

# **Coastal Storm Damage Reduction Feasibility Study, Barrow, Alaska**

## **Information Packet for the Public Meeting**

**April 6, 2005**

**7 p.m. at the  
North Slope Borough  
Assembly Chambers**

## What is the purpose of the meeting?

1. Update community on study progress since last meeting on June 12, 2003.
2. Obtain community input on:
  - Problem Statement
  - Preliminary Measures
  - Identified Possible Impacts
  - Other Community Question/Concerns Pertinent to our Study

## What is the problem?

The Study Team has developed a problem statement to identify the specific problem we are trying to resolve:

*Barrow's way of life is intrinsic to its location. Changing coastal and climatic conditions, have caused Barrow to experience increased frequency and severity of coastal storms. These storms produce hazardous conditions due to flooding and erosion. They pose a threat to public and private infrastructure, particularly, the delivery of basic utility services to residents. This infrastructure is essential for maintaining the cohesion of Barrow as a community, commercial center, and regional seat of government in northern Alaska. The people of Barrow, bound by common traditions, a long history of whaling and mutual reliance, have integrated families from around the world to form the interdependent social network that makes Barrow a unique and distinctive North American town.*

## What are our study planning objectives?

The Problem Statement leads to Planning Objectives for this study, which were identified in the Project Management Plan that was prepared at the start of the study by the Corps and the local sponsor, the North Slope Borough. These include:

- Provide relief from storm damage and shoreline erosion that threatens structures, shoreline bluffs, and critical community infrastructure.
- Reduce flood damages to critical public and private facilities.
- If incidental to gravel excavation, improve navigation for lightering barge loading and unloading (Note: Given the results of the gravel studies to date, it appears very unlikely we will be able to accomplish this objective).
- Protect the sensitive arctic environment and mitigate significant project impacts where reasonable.
- Identify and develop practical ecosystem restoration opportunities, if any, as appropriate.

# Where are we in the study process?

We have recently begun the third year of this three-phase feasibility study:

- Phase 1 – February 2003 to September 2005
  - Develop basic information
  - Define existing and without-project conditions
  - Identify potential measures and join them to form alternatives
  - Screen initial alternatives down to those deserving detailed study
- Phase 2 – October 2005 to January 2007
  - Fully develop, evaluate, and compare detailed alternatives
- Phase 3 – February 2007 to December 2008
  - Public review of draft Feasibility Report and Environmental Impact Statement (EIS)
  - Division Engineer Notice with Final Report and Final EIS
  - Washington Level Review of Final Report and EIS
  - Public review of Final EIS and filing of final EIS with Environmental Protection Agency.

# What studies/work have we completed to date?

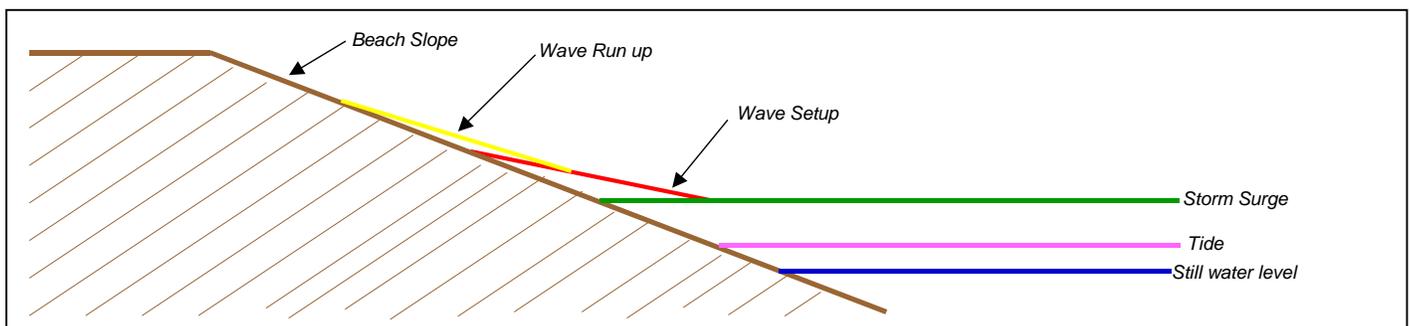
## Hydrology & Hydraulics

**Instrumentation.** Instruments were deployed in the summers of both 2003 and 2004. We achieved full recovery of data in 2003. In 2004, we experienced partial recovery of data from the 5-meter depth because an ice keel damaged the instrument. Since the ocean iced over before recovery of the 10-meter-deep instrument was made, we are still waiting to recover that instrument.

**Deep-Water Wave Analysis.** The analysis is completed. We are waiting for the data and a draft report to be submitted by Corps' Coastal Hydraulics Laboratory (CHL) in Vicksburg, MS.

**Near-Shore Wave Analysis.** This study is currently in-progress by CHL.

**Water Level Study.** This study is currently in-progress by CHL. The storm surge analysis is complete. The next step is the analysis of water level increase due to wave setup.



## What studies/work have we completed to date? (cont.)

**Sediment Transport Study.** This study is still in progress and is being conducted by CHL. Preliminary analysis indicates that there is not as much beach transport as previously thought. It appears majority of the erosion problem may be addressed by focusing on bluff protection in critical areas with limited beach nourishment.

### Geotechnical—Gravel Exploration

The purpose of the gravel exploration was to try to identify a gravel deposit of approximately 2 million cubic yards that could be used for beach nourishment at/near Barrow. Following a literature search, gravel explorations were conducted on the existing Barrow beach and at three potential borrow site locations: BIA Prospect, Cooper Island, and a submerged spit off Point Barrow. The beach, BIA, and Cooper Island explorations were conducted from 28 March thru 27 April 2004, with the spit exploration occurring 3 to 14 August 2004. Suitable gravel in sufficient quantities was found at the BIA Prospect and Cooper Island Borrow Sites.

**Barrow Beach.** Four borings along the beach were drilled at increasing distances from shore as they progressed from southwest to northeast. Borings nearest the beach encountered clean sand. As the distance from the surf-zone increased, the soils contained more silt. The offshore sands are predominately fine sand.

**BIA Prospect Borrow Site.** Thirty-one borings were located in this area that stretched from the vicinity of the existing gravel pits west of Barrow south for about 7 miles. Initial borings indicated a promising site about 3.5 miles south of the existing gravel pits. A total of 15 borings were concentrated in that approximately 3/4-mile-square area (just south of Emaiksoun Lake, Freshwater Lake). There, the near surface soils generally range from 10 to 20 feet thick and consist of frozen silts and silty sand. Below the surface layer, some sands classify as silty sands. In other areas, the sands are relatively clean with variable amounts of gravel, generally less than 3/4-inch in diameter. The soils below the sands consist of frozen silt. This site contains at least 2 million cubic yards of gravel.

**Cooper Island Borrow Site.** Ten borings were made on Cooper Island, stretching over an area of about 4 miles. The island consists of a relatively clean, surficial, sand layer, averaging 11 feet thick, extending to only a few feet below sea level. These sands have up to 40 percent gravel near the surface, decreasing with depth. Silt is near zero at the surface and increases with depth. The sands generally contain 10 to 20 percent gravel and 5 percent silt. This site contains at least 2 million cubic yards of gravel.

**Submerged Spit Borrow Site.** Severe weather conditions, significant winds, seas 6 feet or greater and extensive floating ice and icebergs, impacted the drilling operation. Six borings were obtained from a drill on a landing craft. One boring was located about 2 miles west of Point Barrow, one about 2 miles east, and four spread from about 2 miles north to about 6 miles northwest of the Point. Soils recovered from the borings generally consist of silt or fine sand with 10 to 40 percent silt. None of the samples contained more than 5 percent gravel-sized particles. None of the borings encountered any material appropriate for borrow.

# What studies/work have we completed to date? (cont.)

## Economic Data Collection and Analyses

Current economic work and work completed to date has focused on determining what the existing conditions are in Barrow for potentially damageable facilities, structures and contents, and infrastructure. This work includes elevation surveys for ground structures' first floors, utility service barrels, lagoon berms, and road centerlines. Property and content surveys were also conducted on all commercial businesses, public and industrial structures, as well as 50 randomly selected residential structures.

Existing conditions first must be determined before likely future changes during the 50-year economic analysis period are selected. This condition is called the without-project condition and is used to evaluate all alternatives against possible future storm and flood events. Potential damaging impacts, such as flooding, will then be applied to the future community's infrastructure to determine the most likely estimated damages from these events.

## Environmental Field Studies

**Fishery Survey.** Near-shore waters at the proposed project site in Barrow and at Cooper Island were sampled with a beach seine for species diversity and abundance during August 2004. Species diversity at both sites was low, but abundance of a few species at both sites was relatively high. Capelin and juvenile Arctic cod were most numerous at the Barrow site, where 85 percent of the catch was capelin and 14 percent was Arctic cod. More than 2,000 fish were caught at the Barrow beach sites. Seine hauls at Cooper Island were made on the Beaufort Sea side and the Elson Lagoon side of the barrier island. Fish on the Beaufort Sea side were significantly more numerous with 1,180 fish caught in three hauls, while only 33 fish were caught in three hauls on the Elson Lagoon side. Capelin and Arctic cod were the most abundant species on the Beaufort Sea side of Cooper Island, while least cisco and juvenile sculpin were more abundant on the lagoon side of the island. Three species, capelin, Arctic cod, and least cisco, caught in the survey at Barrow and Cooper Island are biologically significant to the Arctic food web.

**Benthic Invertebrate Survey.** Crab pots were deployed at the sample locations near Barrow for a soak time of approximately 72 hours, with bait jars containing chunks of herring. After a 72-hour soak time, the crab pots along the Barrow coast were empty. Crab pots were deployed near Cooper Island for a 24-hour soak period and were also empty. The extremely shallow water made it unlikely that crabs would be caught.

At each sample location, an attempt was made to obtain benthic grab samples using a 1 cubic meter dredge. Despite repeated attempts, the biologists were unable to obtain valid samples at almost every location. This was most likely due to substrate composition. Many samples had a compacted silt/clay layer on the surface that the dredge had difficulty penetrating. The area sampled is likely poor crab habitat due to unsuitable substrate, which becomes turbid during high winds from the north, west, or south.

## What studies/work have we completed to date? (cont.)

**Vegetation Survey.** A vegetation survey was conducted on Cooper Island in summer 2004. It is an elongated barren island composed predominantly of unconsolidated sand, gravel, stones, and cobbles. This island extends for about 7 to 8 miles east to west, with a width of about 300 to 500 feet, but widens toward the west to reach about 2,700 feet wide in some sections. A few shallow ponds have been formed to the west of the island and probably contain a mixture of water from snowmelt and storms.

A continuous grass cover surrounds the borders of some of these ponds, providing a complementary foraging habitat to arctic terns and several species of shorebirds and waterfowl during the summer. Dominant grasses in these salt marsh communities are creeping arrowgrass and a few individuals of Fisher's tundra grass; both species are known to provide forage for waterfowl. Heavy grazing was observed in some of these communities, probably from shorebirds. Creeping arrowgrass is a small grass that propagates mainly by stolons, which allows it to overcome effects of grazing. This grass is also known for its high nutrient content per unit mass, for nitrogen, magnesium, calcium, and sodium.

Besides the small belts of creeping arrowgrass found along the lagoon shorelines, vegetation is sparse on the rest of the island. A few plant species have adapted to extreme temperatures, winds, and saline/brackish water conditions and have a patchy distribution on the island. Among the plants are arctic poppy, tufted saxifrage, beachrye, scurvy grass, and oysterleaf. Some of these species are found following subtle micro-relief patterns, becoming established at the windward side of small gravelly mounds perpendicular to wind direction. No grazing was observed in these plant species.

### Cultural & Social Field Studies

In 2003, an archeological survey was conducted along the access route for the drill rig to the BIA borrow site. No archeological sites were found. In 2004, Barrow Technical Services Professional Services conducted archeological surveys of Cooper Island and the BIA borrow site.

**BIA Borrow Site.** No cultural resources identified.

**Cooper Island Borrow Site.** The following cultural/social resources were found:

- Eroded house site—determined eligible for the National Register of Historic Places.
- Whale skeleton—no determination made.
- Navy debris—not eligible. Probably from 1963 storm.
- George Divoky camp—no determination made.

**Point Barrow Borrow Site.** The following cultural resources were found at Point Barrow:

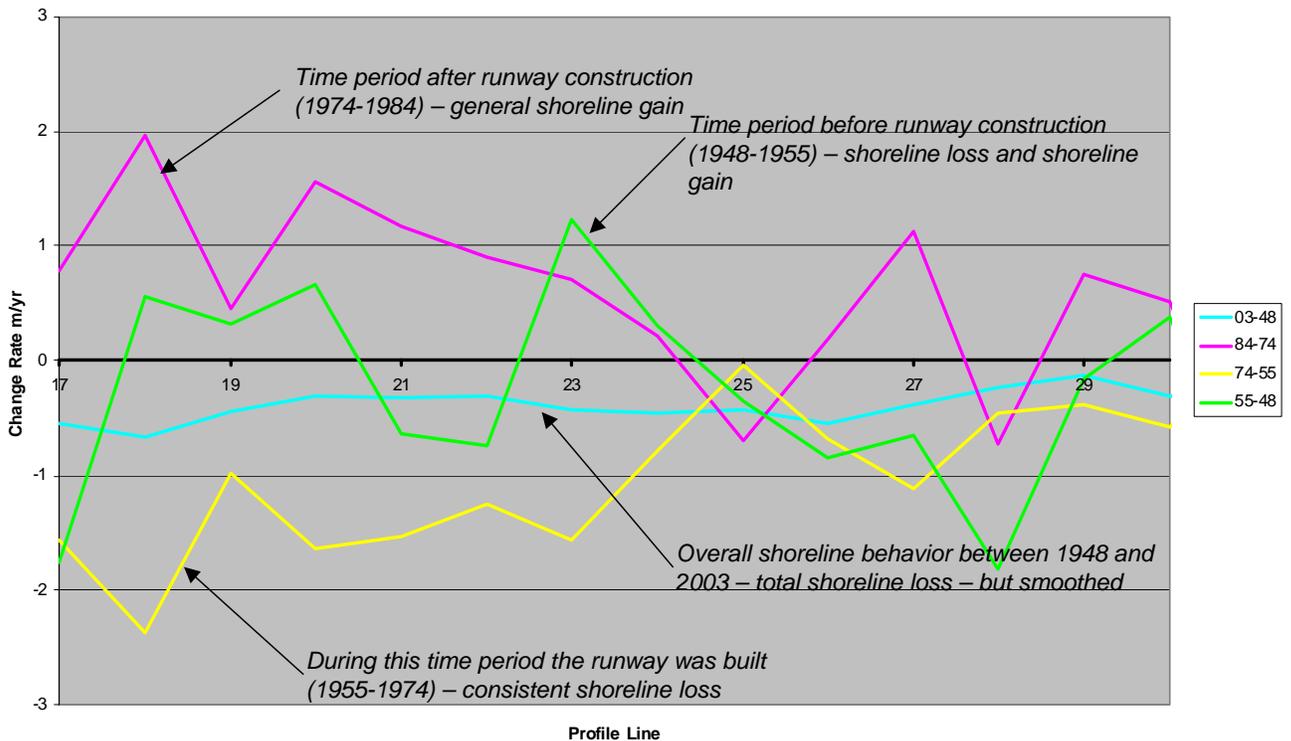
- Nuvuk—contains many graves, artifacts, and house remains. Shows early occupation of the Point Barrow. Area is eligible for the National Register of Historic Places.
- Subsistence use resources.
- Whale butchering area.
- Tourist use area.
- Fall whale butchering on the coast.

# How is the study area defined?

The coastline has been broken down by reaches for analysis. The reaches are defined by the different topography and are referenced by transects. Some of the reaches are shown on the following aerial photographs. Each reach has its own characteristics and will be evaluated for economic benefits and engineering solutions separately. The reaches are defined as follows:

- **Reach 1** – Shoreline in front of existing gravel pit (transects 9-18, partially shown)
- **Reach 2** – Shoreline in front of Barrow (transects 19-29)
- **Reach 3** – Shoreline in front of the lagoon (transects 29-32)
- **Reach 4** – Shoreline in front of Browerville (transects 32-43)
- **Reach 5** – Low-lying beach area from Browerville to north end of landfill (transects 43-55, partially shown).

The graphs below show the erosion/accretion rates for the Barrow shoreline (beach line) for different time frames in the last 55 years. The section locations are marked in the photo on page 8. Before runway construction ('48-'55), the beach was both eroding (below the 0) and accreting (above the 0). During runway construction, there was a consistent shoreline loss due to removal of material. Following runway construction there was a smaller shoreline gain, which resulted in an overall shoreline loss between 1948 and 2003.





Reach 4: Browerville area from transect 32 to 43

Reach 5: Low lying beach, sewage lagoon area from transect 43 to 55



~~46~~

~~43~~

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~~29~~

~~33~~

# What are the preliminary measures being considered and their potential impacts?

Initial Hydraulics and Hydrology studies have indicated the coastal storm damage problem may not be driven by sediment movement as much as previously thought. Current sediment transport analysis indicates that beach materials are not transported very far, so certain potential solutions to reduce the problem are made more or less likely. Since sediment movement does not appear to be a significant contributor to the erosion problem, measures that would affect sediment movement are less likely to be viable. Examples of such measures would be Seawalls (hardened vertical face), Groins, and Offshore Breakwaters. Measures that deal with protection of the existing bluff and replenishment of a “starved beach” are more likely to be considered along with non-structural measures. Examples of such measures are Beach Nourishment, Revetments of various types, Relocations, and other Non-Structural Measures.

## Beach Nourishment

This alternative would place material on the beach to help reduce the impact of waves. In the preliminary June 2001 905(b) Analysis, placing up to 2 million cubic yards of material along the entire 4-1/2-mile-long study area was identified as a potential solution to the coastal storm damage problem at Barrow. Due to the shift in thinking regarding sediment transport, only reduced nourishment in front of the most critical areas appears to be appropriate. The following paragraphs describe the various borrow areas under consideration, likely methods to move the gravel from the borrow site to the beach, and potential impacts resulting from such operations. Wherever imported gravel is placed on the beach and in the near-shore zone, the imported materials could bury the invertebrates living in the sand. Primarily because of costs, the current priority preference for borrow sites is: (1) Point Barrow, (2) BIA Prospect, and (3) Cooper Island. We are now determining the other factors that need to be considered in any comparison between these sites.

BIA Borrow Site. The BIA site consists of gently rolling tundra with scattered lakes. The surface layer consists of frozen silts and silty sands, ranging from 10 to 20 feet thick, which are not suitable for use in beach nourishment. Below this is a layer of clean to silty sands that would be suitable for use. If this site were selected, operations would be conducted during the winter months to minimize impacts on the environment and wildlife. The top layer would be removed and stockpiled near the newly created pit. Gravel would be removed from the pit and hauled in trucks to the beach using both ice and existing roads. The material would be stockpiled along the beach until summer, when it would be spread along the beach. Care would be taken to ensure adequate access to the beach at all times for local residents. Work would be scheduled to minimize impacts on fishing and hunting. Estimated cost for this alternative (if 2 million cubic yards are needed) is \$140 million (\$70 per cubic yard).

Creating the new pit would permanently impact approximately 150 acres of tundra wetlands: 75 acres would be lost creating the new pit and another 75 acres would be impacted by the creation of a disposal site for the unsuitable material from the pit. This would eliminate productive bird habitat, cause permafrost thermokarsting, alter drainage patterns in area wetlands, lakes, and

## What are the preliminary measures being considered and their potential impacts? (cont.)

ponds, degrade water quality, and cause adverse noise and aesthetic impacts. There are no known historical or archeologically sensitive areas near the pit.

Cooper Island Borrow Site. Cooper Island is a barrier island that rises approximately 8 to 10 feet above sea level. The island is composed of sands and gravel that would be suitable for beach nourishment. There is little to no vegetation that would need to be removed. If this site was selected as a gravel source, material would be removed almost down to sea level, loaded on barges and transported to the Barrow beach. Material would be offloaded on the beach and graded as required. Anticipated cost for 2 million cubic yards of material placement would be \$150 million (\$75 per cubic yard).

Removing material from Cooper Island would impact the island surface, potentially causing island breaching and other geo-morphological impacts and consequences to near-shore brackish water habitats and erosion to the mainland. Near-shore mining would impact invertebrate and fish habitats. Mining would also cause adverse impacts to bird nesting, staging, and foraging habitats, disturb long-standing black guillemot research, impact bowhead subsistence hunting by disrupting areas used for lookout and landing whales, and impact polar bear and seal use areas. Ice road or barge route noise could disturb marine mammals e.g. seals, whales, and polar bears.

If Cooper Island was selected as a gravel source, additional testing, evaluation, and consultation for cultural resources would be required. The remains of an eroded house, a whale skeleton, materials from the Navy dispersed by the 1963 storm, and Dr. Divoky's research camp were addressed in a recent report describing the archeological survey conducted in fall 2004 by BTS Professional Services. The house would likely require some mitigation, if gravel was removed, and Dr. Divoky's research camp would need to be evaluated for eligibility for the National Register for Historic Places. The whale skeleton would be tested to determine if it was part of a larger cultural site. The Navy debris from the 1963 storm is not considered significant.

Submerged Spit Borrow Site. Field investigations revealed that adequate quantities of suitable material for beach nourishment were not available at this site, which will not be considered further. The general area offshore from Point Barrow is within the migratory corridor of the bowhead whale. Potential offshore dredging impacts include noise from dredging and barge traffic, which could deter whales from traditional hunting areas. Dredging the sea bottom would adversely affect the water column, fish, invertebrates, seabirds, and marine mammals.

Point Barrow Borrow Site. Point Barrow is a former village site. The point has areas of erosion and accretion. This site has suitable material for beach nourishment, and if this site was selected, work could be done at any time weather permitted. Material would be loaded on trucks, transported to the beach, offloaded on the beach, and graded as required. The estimated cost for 2 million cubic yards material placement is \$96 million (\$48 per cubic yard).

## What are the preliminary measures being considered and their potential impacts? (cont.)

Near-shore mining would impact invertebrate and fish habitats. The near-shore zone is used for whale beaching and harvesting, and foraging by shorebirds.. Polar bears forage on whale carcasses and gravel extraction at this site could cause bear/human interactions. Barge traffic would cause noise and disturbances to wildlife. Truck traffic through town would cause noise and human disturbances.

The Point Barrow site contains important archeological sites. Nuvuk has gravesites and house remains, and was found eligible for the National Register of Historic Places. If this area was considered as a gravel source, considerable consultation would need to take place with the tribes, community members, UIC, the State Historic Preservation Officer, and the Advisory Council on Historic Preservation about the appropriate treatment for this site.

### Erosion Protection

**Revetments.** This alternative would armor the face of the bluff to provide insulation to slow melting permafrost and protect the bluffs from wave action. Methods include super sacks, articulated mats, and rock revetment. A revetment may cause some beach access conflicts. In addition, covering the bluffs would potentially shore bird habitat.

### Flood Damage Reduction

**Raise Roadway.** This alternative would raise the elevation of the road in low-lying areas e.g. in front of the lagoon, at Browerville, and down to the landfill.

### Non-Structural Measures

As part of the erosion and flooding analysis, the applicability of certain non-structural damage reduction measures will be evaluated, and any that appear advantageous will be evaluated and compared with the structural measures previously discussed. Specific non-structural measures will be developed once estimated storm erosion and flood damages for the without-project condition are determined during this spring/summer. Examples of possible non-structural measures include:

- Relocate structures and facilities from potential damage area.
- Relocate roads to less vulnerable locations.
- Relocate damageable segments of the utilidor or portions of the water, sewer, gas, or power utility lines.
- Barrow participates in the National Flood Insurance Program.

The specific impacts of implementing these measures would vary and depend on each measures overall scope and extent. At a minimum, there could be some community disruption during construction, such as noise, dust, access restrictions, etc. Some public and/or private property might be required to accomplish some relocations.

# **What work is planned for summer 2005?**

## **Hydrology & Hydraulics**

The Corps will continue working on analyzing the pre 1963 topography or spot elevations data and formulating an effective solution. We are interested in collecting stories or any recollections of past beach borrow activities associated with infrastructure construction in Barrow (e.g., airport, major building pads, roads, etc. at Barrow or Browerville—not NARL/BASC), detailing location of beach borrow, years of beach borrow use, and estimates of volume used, if possible.

## **Geotechnical**

Identify nearest feasible rock source that would meet Corps specifications.

## **Environmental**

Environmental fieldwork planned for summer 2005 includes continuing the near-shore fish and invertebrate inventory in the Barrow beach area and north toward Point Barrow and potentially Cooper Island. The National Marine Fisheries Service will assist with this study using beach seines. Bird surveys will be conducted principally for shorebirds at the BIA borrow site and along the shore. If Cooper Island remains a viable borrow site, additional bird surveys will be conducted. Vegetation and wetland delineation will be done at the BIA borrow site, and a field investigation will be conducted at a potential rock borrow site.

## **Economics**

Upcoming summer work includes determining damages that could result to the community's water supply, sewage lagoon, utility infrastructure, and any secondary damages that would result from them (e.g. loss of electricity from a flooding event would result in the freezing of water lines.). A social impact study will also be scoped this summer. A data gathering effort will begin soon to help determine the current resources available and to establish the magnitude of work to be completed.

## **Plan Formulation**

Work planned for this summer includes working with the study team to develop specific alternatives from identified measures and identifying Corps policy issues that need to be addressed. In addition, the Corps will develop a scenario analysis to help evaluate and compare alternatives against uncertain future conditions and prepare study team documents for the feasibility scoping meeting currently scheduled for mid-September 2005.

## **How can I find out more about your study, ask questions, or provide comments or concerns?**

Everyone in the community is invited to attend our public information meeting on Wednesday, April 6, 2005, at 7 p.m. in the North Slope Borough Assembly Chambers. The study team from the Corps of Engineers and the U.S. Fish and Wildlife Service will present the status report on this study, answer questions or discuss concerns. We are interested in hearing from you. If you are interested in the study but cannot attend the meeting, you can find information about the study by visiting our web site: [www.poa.usace.army.mil/en/cw/barrow/barrow\\_index.html](http://www.poa.usace.army.mil/en/cw/barrow/barrow_index.html)

To send in comments, please use the sheet of paper just inside the back cover of this packet; add more blank sheets of paper as necessary.

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