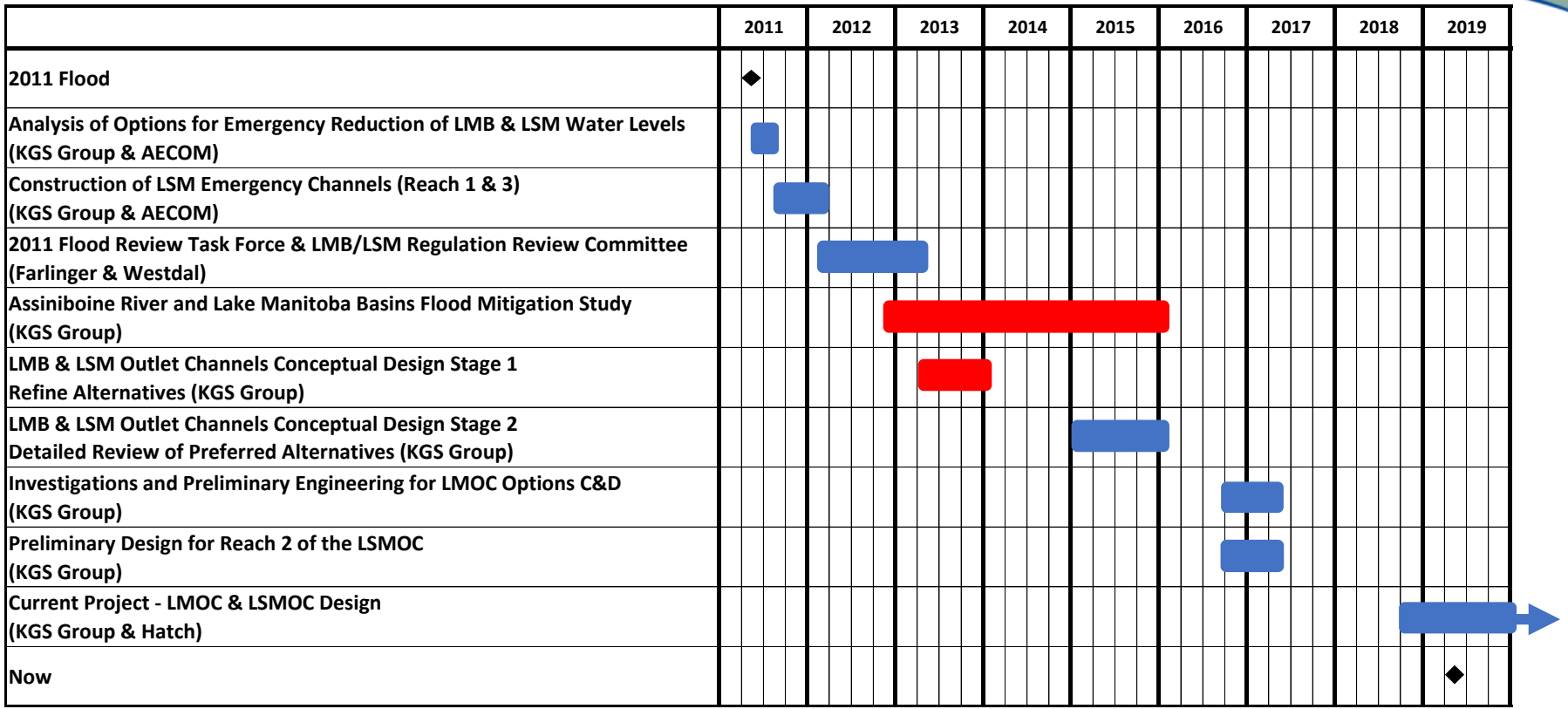
Timeline



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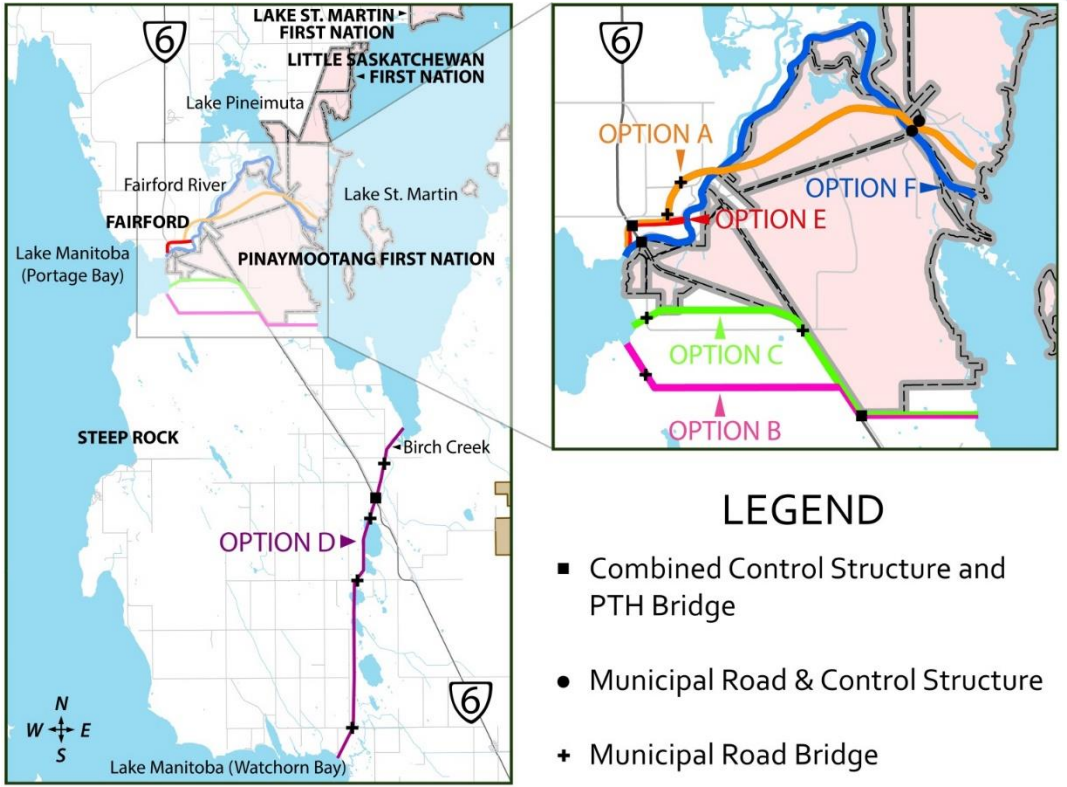
LMB/LSM Outlet Channel Conceptual Design

- Stage 1 study completed in conjunction with AR&LMB Basins Flood Mitigation Study
- Stage 1 goal: refine outlet options for both lakes
  - Considerations to work completed during 2011 flood
  - Development of screening level designs and cost estimates
  - Economic Assessment
  - Initial identification of potential environmental concerns

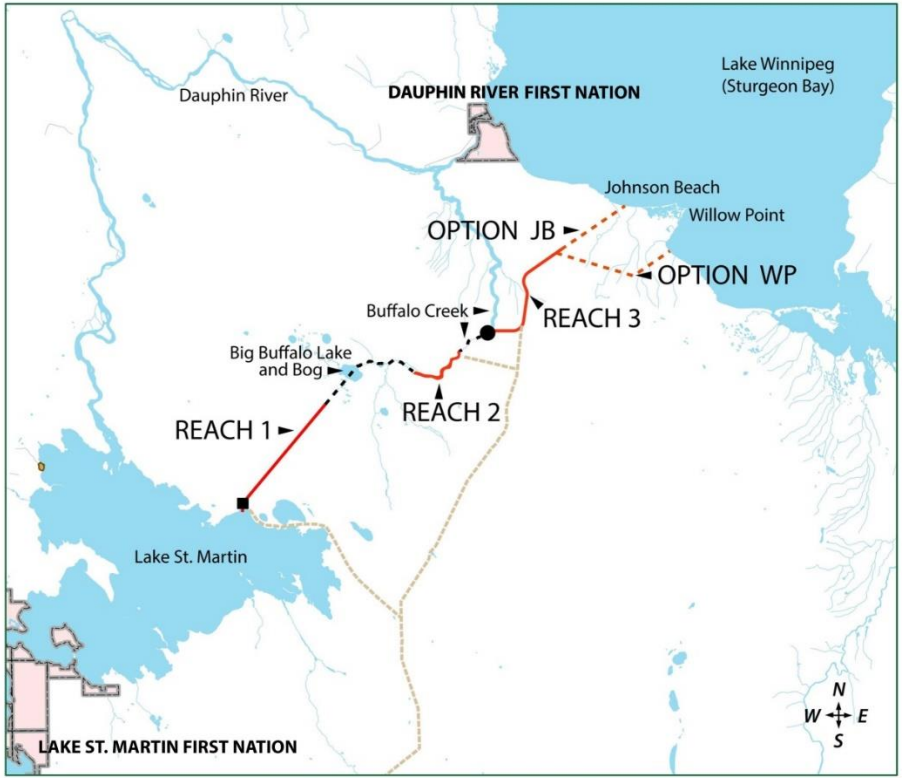
Lake Manitoba Outlet (Stage 1 Study)

- 6 alignment options considered
- Range in flows from 0 to 15,000 cfs
- **Options C & D preferred based on cost and environmental rankings**



Lake St. Martin Outlet (Stage 1 Study)

- 2 alignment options considered for LSM
  - Both through Big Buffalo Lake wetland/bog
- Range in flows from (4000 to 19 000 cfs)
- Both options ranked similarly – **WP option tentatively preferred for socio-economic reasons**



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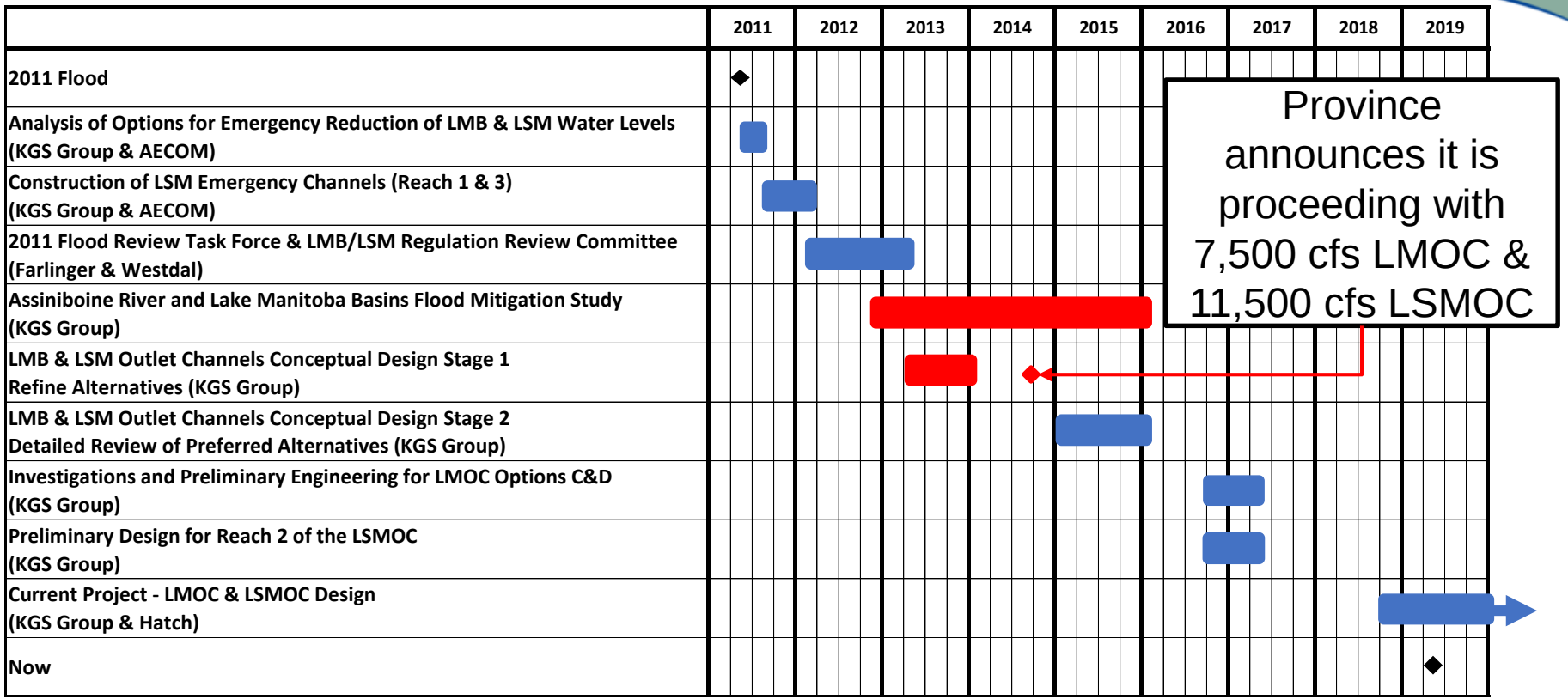

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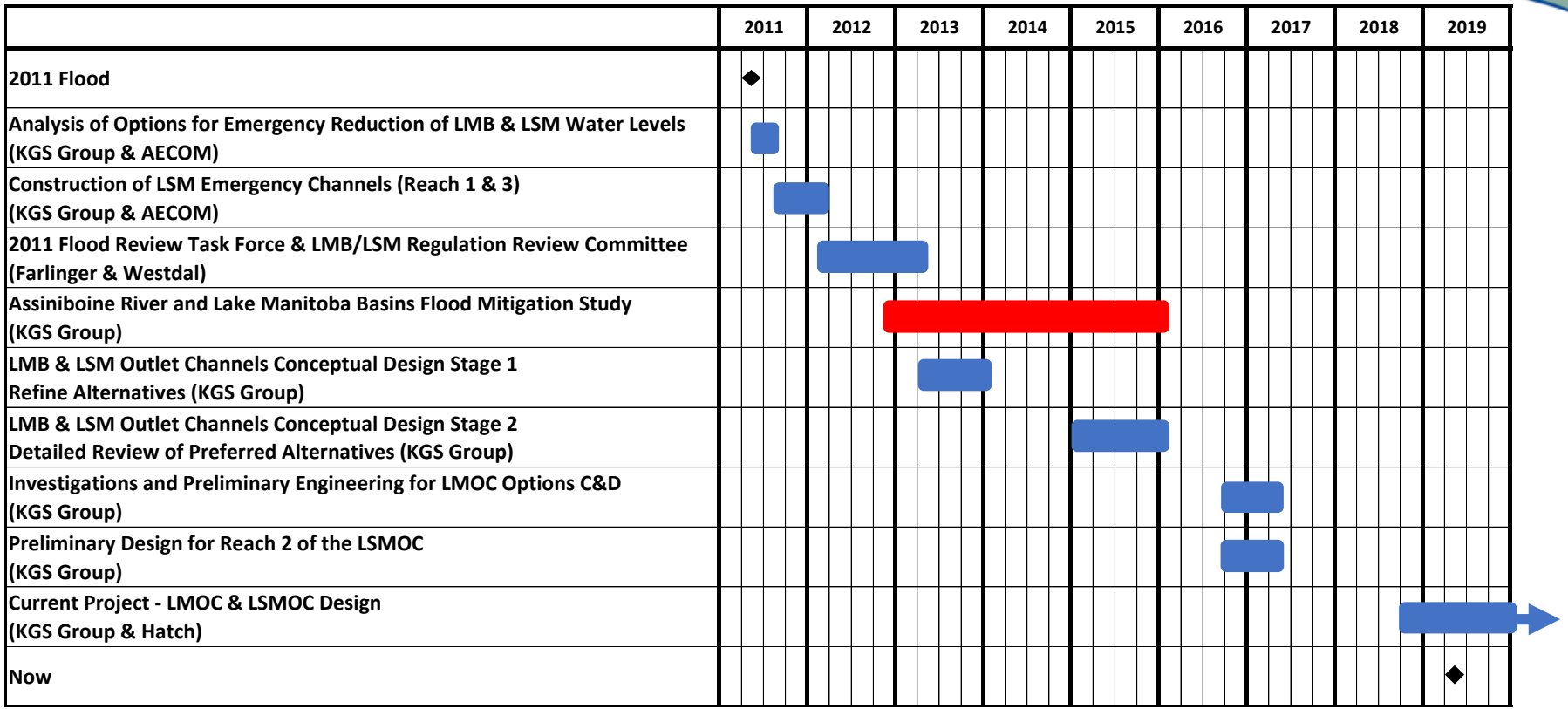
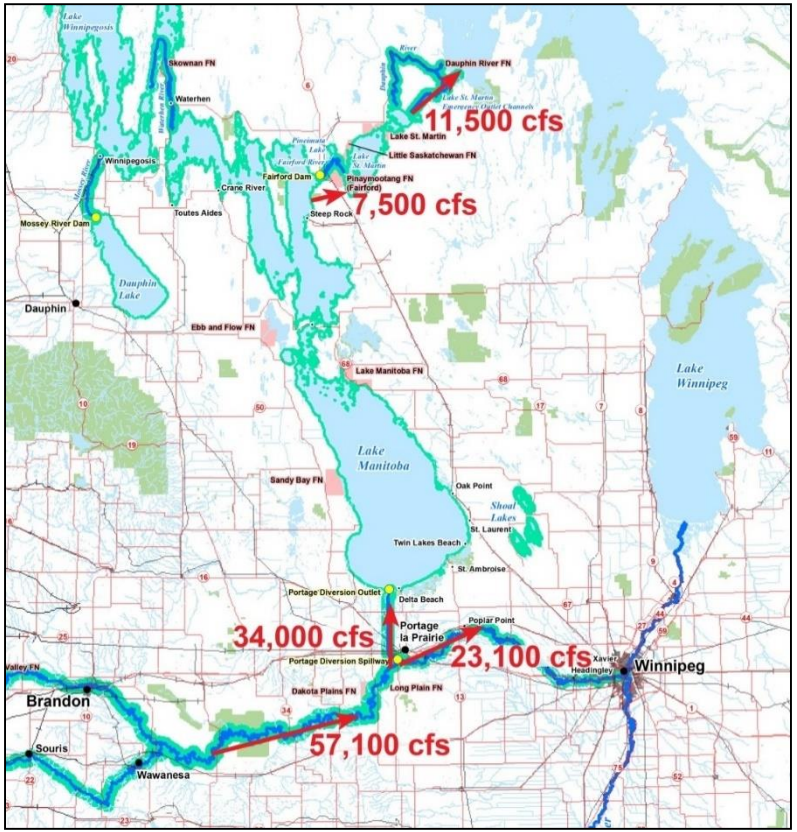


Key Recommendations of Flood Mitigation Study



- **Expansion of the outlet works at LMB & LSM**
- Enhancement of Lower Assiniboine River Dikes
- Expansion of Portage Diversion

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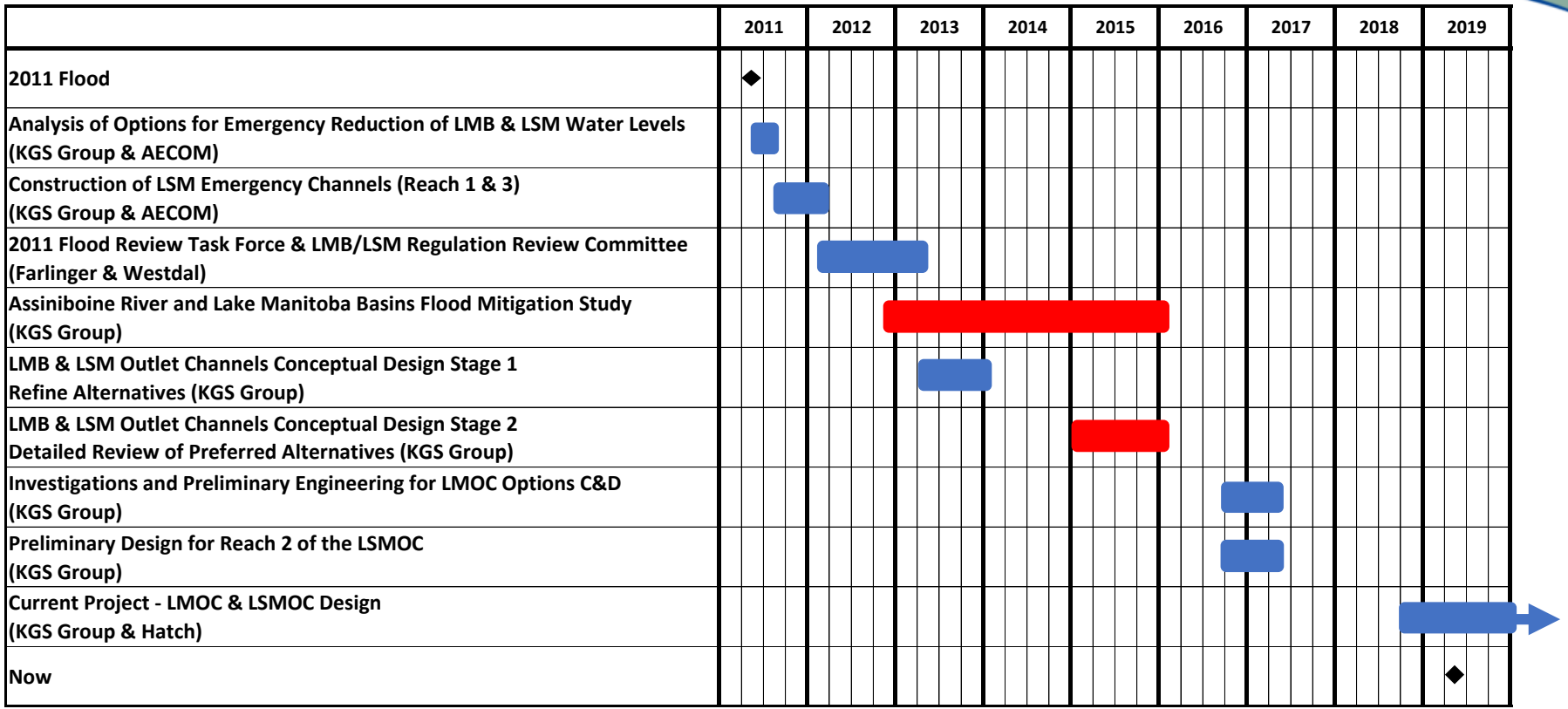
Timeline



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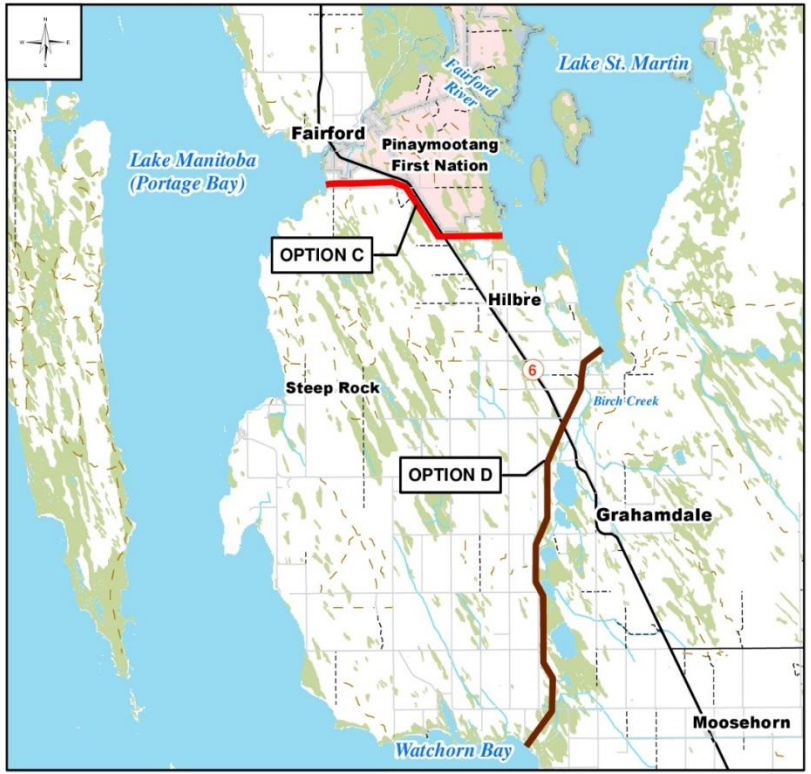
Stage 2 Conceptual Design

- Advancement of conceptual design based on conclusion of Stage 1 study
- Supplemental field investigations
- Environmental screening
- Conceptual cost estimates and schedule
- Additional open house event (Ashern – Sept. 2014)

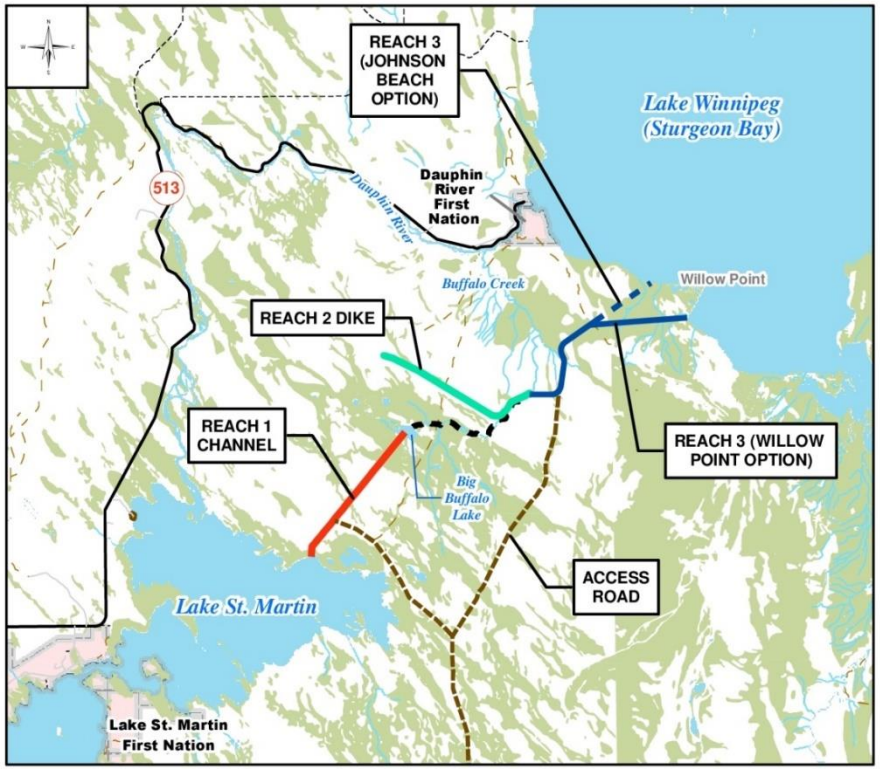
Lake Manitoba Outlet (Stage 2 Study)

- Refinement of alignments
- Key issue:
  - Risks associated with potential groundwater impacts on Route C



Lake St. Martin Outlet (Stage 2 Study)

- Refinement of alignments
- Key Issue
  - Risks associated with water flowing over bog area and surrounding Big Buffalo Lake (plugging due to floating peat)



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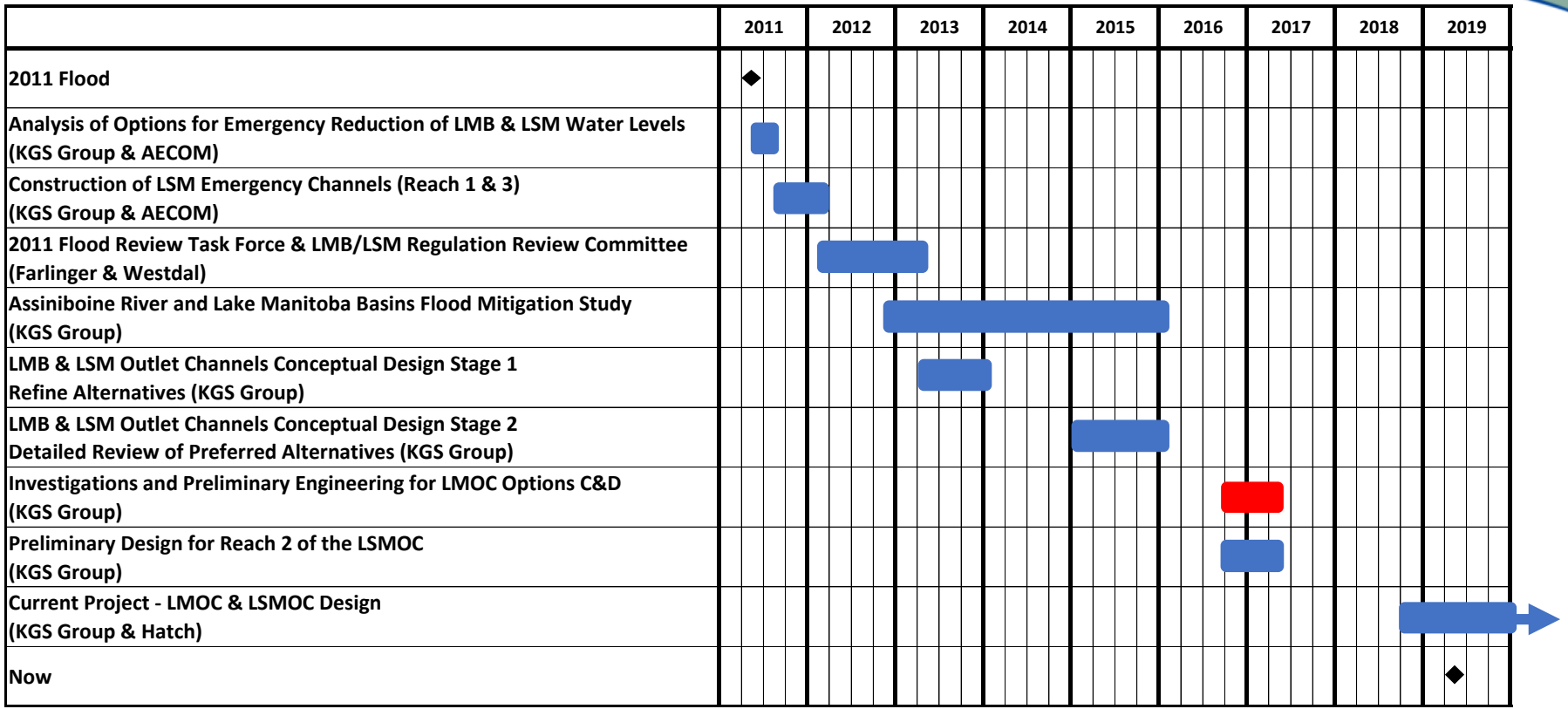
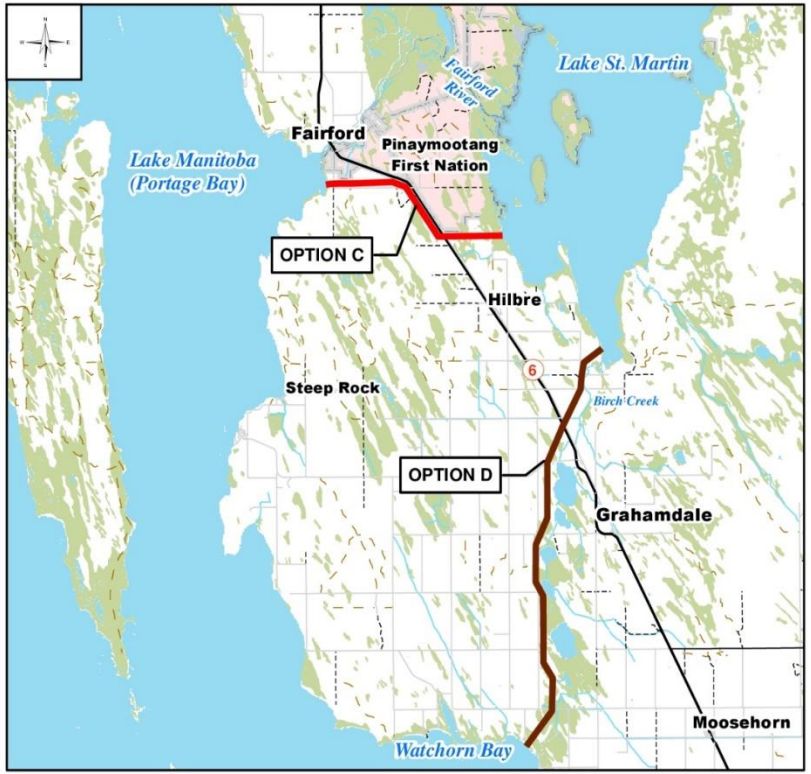


Preliminary Engineering for LMB Options C&D

- Scope of work included:
  - Drilling and monitoring program
  - Groundwater study
  - Surface water study
  - Geotechnical investigations and analyses
  - Risk Assessment



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Preliminary Engineering for LMB Options C&D

- Evaluation Process:
  - Technical workshop
  - Weighting of criteria and rating of options
  - Suitability of the options in meeting project objectives
  - Performance of one option relative to the other

- **Option D scored highest and identified as preferred option**
  - Groundwater impacts and risks were the major factors

Preliminary Engineering for LMB Options C&D

- Based stakeholder input, additional Option “G” considered
- Concluded to have similar concerns to Option C

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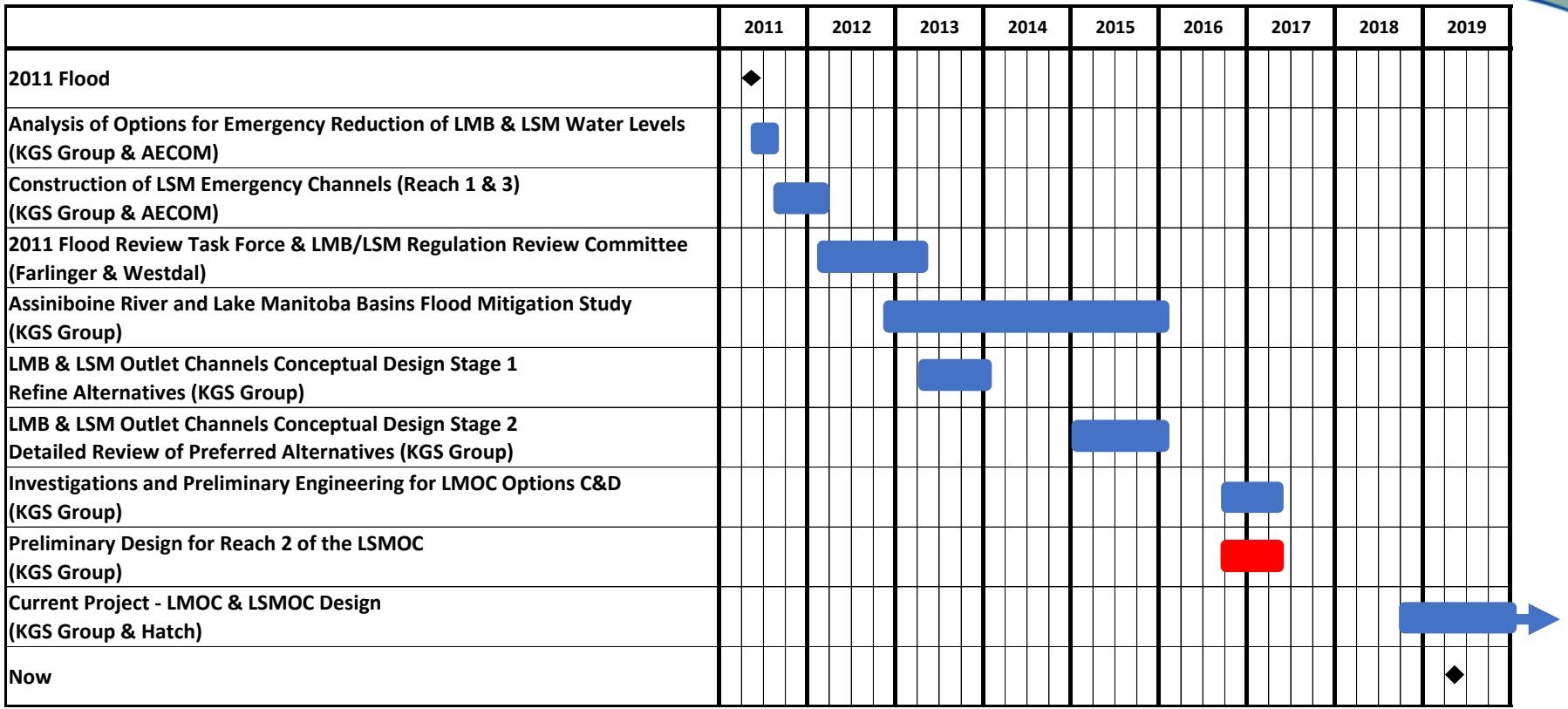

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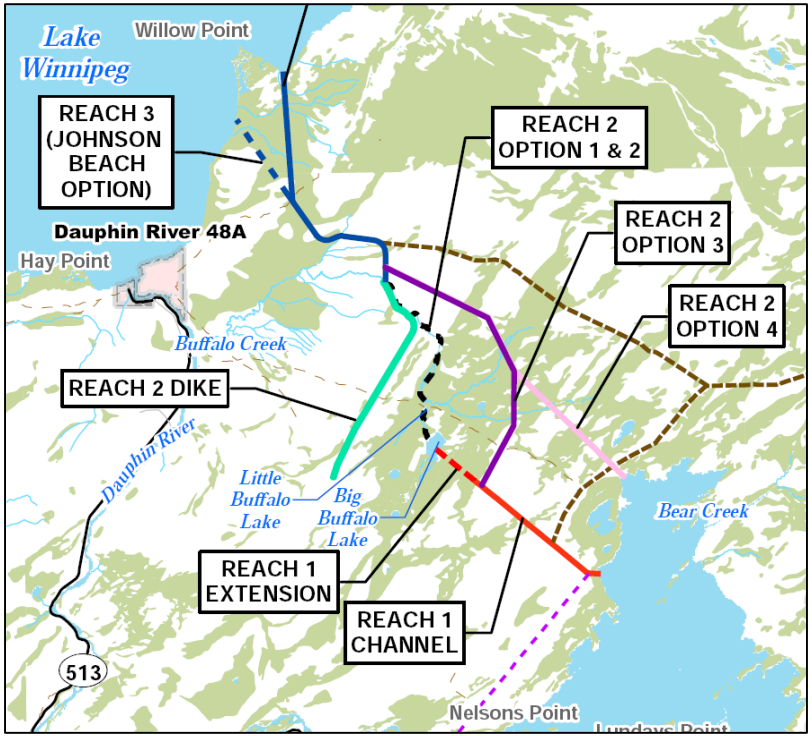
Preliminary Design of Reach 2 of the LSMOC

- Scope of work included:
  - Field Investigations
  - Constructability
  - Operational risks
  - Environmental comparison
  - Maintenance and inspection
  - Cost Estimates
  - Evaluation of options
  - Preliminary Design



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Preliminary Design of Reach 2 of the LSMOC

- Evaluation Process:
  - Technical workshop
  - Weighting of criteria and rating of options
- **Option 4 scored highest and identified as preferred option**
  - Risks associated with Big Buffalo lake wetland complex was the major factor (Options 1&2 not preferred)
  - Constructability, O&M, costs (Option 4 over Option 3)
  - Repurpose or decommission Reach 1

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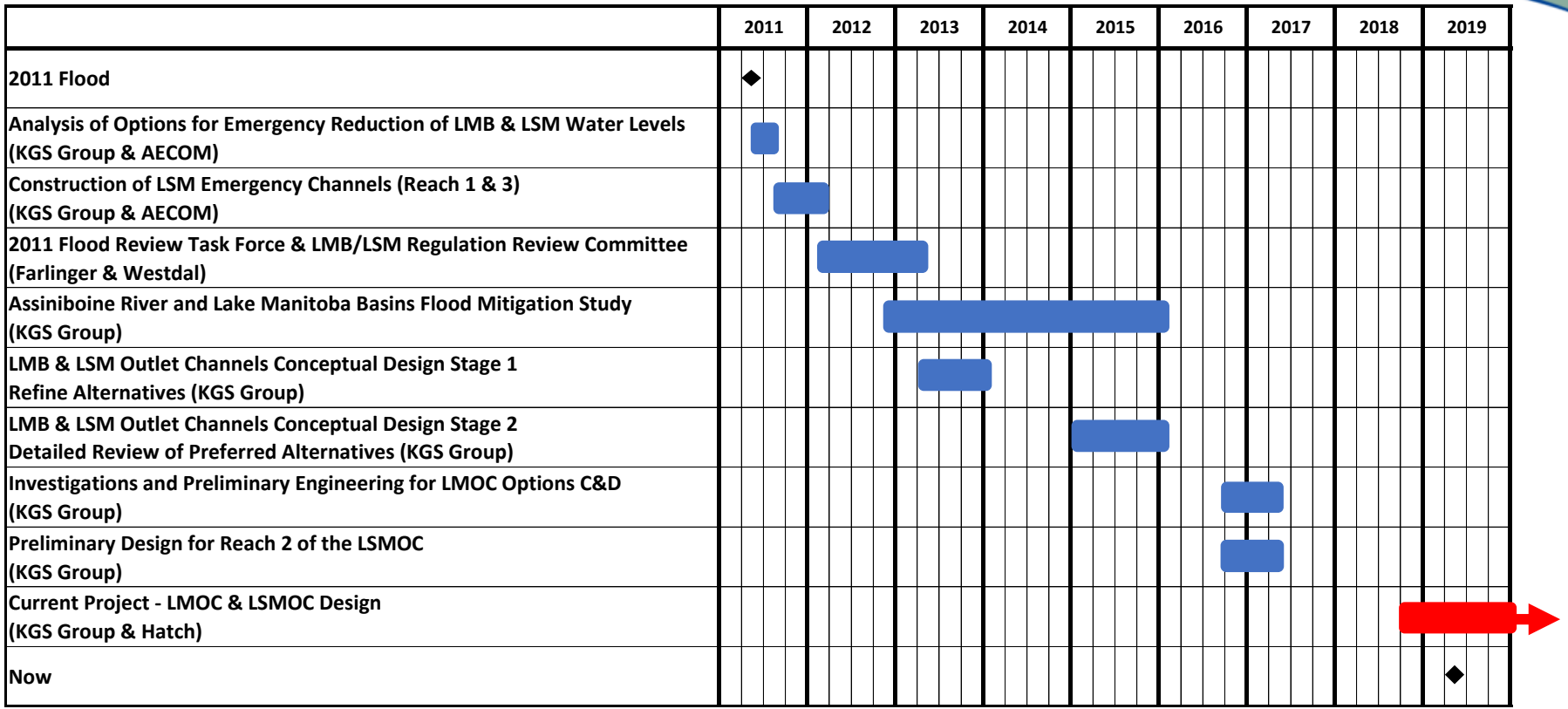
Timeline



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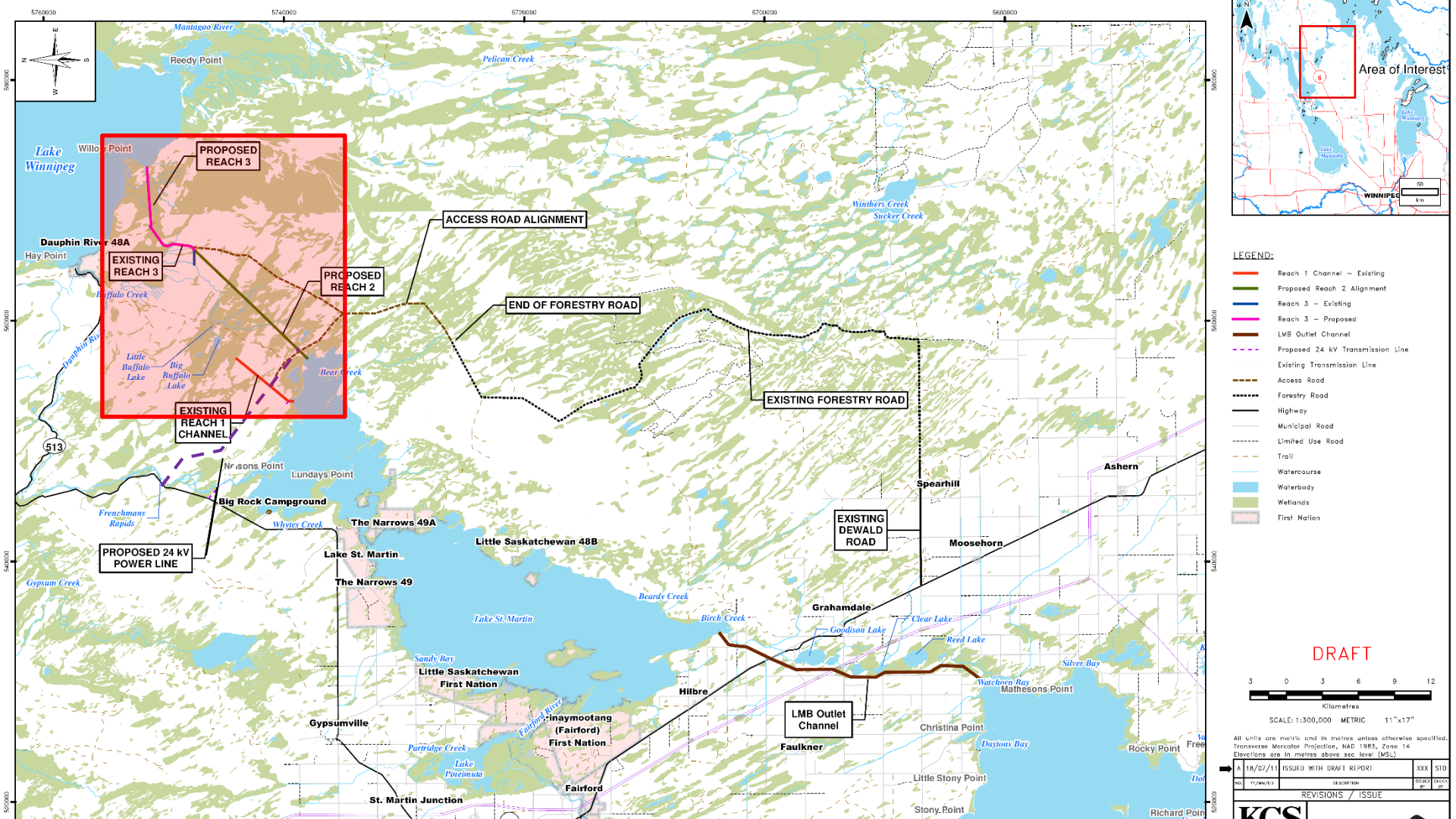
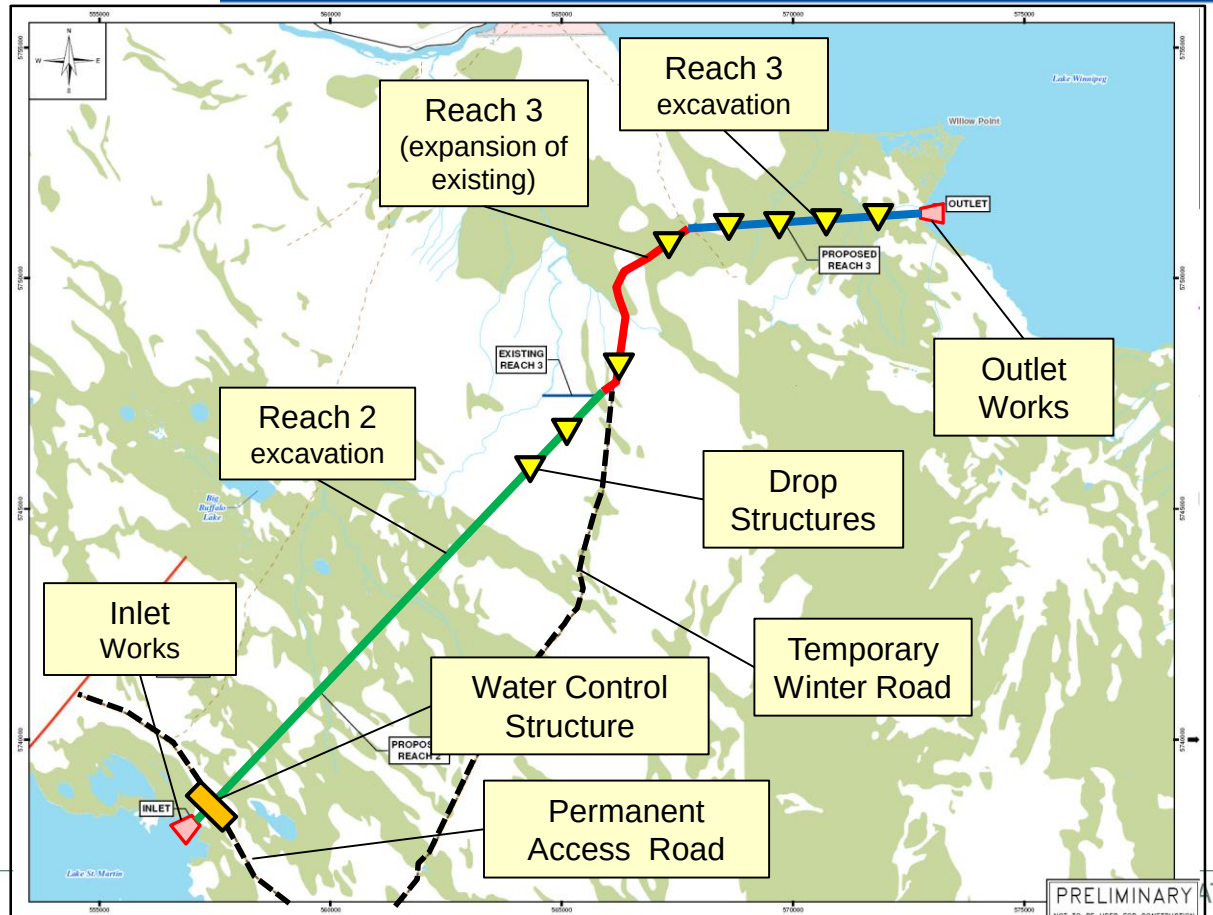
Lake St. Martin Outlet Channel Project


PROPOSED REACH 3
EXISTING REACH 3
PROPOSED REACH 2
ACCESS ROAD ALIGNMENT
END OF FORESTRY ROAD
EXISTING FORESTRY ROAD
EXISTING REACH 1 CHANNEL
PROPOSED 24 kV POWER LINE
EXISTING DEWALD ROAD
LMB Outlet Channel
Area of Interest
Lake Winnipeg
Dauphin River 48A
Hay Point
Willow Point
Reedy Point
Mantagao River
Pelican Creek
Winthers Creek
Sucker Creek
Buffalo Creek
Little Buffalo Lake
Big Buffalo Lake
Bear Creek
Dauphin River
513
Narrows Point
Lundays Point
Big Rock Campground
Frenchmans Rapids
Whyte Creek
The Narrows 49A
Little Saskatchewan 48B
Lake St. Martin
The Narrows 49
Gypsum Creek
Beardy Creek
Birch Creek
Lake St. Martin
Sandy Bay
Little Saskatchewan First Nation
Gypsumville
Partridge Creek
Lake Pineimuta
Fairford River
Pinaymootang (Fairford) First Nation
Fairford
St. Martin Junction
Hilbre
Faulkner
Spearhill
Ashern
Moosehorn
Grahamdale
Goodison Lake
Clear Lake
Reed Lake
Silver Bay
Watchorn Bay
Mathesons Point
Christina Point
Dayton Bay
Rocky Point
Little Stony Point
Stony Point
Richard Point
Lake Winnipeg
Lake Manitoba
WINNIPEG
LEGEND:
Reach 1 Channel – Existing
Proposed Reach 2 Alignment
Reach 3 – Existing
Reach 3 – Proposed
LMB Outlet Channel
Proposed 24 kV Transmission Line
Existing Transmission Line
Access Road
Forestry Road
Highway
Municipal Road
Limited Use Road
Trail
Watercourse
Waterbody
Wetlands
First Nation
DRAFT
3 0 3 6 9 12
Kilometres
SCALE: 1:300,000 METRIC 11"x17"
All units are metric and in metres unless otherwise specified.
Transverse Mercator Projection, NAD 1983, Zone 14
Elevations are in metres above sea level (MSL)
A 18/07/11 ISSUED WITH DRAFT REPORT XXX STO
REVISIONS / ISSUE
KGS

Lake St. Martin Outlet Channel Description



- Design continues to evolve
- Alignment is fixed
- Profile being updated
- Number, location & type of drop structures under review
- WCS location may change

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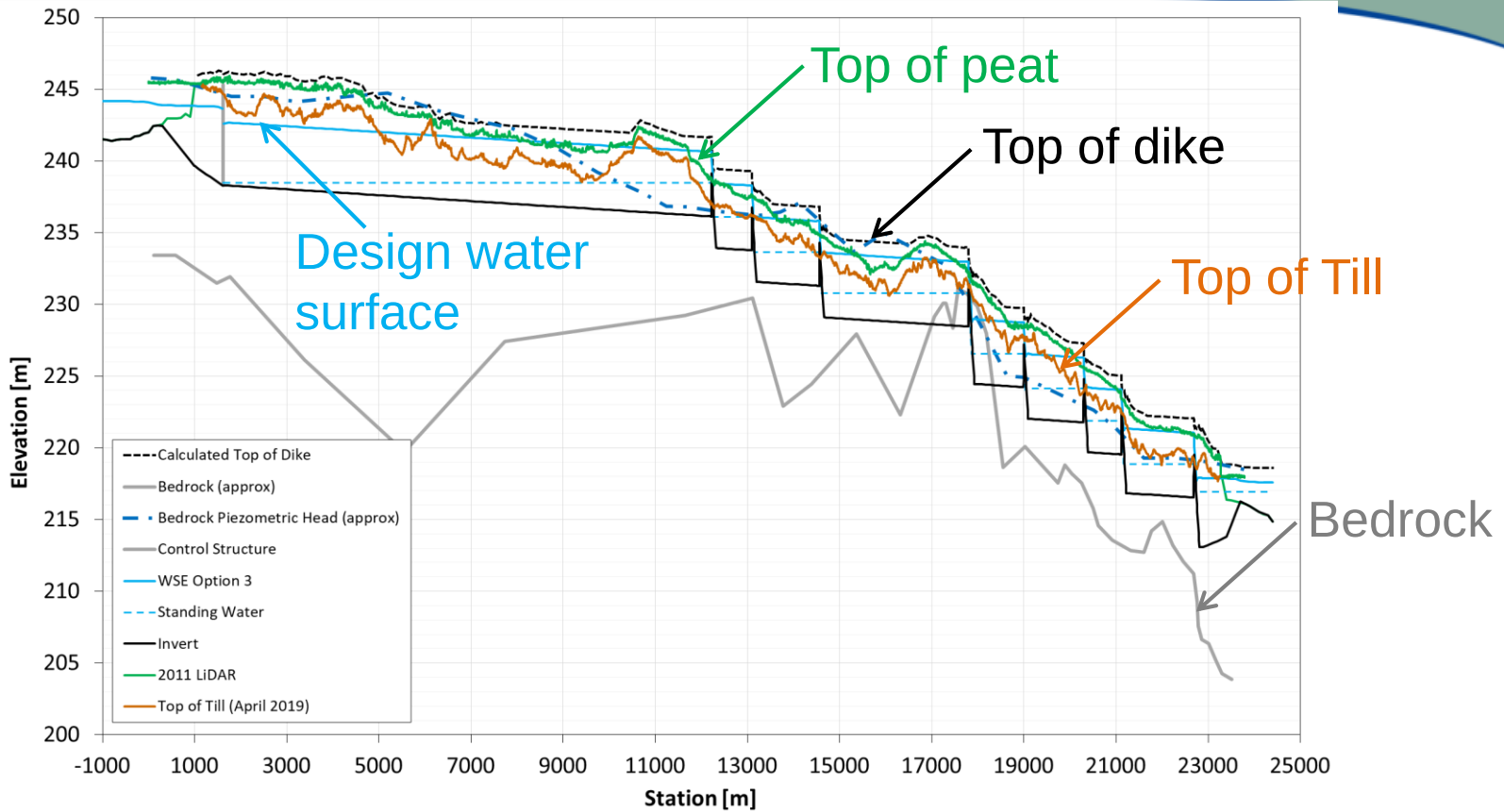
Channel Profile (Current Status)



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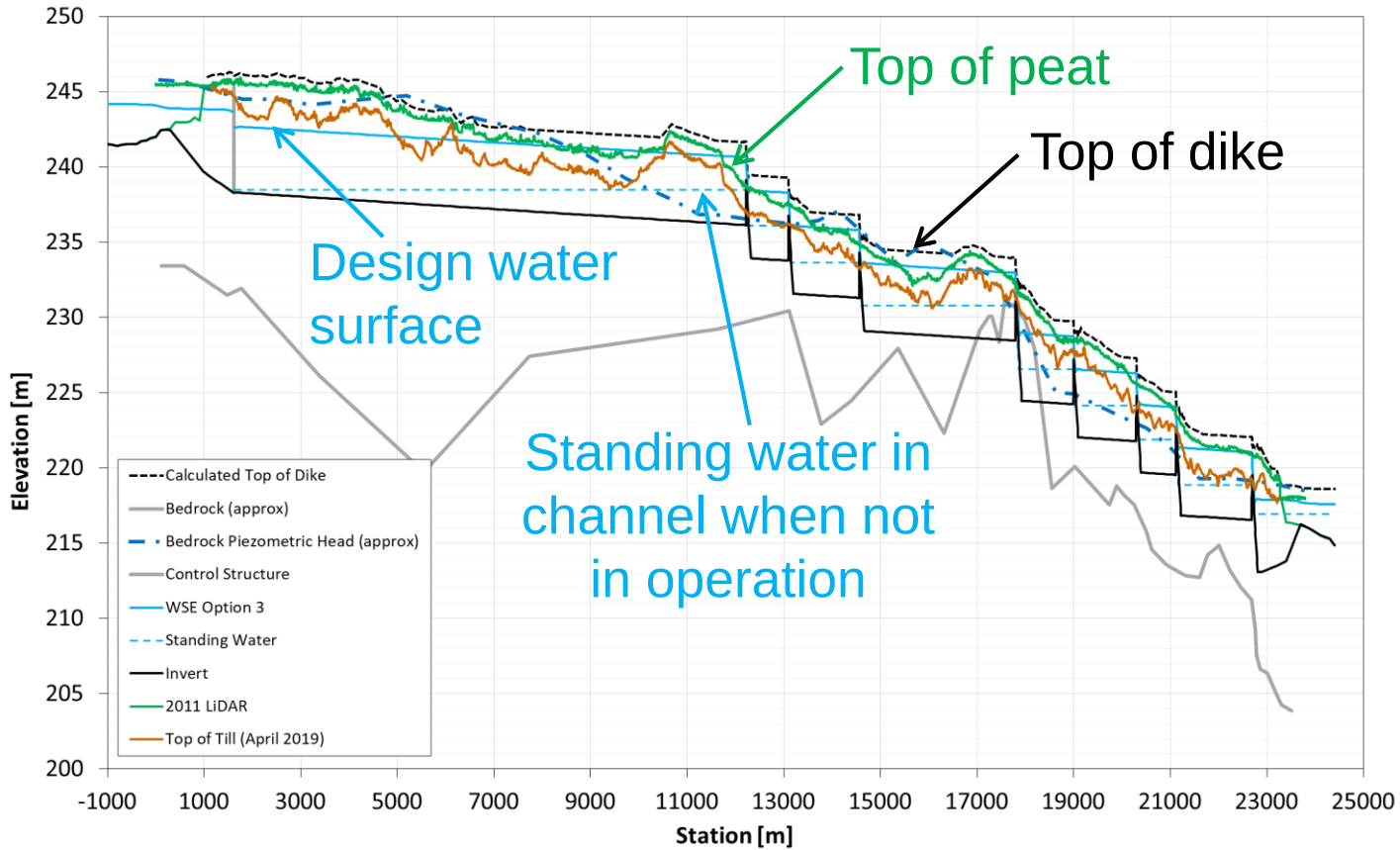

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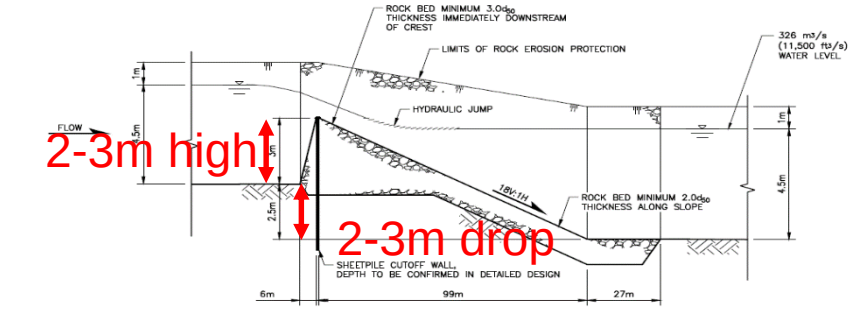
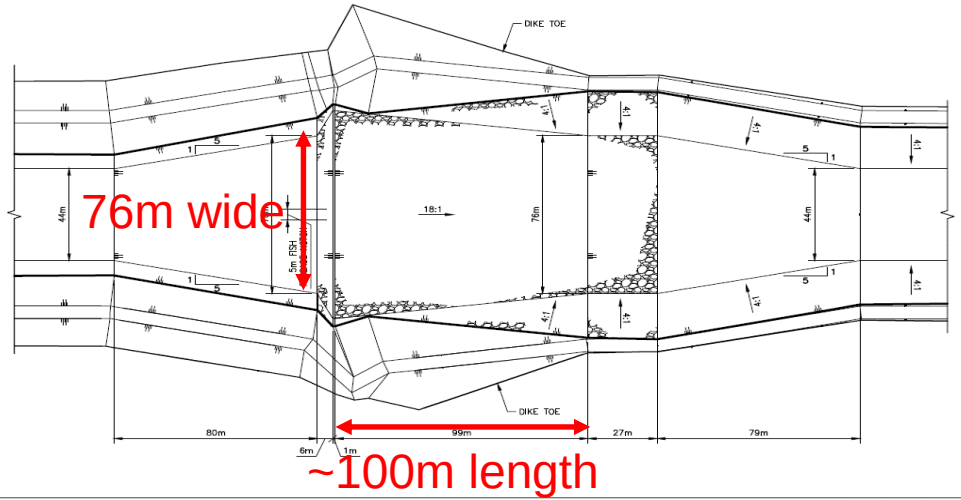
Standing Water in Channel (min. 1m depth)

- Minimizes potential for fish kill due to ice growth and anoxic conditions (need base flow) for stranded fish.
- Reduces extents of channel side slopes exposed to risk of poor vegetation growth due to prolonged wet/dry cycles.
- Minimizes potential risk of extensive vegetation growth in channel base that could reduce channel capacity.
- Minimizes potential for damage to drop structures and channel erosion due to ice growth in winter.

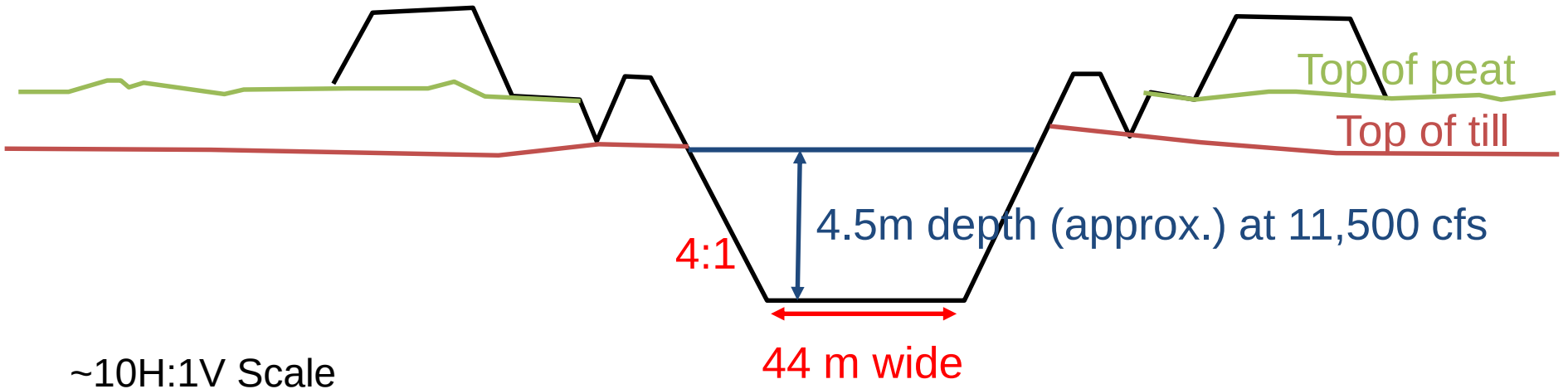
Drop Structures





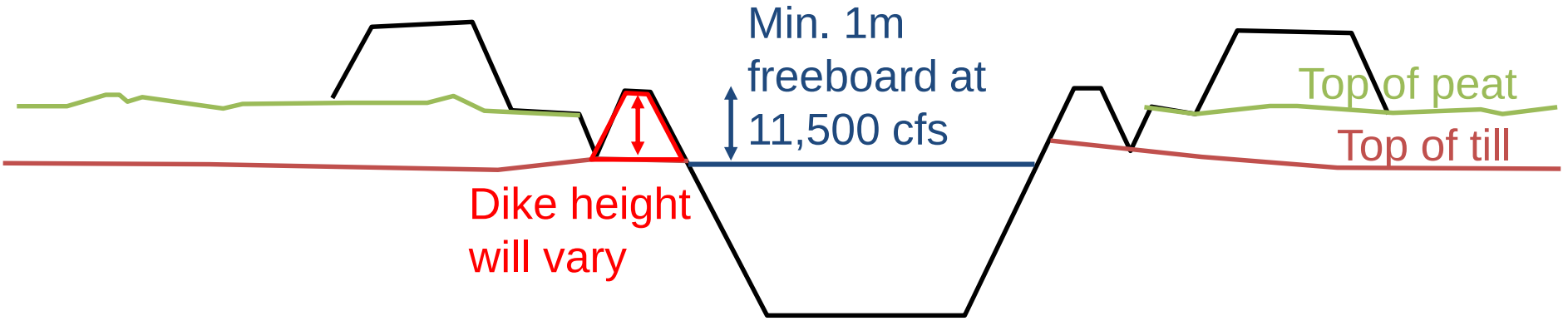
- Rockfill structure (D_{50} ~400mm)
- U/S fish passage not a design requirement
- Notch included at crest to promote D/S fish passage
- Alternate options under considerations (e.g. concrete vertical drop structure)
- Considerations to winter flows and operating guidelines

Typical Cross Section



~10H:1V Scale

Typical Cross Section



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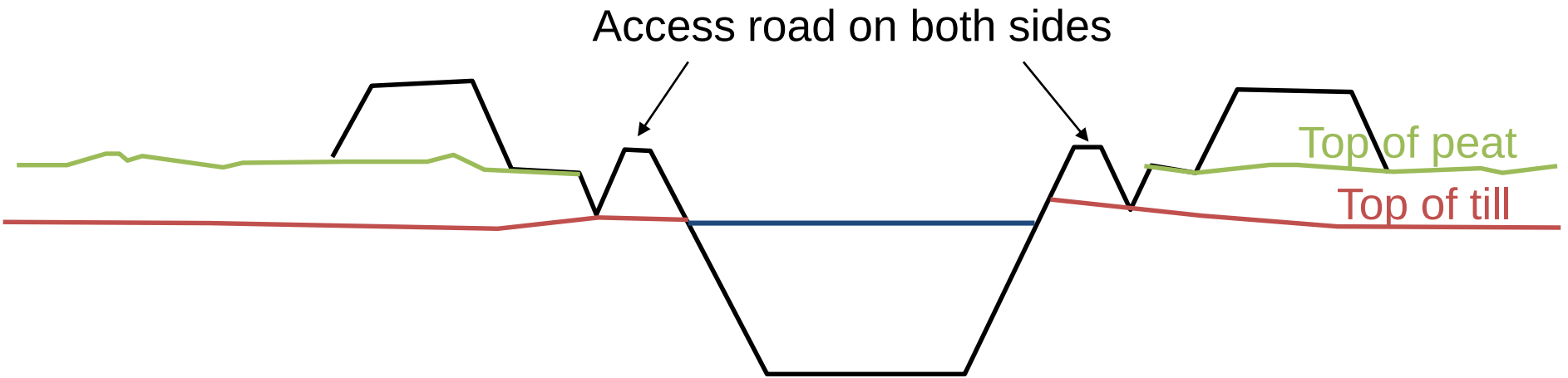

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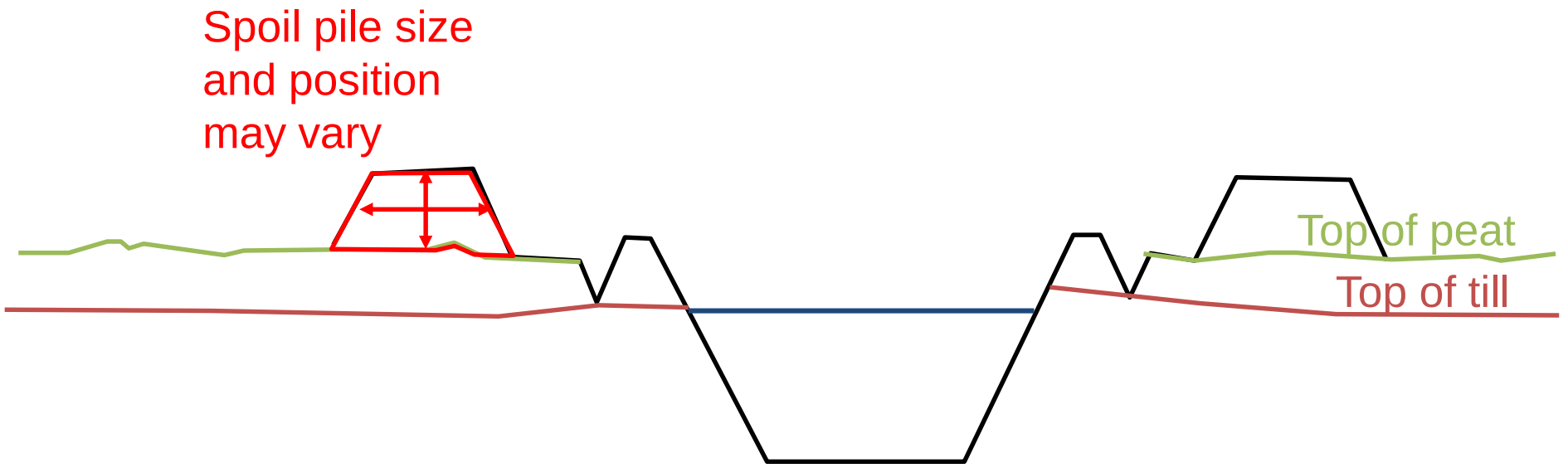

~10H:1V Scale

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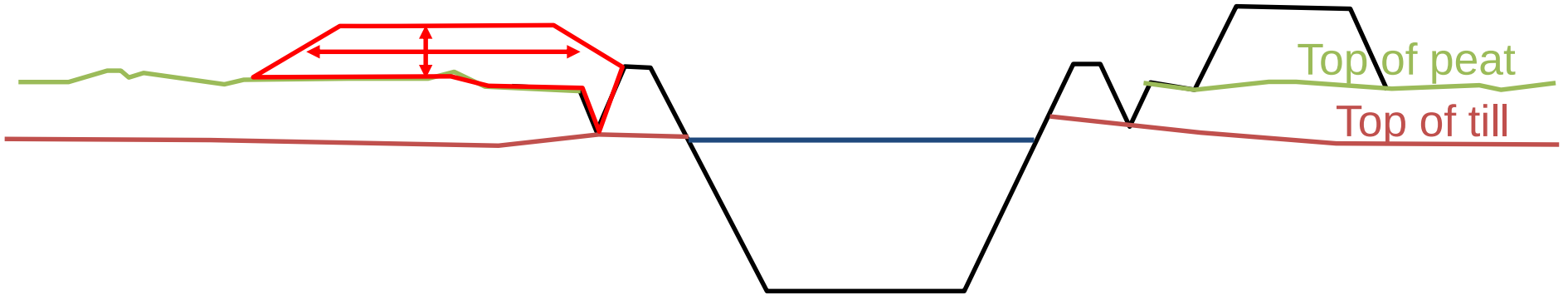
Typical Cross Section

Spoil pile size
and position
may vary



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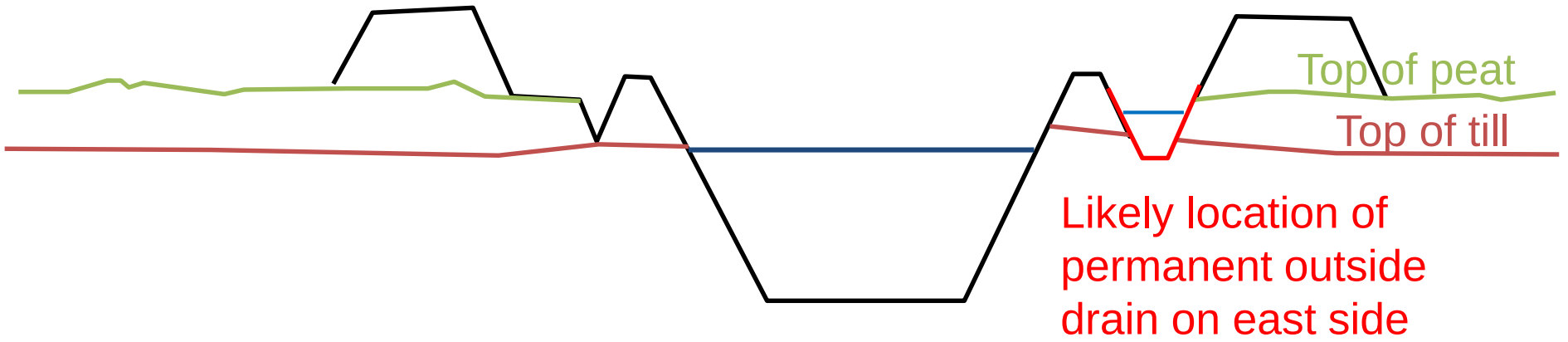

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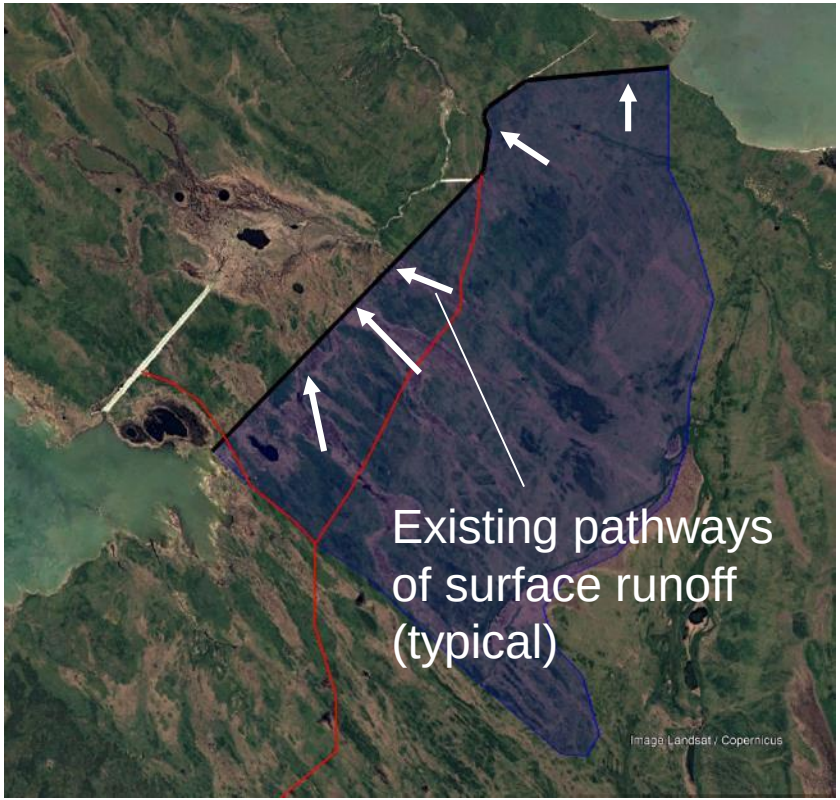
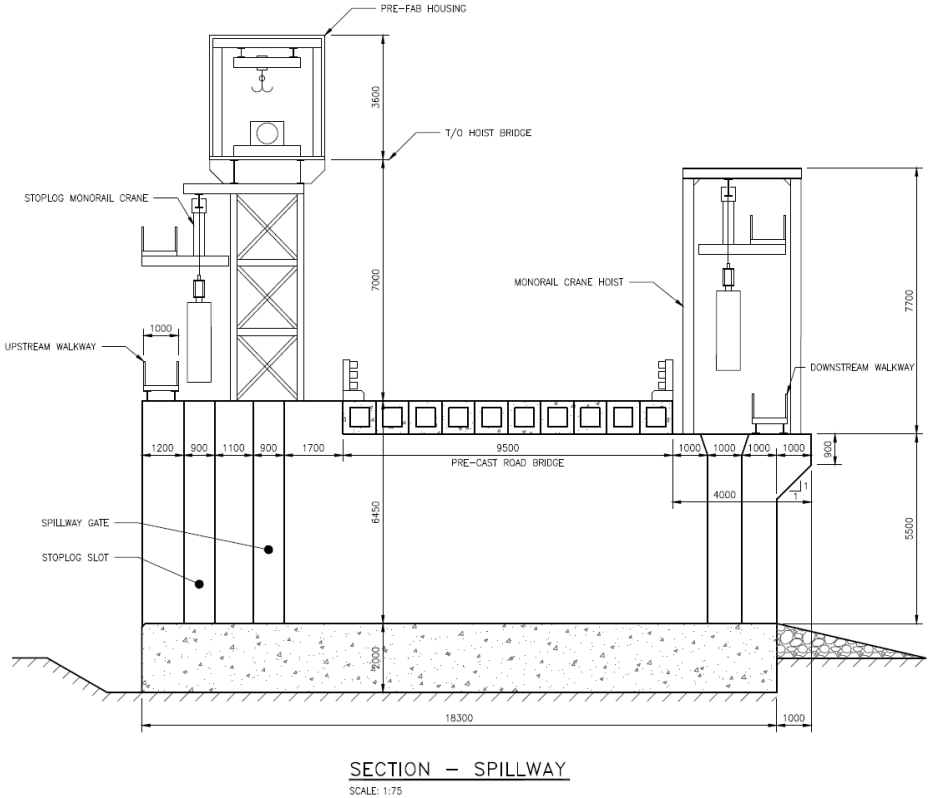
Surface Water Drainage

- Outside drain to be included on east side
- Discharge into channel at predetermined locations
- Extents of peat drainage will vary
- Drainage requirements on west side under review



Water Control Structure



- Concept design sketch
- Currently studying configuration and hoist type
- Similar structure on LMOC

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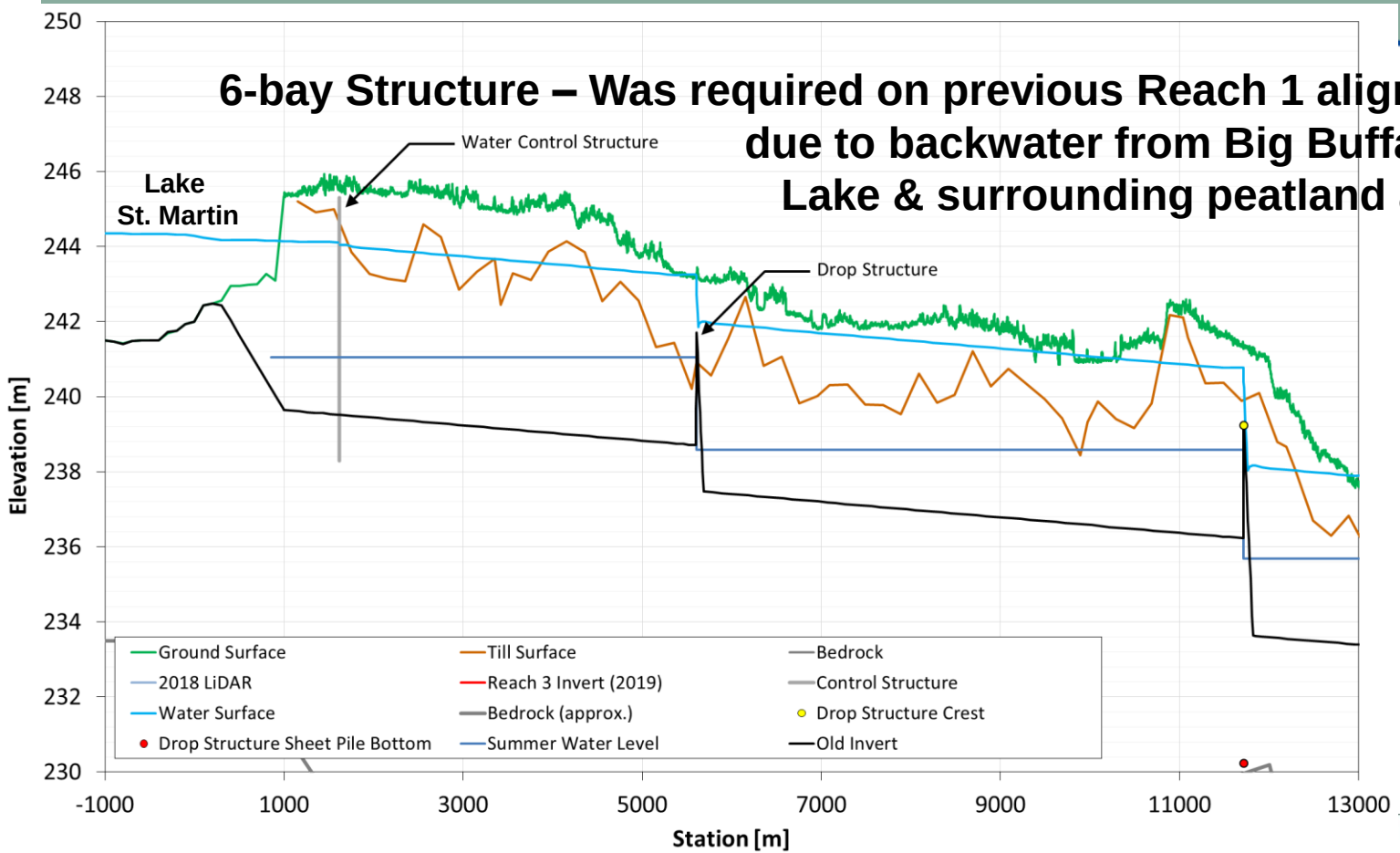
Water Control Structure

6-bay Structure – Was required on previous Reach 1 alignment due to backwater from Big Buffalo Lake & surrounding peatland area



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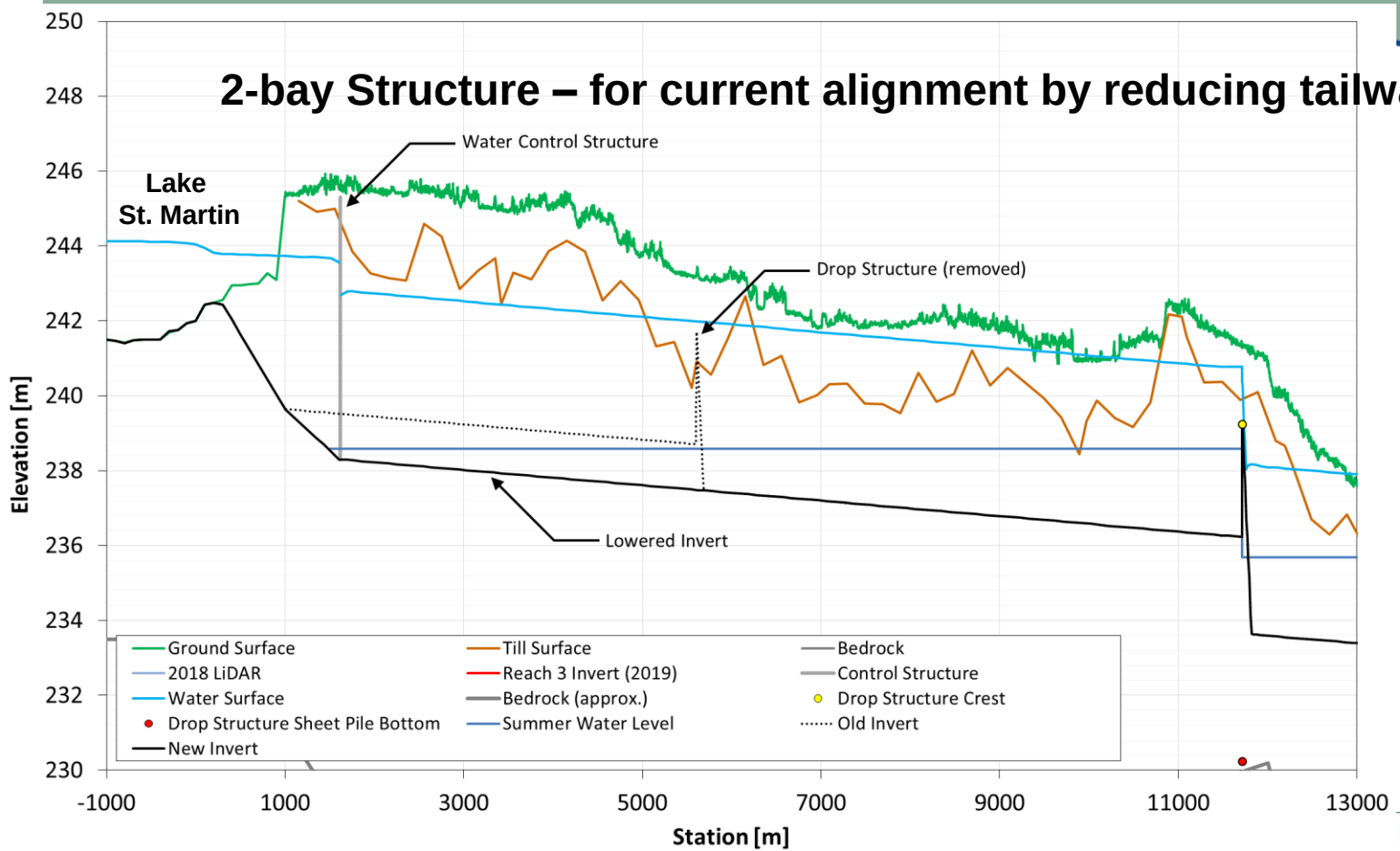
Water Control Structure



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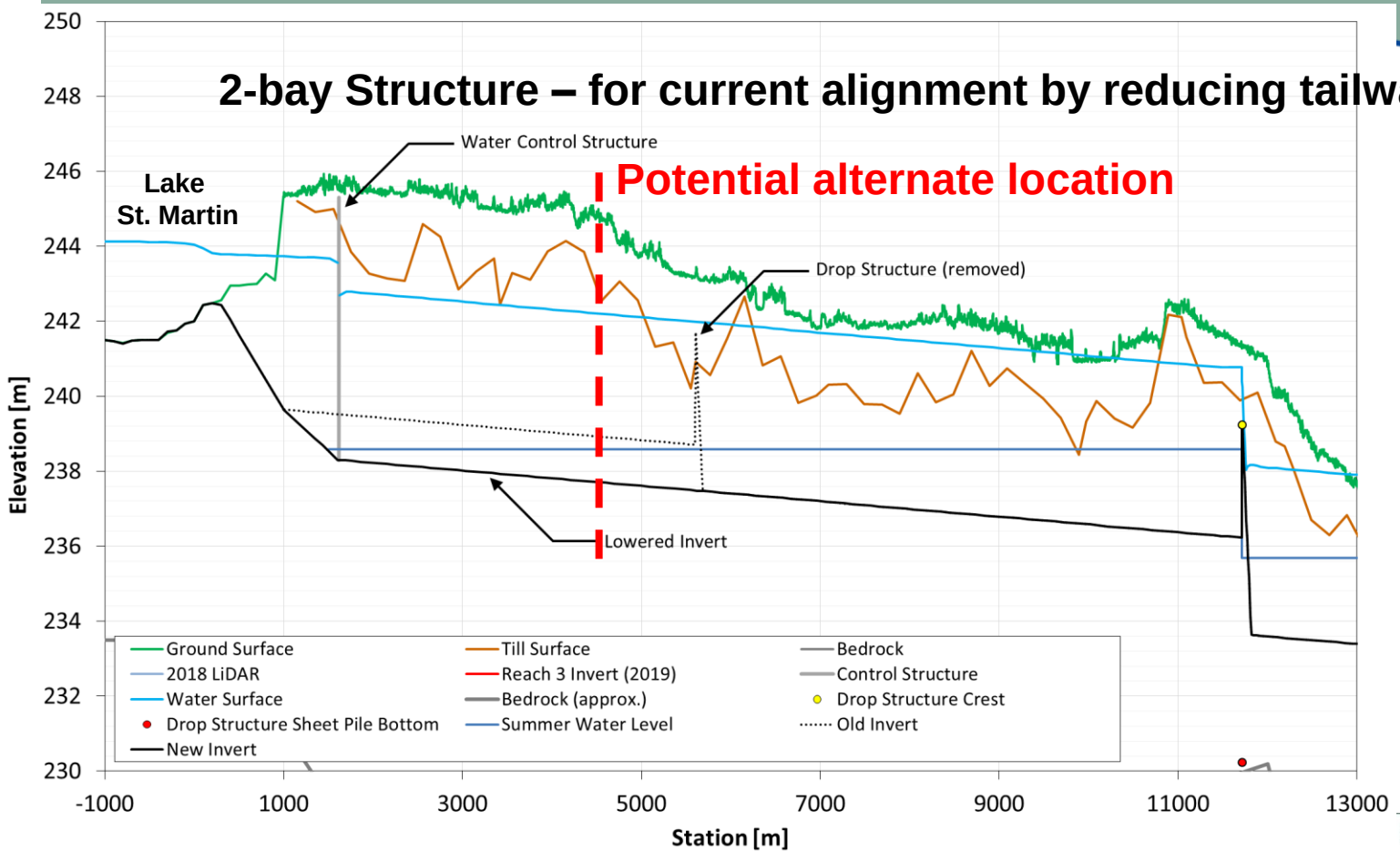
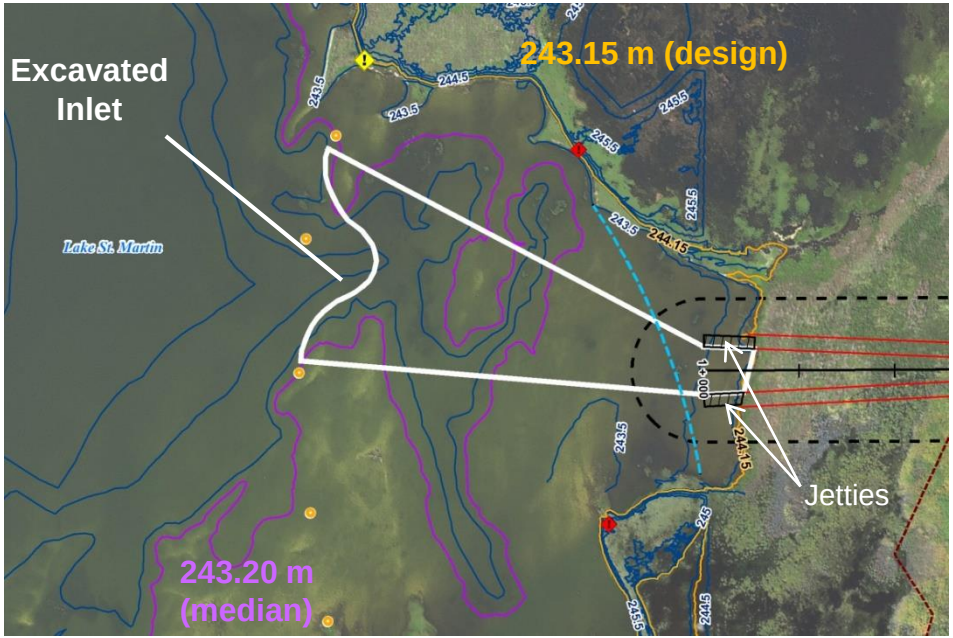
Water Control Structure



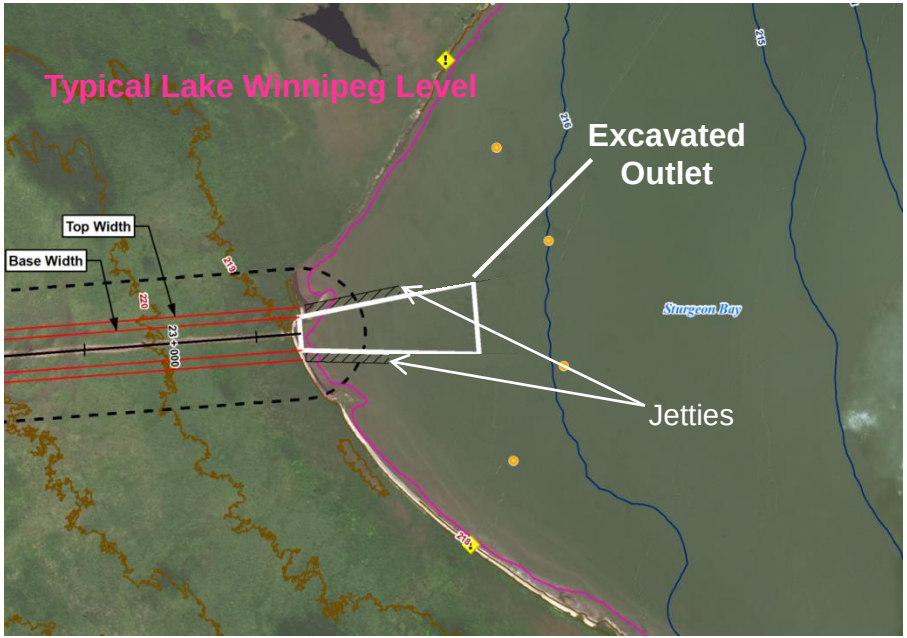
Inlet Works

- Design ongoing
- Lakebed excavation required to achieve design capacity
- Studying shoreline processes
  - stable environment



Outlet Works

- Design ongoing
  - minimize footprint
- Studying shoreline processes
  - dynamic environment
- Key considerations:
  - potential for erosion
  - potential for sedimentation
  - impacts to shoreline geomorphology
  - Design storm / water level



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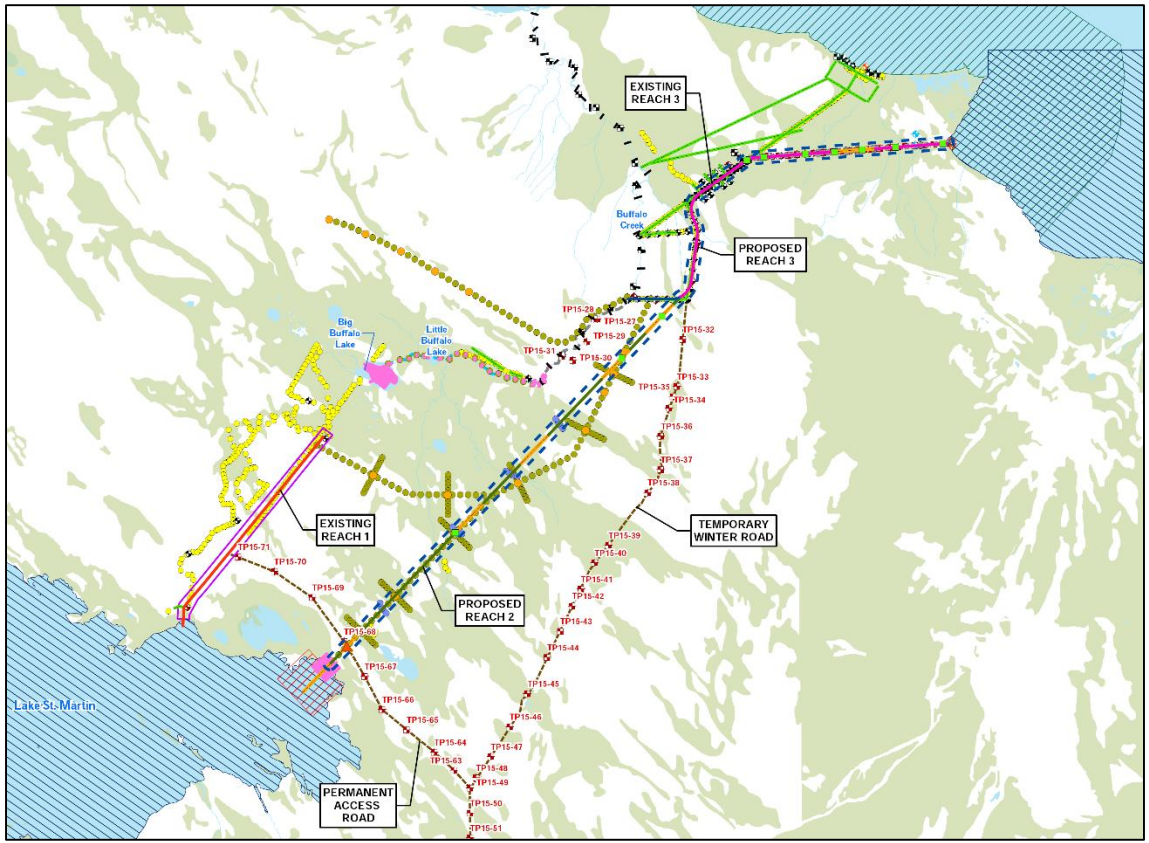
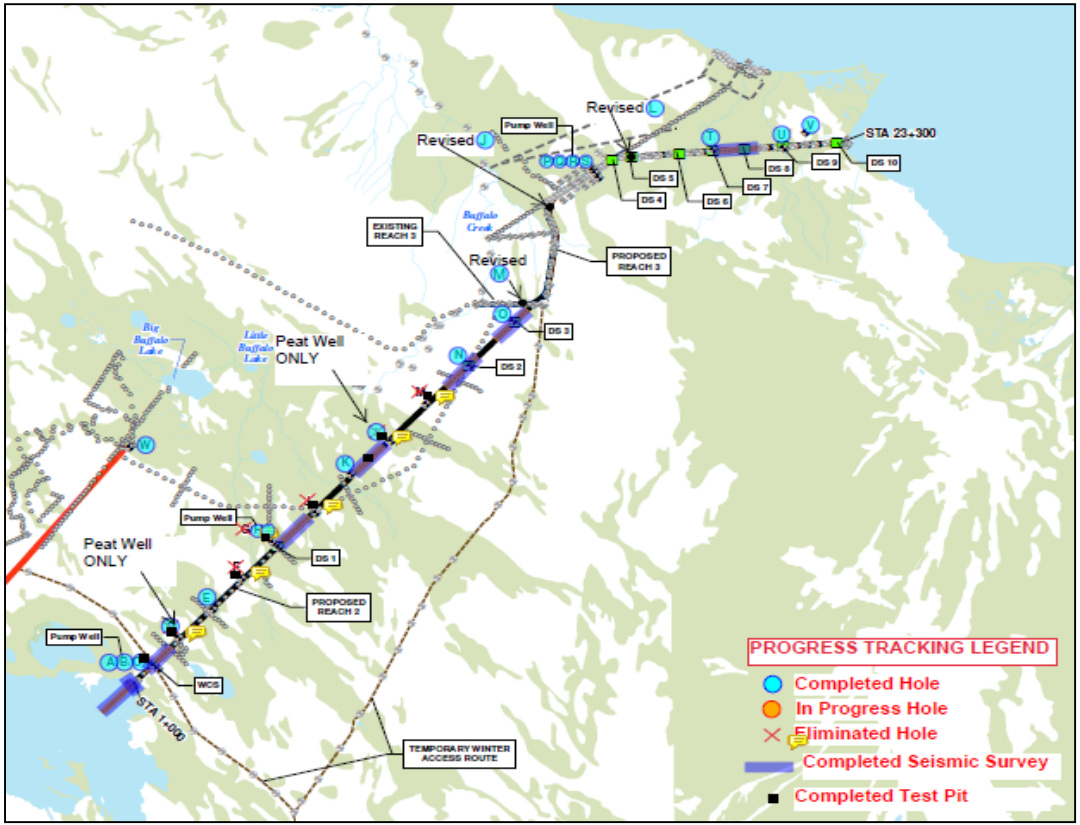
Completed Field Investigations



- Pre 2019 data:
  - 700+ peat probes
  - ~50 hand augers
  - ~50 test holes
  - ~120 test pits
  - ~25 km seismic
  - LiDAR
  - Bathymetry
  - Surveys

Completed Field Investigations



- 2019 winter investigations:
  - 19 test hole locations
  - 3 channel pump wells
  - 1 sentinel well at DRFN
  - 8 test pits
  - Seismic surveys (7.4 km)
  - Topographic surveys
- Lab Testing (In progress)
  - Water Quality – Routine inorganic, dissolved metals, stable isotope and low range tritium.
  - Soils - M/C, Atterberg, Grain Size Analysis, Standard Proctor, Direct Shear

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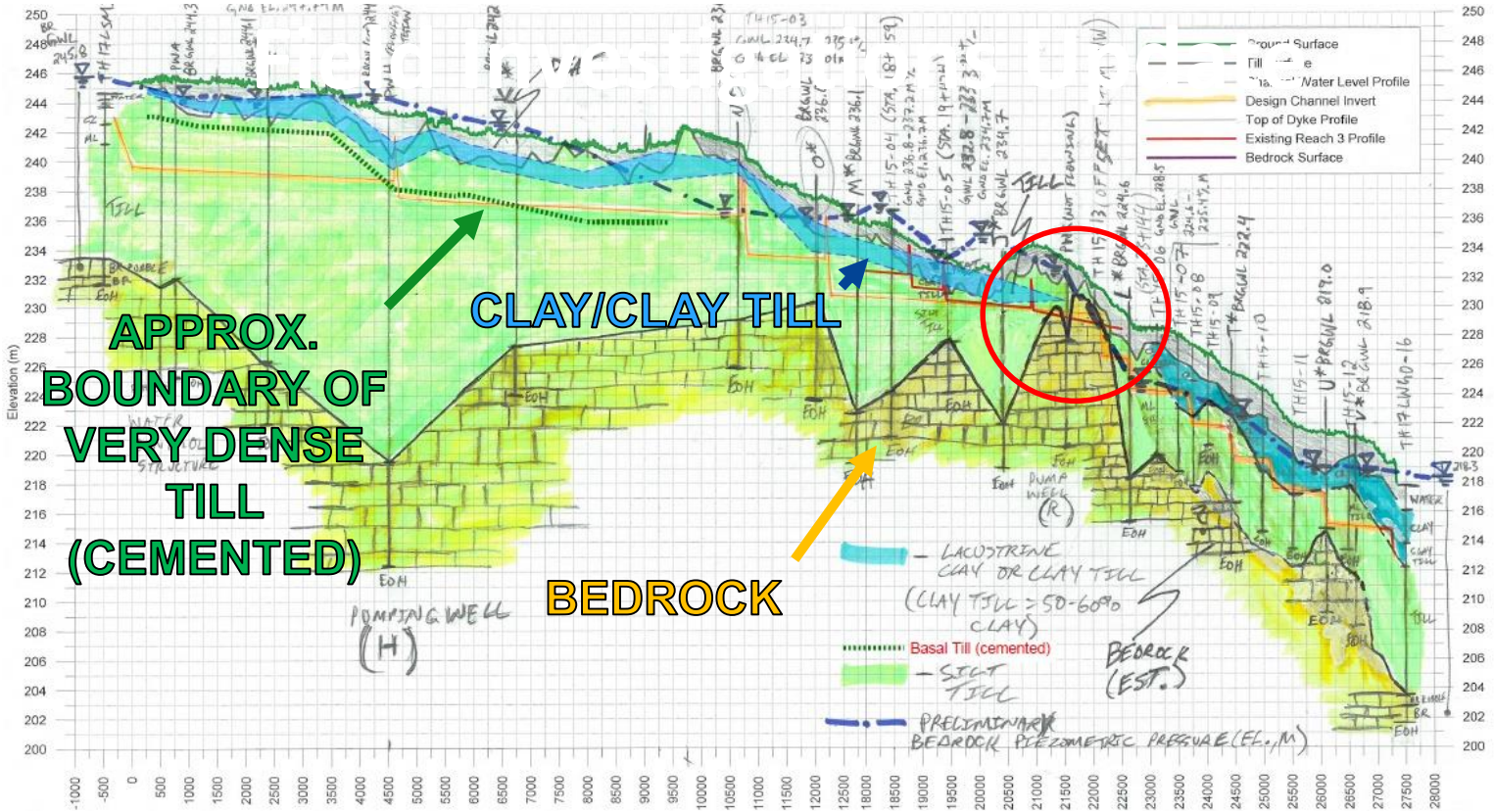
Preliminary Stratigraphic Profile



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Groundwater

- Reach 3 – channel bedrock exposed during emergency channel construction in 2012
  - Result: drop in bedrock piezometric pressure; there is seepage baseflow
- Reach 3 is a bedrock aquifer discharge area - channel design goals:
  - Maintain condition
  - Mitigate increasing pressures due to elevated flood stage profiles

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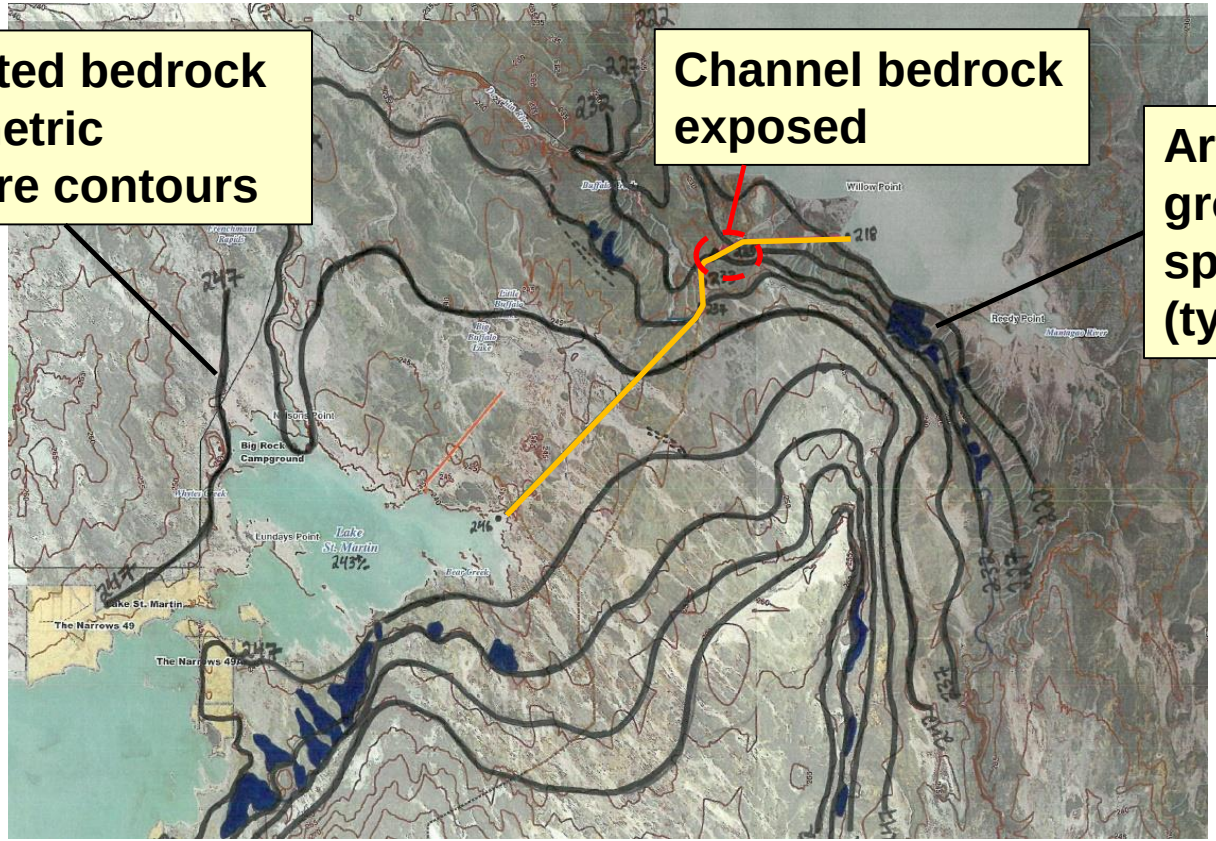
Estimated Bedrock Piezometric Pressure

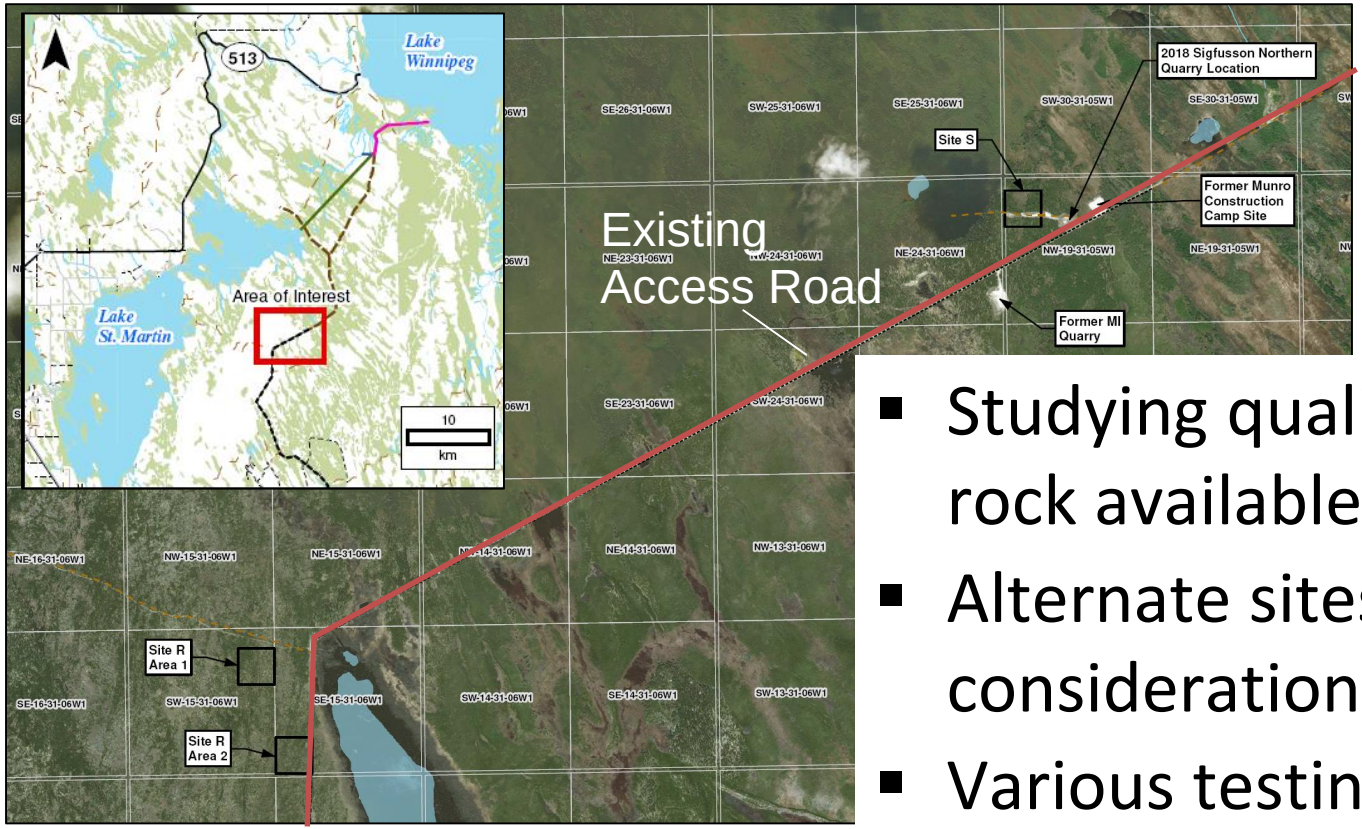
Estimated bedrock piezometric pressure contours

Channel bedrock exposed

Artesian groundwater spring sites (typical)



Rock Availability Assessment



- Studying quality/quantity of rock available for riprap
- Alternate sites under consideration
- Various testing ongoing

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Upcoming Spring/Summer Field Activities

- Rock Availability (inspection, monitoring & drilling)
- Shoreline Morphology (inspection, bathy. & substrates)
- Groundwater monitoring and sampling (multiple sites along channel alignment)
- Sentinel well installation & monitoring (Dauphin River)
- Revegetation surveys and investigations (see next slides)
- Fairford river and Dauphin River flow systems survey (tentative – see next slides)
- Weather station (tentative)

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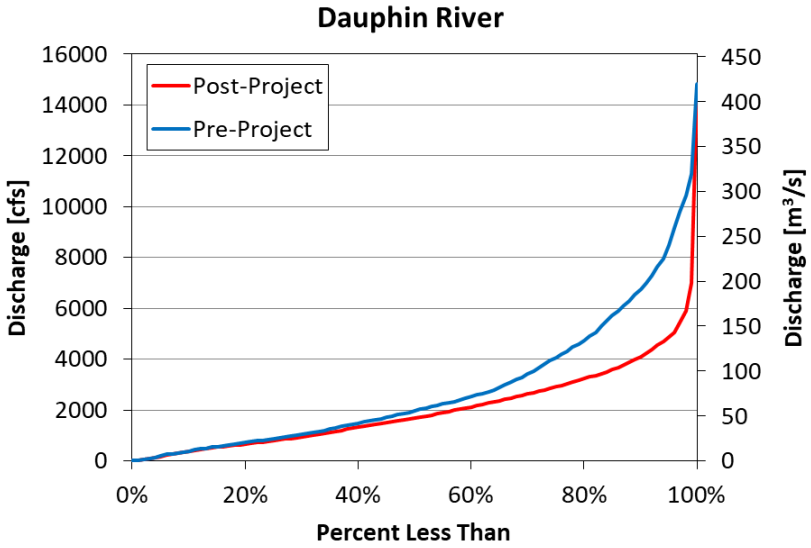
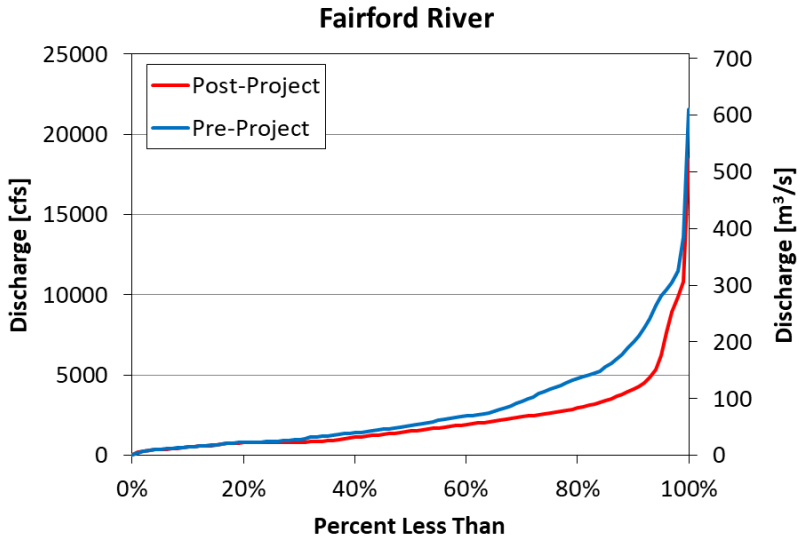
Revegetation Surveys

- Base survey:
  - Vegetation types / unique species & landscape
  - Sources of plant material
  - Soil conditions
- Revegetation field trials
  - Evaluate vegetation performance under various controlled conditions
  - Strengthen confidence in the revegetation design
  - Multiple plots to test varying seed mixes and soil amendments

Fairford River and Dauphin River Flow System

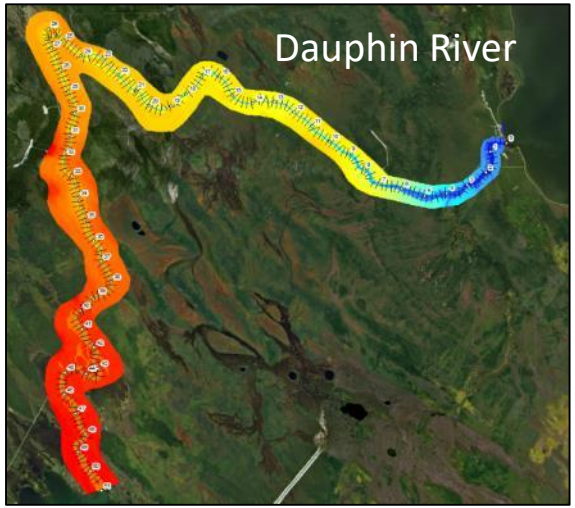
- Outlet Channels will alter the flow regime of the Dauphin / Fairford Rivers.

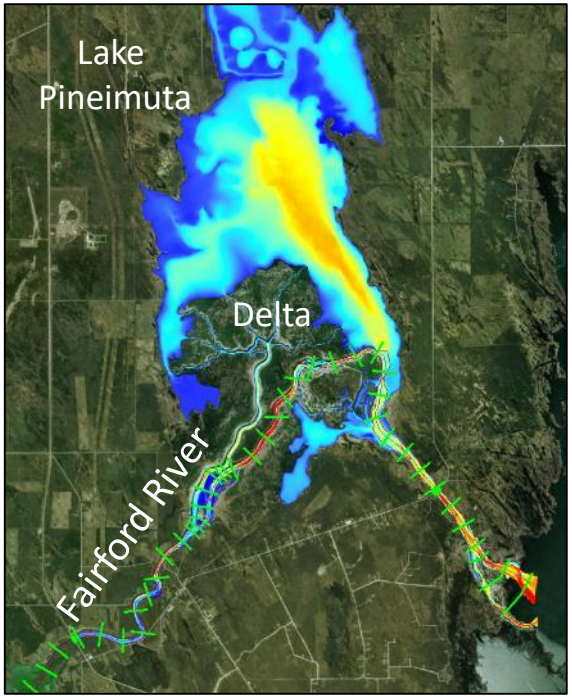




Fairford River and Dauphin River Flow System

- Phased surveys to support modelling and assessments
  - fluvial geomorphology
  - water retention times
  - river ice processes





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