TAB E

Date: 17 May 2006
Division: POD
District: POA

SECTION 117 PROJECT FACT SHEET

1. **Project**. Shishmaref, Alaska, Section 117

2. **Location of Project/Congressional District.**
Shishmaref is on Sarichef Island in the Chukchi Sea, just north of the Bering Strait. It is 5 miles from the mainland, 126 miles north of Nome, and 100 miles southwest of Kotzebue. Shishmaref is surrounded by the 2.6-million-acre Bering Land Bridge National Reserve. Figure 1 shows the project location.

The project area is in the Alaska Congressional District. The Congressional delegation is composed of:

Senator Ted Stevens (R)
Senator Lisa Murkowski (R)
Representative Don Young (R)

3. **Study Authority.**
Fiscal Year 2005 Consolidated Appropriations, Section 117, P.L. 108-447

> *SEC. 117. Notwithstanding any other provision of law, the Secretary of the Army is authorized to carry out, at full Federal expense, structural and non-structural projects for storm damage prevention and reduction, coastal erosion, and ice and glacial damage in Alaska, including relocation of affected communities and construction of replacement facilities.*

Page 41, Senate Report 109-84, for the Energy and Water Development Appropriations Act, 2006, P.L. 109-103.

> *The Committee has provided $2,400,000 for Alaska Coastal Erosion. The following communities are eligible recipients of these funds: Kivalina, Newtok, Shishmaref, Koyukuk, Barrow, Kaktovik, Point Hope, Unalakleet, and Bethel. Section 117 of Public Law 108-447 will apply to this project.*

4. **Study Purpose.**
The purpose of this study is to determine if there is a Federal interest in providing erosion protection at Shishmaref.

5. **Discussion of Prior Studies, Reports and Existing Water Projects.**
The documented history of storm damage and coastal erosion problems at Shishmaref extends back more than 50 years and includes numerous reports by various consultants and State and Federal agencies, including the Corps. Several local protection projects have been constructed with varying degrees of success.

Historical protection attempts – 2003.

BIA protection in foreground - 2003.

a. Recent Corps Projects.

Shishmaref Section 103 – A Section 103 Shoreline Protection project was investigated, with the conclusion that the cost of options for protection would exceed the cost limits of the existing program. The study was terminated in 2003 recommending the most critical areas be addressed through Section 14 and BIA efforts.

Shishmaref Section 14 – A Section 14 project was implemented in 2005 and provided protection to the Shishmaref school. Two hundred and thirty feet of protection was installed for about $1.4 million.

Shishmaref Section 14 – A request for a second Section 14 project was received by the Corps in 2004 for protection of the community washeteria, sewage lagoon, and tannery. The study was not initiated because of lack of funding in the Section 14 program.

Post Construction – Corps project to right / City project to left in 2005.

b. Recent Local Projects.
Bureau of Indian Affairs – A 200-foot section of shoreline protection was installed to protect the road to the airport. This project was funded through the Bureau of Indian Affairs and administered by Kawerak Regional Corporation. The project was constructed in 2004.
will
City of Shishmaref – A section of shoreline protection was installed in 2005, extending 300 feet to the east from the Corps project. This project was funded through the State of Alaska with money specifically appropriated to install shoreline and erosion protection.

6. **Plan Formulation.**

a. Identified Problems.
The Village of Shishmaref is on a narrow barrier island. Its location is constrained by the Chukchi Sea to the northwest and the lagoon to the southeast. Over the years, the community has tried many different techniques to arrest the erosion, including gabions, sandbags, and articulated concrete mats. All these efforts have provided only temporary solutions. Because the shoreline continues to recede, the community has moved houses and other structures back from the edge but has less and less space to do so. Because of this lack of space, the community has expressed a desire to relocate. Recently, the community experienced severe coastal storms that eroded the island of Sarichef to such an extent that the community itself is on the brink of destruction. If left unchecked, critical infrastructure will be destroyed within the next few years. The village has constructed protection for a stretch of the shoreline, but significant portions are left exposed to coastal erosion to include areas where there are many houses, a community store, several fuel tanks, the community sewage lagoon, water supply, and public wash facilities. Even the protected portions of shoreline may be subject to continued erosion forces due to overtopping or scour of undersized armor rock. The Corps installed a 230-foot shoreline protection project, designed to protect the school. Eventually, the project will be outflanked leaving the entire community in jeopardy.


Significant numbers of residences have no erosion protection.

A store on Shishmaref and fuel oil provider with no protection.

The area of concern for this project essentially stretches from the community washeteria westward to the airport, a length of about 3,400 feet. Alaska DOT has expressed that they are examining critical areas of the airport for implementation of shoreline protection. Because erosion at the airport is being addressed by DOT, the airport was not included in our study area.

Hydraulic Conditions. The tides at Shishmaref are generally diurnal with two highs and two lows occurring daily. Tide levels, referenced to mean lower low water (MLLW), are shown in Table 1. Extreme high water levels result from the combination of astronomic tides and rises in local water levels due to atmospheric, wave set-up, and storm surge conditions.

Table 1 - Tide Elevations, Shishmaref, Alaska

Tidal Level	Elevation (ft. MLLW))
Mean Higher High Water (MHHW)	+1.0
Mean High Water (MHW)	+0.9
Mean Tide (MSL)	+0.5
Mean Low Water (MLW)	+0.1
Mean Lower Low Water (MLLW)	0.0
Extreme Low Tide	-0.8

Storm surges are increases in water surface elevation caused by a combination of relatively low atmospheric pressure and wind-driven transport of seawater over relatively shallow and large unobstructed waters. Storm-induced surges can produce short-term increases in water levels to an elevation considerably above mean water levels. Storm surge at Shishmaref has not been studied in depth; however, indications are that the area does experience significant storm surges. Relatively broad beach slopes and shallow bathymetry offshore are conditions that are conducive to high storm surge elevations. Highest storm surge elevations are likely to be on the order of approximately +8 feet MLLW during extreme low-pressure events. As Table 1 shows, astronomic tides at Shishmaref are a relatively minor factor in the fluctuations in water surface elevations. The wind-driven transport of seawater is the most important factor, followed by atmospheric pressure effects.

The wave climate for the Shishmaref area is generally characterized as being oriented in one of two directions depending on wind direction: either from the northeast or from the southwest. Open ocean swell (long period waves) can reach the area from the southwesterly direction; however, such waves would travel from long distances through the Bering Straits and strike the shoreline at an oblique angle. Long-period swell that does reach the shoreline along the community has reportedly not been the primary cause of erosion. Rather, shorter period waves from locally generated storm conditions appear to be the most problematic. The shoreline is directly exposed to the southwesterly and northwesterly fetches across the Chukchi Sea and experiences moderately high waves under storm conditions. Such waves are generally in the 5 to 8-foot-high range with periods of 4 to 5 seconds based on observations at the bluff. Events with waves as high as 15 feet have been reported during extreme storm conditions. These waves do cause severe erosion when coupled with high storm surge elevations.

Erosion rates for this study were analyzed using aerial photography dated July 12, 1972, July 18, 1980, June 17, 1984, and July 19, 2003. These four flights represent the extent of available aerial photographic data. Each flight was used to estimate the alignment of the top of bluff line along the beach frontage. The term "wetted bound" has also been used to describe this alignment in other Corps of Engineers studies. By overlaying the top of bluff lines for each year of aerial photography, a history of bluff recession was prepared for the last 31 years.

Annual erosion rates were estimated by measuring the distance from fixed points in the community, such as existing buildings and the airstrip, to the top of bluff for the four flights. The difference in distance between the various years' flights was calculated, weighted depending on the number of years between flights, and then averaged over the total time period (31 years). This analysis determined an average annual erosion rate at each station. For the aerial photography estimates, a total of nine stations were used. These were roughly equally spaced and representative of the entire shoreline frontage from the west end to the east end of the island.

Results of this analysis indicate an average annual erosion rate of a low of 2.7 feet per year to a high of 8.9 feet per year depending on the station location along the bluff. The economic analysis that follows calls this rate of erosion Rate #1.

Erosion rates for this study were also analyzed using distance measurements performed by the residents of Shishmaref dated at various intervals from the fall of 2001 to the fall of 2003. Measurements were taken a total of 10 times over this period. These measurements represent the closest approximation of actual surveyed land loss due to erosion that is available. Most of the measurements were taken after significant storm events caused loss of land due to erosion. A few were taken in the early summer to establish a baseline for comparison with the following fall seasons. These measurements were used to lay out the estimated top of bluff lines for four selected dates: Fall 2001, July 1, 2002, November 11, 2003, and November 25, 2003. By overlaying the top of bluff lines for each date, bluff recession was estimated for the last 3 years.

Annual erosion rates were again estimated by using measured distances from fixed points in the community, such as existing buildings, to the top of bluff. The difference in distance between the various measurements was calculated, weighted depending on the time period in between measurements, and then averaged over the total time period (approximately 3 years). This

analysis determined an average annual erosion rate at each station. For the measured data estimates, a total of 21 stations were analyzed. Four stations were selected as representative areas for estimating typical erosion rates. These were roughly equally spaced and representative of the entire shoreline frontage immediately adjacent to the community.

Results of this analysis indicate an average annual erosion rate of a low of 13.0 feet per year to a high of 22.6 feet per year depending on the station location along the bluff. The economic analysis that follows calls this rate of erosion Rate #2.

Table 2 - Shishmaref Erosion Rates

Erosion Rates	Source of Data	Years	Low Range	High Range
Rate #1	Aerial Photography	1972, 1980, 1984, 2003	2.7	8.9
Rate #2	Actual Measurements	2001, 2002, Twice in 2003	13.0	22.6

To better understand the erosion rates, figure 2 attached to this report shows the estimated future erosion rates taking into account the current placement of shoreline protection and a possible erosion rate based upon anticipated failure mechanisms. As mentioned before, the installed Corps project may be subject to outflanking and the other protection projects are subject to overtopping failure. As shown in the figure, with the exception of the Corps revetment, the currently installed systems will function poorly to provide even interim protection.

Objectives. Based upon the existing problems, the objective of this project is to develop a shoreline protection project that will provide sufficient protection against erosion until such time that the community can either relocate or develop a different permanent solution. The project life would be 10 to15 years, which is the estimated time for which the community would need to relocate or develop a more permanent solution.

b. Alternative Plans Considered.

No-Action Alternative. The No-Action Alternative does not mean no action will be taken to protect Shishmaref. If no Corps project is implemented, the State and local agencies will continue their efforts to piecemeal shoreline protection. Their projects, as already installed and those planned for the future, are not expected to provide substantial protection for more than one or two storm seasons.

Relocation. The community has chosen the long-term solution of relocation, but this process is expected to take a significant amount of time. Preliminary planning estimates show relocation could cost $180 million and take as long as 15 to 20 years to complete. In addition, completion of shoreline protection at Shishmaref may increase the time available for the community to move. If shoreline protection is successful in decreasing erosion to a manageable rate, alternatives that explore creation of fast land to allow the community to grow may be viable. The relocation alternative, however, does require interim measures to protect the community, whether the community eventually moves or not. Because relocation is a long-term issue, and the need for shoreline protection is immediate, the only alternatives considered for the

remainder of this report are shoreline protection alternatives. Relocation options are being considered under a separate Corps study.

Shoreline Protection Alternatives. As part of a previous Shishmaref analysis, the Corps developed several methodologies for providing shoreline protection, which were beach nourishment, beach nourishment with groins, beach nourishment with offshore breakwaters, and a variety of revetment options. The discussion of how the recommended plan was chosen can be found in subsection d. Description of Recommended Plan.

Alternative 1: Beach Nourishment. Alternative 1 is a beach fill project followed by periodic beach nourishment. This would be accomplished by placing borrow material (sand) along the bluff and beach fronting the community, shaping and compacting the material, and periodically nourishing the material as it erodes under wave action. In order to provide for the necessary 3,400 linear feet of shoreline protection, the length of this alternative would be 4,000 linear feet. Quantities were estimated to be 70,000 cubic yards initial beach fill and 70,000 cubic yards post-storm maintenance fill (assumed to happen annually). The estimated initial construction cost for this project is $7,535,000. Annual maintenance cost of $7,535,000 for beach fill and pipeline dredging and embankment would be required. The life cycle cost for this alternative is $81,531,000 at the April 2006 price level (15 years protection).

Alternative 2: Groins. Alternative 2 is the construction of a series of rock groins in conjunction with beach nourishment. This would be accomplished by constructing rock groins perpendicular to the shoreline along the bluff and beach fronting the community, and nourishing the beach in between the groins with sand. The groins would be approximately 200 feet in length and spaced at 500-foot intervals. In order to provide for the necessary 3,400 linear feet of shoreline protection, the length of this alternative would be 6,000 linear feet. Quantities were estimated to be 467,000 cubic yards of armor rock (8-ton average), 135,000 cubic yards of B rock, 39,100 cubic yards of core rock, 253,000 cubic yards of filter rock, 276,000 cubic yards of bedding rock, 55,000 cubic yards of initial beach fill, 5,000 cubic yards of annual maintenance fill, and 14,000 cubic yards of maintenance armor rock every 15 years. The estimated initial construction cost for this project is $220,633,000. Annual maintenance cost of $3,784,000 for beach fill and pipeline dredging would be required. The life cycle cost for this alternative is $257,797,000 at the April 2006 price level. If, after 15 years, it is found desirable to extend the project life, additional rock would be required.

Alternative 3: Offshore Breakwaters. Alternative 3 is construction of a series of offshore rock breakwaters in conjunction with beach nourishment. This would be accomplished by constructing rock breakwaters parallel to the shoreline at some distance offshore from the bluff and beach fronting the community, and nourishing the beach adjacent to the existing bluff with sand. The breakwaters would be approximately 500 feet in length, spaced with 150-foot gaps, and located approximately 800 feet offshore. In order to provide the necessary 3,400 linear feet of shoreline protection, the length of this alternative would be 6,400 linear feet. Quantities were estimated to be: 122,700 cubic yards of armor rock (8-ton average), 42,700 cubic yards of B rock, 25,600 cubic yards of core rock, 38,400 cubic yards of filter rock, 39,500 cubic yards of bedding rock, and 58,700 cubic yards of beach fill. The estimated initial construction cost for this project is $58,832,000 at the April 2006 price level. Annual/periodic maintenance would not be required during the project life, thus making the life cycle cost the same as the estimated initial construction cost. If, after 15 years, it is found desirable to extend the project life, additional rock would be required.

Alternative 4: Rock Revetment. Alternative 4 is construction of a rock revetment with a design cross-section and armor stone size similar to the seawall the Corps of Engineers constructed in front of the school and teacher's quarters in 2005 under the Section 14 authority. This alternative would be constructed by placing three layers of rock of different gradations and one layer of filter fabric on the bluff along the unprotected beach frontage in the community. It would tie in with the Corps' Section 14 project at its northeast and southwest ends. Per the Shishmaref Section 14, the design wave for this project is 6 feet and the crest elevation is 12 feet MLLW. In order to provide the necessary 3,400 linear feet of shoreline protection, the length of this alternative would add approximately 2,200 feet of revetment to the northeast to the sewage lagoon and 950 feet to the southwest. The length of the project would be 3,150 linear feet, extended to a weighted toe configuration at 12 feet in width and to a crest height of +15 feet MLLW. Quantities were estimated to be: 7,500 cubic yards sand borrow, 23,000 square yards geo-textile fabric, 8,000 cubic yards permeable backfill, 13,000 cubic yards keyed riprap Class II, and 35,000 cubic yards armor rock. This alternative would have an estimated design life of 10 to 15 years. The estimated initial construction cost for this project is $13,096,000 at the April 2006 price level. Annual/periodic maintenance would not be required during the project life, thus making the life cycle cost the same as the estimated initial construction cost. If, after 15 years, it is found desirable to extend the project life, additional rock would be required.

c. Economic Analysis.

This economic evaluation examines both the historic and the presently observed rates of erosion in order to provide a low and high estimate for projected erosion damages at Shishmaref. The rest of this discussion uses Rate #1 for the future rate of erosion based on the 1973 to 2003 rates and Rate #2 for the erosion rates from 2001 to 2003. It should be noted that actual future erosion rates and resulting damages are difficult, if not impossible, to predict, and near-term shore protection projects may slow the rates of erosion depicted here.

The approach used to determine potential erosion damages at Shishmaref is based on several assumptions as they pertain to the damage categories of residential, commercial, public infrastructure, and land values. Damage calculations are based on a 15-year horizon because it is assumed that significant public infrastructure damage will occur during this time and that erosion

at Shishmaref will need to be addressed soon. We also assume that due to the lack of available land, relocation at Shishmaref is not an option for the existing structures. The estimates used in this analysis are based on information currently available.

Following are estimates of the potential damages that could occur from erosion in Shishmaref:

- The number of residences lost over the 15-year project horizon range from 23 to 81 with values of around $4 to $19 million.

- Commercial and public property damages are $3.4 million under Rate #1 for the 15-year project horizon and rise to almost $25 million under the faster erosion Rate #2.

- The value of land lost over the 15-year project horizon ranges from $26,000 to $68,000 using the Nome price per acre of $1,000. Land potentially lost ranges from 25 to 68 acres.

- Given the existing estimates for erosion, the sewage lagoons and landfill will likely need to be closed and cleaned up as necessary during the 15-year project horizon. Taking care of these potential environmental damages will cost approximately $2 million.

Total Erosion Costs. The combined land and residential, commercial, and public infrastructure costs due to erosion at the City of Shishmaref are shown in the following table. This table also includes the cost to close and clean up potential environmental hazards. Total erosion costs range from almost $10 million to almost $46 million for the 15-year project horizon.

Table 3 - Total Erosion Costs (5, 10, and 15-year increments)

Year	Rate #1	Rate #2
	Value Lost	Value Lost
2009	$ 2,361,000	$ 18,350,000
2014	9,471,000	37,480,000
2019	9,700,000	45,753,000

Present Value of Erosion Costs. The present values of the erosion costs at Shishmaref were determined by discounting the value of structures and land based on the year in which they are expected to fail, the current Federal discount rate of 5.125 percent, and a period of analysis of 2005 to 2019. Before the values of the structures were discounted, it was assumed that even without damage from erosion, all the structures would have depreciated in value by 30 percent. As a result, 70 percent of the total structure and content values were discounted to arrive at the present values. Note that structures include residential, commercial, and public infrastructure. The values of closing and cleaning the sewage lagoon and landfill have not been depreciated. Present values over the 15-year project horizon range from $6.5 million under Rate #1 to almost $35 million under Rate #2.

Table 4 - Present Value of Shishmaref Erosion Costs (2005-2019)

Structure Type	Rate #1	Rate #2
Residential	$ 2,839,000	$ 13,387,000
Commercial	-	3,311,000
Public	2,590,000	17,063,000
Land	18,000	47,000
Environmental	1,085,000	1,180,000
Total present value	**$ 6,532,000**	**$ 34,988,000**

Other Social Effects. The social and cultural effects as a result of erosion at Shishmaref cannot easily be reflected in the dollar damages described here. The Shishmaref economy is based on subsistence supplemented by part-time earnings and transfer payments. Potential negative effects are loss of independence, lack of employment opportunities, competition for scarce subsistence resources, and cultural differences. Adverse life, health, and safety issues include loss of tribal entity, language loss, increased health risks, and perceived safety in the new location.

Ability to Pay. According to Census 2000, the average household income in Shishmaref is about 60 percent of the State average, while the poverty level, unemployment level, and not working percentage are all higher than the State averages by significant amounts. Shishmaref facilities are well below normally acceptable standards, and the population density per house is 3.96 persons compared with a statewide average household of 2.74 persons.

Table 5 - Census 2000 data for Shishmaref and statewide.

	Population	Families below poverty	Unemployed	Median household income	Not in labor force	Household size	Lack Comp Plumb	Lack Comp Kitchen	Lack Phone
Shishmaref	562	16.2%	9.5%	$30,714	42.3%	3.96	95.8%	92.3%	13.4%
Alaska	626,932	6.7%	6.1%	$51,571	28.7%	2.74	6.3%	5.6%	3.0%

Shishmaref does not have available revenues or sufficient population and income to cost-share and sponsor the required work. The city's 2 percent sales tax earned them a little over $34,000 in 2004 according to *Alaska Taxable* published by the Alaska Department of Commerce, Community and Economic Development. The DCCED website shows total municipal revenues from all sources for 2003 at $139,631. Most of their revenue is derived from the washeteria and it appears that most of their expenditures are for labor associated with the public utilities. Shishmaref is eligible for Power Cost Equalization (PCE) funds, but these funds have been declining in recent years from $0.20 per kWh in 2003 to less than $0.15 per kWh in 2004. This puts additional pressure on the community to pay for utilities as PCE funds continue to dwindle.

d. Description of Recommended Plan.

The recommended plan is the least cost plan that will meet the project objectives of providing shoreline protection until the community moves or develops a more permanent solution, which entails providing shoreline protection for 10 to 15 years. Based on comparison costs for the various alternatives, as shown in the following table, the revetment option is the least expensive, thus it has been chosen as the recommended alternative.

Table 6 - Summary of Alternative Costs

Alternative Description	Initial Construction Estimate	Periodic Maintenance	Discounted Maintenance (15-year life)	Total Life-Cycle Cost (15-year life)
1. Beach Nourishment	$ 7,535,000	$ 7,535,000	$ 73,996,000	$ 81,531,000
2. Groins	220,633,000	3,784,000	37,164,000	257,797,000
3. Offshore Breakwaters	58,832,000	-	-	58,832,000
4. Rock Revetment	13,096,000	-	-	13,096,000

Note: Periodic maintenance costs have been discounted using the FY06 discount rate of 0.05125 percent and extending the project to a 15-year life. All costs have been rounded to the nearest thousand. Alternatives 2 and 3 do not include costs for maintenance that would likely be required at year 15.

Selection of Recommended Plan. The cost comparison shows rock revetment to be the least cost option. There are also other factors that make the revetment the most preferred plan. The current practice of shoreline protection at Shishmaref is revetment. Approximately 730 linear feet of revetment have been installed in the last few years, including about 230 feet of Corps designed and constructed revetment. Being that revetment has been the preferred option to date (i.e. sponsored by the community, able to get permits, known results), installing more revetment would provide a cohesive and consistent project thus making revetment the preferred option.

Secondly, new revetment designs are showing promise for a longer than anticipated project life. Corps engineers have observed that the typical failure mechanism for previous protective structures at Shishmaref has been related to overtopping. A wave would overtop the structure, wash away the fine-grained sands, thus exposing permafrost. The exposed permafrost would then melt, causing structural instability for the shoreline protection project resting upon it. The new design takes into account the potential for overtopping and increases the amount of filter material in order to keep the fine-grained sands in place. It is also believed that by keeping these fine-grained sands in place, the permafrost layer holding the shoreline together may begin to expand. The Corps is currently logging the internal temperature of the Section 14 revetment using temperature gauges that were placed inside the revetment prism during construction. The Corps will use this information to refine designs and possibly increase the lifespan of projects to an even greater degree. If the current belief holds true, the life cycle costs of the revetment project would decrease as less maintenance would likely be required.

A third consideration is the time and cost needed for design of the project. The Corps already has plans and specification for the Section 14 project on Shishmaref that could be easily adapted

to a revetment extension project. Alternatives 1, 2, and 3 would likely require extensive design work and numerical models prior to implementation.

A fourth consideration is the success of the previous revetment project and the anticipated longer life expectancy for this project. If this rock revetment project performs as expected, the community may be able to avoid the $180 million relocation alternative altogether. Future analysis will determine the viability of this option versus the need to relocate the entire community. In terms of justification for this project, relocation of the affected residential and commercial buildings and public infrastructure is estimated to cost approximately $45.9 million under the slower erosion Rate #1 profile and rises to $76.3 million under the more recent active erosion Rate #2. These estimates assume that the community moves to a new location requiring site preparation, utility installation, and new infrastructure to support the relocated buildings. Collocation with another Alaska community is not considered due to the adverse social effects associated with such a move. Therefore, the rock revetment alternative is less costly than relocation of the threatened facilities.

Taking the above observations into consideration (lower costs, local and agency acceptability, potential for longer revetment design life, significantly less design requirement), the revetment alternative appears to be the best option and the least costly to meet the project objectives, thus making Alternative 4: Rock Revetment the recommended alternative.

Description of the Recommended Plan. This alternative would be constructed by placing three layers of rock of different gradations and one layer of filter fabric on the bluff along the unprotected beach frontage in the community. It would tie in with the Corps' Section 14 project at its northeast and southwest ends. It would extend approximately 2,200 feet to the northeast to the sewage lagoon and 950 feet to the southwest. Per the Shishmaref Section 14, the design wave for this project is 6 feet and the crest elevation is 12 feet MLLW. This project would incorporate upgrades to the existing BIA and city projects to provide a constant and continual level of protection for the project. This alternative would have an estimated design life of 10 to 15 years. Figure 3 shows a typical section and footprint of the proposed alternative.

Cost Estimate. Estimated cost for construction of the preferred alternative is $13,096,000. The estimate is based on a total of 3,150 linear feet of shoreline revetment. Approximately 2,200 linear feet of revetment would be placed east of the school and the remaining 950 linear feet would be placed west of the school. This cost estimate assumes a one-time construction lasting approximately 2 years. The estimate is based on quantities provided by the Corps' design team and the bid results from a recent award of a similar design at Shishmaref. The estimate includes a 4 percent escalation factor to bring the costs forward for an FY06 award. The project also includes a 25 percent contingency for potential design changes that may occur and an 8 percent Supervision and Administration cost.

Table 7 – Initial Construction Estimate

Item	Cost
1. Mobilization/Demobilization	$ 2,808,000
2. Geo-textile filter fabric	258,000
3. Permeable backfill	764,000
4. Keyed riprap Class II	1,643,000
5. Armor Rock	7,371,000
6. Contractor testing/Construction schedule	21,000
7. Surveying/staking	70,000
8. Sand	158,000
9. Temporary traffic control	3,000
Total	13,096,000

Note: Includes Supervision & Administration at 8 percent and 25 percent construction contingency.

Project Implementation Plan. Construction of this project will require funding beyond the Alaska Coastal Erosion FY 2006 appropriation, causing this project to be implemented incrementally as funding becomes available. This will increase the number of mobilizations needed, thus increasing the overall cost of the project. The first increment of funding is estimated to be $1,362,000, which would pay for approximately 175 linear feet of revetment. This first segment would be to the east of the existing Corps and city revetments as shown on the attached Figure 3. This segment was chosen through a combination of assessments by Corps engineers and at the request of the community. Field measurements taken in early 2006 showed the shoreline had eroded over 50 feet over the last year in the area proposed for this first segment making it the best candidate for immediate attention.

Table 8 – Initial Segment Estimate

Item	Cost
1. Mobilization/Demobilization	$ 702,000
2. Geo-textile filter fabric	14,000
3. Permeable backfill	42,000
4. Keyed riprap Class II	91,000
5. Armor Rock	410,000
6. Contractor testing/Construction schedule	21,000
7. Surveying/staking	70,000
8. Sand	9,000
9. Temporary traffic control	3,000
Total	1,362,000

Includes S&A

The remaining 2,975 linear feet of revetment will cost $12,770,000**.** Assuming this funding will become available in 2007, the total implementation cost of the project is estimated to be $14,132,000. If funding remains constrained and more incremental construction is required, each additional mobilization will add more cost, thus raising the overall implementation cost.

Table 9 – Complete Implementation Cost

Item	First	Remaining	Total
1. Mobilization/Demobilization	$ 702,000	$ 2,862,000	$3,564,000
2. Geo-textile filter fabric	14,000	249,000	263,000
3. Permeable backfill	42,000	735,000	777,000
4. Keyed riprap Class II	91,000	1,581,000	1,672,000
5. Armor Rock	410,000	7,095,000	7,505,000
6. Contractor testing/Construction schedule	21,000	21,000	42,000
7. Surveying/staking	70,000	72,000	142,000
8. Sand	9,000	152,000	161,000
9. Temporary traffic control	3,000	3,000	6,000
Total	1,362,000	12,770,000	14,132,000

Includes S&A

Real Estate Considerations. The non-Federal sponsor, the City of Shishmaref, must provide, at no cost to the Government, all lands, easements, and rights-of-way that the non-Federal sponsor owns or controls as of the effective date of the agreement that the Government determines are required to implement the project. All other LERRD requirements will be performed by the Government at full Federal expense. Title of any lands, easements, and rights-of-way acquired by the Government will be in the name of the non-Federal sponsor. Since the project is being constructed at full Federal expense, the city will not be afforded credit for the LER provided. Any lands acquired for the project will be in compliance with Public Law 91-646, as amended. Permanent and temporary easements will be needed for the project.

Based upon preliminary plans, it appears that several individual lots will be affected. Thus, individual permanent easements will have to be obtained from various landowners. This may include Native allotments, Native Corporation lands, State lands, and/or private ownerships. If Native allotments are involved, working with BIA will take an extra several months. The temporary staging area(s) have not yet been defined.

Project lands are currently owned by the State of Alaska, Dept of Natural Resources, although the State Dept of Transportation & Public Facilities has management oversight of the fast lands by way of an Interagency Land Management Transfer. No Corps lands are included within the project area. The value of LER is considered nominal, however, the incidental and administrative costs for acquisition of lands are estimated at $25,000.

Office of Counsel's opinion on whether Navigational Servitude is available will need to be obtained. A gross appraisal and baseline cost estimate for the project's LER will be prepared at a later time. In addition, an assessment of the non-Federal sponsor's acquisition capability has been completed.

Environmental Considerations. Shishmaref was once known as Kigiqtaq (also spelled Qikiqtaq and Kikiktuk) and was the largest community in the region. The settlement dates to at least the Late Western Thule period (AD 1000 – 1800). Early visitors to the area reported that

semi-subterranean homes were spread along the beach ridges on Sarichef Island. Shishmaref became a major commercial center during the 1899 Gold Rush to Nome, and it was during that time that the first milled lumber buildings were built in the area of the present-day community. The post office was opened in 1901 and a school was built in the early 1920s.

A variety of anthropological, archaeological, and historical work has been done at Shishmaref and on Sarichef Island. Only two archaeological sites are recorded in the Alaska Heritage Resources Survey (AHRS) database on the island: SHF-00004 and SHF-00033. Evidence of older occupations could be encountered "in almost any area of the town… suitable for human use." Areas of the bluff were examined before construction of a seawall and a proposed sand source northeast of the community. No new cultural resources in the project areas were reported. Construction of stabilization projects in Shishmaref in 2003 and 2005 were monitored by archaeologists and no cultural material was encountered. The Corps will require that construction activities be monitored by an archaeologist meeting the Secretary of Interior standards (36 CFR 61).

The sandy un-vegetated beaches and sparsely vegetated bluffs would be affected by the revetment construction; however, no significant wildlife habitat would be affected. Subsistence hunting along the beach for small game, waterfowl or harvesting plants could be temporarily affected as well as set net fishing for salmon and whitefish. Timing restrictions for these activities were not imposed for the previously constructed projects. There are no endangered species or essential fish habitat issues. A full public interest review and environmental assessment will be conducted for the expanded project.

7. **Views of Sponsor.** The City of Shishmaref will act as the local sponsor and has expressed enthusiastic support for the project. The community, in their recent requests for assistance to Congress, state that they realize immediate shoreline protection is needed. They state that even if they relocate, that action is still 15 to 20 years into the future, thus making the need for shoreline protection critically important. The community has passed a resolution in support of the shoreline protection project and is drafting a letter of intent for the project.

8. **Views of Federal, State, and Regional Agencies.** Scoping for the expanded revetment project indicates that resource agencies have minimal concerns with the project. A previous Fish and Wildlife Coordination Act Report for the project area is sufficient and will be updated with a letter for the recommended plan. The State Historic Preservation Officer will be notified about the recommended plan and is expected to agree to a no effect determination if a qualified monitor is on site during construction. There is minimal effect to near-shore essential fish habitat, and no threatened or endangered species or their critical habitat are in the project area. Formal consultation correspondence will be contained in the environmental assessment.

9. **Status of Environmental Statutes Compliance.** The environmental assessment is being completed, and a finding of no significant impact is expected to be appropriate. Water quality certification, Coastal Zone Management Consistency final determinations, essential fish habitat and State Historic Preservation Officer consultations will be completed after the public interest review.

10. **Significant Effects.** N/A

11. **Implementation Schedule.** The entire project, if funded in one phase, would take two seasons to construct. However, funding shortfalls are anticipated, and the project will most likely be phased based upon available funding. Multiple phases will incur multiple mobilizations and demobilizations of materials and equipment, and due to lessened "economies of scale", costs will escalate. As explained earlier in this report, the first increment of the project is approximately 175 linear feet of revetment estimated to cost $1,362,000. The schedule below assumes the construction of the first increment to be constructed within existing funds available.

a. Contract Award: 1st Phase - 31 July 2006

b. Project Completion: 1st Phase - 30 Sep 2006

12. **Supplemental Information.**

a. Headquarters Guidance. The VTC Fact Sheet dated 12 December 2005 contained the following instructions for implementing projects under the aforementioned legislation.

The Alaska Coastal Erosion Section 117 Program will follow the processes, procedures, and regulations for the Continuing Authorities Program, Section 14, Emergency Streambank and Shore Protection and any changes issued thereto, with the following exceptions.

1. *Funding. Funding is 100 percent Federal.*
2. *Federal Limit. There is no statutory Federal cost limit.*
3. *PCA. A new model Project Cooperation Agreement is required and will be developed and submitted to ASA (CW) for approval.*
4. *No Limit. There is no limit on facilities eligible for protection.*
5. *Types of Projects. All types of projects authorized by Section 117 may be implemented.*

b. Items of Local Cooperation. The following lists major items of cooperation that will be in the Project Cooperation Agreement.

I. Not less than once each year, inform affected interests of the extent of protection afforded by the project;

II. Agree to participate in and comply with applicable Federal floodplain management and flood insurance programs;

III. Comply with Section 402 of the Water Resources Development Act of 1986, as amended (33 U.S.C. 701b-12), which requires a non-Federal interest to prepare a floodplain management plan within one year after the date of signing a project cooperation agreement, and to implement such plan not later than one year after completion of construction of the project;

IV. Publicize floodplain information in the area concerned and provide this information to zoning and other regulatory agencies for their use in adopting regulations, or taking other actions, to prevent unwise future development and to ensure compatibility with protection levels provided by the project;

V. Prevent obstructions or encroachments on the project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) such as any new developments on project lands, easements, and rights-of-way or the addition of facilities which might reduce the level of protection the project affords, hinder operation and maintenance of the project, or interfere with the project's proper function;

VI. Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the non□Federal sponsor owns or controls for access to the project for the purpose of completing, inspec-ting, operating, maintaining, repairing, rehabilitating, or replacing the project;

VII. Hold and save the United States free from all damages arising from the construction, operation, maintenance, repair, rehabilitation, and replacement of the project and any better-ments, except for damages due to the fault or negligence of the United States or its contractors;

VIII. Cost Sharing. All costs for design/construction of projects carried out pursuant to Section 117 will be at full Federal expense, except as discussed in the following paragraphs. Each party will be solely responsible for its costs of participation in the Project Coordination Team.

IX. Lands, Easements, Rights-of-Way, Relocations, and Disposal Facilities (LERRD). The non-Federal sponsor must provide, at no cost to the Government, all lands, easements, and rights-of-way that the non-Federal sponsor owns or controls as of the effective date of the agreement that the Government determines are required to implement the project. All other LERRD requirements will be performed by the Government at full Federal expense. Title of any lands, easements, and rights-of-way acquired by the Government will be in the name of the non-Federal sponsor.

X Hazardous Substances. The Government will perform any investigations for hazardous substances that the Government determines to be necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. Sections 9601-9675, that may exist in, on, or under lands, easements, and rights-of-way that the Government determines to be required for the project. In addition, should the Government determine to initiate or continue with construction after considering any liability that may arise under CERCLA, the Government will be responsible, as between the Government and the non-

Federal sponsor, for the costs of clean-up and response, to include the costs of any studies and investigations necessary to determine an appropriate response to the contamination for any contamination occurring prior to the end of the period of construction. Any costs of clean-up and response performed after the period of construction will be considered an OMRR&R obligation and will be the responsibility of the non-Federal sponsor.

XI. Historic Preservation. The Government will perform any identification, survey, or evaluation of historic properties and perform or ensure the performance of any mitigation activities or actions for historic properties or that are otherwise associated with historic preservation including data recovery activities that are required prior to the end of the period of construction. Any identification, survey, or evaluation of historic properties performed after the period of construction will be considered an OMRR&R obligation and will be the responsibility of the non-Federal sponsor.

XII. Operation, Maintenance, Repair, Replacement, and Rehabilitation (OMRR&R). The non-Federal sponsor will be responsible for performance of OMRR&R of a project constructed pursuant to Section 117. All agreements for design/construction will state that, as between the Government and the non-Federal interest, the Government will have no responsibility for the OMRR&R of the project.

The recommendations for implementation of a shoreline protection project at Shishmaref, Alaska reflect the policies governing formulation of individual projects and the information available at this time. They do not necessarily reflect the program and budgeting priorities inherent in the local and State programs or the formulation of national civil works water resources program. Consequently, the recommendations may be changed at higher review levels of the executive branch outside Alaska before they are used to support funding.

13. **Attachments**

Table 1 - Economic and Financial Data for Recommended Plan
Figure 1 – Vicinity Map
Figure 2 – Erosion Rate Diagram
Figure 3 – Recommended Plan

TABLE 1

ECONOMIC AND FINANCIAL DATA FOR RECOMMENDED PLAN

(All costs in thousands of dollars)

a. Estimated Implementation Costs: (2006 Price Levels)		b. Economic Data: (5.125 %, 15 year life)
Federal	$13,096	Annual Charges: NA
Non-Federal		OMRR&R: $0
LERRD	$25	
Cash	$0	
		Annual Benefits: $ N/A Least Cost Analysis
Total	$13,121	BCR: N/A

c. Cost Allocation: N/A Single Purpose

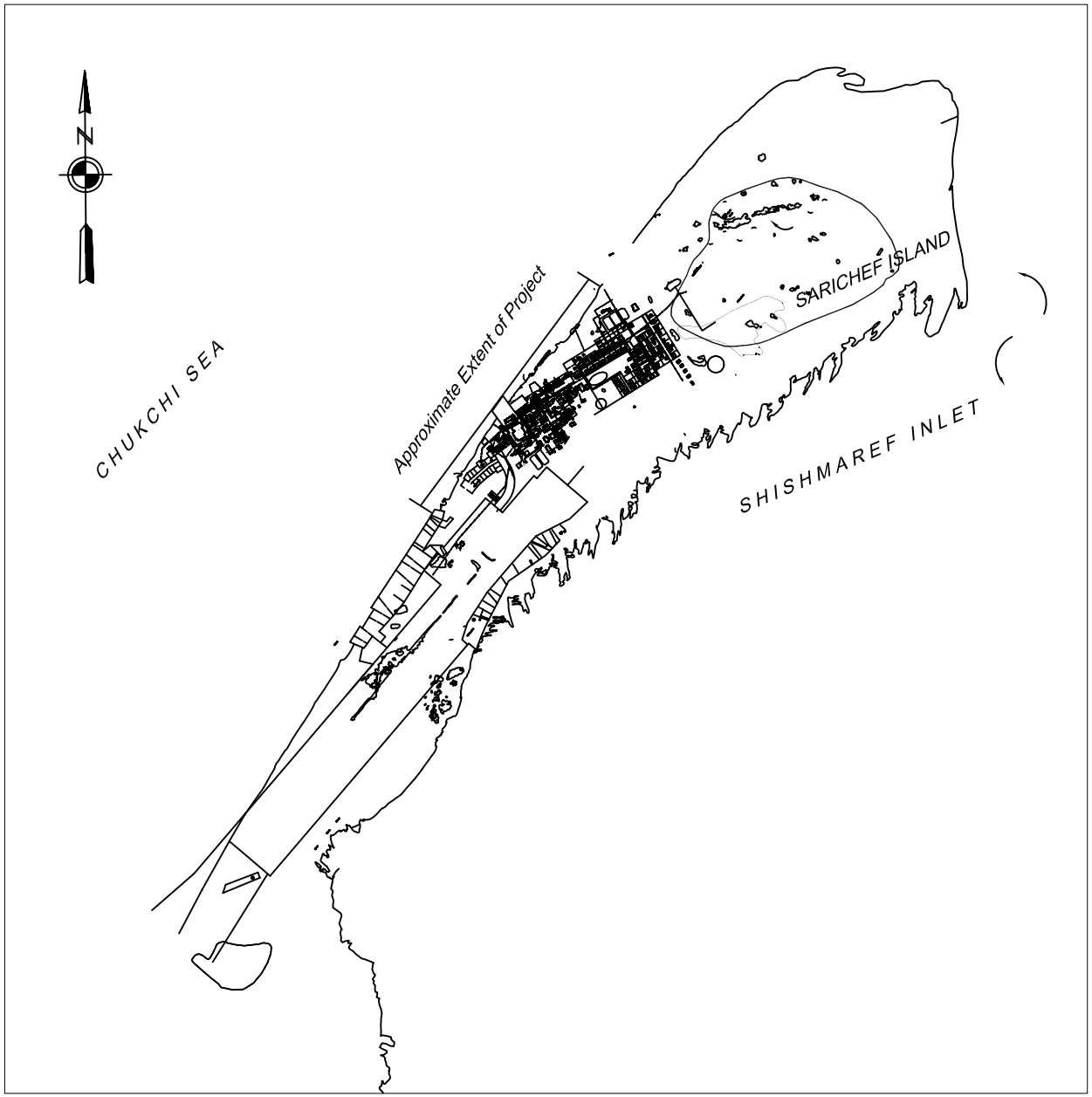
d. Allocations to Date:

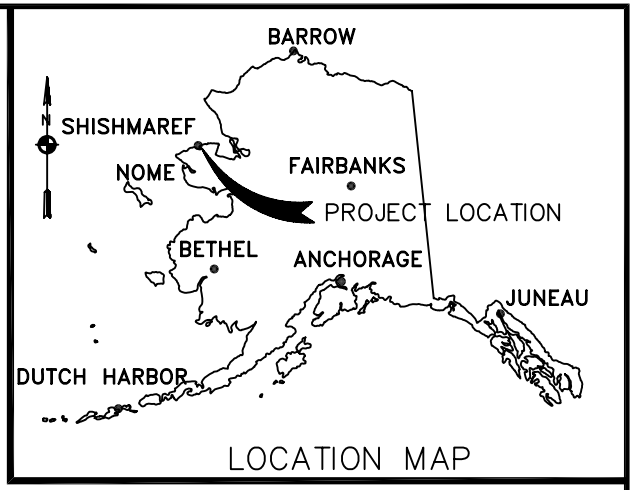
	Federal	Non-Federal
Feasibility	$ 22	
PED	$ 170	$0
Total	$ 192	$0

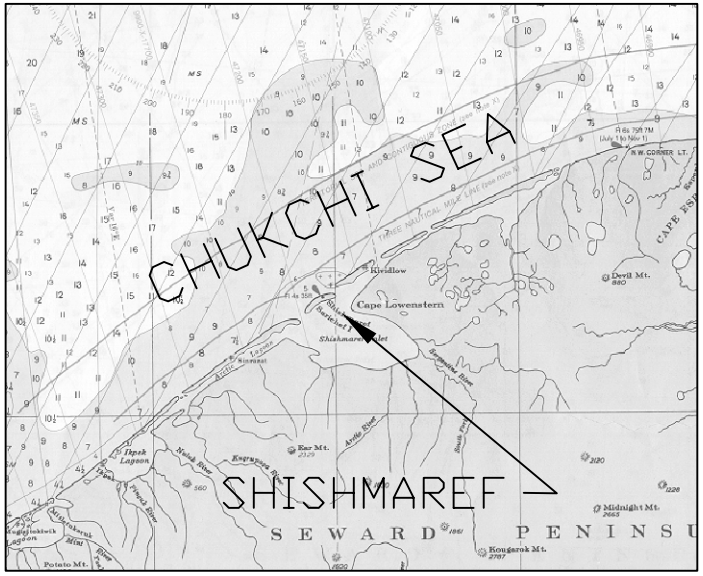
e. Remaining Requirements:

	Federal	Non-Federal
PED	$ 130	$0
Construction	$13,096	$25
O&M	$0	$0
Total	$13,226	$25
f. Total Allocations	$ 192	$25
g. Future Non-Federal Reimbursements		$0
h. Ultimate Cost:	$13,418	$25

i. Note: Project lands are currently owned by the State of Alaska, Dept of Natural Resources, although the State Dept of Transportation & Public Facilities has management oversight of the fast lands by way of an Interagency Land Management Transfer. No Corps lands are included within the project area. The Non-federal Sponsor will need to acquire the necessary real estate interests for construction, operation, and maintenance of the project. The value of LER is considered nominal, however, the incidental and administrative costs for acquisition of lands are estimated at $25,000.







ALASKA DISTRICT
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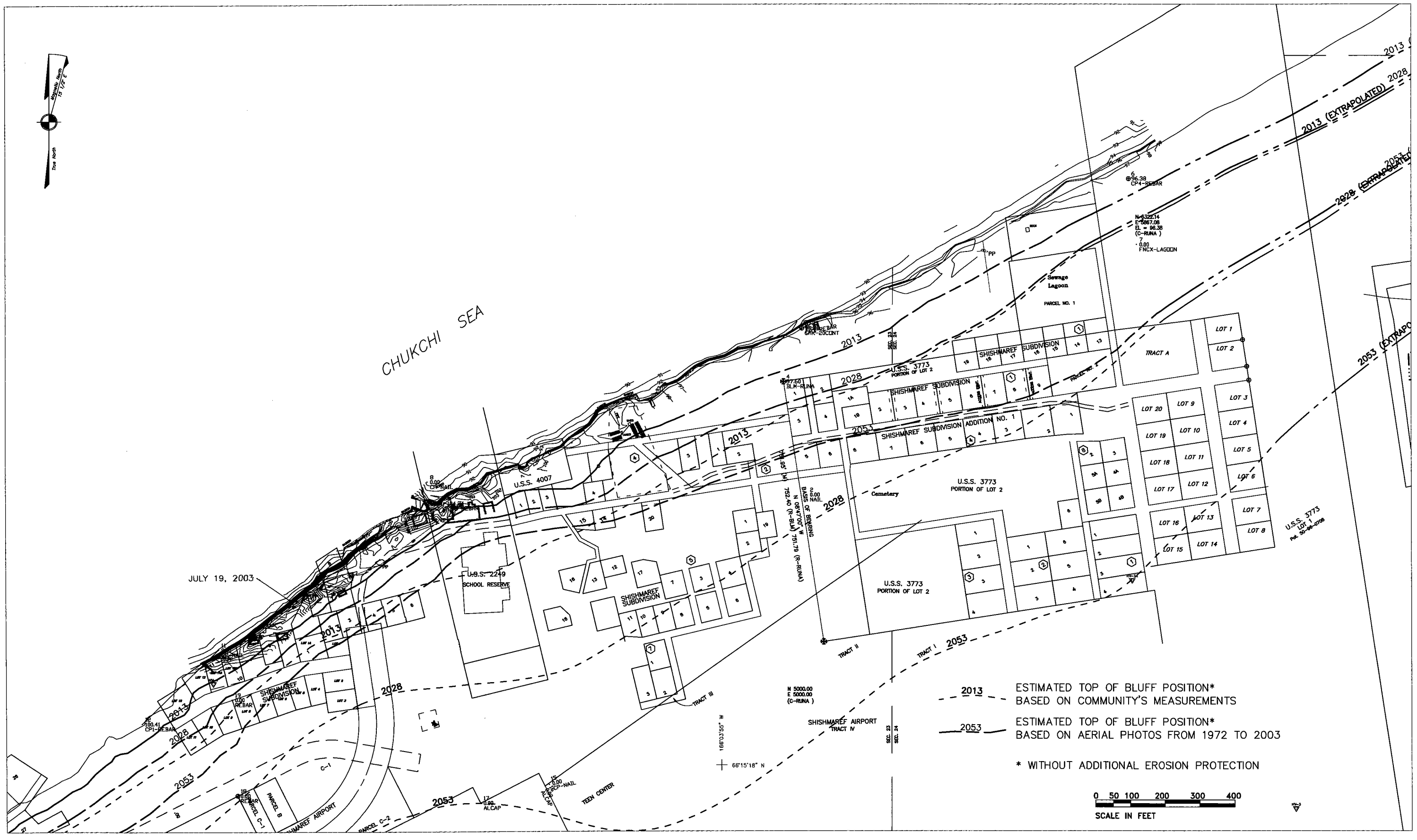
CIVIL WORKS BRANCH

PROJECT AREA MAP

SHISHMAREF SHORE PROTECTION

1

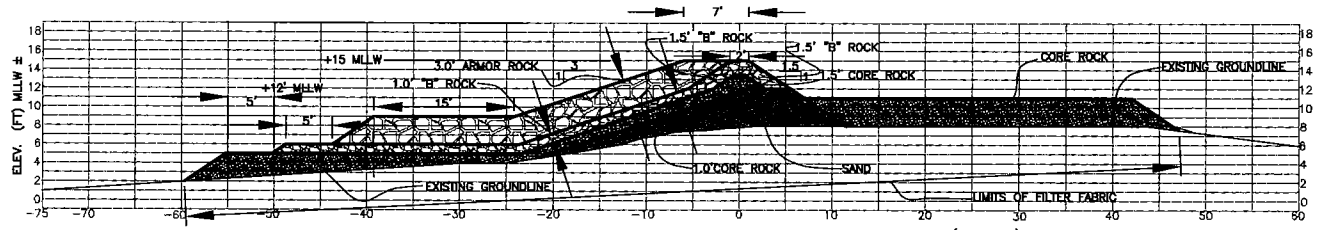


ALASKA DISTRICT
CORPS OF ENGINEERS
CIVIL WORKS BRANCH

ESTIMATED FUTURE TOP OF BLUFF POSITIONS (10, 25, AND 50 YEARS) FROM PRESENT

SHISHMAREF, ALASKA

2



REVETMENT TYPICAL SECTION

ALASKA DISTRICT
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SITE PLAN – ROCK REVETMENT (FOOTPRINT) AND TYPICAL SECTION

SHISHMAREF, ALASKA

3