alton
NATURAL GAS STORAGE LP

Estuary Monitoring Plan

Presented by: Bob Rutherford

October, 2014

Protecting the environment

River wide monitoring of fish at the river site

- Striped bass egg and larvae abundance and life stage
  - Flood tide plankton net sampling in the main river channel every 10 minutes on the 90 minute flood-tide:
    May and June, while operating
    - Frequency = 4 to 5 days a week
  - Ebb tide plankton net sampling in the main river channel every hour through the ebb tide- May and June, while operating, in conjunction with water intake and outfall sampling (see below)
    - Frequency = weekly
  - Seine net sampling on the West sand bank of the site:
    June to September (catches all species present)
    - Frequency = weekly

Protecting the environment

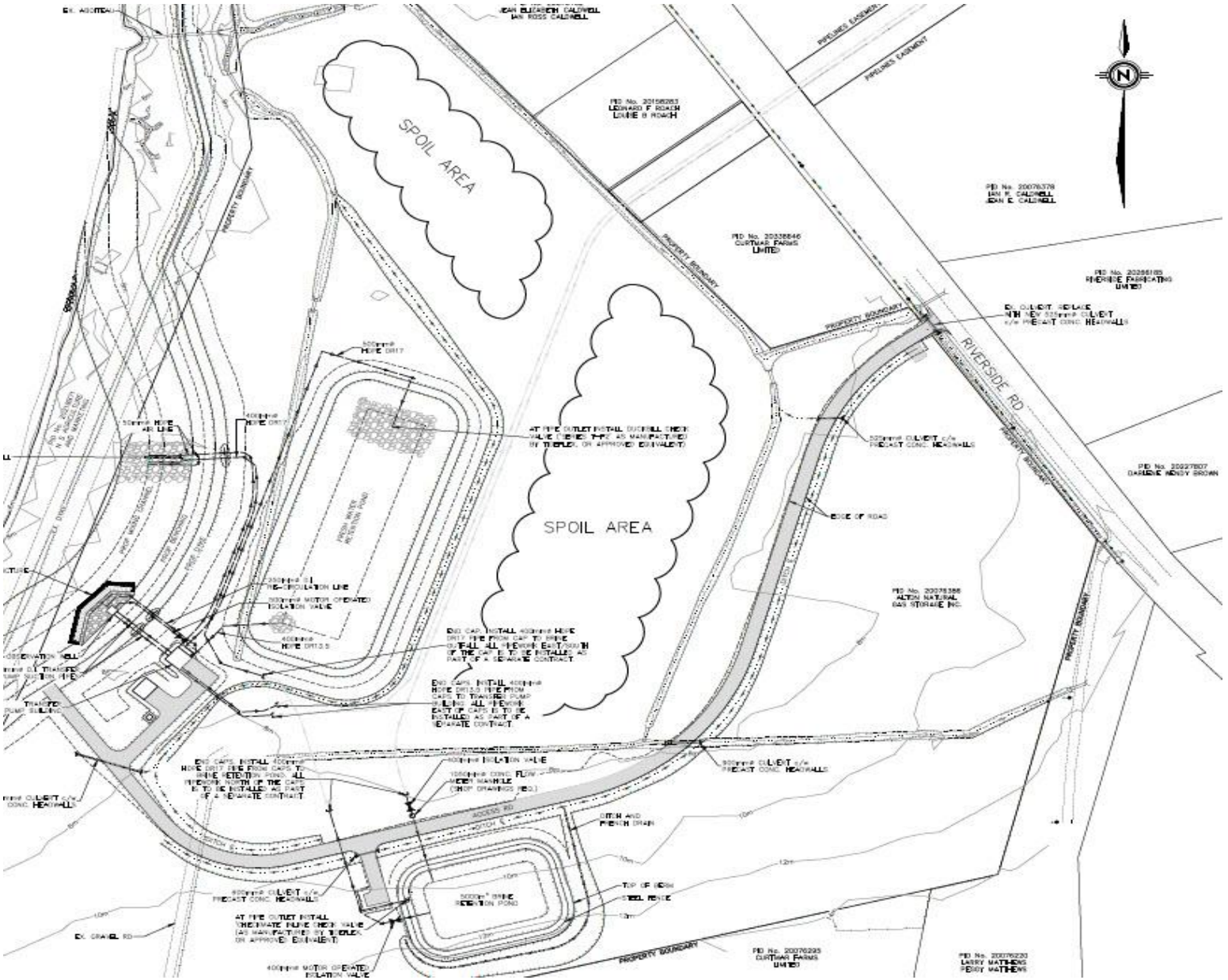
River wide monitoring of fish in the upper estuary

- Striped bass egg and larvae spatial distribution, density and life stage
  - Plankton net sampling starting at the salt front at high tide and sampling approximately every kilometre back downstream to the Alton site-spring
    - Frequency = weekly
  - Seine net sampling upstream on the Shubenacadie River at the Highway 102 bridge. (catches all species present)
    - Frequency = weekly

River wide monitoring – water

- Water salinity and temperature monitoring
- Alton site
  - CDT on bottom of the river 100 meters downstream of the constructed channel
- Upriver Shubenacadie River
  - CDT attached to the Highway 102 bridge
- Upriver Stewiacke River
  - CDT attached to the CN train bridge
- Frequency: On going sample each 10 min, loggers downloaded bi-weekly

River site overview



Channel site – fish migration

- Channel use monitoring - migration routes
  - Atlantic salmon smolt acoustic tagging will be done to see if they use the channel – spring 2015
  - Striped bass acoustic tagging will be done to see if they use the channel – spring 2015 with monitoring till 2016
- Vemco receivers one will be located in the center of the new channel and one on each side of the river upstream of the channel

Channel site – fish

- Water intake
  - Pump tests/plankton net sampling for the species, numbers, life stage and mortalities
  - Samples will be taken at the intake face and in the intake well inside of the gabion face
  - Velocities at the intake face will be measured during low flow, mid flood tide, slack tide, and mid ebb tide along transects along the face to obtain a picture of the current patterns during intake
- Three times a week for April through June except during shut down during the presence of bass eggs, then once a week through to late fall

Channel site – fish

- Brine discharge site
  - Pump test / plankton net sampling at the discharge site at low water /mid water /high water
  - Three times a week for all of April through and June, then once a week through to late fall

Channel site – water depth, salinity and temperature

- Discharge site
  - At 5 meters either side of the toe of the outfall an array of CDTs at 1.5m vertical spacing. Bottom, 1.5m, 3.0 m and 4.5m
- Channel ends
  - CDT at bottom at both ends
- Real time monitoring at bottom @ 5m plus channel entrance
- Frequency: Ongoing readings each 10 minutes. Data down loaded daily during the first week of start-up and then three times a week until full brining is achieved then continued for 1 month
- Probes may have to be removed during bad ice conditions
- Ongoing operation download schedule will be once a week

Protecting the environment

Data reporting

- Quarterly reports will be sent to Nova Scotia Environment and Department of Fisheries and Oceans & Environment Canada

- The data will be available to government departments at any time upon request

Channel site water quality standards

- Background salinities range from near 0 ppt to short peaks just after the high tide that can exceed 28 ppt based on 2007 to 2013 monitoring
- Maintain salinities at or below 7 ppt above background on the bottom at 5m from the outfall
- Salinities will not exceed 28 ppt to keep salinities within the natural range
- Air will be mixed with the outflow brine water to improve mixing with air lines on both sides of the outlet pipes to mix the bi-directional flow
- Brine discharge will be stopped if salinity does not remain within standards
- Calculations based on data collected to date that the increase in salinities will be less than 4ppt above background

Channel site water quality standards

- Temperature
  - Tidal water temperatures commonly vary as much as 8 ^{0}C degrees on the turn of a tide.
  - Temperature of the brine returning from the caverns to the holding pond may adjust toward ground water temperature in the pipeline. It will change to ambient temperature in the holding pond. Outfall temperatures are expected to mirror the river water temperatures. The volume compared to the channel flows is very small it is expected temperature changes will be too small to measure. Temperature will be monitored by the CDTs at the outfall and at the channel outlets.

Channel site water quality standards

- Dissolved oxygen
  - The brine water oxygen levels will match the oxygen levels of the input water based on water temperature of the settling pond
- Suspended sediments
  - This is a highly turbid area at all times
  - The brine water will now be sediment free

Channel site - general

- Brining operations will be shut down during peak Stripped bass spawning events

- Upstream migrants may enter the mixing channel but there will be no resting or holding water so they will move through quickly. If conditions are not to their liking they will leave before they are harmed as the conditions change gradually and they can sense salinity changes

- Downstream migrants tend to travel with the current and well up in the water column. They have the potential to come in contact with an abrupt salinity change at the outfall and for that reason the increase in salinity levels shall be monitored and kept within the ranges set above when downstream migrating populations are present

Channel site water quality standards

- The current in river monitoring program will be continued during brining operations. We now have background data from 2007 to 2014
- Site monitoring will be undertaken as soon as the site is operating.
- Brining operations are expected to begin in the fall of 2014 and ramp up to full operations over 6 to 8 months. This will provide time to adjust the operations if necessary to meet the required standards before the spring runs of fish
- The sediment pond and the holding pond both provide the opportunity to time intake and discharge to minimize affects in the river

Frequently asked questions

- How will the change in river flow effect fishing grounds?
- Could operation of the water intake result in the death of fish in the area of the intake?
- Could operation of the brine mixing pond result in the death of fish? Could the release of the diluted brine impact on the health or behavior of fish?
- Is additional information required in order to predict effects on Atlantic salmon, related to the operation of the water intake and brine mixing pond? Could Atlantic salmon be harmed by the operation of the water intake and brine mixing pond?
- Is the recommended mitigation and monitoring associated with the water intake and brine mixing pond appropriate? Are there any further recommendations for mitigation and monitoring?
- Will there be third party testing of river salinity, quality?
- What is the expected chemical composition of the discharge brine relative to the natural range in the chemical composition of the estuarial water at the proposed project discharge location?