Internal Draft
Appendix Outline

An Assessment of Impacts of the Proposed Point Thomson Dock on Oceanography and Sediment Processes

Point Thomson EIS

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1.0 Introduction

Given the history and controversies concerning the environmental effects of dock and causeway structures on the North Slope, one of the main concerns for the public and agencies reviewing the proposed development will be that the proposed Pt. Thomson Dock will potentially cause similar and further deleterious impacts to the marine environment. Of particular concern is that the dock may alter circulation, salinity, and temperature patterns in the area, thus affecting fish usage and migration and altering or reducing preferred habitat. To address these concerns, key similarities and differences in the proposed Point Thomson dock versus other docks and causeways in the region (e.g., length and location within the barrier islands) are important and have been highlighted to address concerns with respect to potential impacts of another dock structure on the North Slope. At this time, it is assumed that no additional new numerical analyses or oceanographic modeling are required to address the dock issue, as sufficient oceanographic data exists for both the area and region including analyses of the effects of the West Dock and Endicott causeways that can be utilized.

It is also expected that the dock could alter both sedimentation and coastal erosion patterns in its immediate vicinity. Although the final design is not yet available, it is assumed at this time that issues with respect to dock armoring will need to be addressed. This issue will be addressed qualitatively by utilizing information from existing structures on the North Slope where various types of armoring have been used. Armoring will be examined for effectiveness and maintenance history and a comparison will be made of the oceanographic regime for these structures and the water depths where different types of armoring have effectively been used.

2.0 Dock Design and Configuration

2.1 General Design Considerations

- General description of dock design including intended use, length, width, etc.
- Discripition of dock configuration with respect to local bathymetry, need for navigation channel, and water depths required for different periods in its history (construction versus long-term use)(Figure 1).
- Dock armoring design.

2.2 Size Comparison to other North Slope Docks and Causeways

- Pt. Thomson Dock is substantially shorter (~ 5-6% as long) than either the West Dock or Endicott Causeways (Figure 2).

- Pt. Thomson Dock terminus is in 7 feet of water versus 12 to 14 feet for either the West Dock or Endicott Causeways and does not extend into marine water.
- Pt. Thomson Dock (750 feet) is similar in length to the Badami Dock (1100 feet) (Figure 2).
- Pt. Thomson and Badami Docks terminate in similar water depths, 7 feet versus 6.5 feet.

3.0 Oceanography

3.1 Description of Concerns Based on West Dock and Endicott Causeways

- Large offshore deflection of nearshore warm estuarine waters resulting in the potential loss of habitat and interruption of coastal flow.
- During easterly wind and regional upwelling conditions causeways can cause marine intrusions and enhance vertical mixing on the lee side of the causeway as a result of the causeway extending offshore into marine waters.
- Docks and causeways can present both a physical and hydrographic (temperature and salinity) discontinuity that may potentially pose a barrier to fish passage.
- West Dock causeway impedes the flow of warm estuarine waters from entering Simpson Lagoon
- Dock structures may affect ice conditions by slowing breakup and/or hastening freezeup in their immediate area.
- Length of dock may need to be altered or breaches included if adverse effects are predicted for the Pt. Thomson dock. Include description of breaching that was added to the Endicott and West Dock causeways to mitigate environmental impacts.

3.2 Point Thomson Dock Oceanography and Comparison to other Structures

- Pt. Thomson dock does not extend into offshore marine waters and hydrographic conditions in its vicinity are well mixed with the exception of early season when stratified conditions may persist for a short period of time. (Figures to be added that will detail temperature and salinity conditions that have been observed).
- Dock is within the Lions Lagoon and will not affect the movement of water within the lagoon system.
- During easterly wind conditions and regional upwelling, Pt. Thomson dock is located upcurrent from marine intrusions entering the Mary Sachs entrance and thus would not impact or be affected by these marine water masses as evidenced by the Lions Lagoon bathymetry (Figure 3).
- Size of dock is smaller (750 feet) than natural points and promontories along the mainland shoreline of Lions Lagoon that extend up to 5000 feet offshore as seen on the regional maps. Any affects or perturbations to oceanographic conditions would

be expected to be smaller than those caused by these natural structures and within the region of their influence (e.g. Pt. Thomson) (Figures 2 and 3).

- The effective length of the Pt. Thomson Dock that extends into and affects nearshore flow is approximately half of its overall length (375 feet [~100 m]) due to shoreline orientation and shallow water depths (Figure 4).
- The shoreward half of the dock is in water depths of 0-3 feet, the area that typically would be considered the 'surf zone', where alongshore currents are small due to effects of bottom friction. Although this zone may be important for sediment transport and fish passage, dock effects on water flow volume will be minimal.
- Based on scaling analysis for fluid dynamics, primary alterations in circulation are expected over length scales similar to the dimensions of the structure (4-6 km for the West Dock and Endicott causeways).
- Scaling analysis for the Pt. Thomson dock indicate primary perturbations to local circulation would be confined to a region within approximately 100 m of the dock (Figure 4).
- A wake eddy may form during certain conditions, for both easterly and westerly winds, that could enhance vertical mixing of the water column. Given the general lack of vertical stratification in its vicinity, changes to temperature and salinity conditions are expected to be minimal and confined to a 100 meter region from the dock (Figure 4).
- Hydrographic conditions within Lions Lagoon have been found to respond rapidly to easterly winds by getting colder and saltier as a result of marine water entering through Flaxman Island Pass, Mary Sachs Entrance, and other channels between the barrier islands. The proposed dock will not affect these processes.
- Hydrographic conditions within Lions Lagoon during westerly winds indicate that any estuarine water that is present will hug the shoreline with water being transported out of the lagoon through all of the barrier island channels. Currents will be temporarily altered in the vicinity of the dock as seen for easterly wind conditions. The dock will have no noticeable affect on temperature and salinity patterns since vertical variations in temperature and salinity are minimized by westerly winds.

4.0 Sediment and Coastal Processes

4.1 Description of Concerns

- Alterations in sediment transport may affect accretion and erosion of marine sediments.
- Dock may cause changes to the shoreline and affect shoreline erosion processes
- Dock induced alterations may result in sediment deposition within the dredge channel and will require periodic maintenance dredging.

- Potential erosion of the dock structure and need for armoring.

4.2 Point Thomson Dock and Affects on Sediment Processes

- Sedimentation and coastal process issues will be addressed by extrapolating data from existing coastal structures such as West Dock where sediment processes and coastal geomorphology studies were conducted. Also, results of the URS sediment transport study that is being conducted for the proposed Pt. Thomson Development will be critical for this analysis (note: report pending).

- Issues with respect to armoring are awaiting final design from Exxon Mobil. If a proposed dock design does not include armoring, then it is expected that dock armoring issues will need to be addressed. Armoring will be addressed qualitatively by utilizing information from existing structures on the North Slope where various types of armoring have been used, their effectiveness and maintenance history, a comparison of the oceanographic regime for these structures, and the water depths where different types of armoring have been used.

- Engineering analysis report on armoring for the Pt. Thomson dock is expected from Exxon Mobil and will be used to supplement other data that is collected to address this issue.

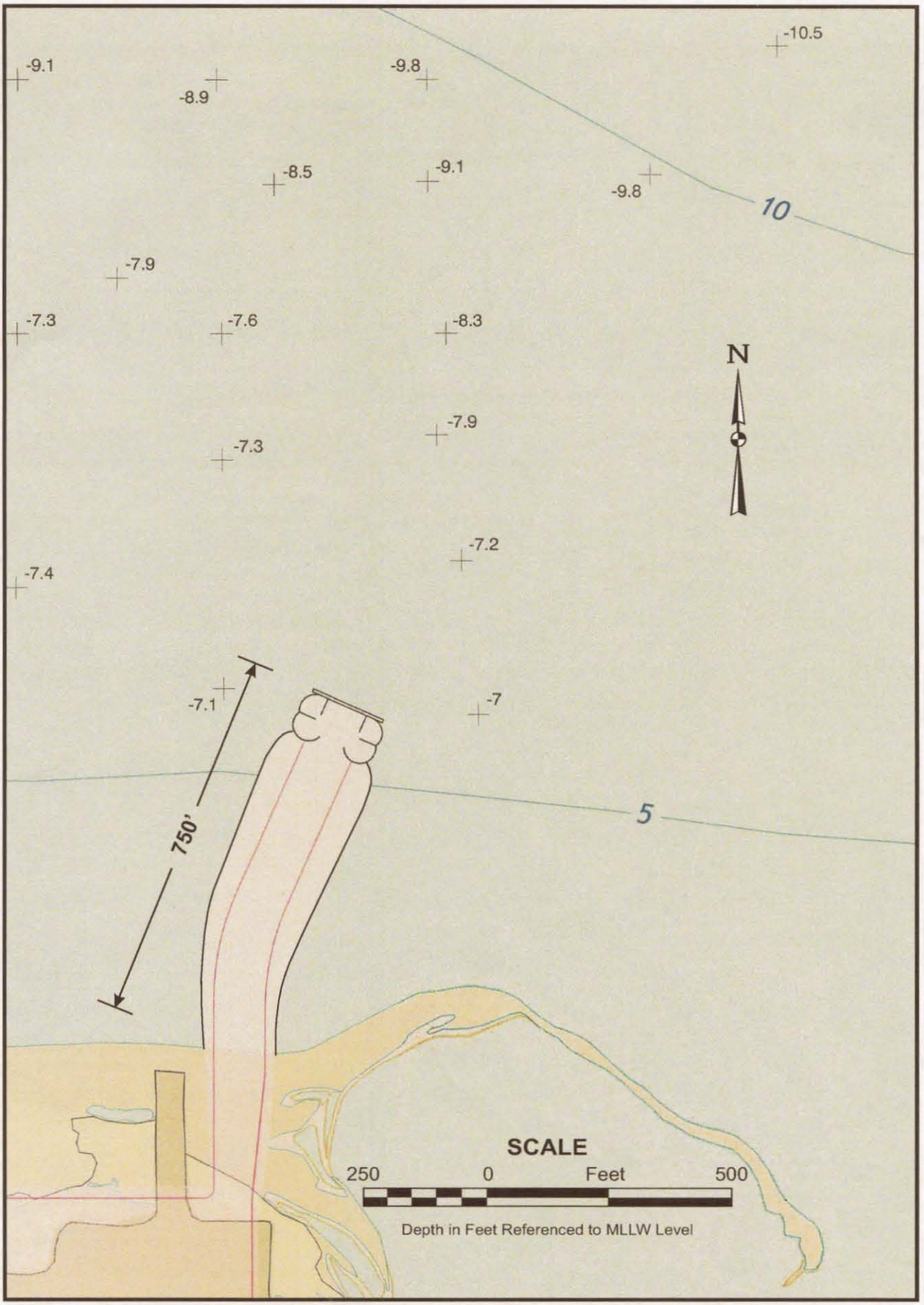

Figure 1. Proposed Dock with Local Bathymetry in Feet Referenced to MLLW Level.

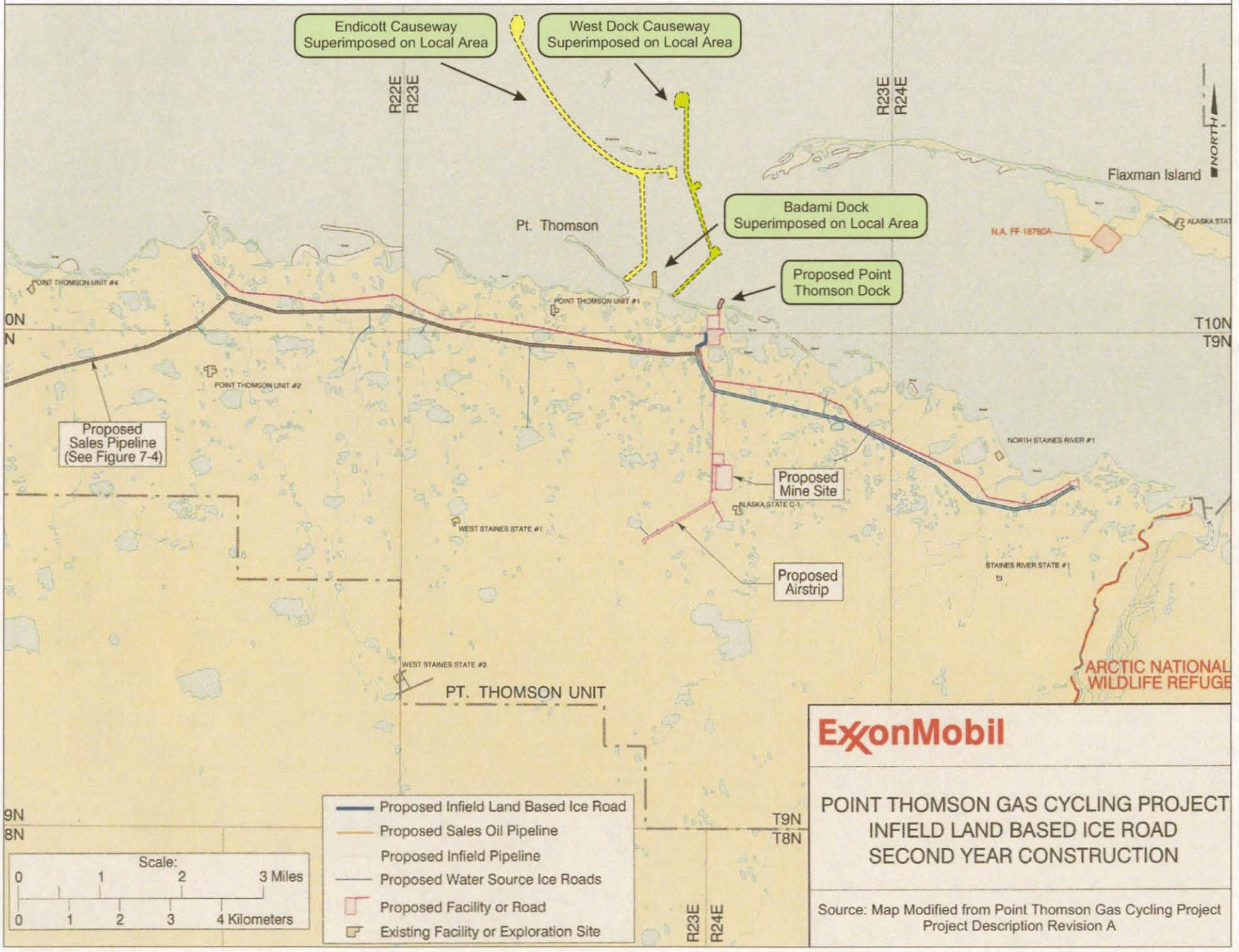

Figure 2. Size Comparison of Proposed Pt. Thomson Dock to Endicott Causeway, West Dock Causeway, and Badami Dock.

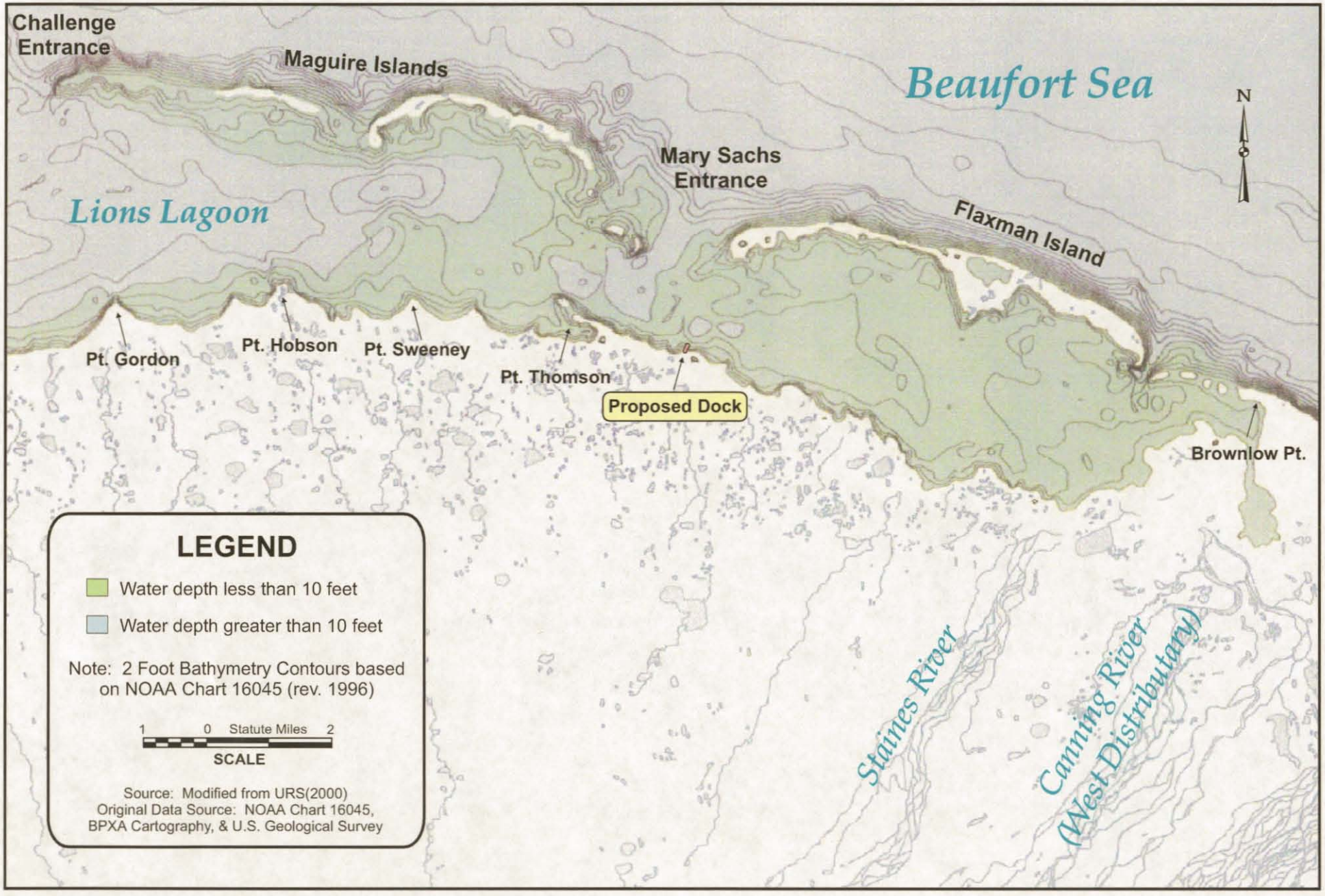

Figure 3. Lions Lagoon Bathymetry.

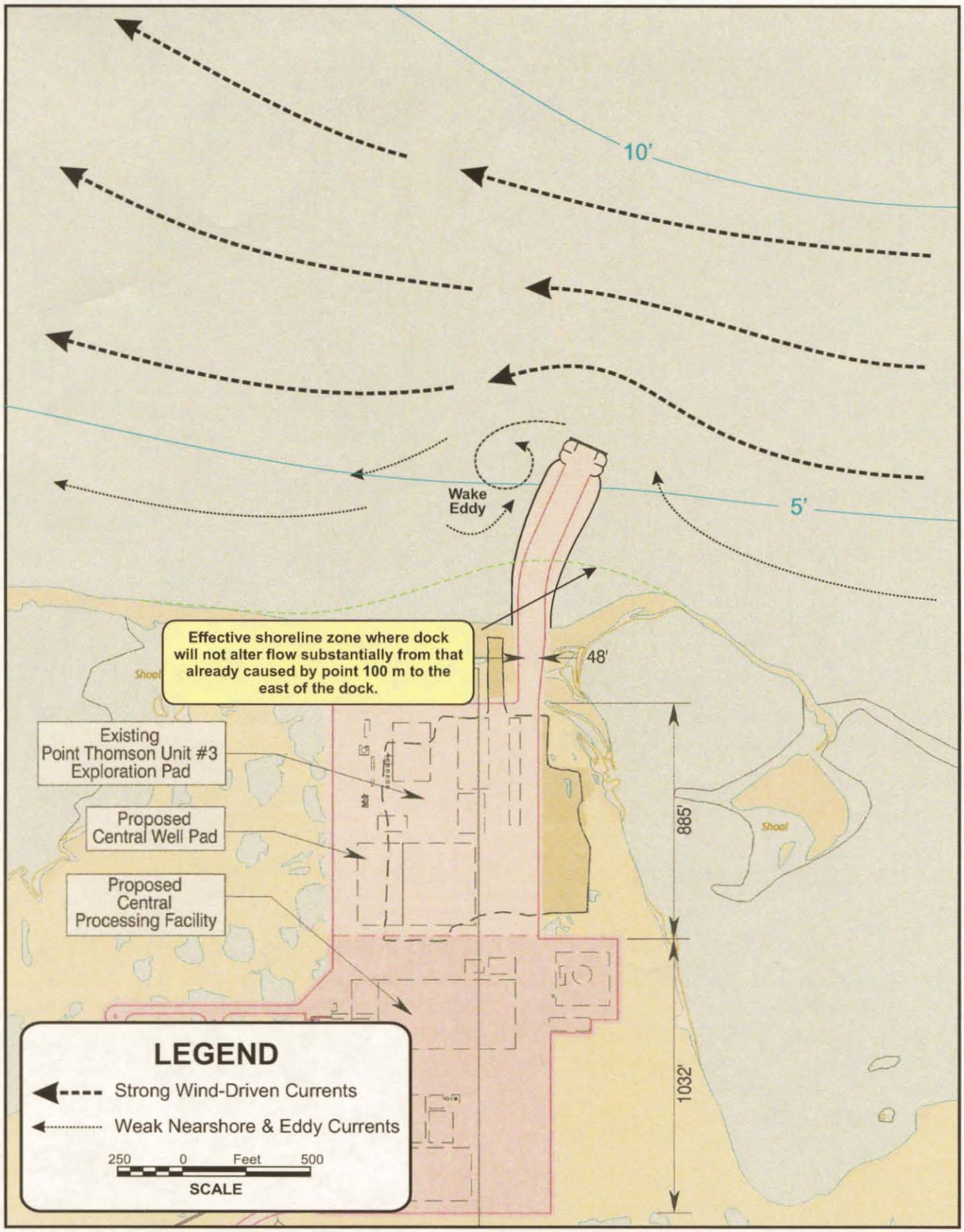

Figure 4. Generalized Currents with Respect to the Proposed Dock for Easterly Wind Conditions.