DOCK AND MARINE INFRASTRUCTURE IMPROVEMENTS TECHNICAL REPORT

QUINHAGAK, ALASKA

JUNE 2010

EXECUTIVE SUMMARY

Report Purpose: This report presents an evaluation of the marine infrastructure problems and opportunities at Quinhagak and presents preliminary design concepts and costs. These concepts focus on improving waterborne access to the village.

Study Partners and Scope: The findings of this report are based on a collaborative study effort between the Denali Commission, Quinhagak, marine transportation providers, and the Army Corps of Engineers.

Community Profile: Quinhagak is a remote village of 661 people on the east shore of Kuskokwim Bay. The predominantly Yupik community practices a subsistence lifestyle harvesting both flora and fauna for nutritional needs. The population rose from 555 in 2000 to 661 in 2008 and is 96 percent Alaska Native. The village contains 4.7 square miles of land and 0.6 square miles of water. The area has a maritime climate and therefore experiences cool, wet summers and warm, wet winters. Quinhagak lies approximately 70 air miles south of Bethel and 420 air miles southwest of Anchorage.

Problem description: Unreliable access from the open water of Kuskokwim Bay to the Native Village of Quinhagak hinders the delivery of fish product, fuel, and other goods to the community. Insufficient water access also hinders the export of processed seafood, results in lower quality and lost fish product, and limits search and rescue operations.

Potential Project Implementation: Before a project can be implemented using Federal funds additional studies may be required to meet National Environmental Policy Act (NEPA) requirements. Because of the wide range of alternatives evaluated, formal study scoping has not been conducted and it is uncertain at this time if a project at Quinhagak would require an Environmental Assessment (EA) or an Environmental Impact Statement (EIS). If an alternative was selected to be implemented, geotechnical investigations and surveying and mapping should be conducted to reduce construction risks and cost overruns.

Report Findings and Alternatives Considered: This report finds that there is not a simple solution for significant improvement of water access to Quinhagak. To a large extent this is due to the extensive shallow intertidal zone from the naturally deep water of Kuskokwim Bay to the city dock (a distance of about 2 ½ miles) and the continuously shifting channel of the Kanektok River. A summary of the alternatives considered is presented below and in the main report section. More detailed information is located in Appendix B, Hydraulics.

- **Alternative 1 (Causeway with Deepwater Dock and Single Span Bridge).** A causeway extending to deepwater would aid in the delivery and export of fresh fish product to Quinhagak and the delivery of fuel and freight. Local commercial fishing and subsistence boats would still have to navigate the shallow water to return to Quinhagak and would not benefit from these improvements.
- **Alternative 2 (Jetties and Dredged Channel).** A dredged channel from deepwater of Kuskokwim Bay to the city dock would enable all vessels to avoid many of the delays in reaching Quinhagak. Most vessel damages currently sustained from groundings would also be avoided.
- **Alternative 3 (½-Mile Dredged Channel).** A dredged channel extending ½ mile from the city dock would provide some benefit to barge operators since this is where their groundings most frequently occur.
- **Alternative 4 (2 ½-Mile Dredged Channel).** A dredged channel from deepwater of Kuskokwim Bay to the city dock would enable all vessels to avoid many of the delays in reaching Quinhagak. Most vessel damages currently sustained from groundings would also be avoided.
- **Alternative 5 (Dock Relocation).** Relocation of the dock to the main channel of the Kanetok River would provide little to no benefit to the users since they would still be required to navigate the shallow waters to Quinhagak.
- **Alternative 6 (Airport Improvement).** Leveling the grade of the airport would allow aircraft to take off with a heavier payload. This could allow for more and fresher product to be exported. However, the shallow water would continue to limit the delivery of fresh product to the processing plant.
- **Alternative 7 (Channel Marking and Buoy Upgrades).** Annual placement of channel markers would provide benefit to vessels by reducing the rate of groundings and associated delays.
- **Alternative 8 (Hovercraft).** Use of a hovercraft to lighter fish product from barges and tenders in Kuskokwim Bay to the city dock would aid in the delivery of product to the processing plant. Local commercial fishing and subsistence boats would still have to navigate the shallow water to return to Quinhagak and would not benefit from this alternative.

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1.0 Study Scope

This study examines the need for improved waterborne access and other related marine infrastructure at Quinhagak, Alaska.

2.0 Study Partners and Authority

The findings of this report are based on a collaborative study effort between the Denali Commission, Quinhagak, marine transportation providers, and the Army Corps of Engineers.

3.0 Community Profile

Quinhagak, Alaska is a remote Yupik village of 661 people on the east shore of Kuskokwim Bay. The predominantly Yupik community practices a subsistence lifestyle harvesting both flora and fauna for nutritional needs. According to State of Alaska Department of Labor and Workforce Development population estimates the number of people residing in Quinhagak rose from 555 in 2000 to 661 in 2008. According to Census 2000 the population of Quinhagak is 96 percent Alaska Native. It lies 70 air miles south of Bethel and 420 air miles southwest of Anchorage. The village contains 4.7 square miles of land and 0.6 square miles of water. The area has a maritime climate and therefore experiences cool, wet summers and warm, wet winters. Temperatures range from 41^{o} F to 57^{o} F in the summer and 6^{o} F to 24^{o} F in the winter. The location of Quinhagak and vicinity map is shown in Figures 1 and 2.

Figure 1. Location Map

Figure 2. Quinhagak Vicinity Map

4.0 Problem description

Unreliable access from the open water of Kuskokwim Bay to the Native Village of Quinhagak hinders the delivery of fish product, fuel, and other goods to the community. Insufficient water access also hinders the export of processed seafood, results in lower quality and lost fish product, and limits search and rescue operations.

5.0 Plan Formulation

This study examines the potential solution to improve waterborne access to the village of Quinhagak. Improved access to dock facilities will reduce delays in the delivery of goods and improve economic value of commercial fisheries. Below is a summary of the marine related activities at Quinhagak and opportunities for improvement:

- Commercial Fishing - Vessels from surrounding areas almost exclusively deliver their catch to a tender in Kuskokwim Bay as they are unfamiliar with the changing channel of the Kanektok River. Local vessels, however, need to access the river in order to return home. Therefore, they often bypass the tender and deliver their catch straight to the city dock. During this process they become stuck on sandbars or are forced to stay out of the mouth of the Kanektok River until the tide rises to a point that allows them to return to port. Vessels are often damaged, necessitating the repair or replacement of motors and hulls.

- Fish Processing – The Coastal Villages Seafoods processing plant at Quinhagak operates at a reduced capacity (73%) mainly due to difficulty vessels face in navigating the waters to the dock at Quinhagak. Additionally, Coastal Villages Seafoods operates a large tender vessel in Kuskokwim Bay near the mouth of the Kanektok River in order to allow fishermen to avoid traveling to the city dock thereby avoiding the risk of grounding. Due to the navigational conditions the tender is rarely able to come to the city dock and relies on a shuttle boat to lighter fish to the dock. The shuttle boat often sustains damage from grounding.

Degradation of fish is an issue that plagues processing operations at Quinhagak. When tidal conditions make lightering fish from the tender to the dock impossible the fish begins to degrade, lowering revenue as the lower grade product commands a lower first wholesale price.

If the navigational issues were resolved, the plant could operate at full capacity. Coastal Villages Seafoods has indicated that they would be able to staff a smaller tender with much lower operating costs and the need for a shuttle boat would be eliminated.

- Subsistence – Subsistence harvesting is a way of life for residents of Quinhagak with the bulk of activity centering on the Kanektok River and Kuskokwim Bay. The boats used by the residents are subject to the same damages that plague vessels related to commercial fishing and processing. Vessel damages for subsistence fishing boats are assumed to be similar to those realized by the commercial fishing vessels. Subsistence vessels are also subject to the same delays in traversing the mouth of the Kanektok River leading to decreased harvests, degraded fish value, and lost opportunities.

- Fuel Barge Operations - Due to navigational conditions, Crowley Marine Services' fuel barge becomes stuck for a full tide cycle once per delivery. In addition, conditions sometimes dictate that fuel be flown in when a barge is unable to make a delivery. While rare, it is estimated that a full fuel load would have to be flown in once every 10 years.

- Freight Operations - Northland Barge Services calls on Quinhagak to deliver freight. Northland Barge uses landing craft to lighter freight into Quinhagak. While rare, Northland sometimes becomes grounded for several days, resulting in costly delays.

- Search and Rescue Operations - Because of the remote nature of the village, there are various parties that could potentially be involved in a search and rescue operation (U.S. Coast Guard, Alaska State Troopers, Village Public Safety Officer). It is assumed this vital community service would be more efficient if navigational conditions were improved by allowing the first responders to enter and exit the Kanektok River without the possibility of losing precious time while grounded or waiting for high tide.

Alternatives Considered

Several alternatives were developed to address the existing problems.

1. Causeway and Deep Water Dock,
2. Jetties and Dredged Channel,
3. ½-mile Dredged Channel,
4. 2 ½-mile Dredged Channel,
5. Dock Relocation,
6. Airport Repair,
7. Channel Marking and Buoy Upgrades
8. Hovercraft

These alternatives are discussed in more detail in Appendices A and B. A summary of the real estate ownership is presented in Appendix C.

Other alternatives were evaluated but eliminated from further consideration. These include a road to a neighboring village and redirection of the Kanetok channel and are discussed on Pages 14 and 15. Table 1 summarizes the problems addressed under each alternative.

Table 1. Summary of Effectiveness of Alternatives

	Problems Addressed				
Alternative	**Processing**	**Commercial Fishing**	**Subsistence Fishing**	**Fuel Delivery**	**Freight Delivery**
1. Causeway w/Dock and Bridge	✓			✓	✓
2. Jetties and Dredged Channel	✓	✓	✓	✓	✓
3. ½ mile Dredged Channel	✓	✓	✓	✓	✓
4. 2 ½ mile Dredged Channel	✓	✓	✓	✓	✓
5. Dock Relocation					
6. Airport Repair					
7. Channel Marking	✓	✓	✓	✓	✓
8. Hovercraft	✓				
Road to Other Village				✓	✓
Redirect River Channel					

Table 2. Summary of Alternative Pros, Cons, and Costs

Alternatives	Pros	Cons	Initial Cost	Annual Operation and Maintenance Cost
1. Causeway w/Dock and Bridge	Partially addresses some benefit categories	High initial cost No decline in vessel damages	$ 252,219,000	$ 250,000
2. Jetties and Dredged Channel	Fully addresses all benefit categories	High initial cost High risk of channel shoaling High annual O&M	$ 372,529,000	$ 3,600,000
3. ½ mile Dredged Channel	Partially addresses some benefit categories	High risk of channel shoaling High annual O&M Environmental Concerns	$ 5,969,000	$ 2,500,000
4. 2 ½ mile Dredged Channel	Fully addresses all benefit categories	High risk of channel shoaling High annual O&M Environmental Concerns	$ 40,744,000	$ 7,000,000
5. Dock Relocation	Minimally addresses benefit categories	Little to no improvements to conditions and benefits	$ 11,901,000	$ 43,000
6. Airport Repair	Increased aircraft payloads	Little to no improvements to conditions and benefits	$ 5,686,000	$ 0
7. Channel Marking	Partially addresses some benefit categories	Natural channels remain shallow for navigation	$ 124,000	$ 23,000
8. Hovercraft	Partially addresses some benefit categories	High operating cost	Purchase - $ 2,000,000 Lease - $ 0	Purchase - $2,663,000 Lease - $3,050,000
Alternatives Excluded From Consideration				
Road to Other Village	Minimally addresses benefit categories	High initial cost Environmental Issues due to National Wildlife Refuge	N/A	N/A
Redirect River Channel	Minimally addresses benefit categories	Little to no improvement to conditions and benefits	N/A	N/A

Before a project can be implemented using Federal funds additional studies may be required to meet National Environmental Policy Act (NEPA) requirements. Because of the wide range of alternatives evaluated, formal study scoping has not been conducted and it is uncertain at this time if a project at Quinhagak would require an Environmental Assessment (EA) or an Environmental Impact Statement (EIS). If an alternative was selected to be implemented, geotechnical investigations and surveying and mapping should be conducted to reduce construction risks and cost overruns.

Alternative 1 – Causeway and Deep Water Dock. This alternative consists of a causeway extending from shore 8,600 feet to deep water (depth of -14 feet, MLLW) of Kuskokwim Bay. See Figure 3. A dock would be located on the seaward end of the causeway to allow for offloading of goods and transport to the community. A nearshore gap in the causeway would be included to facilitate the migration of anadromous fish and minimize disruption of longshore sediment transport. A single lane bridge would be located at the gap. The benefits of this alternative include increased efficiencies in processing, freight, and fuel operations. The cost of this alternative is $252.2 million. The annual maintenance cost is $250,000.

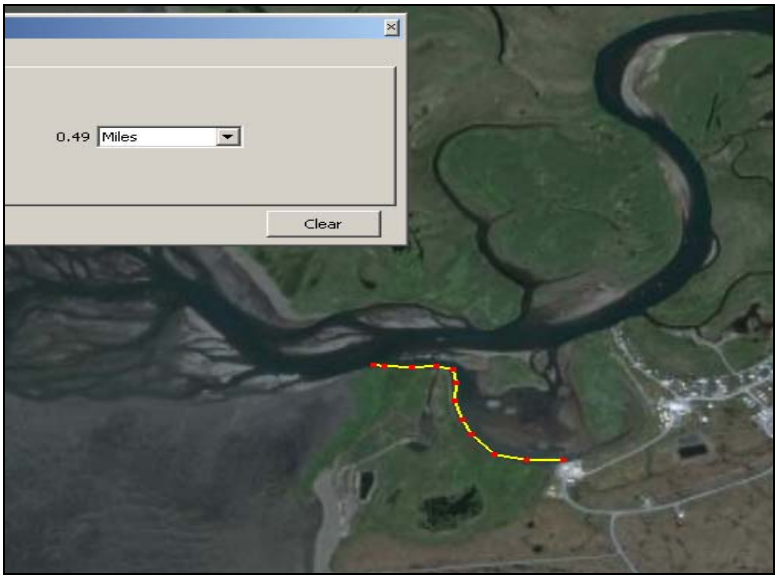
Figure 3. Alternative 1 – Causeway and Dock

Alternative 2 – Jetties and Dredged Channel. This alternative consists of two 8,600-foot jetties which would stabilize a dredged channel from the mouth of the Kanektok River to deep water (depth of -14 feet MLLW) of Kuskokwim Bay. See Figure 4. A nearshore gap would be included in each jetty to facilitate the migration of anadromous fish and minimize disruption of longshore sediment transport. Benefits of this alternative include increased efficiencies in processing, commercial fishing, subsistence, freight, and fuel operations. The cost of this alternative is $372.5 million. The annual maintenance cost is $3.6 million.

Figure 4. Alternative 2 – Jetties and Dredged Channel

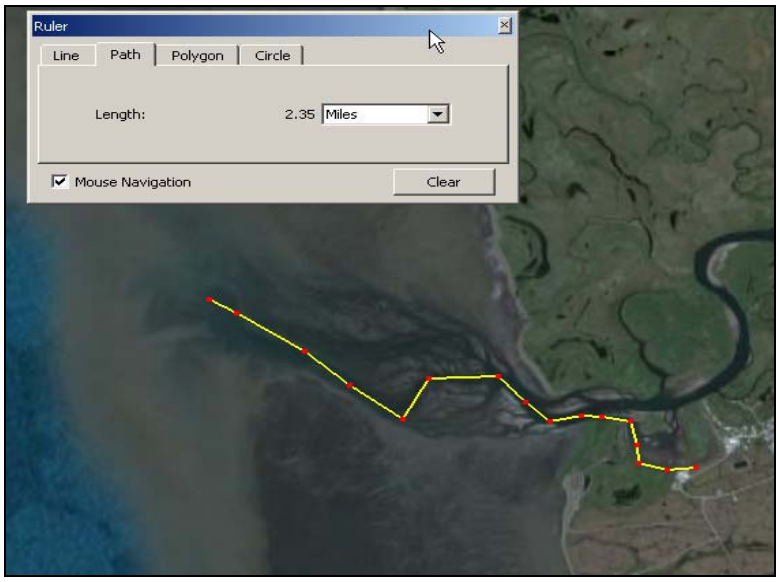
Alternative 3 – ½-Mile Dredged Channel. This alternative consists of ½-mile long channel dredged to a depth of -14 feet, MLLW. See Figure 5. The channel would extend from the dock face to the main channel of the Kanetok River. The channel would have a width of 75 feet and under average weather and tidal conditions allow barge operators to operate without delays. The cost of this alternative is $6.0 million. The annual maintenance cost is $2.5 million.

Figure 5. Alternative 3 – ½-Mile Dredged Channel



Alternative 4 – 2 ½-Mile Dredged Channel. This dredged channel would extend from the dock face to a natural depth of -14 feet MLLW in Kuskokwim Bay. See Figure 6. The channel would have a width of 75 feet and under average weather and tidal conditions allow commercial and subsistence vessels and barge operators to operate without delays. The cost of this alternative is $40.7 million. The annual maintenance cost is $7 million.

Figure 6. Alternative 4 – 2 ½-Mile Dredged Channel



Alternative 5 – Dock Relocation. This alternative consists of relocating the city dock. The proposed site is on the main channel of the river, labeled "New Dock Site" in Figure 7. This alternative is dependent on tidal fluctuations and does not solve issues related to damages to vessels transiting the mouth of the Kanektok River. Costs to relocate the dock vary with site location, real estate issues, and infrastructure upgrades. The cost of this alternative is $11.9 million. The annual maintenance cost is $43,000.

Figure 7. Alternative 5 - Dock Relocation

Alternative 6 – Airport Improvements. This alternative consists of rehabilitating the surface at Quinhagak's airport. See Figure 8. The new airport at Quinhagak was opened in November 2004. However, frost heaving has resulted in an uneven runway surface including a large heave that has restricted takeoff and landing weights, causing inefficiencies. Smoothing the runway surface would require grading the surface and resurfacing with gravel. Performing this task would require coordination with the State of Alaska Department of Transportation and Public Facilities.

Rehabilitation of the runway does not appear to result in any appreciable benefits as it does not address the known problems of vessels grounding while trying to access the existing dock. There may be small gains in efficiency of flying out fresh fish product as the DC-6 aircraft used to transport the product could fly a full payload of 31,000 pounds instead of their current limit of 18,500 pounds. Degraded fish product because of channel conditions makes the transport of fresh fish product unlikely.

The cost of this alternative is $5.7 million. No additional operation and maintenance cost would be incurred from repair of the airport.

Figure 8. Alternative 6 – Airport Repair

Alternative 7 – Channel Marking and Buoy Upgrades. Coastal Villages Seafoods currently marks the channel of the Kanektok River in Kuskokwim Bay to the best of their abilities as shown in Figure 9. Storms often move the buoys and the channel migrates so quickly that the buoys need to be relocated multiple times per season. The channel is still fairly shallow due to tidal conditions and the ability of watercraft to access the city dock depends more on the depth of the channel than how well it is marked.

This alternative consists of placing ten navigation buoys to mark the channel and assist in better navigation of the channel. A vessel capable of operating in shallow waters and placing and pulling the buoys would be purchased and operated by local labor. The cost of this alternative is $124,000. The annual maintenance cost is $23,000.

Figure 9. Alternative 7 – Channel Marking and Buoy Upgrade

Alternative 8 – Hovercraft. This alternative involves putting a hovercraft into service for use of ferrying fish, fuel, and goods between Kuskokwim Bay and the city dock. A hovercraft is currently in use in Bethel and the surrounding villages. See Figures 10 and 11. It provides cargo and passenger service, has been more reliable and cost-effective than air service, and has had a negligible environmental impact. The craft in use in Bethel has a payload of 12,500 pounds with cargo space depending on passenger configuration. Alaska Hovercraft Ventures also owns and operates 15 larger LACV-30 hovercrafts with a payload of 30 tons. These larger hovercrafts are 76.5 feet long and have 1,600 square foot cargo decks capable of carrying containers and vehicles.

Use of a purchased hovercraft would have an initial cost of $2,000,000 and an annual operating cost of $2,663,000. Use of a leased hovercraft would only have an annual operating cost, estimated at $3,050,000.

Figure 10. Alternative 8 - Hovercraft

Source: Alaska Hovercraft Ventures

If the hovercraft alternative were selected, environmental impacts would be limited and the community could train a local workforce to operate and maintain the craft. Detracting from this alternative are large costs which may vary with ownership status. A lease or contract use agreement may be less costly; however, this may lessen or eliminate any local workforce development benefits. This alternative would allow Coastal Villages Seafoods to operate a smaller tender since it would be rare that the hovercraft would be unable to ferry fish from the tender to the dock for processing and it is possible that the hovercraft could ferry in freight and fuel. Depending on where the hovercraft originates, there may be additional operational costs of lightering fuel and goods to the smaller vessel. Commercial and subsistence vessels would still sustain damages in the shallow channel.

Figure 11. Greater Carrying Capacity Hovercraft

Alternatives Excluded From Consideration

- **Road to Neighboring Village.** This alternative consists of constructing a road intertie to the nearest village to Quinhagak. The nearest villages are Eek (33 air miles north) and Goodnews Bay (45 air miles south). See Figure 12. A road to either of these villages would yield little in benefits to the fishing industry or barge operators as neither location has access to deepwater, a navigable waterway, or an upgraded airstrip. Since Quinhagak is located in the Yukon Delta National Wildlife Refuge, there may be significant environmental concerns in constructing these roadways.

Figure 12. Quinhagak and Neighboring Communities

- **Redirect Kanetok Channel.** This alternative redirects the Kanektok River to mimic one of its historical paths shown as "Proposed" in Figure 13. This would require the use of a large amount of fill and armor stone to protect the newly placed bank. This alternative would yield little benefit to river users as the majority of the problems incurred at Quinhagak are due to the channel of the Kanektok River in Kuskokwim Bay and not depth at the city dock. Because of the river's meandering characteristic, this alternative would not provide a long-term fix.

Figure 13. Redirect Kanetok Channel

6.0 Economics Summary

Reliable water access to Quinhagak is important to the community's welfare. A causeway extending from the city dock to deepwater of Kuskokwim Bay or use of a hovercraft would aid in the delivery and export of fresh fish product to Quinhagak. Local commercial fishing and subsistence boats would still have to navigate the shallow water to return to Quinhagak and would not benefit from these improvements. A dredged channel from deepwater to the city dock would enable all vessels to avoid many of the delays in reaching Quinhagak. Most vessel damages currently sustained from groundings would also be avoided. Annual marking of the natural channel of the Kanektok River would provide benefit to vessels by reducing the rate of groundings and associated delays. More detailed information is presented in Appendix A.

7.0 Environmental Effects - General considerations

Potential actions can be grouped as dredging and shoreline modification. None of the alternatives considered in detail would substantially affect species listed under the Endangered Species Act, covered by the Marine Mammal Protection Act, or listed in the register of historic places. Migratory birds, wetlands, and water quality could be affected by shoreline alteration.

Dredging would predominately affect aquatic/estuarine resources. The principle resources of concern for dredging are fish (particularly anadromous fish), their food, and their habitat. The Kanektok River at Quinhagak is widely known for its rainbow trout population, but Chinook, chum, and pink salmon, Arctic char, and whitefish are anadromous inhabitants of the river. The nearby Kuskokwim estuary is feeding, rearing, and migratory transition habitat for those fish and anadromous fish from other streams in the Kuskokwim drainage.

Dredging and the disposal of dredged material can greatly increase the amount of material suspended in water, can cover bottom habitat, and can produce noise and activity that may displace fish and other organisms. Technical studies of salmon behavior have not shown that noise, activity, and other dredging effects are likely to prevent adult salmon from returning to spawning streams, but dredging and dredged material disposal could exclude them from at least limited habitat areas.

Out-migrating salmon juveniles need estuarine conditions where they can adapt to ocean water, feed, and find escape habitat for some period as they leave their natal streams. They are less able than adults to escape from adverse conditions and may be more easily injured by suspended sediment or loss of feeding habitat. State and Federal fisheries resource and regulatory agencies recognize this potential and usually request or require dredging activity in rivers and estuaries to stop during salmon out-migration. This period varies among salmon streams and among the different species. In a system like the Kuskokwim River drainage, dredging might be prohibited for 6 weeks or more after spring breakup.

8.0 Other Needed Studies

Environmental. Some environmental studies have been performed within the project region. Additional baseline studies would likely be required. Formal study scoping has not been conducted and it is uncertain at this time if the project would require the development of an Environmental Assessment (EA) or an Environmental Impact Statement (EIS).

Surveying and Mapping. A detailed survey and mapping of the project area would be conducted before developing detailed design of alternative(s).

Engineering. Wind and wave and sediment transport analyses would be required to design the jetties and dredged channels. Geotechnical investigations along construction alignments would also be required.

9.0 Conclusions

This report finds that there is not a simple solution for significant improvement of water access to Quinhagak. The solutions that address the primary problems of the community are costly and would require extensive environmental and engineering studies and analyses. To a large extent this is due to the extensive shallow intertidal zone from the naturally deep water of Kuskokwim Bay to the city dock (a distance of about 2 ½ miles) and the continuously shifting channel of the Kanektok River.

Dock and Marine Infrastructure Improvements

Quinhagak, Alaska

Appendix A – Economics

DOCK AND MARINE INFRASTRUCTURE IMPROVEMENTS
APPENDIX A - ECONOMICS
QUINHAGAK, ALASKA

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FIGURES

TABLES

I. COMMUNITY PROFILE

Quinhagak, Alaska is a remote village of 661 people on the east shore of Kuskokwim Bay in the Bethel Recording District.[1] It lies approximately 70 air miles south of Bethel and 420 air miles southwest of Anchorage. The community practices a subsistence lifestyle harvesting both flora and fauna for nutritional needs. Quinhagak population was established more than 1,000 years ago. Its Yupik name, "Kuinerraq" means "new river channel" and was the first village on the lower Kuskokwim River to have sustained contact with non-natives. It was first charted on a map in 1826. A Monrovian mission was established in 1893 followed by a store in 1904, a post office in 1905, an electric plant in 1928, and city incorporation in 1975.

A. Population

According to State of Alaska Department of Labor population estimates the number of people residing in Quinhagak rose from 555 in 2000 to 661 in 2008 as shown in Figure 1 and is projected to grow at 0.68% over the 50-year period of analysis.[2] According to Census 2000 the population of Quinhagak is 96 percent Alaska Native compared to 19 percent statewide. The other racial groups were White (2.7 percent) and Two or More Races (1.3 percent). Quinhagak's population is 52.3 percent male and 47.7 percent female which is close to the statewide average of 52 percent male and 48 percent female. The median age of Quinhagak's population is 26.6 years compared to 32.4 years statewide.

This increase is contradictory to the trend of population decreases in many villages in rural Alaska as noted by a May 2008 report by the Institute of Social and Economic Research.[3]

The report shows a trend of larger communities gaining population from residents of other villages seeking better housing, better economic opportunities, and lower costs of living. Quinhagak has a processing plant, store, washeteria, and health clinic, providing some basic services to the community that some surrounding villages do not have. All of these services combine to make Quinhagak one of the more desirable locations in the area and may explain why its population is increasing.

[1] State of Alaska Department of Labor and Workforce Development Research and Analysis Section 2008 population estimate.

[2] State of Alaska Department of Labor and Workforce Development Population Projections.

[3] Martin, Stephanie, Killorin, Colt. University of Alaska Anchorage, Institute of Social and Economic Research. Fuel Costs, Migration, and Community Viability. 12 May 2008.

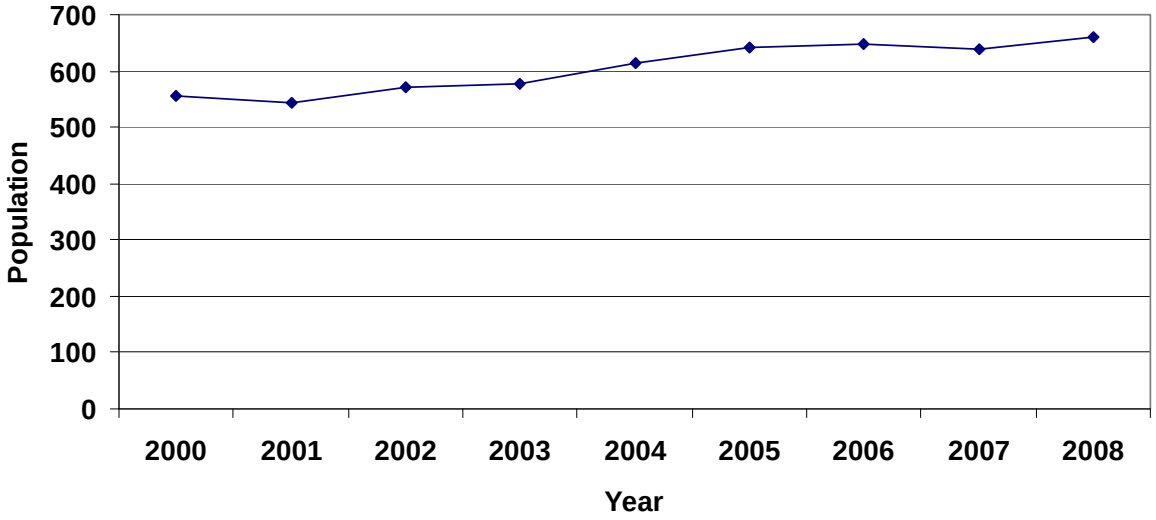

Figure 1. Quinhagak Population (2000-2008)
Source: State of Alaska, Department of Labor and Workforce Development, Research and Analysis Section, Demographics Unit

B. Employment and Income

1. Employment Overview

According to Census 2000, total employment in Quinhagak is 126 of which 94 are employed by the government. The largest private employment sectors are Educational, health, and social services at 31.0 percent and Retail trade at 7.9 percent of total employment, respectively.

Unemployment is 15.4 percent (23 individuals). The true unemployment picture is not reflected in these statistics as 214 individuals are eligible workers but considered not in the workforce because they are not seeking work. The effective unemployment rate by counting these individuals is 65.1 percent. Many factors can play into the decision to search for jobs, including: scarce availability, informal searching (through communal connections), and seasonal shifts in job opportunities and subsistence activities. In addition to wage earning jobs, many residents practice a subsistence lifestyle harvesting various types of flora and fauna. Table 1 summarizes work-for-wages information.

According to Census 2000, the per capita income in Quinhagak was $8,127 with a median household income of $25,156 compared to statewide averages of $22,660 and $51,571, respectively. According to Census 2000, 26.1 percent of Quinhagak residents were living below the poverty level.

Table 1. Employment by Category and Industry

Employment Category	Number	Percent
Private wage and salary workers	30	23.8
Government workers	94	74.6
Self-employed	2	1.6
Industry		
Construction	8	4.8
Retail trade	10	7.9
Finance, insurance, real estate, and rental and leasing	5	4.0
Professions, scientific management, administrative, and waste management services	1	0.8
Educational, health and social services	39	31.0
Other services (except public administration)	4	3.2
Public administration	31	24.6

Source: U.S Bureau of the Census, Census 2000

Note: Census data is taken at a discrete point in time therefore fishing may not have been active during the data collection period. As of August 2009, there were at approximately 125 people employed at the Coastal Villages Seafood processing plant.

2. Commercial Fishing

Commercial fishing makes up a large part of private employment in the community. According to the Alaska Department of Fish and Game, residents held 87 commercial fishing permits in 2008, landing approximately 1.28 million pounds of fish giving estimated gross earnings of $635,000. Average annual landings since 2000 are approximately 1.0 million pounds with average gross earnings in that timeframe of approximately $441,000. The highest gross earnings achieved during the examined period came in 2008 with estimated gross earnings of $634,772. The low came in 2001 with earnings of $209,008. Total pounds landed reached a high of 1.36 million pounds in 2007 with a low of 559,320 pounds in 2001. Table 2 summarizes the annual information.

Table 2. Quinhagak Residents Commercial Fishing Activity

Year	Number of Permit Holders	Number of Permits Issued	Number of Fishermen	Number of Permits Fished	Total Pounds Landed	Estimated Gross Earnings	Earnings Per Pound	Pounds per Permit Holder	Value per Permit Holder
2000	100	138	74	91	792,043	$388,622	$0.49	7,920	$3,886
2001	96	135	65	75	559,320	209,008	0.37	5,826	2,177
2002	92	120	67	70	696,342	219,311	0.31	7,569	2,384
2003	90	113	66	70	937,888	276,846	0.30	3,076	3,076
2004	91	113	70	74	1,352,814	553,564	0.41	14,866	6,083
2005	85	103	73	76	1,082,600	524,615	0.48	12,736	6,172
2006	82	100	70	74	1,154,200	539,016	0.47	14,076	6,573
2007	82	101	63	69	1,363,014	621,441	0.46	16,622	7,579
2008	87	105	71	81	1,280,853	$634,772	$0.50	14,722	$7,296

Source: State of Alaska Commercial Fisheries Entry Commission. Earnings columns have been adjusted to 2008 dollars using the Anchorage Consumer Price Index.

C. Infrastructure and Facilities

1. Utilities

Electricity is provided by Alaska Village Electrical Cooperative via a diesel generator that has a peak capacity generation of 1,061 KW.[4] AVEC has installed the foundations for three 100 KW wind turbines with plans to bring the turbines online in the spring of 2010 with the potential for three more in the future. According to the most recent State of Alaska Power Cost Equalization Study the effective residential rate in Quinhagak is $0.1954 per kWh.[5]

Water is drawn from the Kanektok River. Kanektok means “constantly changing” in Yupik. Forty of the village’s homes are served by a flush/haul system. The school and washeteria are connected directly to the water plant. Potable water is delivered by truck and septic trucks haul wastewater to a sewage lagoon. A Village Safe Water project has connected these homes to a sewer system with plans to eventually connect the majority of the city to the system.

[4] Alaska Village Electric Cooperative

[5] State of Alaska, Alaska Energy Authority. “Statistical Report of the Power Cost Equalization Program”. 18th Edition, February 2007.

2. Transportation

Quinhagak is served by a 4,000-foot runway.[6] A water landing site is available on the Kanektok River.[7] Daily flights to/from Bethel are operated by various carriers. Due to runway conditions some cargo airplanes carry reduced capacities.

The city dock is located near the mouth of the Kanektok River. The dock is made of sheet pilings backfilled with gravel and has an adjacent sloped area for front-loading landing craft. The dock has two cranes for use in transloading material. A small boat harbor is located in a slough upriver near town.

The area is served by a local system of gravel roads. In addition to serving the town, airport, and dock, the system has termini at the Arolik River three miles to the south, beach access one mile to the west, and gravel pits two miles to the east. While there are no roads connecting Quinhagak to other communities there are winter trails marked to Eek, 33 miles to the north, and Goodnews Bay, 45 miles to the south.[8]

3. Community Facilities

A health clinic, washeteria, and store are all available locally. Kuinerrarmiut Elitnaurviat School is attended by 196 students from kindergarten through 12th grade and is part of the Lower Kuskokwim School District.[9] The State of Alaska lists ten buildings associated with the school totaling 26,000 square feet.[10] Included are the main school facility, two shops, a student store, two warehouses, two generator modules, a vocational education classroom, and a storage facility. Coastal Villages Region Fund has plans to open a Fisheries Service Center in Quinhagak which would assist fishermen in maintaining their vessels and gear.

4. Housing

Census 2000 lists a housing inventory of 153 housing units with a median value of $36,100. Approximately 55 percent of the homes had been built prior to 1980. Approximately 40 percent of the homes had 3 rooms or less. Ninety percent of the homes use fuel oil for heat with the remainder using wood for heat or not indicating a fuel source.

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[6] State of Alaska Department of Community and Economic Development Division of Community and Regional Affairs Detailed Community Information Database.

[7] Federal Aviation Administration Quinhagak Airport Diagram: http://www.alaska.faa.gov/fai/images/ARPT_DIAGRAMS/AQH.gif

[8] State of Alaska Department of Community and Economic Development Division of Community and Regional Affairs Detailed Community Information Database.

[9] State of Alaska Department of Education and Early Development. "Assessment and Accountability. Enrollment by School and Grade as of October 1, 2007, FY 2008". October 1, 2007.

[10] State of Alaska Department of Education and Early Development. Facilities Listing, Quinhagak.

D. Government

Quinhagak is an incorporated 2nd class city and is located in the unorganized borough. The city is served by a mayor and city council as well as an advisory school board and levies a three percent sales tax. Quinhagak's federally recognized tribe, the Native Village of Kwinhagak, provides services under a Memorandum of Agreement with the City of Quinhagak. The village is served by a board with an administrator leading the day-to-day operations. The Regional ANCSA Corporation is Calista Corporation whose region includes the villages of the lower Yukon River, the central and lower Kuskokwim River, Nunivak Island, and the Bering Sea coast from the mouth of the Yukon River south to Cape Newenham. The 56 original Calista villages are organized in 46 for-profit village corporations, each with surface estate ownership.[11] The Village ANCSA Corporation is Qanirtuuq Corporation which operates a local market, hardware store, and fuel farm.

[11] Calista Corporation, Region/Land Description. http://www.calistacorp.com/about/region_description.html

II. ASSESSMENT OF NEEDS

A. Commercial Fishing.

The Quinhagak city dock is located in a bend of the Kanektok River that is slowly silting in and will eventually form an oxbow lake. The channel from this oxbow exits into the Kanektok River near its confluence with Kuskokwim Bay. Silty conditions and large tidal action in Kuskokwim Bay have left multiple deposits at the mouth of the Kanektok River leading to challenging navigational conditions for vessels trying to access the city dock. See Figures 2 and 3.

Figure 2. Sandbar at Kanektok River Mouth with Tender in the Distance

Discussions with residents revealed that in the last 20 years navigational conditions at Quinhagak have deteriorated from fishermen being able to utilize vessels up to 26 feet in length and equipped with outboards to the current situation in which fishermen must use vessels with much less draft and increasingly equipped with jetted motors. Discussions with Tim Hillyer, Operations Manager for Coastal Villages Seafoods at Quinhagak revealed that often there is only six inches of available draft. Coastal Villages Seafoods, the owner and operator of the processing plant as well as the only buyer of fish at Quinhagak, attempts to mark the channel; however, due to the migratory nature of the channel at the mouth of the Kanektok River these efforts are often ineffective. Storms often wash the buoys away and vessels become grounded on sandbars in the river mouth.

Subsistence and commercial fishermen have reported being grounded multiple times, sometimes choosing between waiting for up to 12 hours in their open skiffs for the next high tide or getting into the water and either wading to shore or pushing their boats free from the sandbars. Anecdotal evidence of damaged hulls, propellers, and shafts is abundant with most fishermen replacing at least two propellers, one lower unit, and one water pump per year. In addition, fish is often spoiled or degraded upon delivery due to the extra time the fish is held in skiffs or on the tender while awaiting favorable tides.

To counteract these conditions, Coastal Villages Seafoods has posted a 115-foot tender in Kuskokwim Bay to service fishermen. This vessel has an annual operating cost of $500,000. However, the tender is mainly utilized by fishermen from other villages who are unfamiliar with the channel of the Kanektok River and have no other reason to go to the city dock. The fish from the tender is lightered to the dock via a 40-foot shuttle boat which faces the same challenges as the commercial fishing boats. Due to the fact that the fishermen from Quinhagak must still navigate the Kanektok River delta to return home they often choose to deliver their fish to the city dock.

There is a limited sport fishery on the Kanektok River. While there, we were informed that these operations contribute little to the local economy. All supplies are flown in and there is no tax structure in place to garner revenue from these operations.

Due to existing navigational conditions commercial fishing vessels are often damaged, necessitating the replacement of two propellers, one lower unit, and one water pump per vessel, per year. Due to the remote nature of Quinhagak replacement parts are expensive. It is estimated that the annual cost in replacement parts for the commercial fishing fleet is approximately $77,000. This information is summarized in Table 3.

Table 3. Annual Commercial Fishing Vessel Damages

Part	Annual Number Replaced	Replacement Price	Total
Propeller	2	$ 250	$ 500
Lower Unit	1	1,350	1,350
Water Pump	1	$ 65	65
Annual Damage per Vessel			1,915
Number of Vessels			40
Total			$77,000

Note: Total has been rounded to nearest 000's.

The State of Alaska Commercial Fisheries Entry Commission states that in 2008, 40 commercial fishing vessels from Quinhagak were active. Vessels from surrounding areas almost exclusively deliver their catch to a tender in Kuskokwim Bay as they are unfamiliar with the changing channel of the Kanektok River.

Figure 3. Tender Docking with Assistance During High Tide

Local vessels, however, need to access the river in order to return home. Therefore, they often bypass the tender and deliver their catch straight to the city dock. During this process they become stuck on sandbars or are forced to stay out of the mouth of the Kanektok River until the tide rises to a point that allows them to return to port. According to a study by Cornell University, 57 percent of Alaska fishermen engaged in salmon fisheries would use delay times to conduct other fishing activity while 43 percent would use that additional time for leisure activity. The study found that captains on salmon fishing vessels earned a wage of $71.17 per hour with a leisure value of $23.72. The average hourly wage rate for crew members on salmon fishing vessels is $57.13 with a leisure value of $19.04.[12] Assuming that each vessel in the fleet carries one captain and one crew member and navigational conditions were such that vessels did not have to wait for optimal tidal conditions in order to return from

[12] "Value of Time Commercial Fishermen in Alaska Could Save with Improved Harbor Facilities." Cornell University. September 2006.

fishing it is estimated that the fleet could gain $439,000 in efficiencies on an annual basis. These calculations are summarized in Table 4.

Table 4. Increased Commercial Fishing Activity

Inputs for Fishing Time Saved	Number of boats	Number of openings	Time saved per boat per opening (hrs)	Total time saved annually (hrs) (a)
	40	30	4	4,800
Inputs for Value of Time Saved	**Fishing Wages (b)**	**Leisure Wages (d)**	**Percent time fishing (c)**	**Percent time leisure (e)**
Captain (1)	$ 71.17	$ 23.72	57%	43%
Crew (1)	57.13	19.04	57%	43%
Annual value of time saved	**$ 439,000**			

Source: Cornell University *Value of Time Commercial Fishermen in Alaska Could Save with Improved Harbor Facilities* September 2006 for Fishing Wages (b) and Percent time fishing (c). Number of boats based on active vessels from Commercial Fisheries Entry Commission in 2008. Number of openings based on information obtained from Coastal Villages Seafoods plant.

Note to table: Annual Value of time saved equals (a * (b * c + d * e))

In 2008, the Coastal Villages Seafoods processing plant at Quinhagak processed approximately 2.2 million pounds of salmon in the round which is approximately 73 percent of the plant's total capacity of 3.0 million pounds.[13] An increase in harvest to 3.0 million pounds per year gives an annual benefit of approximately $313,000 as shown in Table 5.

Table 5. Increased Annual Harvest and Income to Commercial Fishermen

Species	Current Harvest (lbs)	Potential Harvest (lbs)	Current Ex-vessel Price	Current income	Potential Income	Increase in Income
King	208,216	245,850	$0.74	$153,761	$ 181,553	$ 27,792
Red	647,767	881,939	0.58	376,723	512,911	136,188
Coho	887,748	1,204,476	0.44	393,826	534,334	140,508
Chum	488,391	667,735	0.05	24,491	33,484	8,993
Total:	2,232,122	3,000,000		$949,000	$1,262,000	$313,000

Note: Totals have been rounded to the nearest 000's

[13] Interviews. Tim Hillyer. July-August 2009.

B. Processing

In 2008 the Coastal Villages Seafoods processing plant at Quinhagak processed approximately 2.2 million pounds of salmon in the round which is approximately 73 percent of the plant's total capacity of 3.0 million pounds.[14] The main reason that the plant operates at reduced capacity is unfavorable navigational conditions. If the navigational issues were resolved the plant could operate at full capacity. Discussions with John Linderman, Regional Supervisor, State of Alaska Department of Fish and Game and subsequent research of state publications revealed that there is sufficient capacity in the fishery as a whole to accommodate an increase in throughput at the plant to 3.0 million pounds of fish.[15,16] An increase in plant throughput to 3.0 million pounds per year while maintaining the current species mix to the extent possible and using the plant's current product mix would yield an increase in production benefits of $1.59 million per year as shown in Table 6.

Table 6. Processing Increase in Production Benefits

Species	Product	Product First Wholesale Price/lb.	Current Input Stock (lbs)	Potential Input Stock (lbs)	Increase in Input Stock (lbs)	Useable Weight By Product	Increase in Finished Product	Increase in Revenue
King	Headed & Gutted Fresh	$ 4.25	50,200	59,300	9,100	72.0%	6,600	$ 28,050
	Headed & Gutted Frozen	3.75	120,600	142,300	21,700	72.0%	15,600	58,500
	Frozen Fillet	5.00	30,100	35,600	5,500	50.0%	2,800	14,000
Sockeye	Headed & Gutted Fresh	3.00	156,300	212,800	56,500	72.0%	40,700	122,100
	Headed & Gutted Frozen	3.25	375,100	510,600	135,500	72.0%	97,600	317,200
	Frozen Fillet	4.00	93,800	127,700	33,900	50.0%	17,000	68,000
Coho	Headed & Gutted Fresh	2.60	214,200	290,600	76,400	72.0%	55,000	143,000
	Headed & Gutted Frozen	2.40	514,000	697,400	183,400	72.0%	132,000	316,800
	Frozen Fillet	3.50	128,500	174,300	45,800	50.0%	22,900	80,150
Chum	Headed & Gutted Fresh	1.50	117,800	161,100	43,300	72.0%	31,200	46,800
	Headed & Gutted Frozen	1.15	282,800	386,600	103,800	72.0%	74,700	85,905
	Frozen Fillet	3.00	70,700	96,700	26,000	50.0%	13,000	39,000
All	Sujiko Roe	$ 10.00	78,100	105,000	26,900	100.0%	26,900	269,000
Total			2,232,200	3,000,000	768,000		536,000	$1,589,000

Source: Product mix, first wholesale price, and useable weights based on interviews with Coastal Villages Seafoods plant manager.

Note: Rounded to nearest 00's.

[14] Interviews. Tim Hillyer. July-August 2009.

[15] State of Alaska Department of Fish and Game. Escapement Goal Ranges from Escapement Goal Review of Select AYK Region Salmon Stocks. January 2004

[16] State of Alaska Department of Fish and Game. Preliminary 2008 Kuskokwim Area Salmon Fishery Summary. September 24, 2008.

Coastal Villages Seafoods operates a large tender vessel in Kuskokwim Bay near the mouth of the Kanektok River in order to allow fishermen to avoid traveling to the city dock thereby avoiding the risk of grounding. Due to the navigational conditions the tender is rarely able to come to the city dock therefore a shuttle boat lighters fish from the tender to the dock. The shuttle boat often sustains damage from running the narrow, shallow channel, replacing two propellers, one lower outboard unit, and two engines per year at an annual cost of $52,000 as shown in Table 7.

Table 7. Annual Processer Vessel Damages

Part	Annual Number Replaced	Replacement Price	Total
Propeller	2	$ 250	$ 500
Lower Unit	1	1,350	1,350
Water Pump	1	65	65
Engines	2	$25,000	50,000
Total			$52,000

Source: Tim Hillyer, Operations Manager, Coastal Villages Seafoods, Quinhagak

If navigational issues were resolved Coastal Villages Seafoods has indicated that they would be able to staff a smaller tender with much lower operating costs and the need for a shuttle boat would be eliminated. Table 8 shows the calculation for this benefit.

Table 8. Annual Tender Operating Cost Savings

Vessel	Current Operating Costs	Estimated Operating Cost	Annual Savings
Tender	$500,000	$150,000	$350,000
Shuttle	50,000	0	50,000
Totals:	$550,000	$150,000	$400,000

Source: Tim Hillyer, Operations Manager, Coastal Villages Seafoods, Quinhagak

Currently, degradation of fish is an issue that plagues processing operations at Quinhagak. When tidal conditions make lightering fish from the tender to the dock impossible the fish begins to degrade, lowering revenue as the lower grade product commands a lower first wholesale price. Roe, which commands a first wholesale price of $10 per pound, is the first product to be lost. Losses of roe alone total $245,000 annually as shown in Table 9.

Table 9. Annual Roe Loss Due to Degradation

Degraded Tender Loads	Total Lbs. of Fish per Tender Load	Percent Roe by Weight	First Wholesale Price	Total Loss
7	100,000	3.50%	$10	$245,000

Source: Tim Hillyer, Operations Manager, Coastal Villages Seafoods, Quinhagak

While fish is rarely lost it sells at a lower price due to the degradation if delivery from the tender to the processing plant has been delayed. These grade reductions due to navigational conditions total approximately $225,000 per year as shown in Table 10.

Table 10. Annual Non-Roe Loss Due to Degradation

Low Estimated Annual Degradation Loss	High Estimated Annual Degradation Loss	Average
$150,000	$300,000	$225,000

Source: Tim Hillyer, Operations Manager, Coastal Villages Seafoods, Quinhagak

C. Subsistence

Subsistence harvesting is a way of life for residents of Quinhagak with the bulk of activity centering on the Kanektok River and Kuskokwim Bay. The boats used by the residents are subject to the same damages that plague vessels related to commercial fishing and processing. Based on the 2000 Census, there are 169 occupied households in Quinhagak and we assume that each of these households have access to at least one subsistence fishing vessel. There are 40 active commercial fishing vessels in Quinhagak and we assume that these vessels are also used for subsistence purposes. To avoid double counting, we use 129 subsistence fishing vessels as our base (169 households minus 40 commercial fishing vessels equals 129). Vessel damages for subsistence fishing boats are assumed to be similar to those realized by the commercial fishing vessels. Were navigational issues to be resolved, these damages could be avoided leading to a savings of approximately $247,000 per year as shown in Table 11.

Table 11. Annual Damages to Subsistence Vessels

Part	Annual Number Replaced	Replacement Price	Total
Propeller	2	$ 250	$ 500
Water Pump	1	65	65
Lower Unit	1	$1,350	1,350
Annual Damage per Vessel			1,915
Number of Vessels		x	129
Total			$247,000

Note: Total has been rounded to nearest 000's.

Figure B-4. Fish Drying on Racks

Subsistence vessels are also subject to the same delays in traversing the mouth of the Kanektok River leading to decreased harvests. It is conservatively assumed that if the navigational issues were resolved the subsistence harvest could increase by about 10 percent. The harvest fluctuates with population levels and therefore changes from year to year. Benefits are estimated given price per pound for protein in Quinhagak. Local costs for protein are summarized in Table 12.

Table 12. Meat Prices at Qanirtuuq Store on July 31, 2009

Description	Price per lb
Pork Chops Center Cuts	$ 6.79
Pork Loin Roast	4.86
Pork Baby Back Ribs	8.09
Pork Spare Ribs	4.89
Corned Beef	5.39
King Crab Legs	34.89
Pork Chop Boneless	6.75
Reindeer Stew Meat	11.89
Ground Beef	3.65
Beef Stew Meat	6.05
Beef Short Ribs	7.15
Korean Style Short Ribs	8.79
Beef Rump Roast	4.79
Beef T-Bone Steak	13.89
Beef Rib Steak	14.35
Beef Tongue	5.89
Beef Shoulder Cod	4.79
King Crab	27.29
Oxtail	7.49
Beef Tripe	6.59
Beef Round Steak	6.89
Beef Heart	2.85
Average Local Price per Pound for Protein:	**$ 9.27**

The population in Quinhagak is forecast to grow 0.68 percent over the 50-year examined period.[17] Using a survey of the representative year of subsistence harvest at Quinhagak and assuming that subsistence harvesting could increase by 10 percent with no navigational challenges the potential increase can be calculated as shown in Table 13.[18]

Table 13. Increase in Subsistence Harvests

Year	Population	Projected Harvest at Status Quo	Projected Harvest with Navigational Improvements	Increase with Navigational Improvements
0	661	$4,707,000	$5,177,700	$470,700
1	665	4,738,100	5,211,900	473,800
2	670	4,769,400	5,246,300	476,900
3	674	4,800,800	5,280,900	480,100
4	679	4,832,500	5,315,800	483,300
5	683	4,864,400	5,350,800	486,400
10	706	5,027,100	5,529,800	502,700
20	760	5,368,900	5,905,800	536,900
30	815	5,734,000	6,307,400	573,400
40	874	6,123,800	6,736,200	612,400
50	937	$6,540,200	$7,194,200	$654,000

D. Fuel Operations

Crowley Marine is the fuel barge operator that services Quinhagak. A conversation with Walt Tague, Director of Operations for Crowley Marine revealed the challenges that fuel barges encounter while delivering to Quinhagak. Crowley has adapted its operations to meet the challenging conditions present at many of the villages it serves, including Quinhagak. Crowley's barges carry all-wheel drive trucks to deliver fuel to tanks not located at the dock at an additional cost of $0.35/gallon. When a dock is inaccessible, Crowley can perform

[17] State of Alaska, Department of Labor and Workforce Development. Alaska Population Projection Data Sheets, Southwest Region, Bethel Census Area. 2006.

[18] State of Alaska, Department of Fish and Game, Subsistence Section, Community Subsistence Information System. www.subsistence.adfg.state.ak.us/CSIS

"hose pulls" however, they prefer to keep the length of these hose pulls under 200 feet and charge by 50 foot increments over 200 feet. Crowley recently invested $10 million to purchase tugs with 3.5 foot draft in order to make operations into these communities easier and more efficient but even with such a shallow draft deliveries can be challenging. Mr. Tague said that Crowley gives its best effort to get into Quinhagak and other villages because they understand the importance of this service.

Crowley delivers fuel to Quinhagak twice per year, timing the deliveries to occur during high tide cycles in early June and mid-September with a cycle available in late October if a delivery cannot be made during the other windows. The October cycle is undesirable due to frequent foul weather conditions during that time of the year. Mr. Tague said that even if there is a high tide, east winds pushing water out of the bay can make the tides unusable.

Mr. Tague said that it is not unusual for the barge to become stuck and forced to wait up to 12 hours for the next high tide but said every delivery is different because of the changing channel. This was illustrated in September 2009 when Crowley's fuel barge CMS 160-1, which was carrying 71,000 gallons of jet fuel and 71,000 gallons of gasoline, became stuck in the Kanektok River while trying to access the Quinhagak city dock.[19] Crowley's tugs have an operating cost of $475/hour therefore delays can be very costly.

Figure 5. Crowley Barge Stuck in Kanektok River
Source: Sherry Marousek-Pederson

[19] "Fuel-toting vessel stuck in wildlife refuge". Anchorage Daily News. 18 Sept. 2009

In 2001/2002 Qanirtuuq Corporation was forced to fly in fuel. Mr. Tague said that when fuel is flown in it adds a cost of $2/gallon and said that generally a planeload holds 4,000 gallons. Mr. Tague would not say what the rates are for fuel in Quinhagak but did say that the pricing scheme groups villages into "zones" and that Quinhagak is in the lower Kuskokwim zone so that navigational improvements in one village would not have a direct effect on pricing for the zone as a whole.

Figure 6. Fuel Farm at Quinhagak

Due to navigational conditions, it is normal for Crowley's barge to become stuck for a full tide cycle once per delivery. Crowley's tugs operate at a cost of $475 per hour making delays very expensive.[20] Annual delay expenses are show in Table 14.

Table 14. Fuel Barge Annual Delay Costs

Number of Annual Deliveries	Hours Delayed per Delivery	Operating Cost per Hour	Total Annual Delay Costs
2	12	$475	$11,400

[20] Conversation with Mr. Walt Tague, Director of Operations, Crowley Marine, August 2009.

In addition, conditions sometimes dictate that fuel be flown in when a barge is unable to make a delivery. While rare, it is estimated that a full fuel load would have to be flown in once every 10 years at an added cost of $2 per gallon. Local fuel storage capacities are shown in Table 15.[21]

Table 15. Cost of Flying in Fuel

Fuel Customers	Fuel Supply (gallons)
LKSD	42,200
City of Quinhagak	12,900
Native Village of Quinhagak	43,700
AVEC	104,300
Qanirtuuq	145,200
Moravian Church	3,700
A&C Market	9,600
Army National Guard	4,500
Total Fuel Capacity (gallons)	366,100

Source (Fuel Capacity): State of Alaska Department of Community and Economic Development Division of Community and Regional Affairs Detailed Community Information Database.

E. Freight Operations

Northland Services is the freight barge operator that regularly services Quinhagak. A conversation with Maureen Fitzgerald of Northland revealed that Northland calls on Quinhagak twice annually in the spring and fall depending on tide cycles and the amount of freight being shipped but will go in whenever there is sufficient freight and adequate conditions and plans to deliver to Quinhagak up to five times in 2009. Northland uses landing craft at Quinhagak that either base out of Bethel or operate from a barge stationed outside of Hooper Bay. In 2009 Northland's landing craft became stuck for 2.5 days.

Chartered freight barges infrequently call on Quinhagak for construction projects, however the success of these operations are questionable as large sections of pipe needed for the Village Safe Water Project had to be flown in at considerable expense. Some of these barges travel with specialized landing craft specifically built to access ports with low water levels

[21] $2/gallon is estimated additional cost by Walt Tague, Director of Operations, Crowley Marine, August 2009

however these are inconsistently effective at Quinhagak. The added expense of using these craft is passed on to the residents, inflating the cost of goods.

Through a number of discussions with community businessmen it was discovered that it is often just as cost effective to have freight flown in. A number of aircraft service Quinhagak including, but not limited to, Cessna 207As, Piper Grand Caravans, and DC-6s. The DC-6s have a payload of between 27,500 and 31,000 lbs but are limited by runway conditions to 18,500 lbs.

Northland Barge Services calls on Quinhagak to deliver freight. A discussion with Maureen Fitzgerald, Northland Barge Services revealed the challenges faced in delivering freight to Quinhagak. Northland Barge uses landing craft to lighter freight into Quinhagak. While rare, Northland sometimes becomes grounded for up to 2.5 days during a delivery. It is estimated that this happens once every ten years. Northland's landing craft have a daily average operating cost of $12,500 making delays such as this very expensive.[22]

Table 16. Freight Barge Delay Cost

Low Estimated Daily Operating Cost	High Estimated Daily Operating Cost	Average	Delay (Days)	Total Cost
$10,000	$15,000	$12,500	2.5	$31,250

F. Search and Rescue

The village has a Village Public Safety Officer (VPSO) but according to Wassillie Pleasant, VPSO Quinhagak, he does not have any vessels with which to perform search and rescue and instead relies on the help of volunteers from the community.[23] The vessels used to perform search and rescue operations are often of the same size as those being rescued and face the same navigational challenges. VPSO Pleasant states that he responds to more search and rescue calls than he is able to count and was hesitant to give an annual average for number of operations performed. He said that search and rescue operations can last up to three days.

In 2008 there was an accident involving an aircraft. A boat responded but became stuck on exit into the bay necessitating the response of three more boats. There was a fatality aboard the aircraft. Local response is vital in this area as the nearest Coast Guard Marine Safety Detachments are located in: Kodiak, 365 miles southeast of Quinhagak; and Dutch Harbor, 440 air miles southwest of Quinhagak. The nearest Alaska State Troopers Detachment is located in Bethel which is 70 air miles north of Quinhagak.

[22] Conversation with Maureen Fitzgerald, Northland Services, August 2009.

[23] Conversation with Wassillie Pleasant, VPSO, Quinhagak

Because of the remote nature of the village and the various parties that could potentially be involved in a search and rescue operation (U.S. Coast Guard, Alaska State Troopers, VPSO) it is hard to quantify the benefits to search and rescue operations. However, it is assumed that this vital community service would be more efficient if navigational conditions were improved by allowing the first responders, including the VPSO, to enter and exit the Kanektok River without the possibility of losing precious time while grounded or waiting for high tide.

III. SUMMARY

A discussion of how each alternative addresses the need for improved access to dock facilities is provided below. More detail on the alternatives is provided in Appendix B – Hydraulics.

Alternative 1 (Causeway and Dock). A causeway extending to deepwater would aid in the delivery and export of fresh fish product to Quinhagak and the delivery of fuel and freight. Local commercial fishing and subsistence boats would still have to navigate the shallow water to return to Quinhagak and would not benefit from these improvements.

Alternative 2 (Jetties and Dredged Channel). A dredged channel from deepwater of Kuskokwim Bay to the city dock would enable all vessels to avoid many of the delays in reaching Quinhagak. Most vessel damages currently sustained from groundings would also be avoided.

Alternative 3 (½-Mile Dredged Channel). A dredged channel extending ½ mile from the city dock would provide some benefit to barge operators since this is where their groundings most frequently occur.

Alternative 4 (2 ½-Mile Dredged Channel). A dredged channel from deepwater of Kuskokwim Bay to the city dock would enable all vessels to avoid many of the delays in reaching Quinhagak. Most vessel damages currently sustained from groundings would also be avoided.

Alternative 5 (Dock Relocation). Relocation of the dock to the main channel of the Kanetok River would provide little to no benefit to the users since they would still be required to navigate the shallow waters to Quinhagak.

Alternative 6 (Airport Improvement). Leveling the grade of the airport would allow aircraft to take off with a heavier payload. This could allow for more and fresher product to be exported. However, the shallow water would continue to limit the delivery of fresh product to the processing plant.

Alternative 7 (Channel Marking and Buoy Upgrades). Annual placement of channel markers would provide benefit to vessels by reducing the rate of groundings and associated delays.

Alternative 8 (Hovercraft). Use of a hovercraft to lighter fish product from barges and tenders in Kuskokwim Bay to the city dock would aid in the delivery of product to the processing plant. Local commercial fishing and subsistence boats would still have to navigate the shallow water to return to Quinhagak and would not benefit from these improvements.

Dock and Marine Infrastructure Improvements

Quinhagak, Alaska

Appendix B - Hydraulics

DOCK AND MARINE INFRASTRUCTURE IMPROVEMENTS

QUINHAGAK, ALASKA

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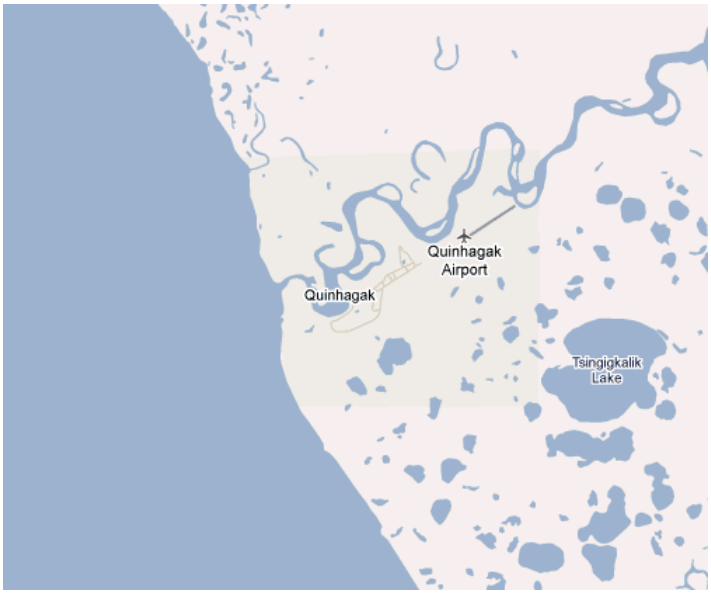
Location of project

A. Environmental/Climatological Data

Quinhagak is located along the Kanektok River on the east shore of Kuskokwim Bay, less than a mile from the Bering Sea coast. See Figure 1. It lies 70 miles southwest of Bethel, at approximately 59º 45' N Latitude, 161º 54' W Longitude. The area encompasses 4.7 square miles of land and 0.6 square miles of water. Quinhagak is located in a marine climate. Precipitation averages 22 inches, with 43 inches of snowfall annually. Summer temperatures average 41º F to 57º F, winter temperatures average 6º F to 24º F. Extremes have been measured from 82º F to -34º F.

Figure 1. Quinhagak Vicinity



B. Tides

Tides at Quinhagak are diurnal with two highs and two lows occurring daily. Tide levels referenced to mean lower low water (MLLW) are shown in Table 2.

Table 1. Tide Elevations

Level Type	Level Referred to MLLW (ft)
Mean Higher High Water (MHHW)	12.3
Mean Tide Level	5.3
Mean Range	9.7
Mean Lower Low Water (MLLW)	0.0

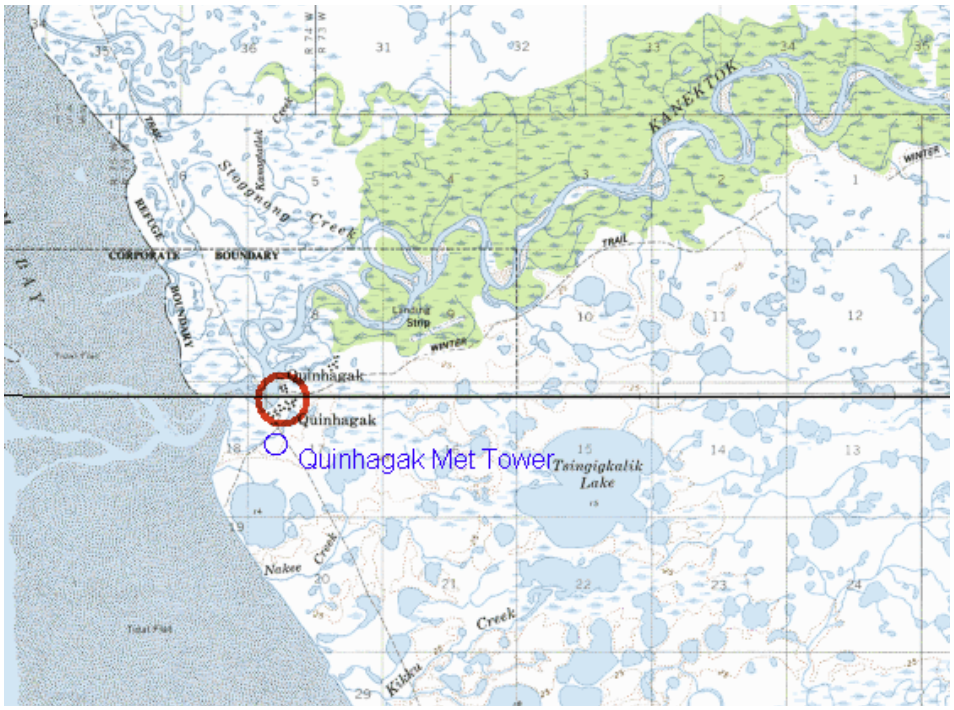
Sources: http://tidesandcurrents.noaa.gov for Eek Channel, off Quinhagak

C. Wind and Wave Data

Wave measurements have not been recorded in the area of Quinhagak. The city is located on the Kanektok River, so waves at Quinhagak are not a navigation issue at the barge landing. The approach to Quinhagak is over the Kuskokwim River delta where a river channel cuts through the delta. A depth limited wave at mean higher high water level (MHHW) over the mudflat with an elevation of 0 feet would be 9.75 feet high. This wave height was used to size the armor stone for the causeway and jetty alternatives.

Wind can be extreme at Quinhagak. A wind study was performed by V3 Energy LLC to determine if Quinhagak was a viable candidate for wind turbines. Wind measurements were made at the location shown in Figure 2. As shown in Figure 3, Quinhagak winds are directional from the north-northwest to north-northeast with a lesser south to southeast wind component.

Figure 2. Location of Wind Gathering Data



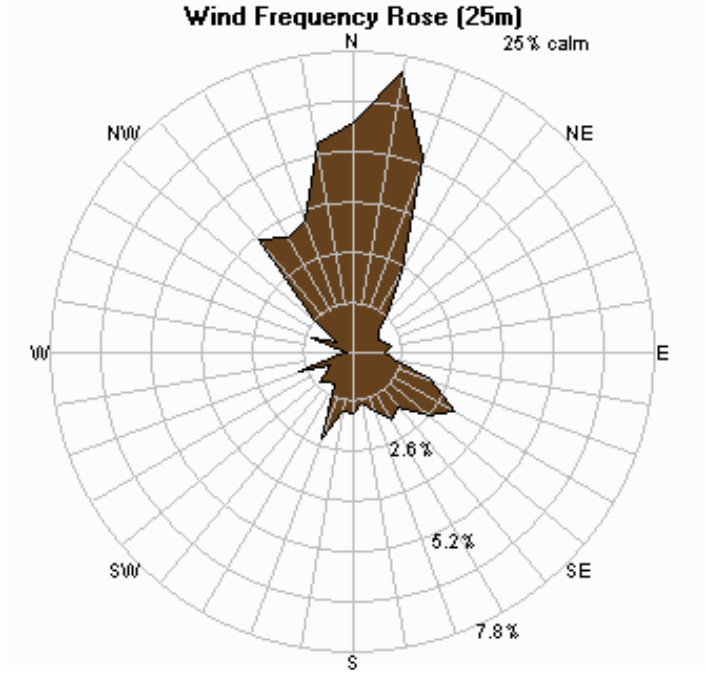
Monthly Average Wind Speeds (Channel 1 – 30 meters)

The northeast (30-meter) anemometer wind speed average for the reporting period is 6.64 m/s. The southwest (second 30-meter) anemometer wind speed average is 6.62 m/s and the southwest (20-meter) anemometer wind speed average for the reporting period is 6.19 m/s. The daily wind speed profile indicates that the lowest winds of the day occur in the morning at about 8 to 9 am and the highest winds of the day occur in the early evening at about 5 to 6 pm and again in the early morning hours of 1 to 2 am. Wind data is shown in Table 1.

Table 2. Monthly Wind Speeds

Year	Month	Mean (m/s)	Max (m/s)
2005	Oct	5.5	11.9
2005	Nov	7.2	16.1
2005	Dec	5.8	17.5
2006	Jan	4.9	13.8
2006	Feb	9.6	27.2
2006	Mar	6.8	23.7
2006	Apr	6.8	17.8
2006	May	5.3	12.8
All Data		6.6	27.2

Figure 3. Wind Rose for Quinhagak



D. Design Vessel

The design vessel is the CMS 160-4 operated by Crowley Maritime Services with a length of 160 feet, beam of 46.1 feet, and a draft of 9.4 feet. A one-way traffic channel design width of 161 feet wide with 3 horizontal to 1 vertical (3H:1V) side slopes was used for all dredge calculations. A bathymetric survey was not performed but a random sampling of bottom elevations in the channel area indicated that an elevation of -2 feet is a representative channel depth. A dredge prism depth of -12.4 feet was used to calculate the dredge volumes.

E. Channel Depth

The minimum required channel depth for the barge fleet was based on the following criteria:

Table 3. Required Channel Depth

Design Parameter	Value [ft]
Vessel Draft	9.4
Pitch, roll, and heave	1.5
Salt to Fresh water increase	0.3
Tide Allowance*	0
Safety Clearance (based on sand & gravel bottom)	2
Dredge tolerance	1
Depth needed	-14.4

*Tide allowance assumes some periods of inoperability during extreme low tides.

General Information and Alternatives

A. General

This reconnaissance-level report is based on a site visit and information gathered from reports and studies. All costs presented herein are parametric costs only using scalable values taken from bid proposals from various other jobs using a large amount of engineering judgment to adjust these costs to this site. It must be emphasized that this is a decision making level report, not a design level report. While the information presented is believed to be representative, it is based on very preliminary information that will have to be checked and verified at the design stage before anything is built.

B. Proposed Alternatives

Alternative 1 - Causeway.

This alternative consists of a breakwater causeway extending from shore 8,600 feet to deep water (depth of -14 feet, MLLW) of Kuskokwim Bay. A plan view and cross section of the causeway are shown in Figure 4 and 5. A dock would be located on the seaward end of the causeway to allow for offloading of goods and transport to the community. A nearshore gap in the causeway would be included to facilitate the migration of anadromous fish and minimize disruption of longshore sediment transport. A single lane bridge would be located at the gap. A 9.75 foot depth limited wave was assumed for sizing the seven-ton armor stone. The cost of this alternative is $252.2 million. The annual maintenance cost is $250,000. Quantity and cost information is provided in Table 4.

Construction would be performed over two seasons, requiring two mobilizations and demobilizations. Annual operation and maintenance for the bridge and dock is estimated at four percent of the initial cost occurring every five years. Breakwater maintenance is estimated at 2.5 percent of the armor rock cost occurring every 15 years.

Figure 4. Alternative 1 – Causeway

Figure 5. Typical Causeway Cross Section

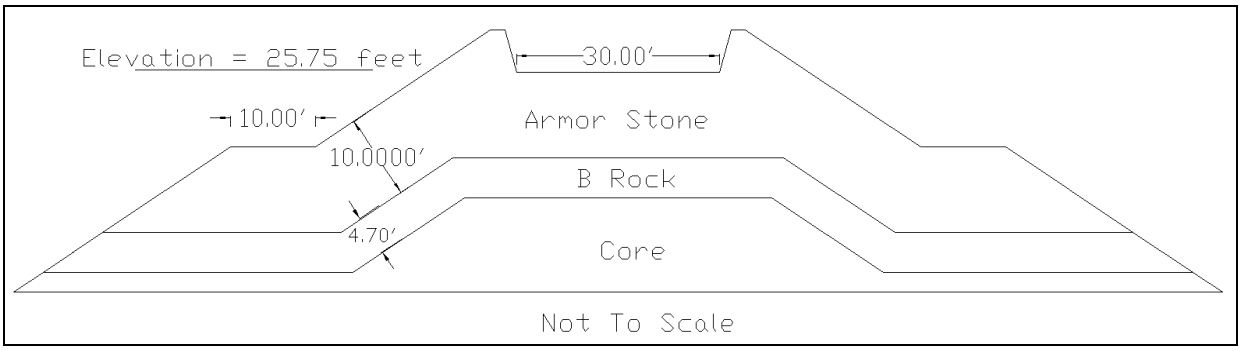


Table 4. Alternative 1 - Quantities and Costs

Type	Quantity	Unit of Measure	Unit Cost	Total Cost
Mob/Demob	2	LS	$3,000,000	$ 6,000,000
Armor Rock	355,000	CY	250.00	88,750,000
B Rock	200,000	CY	150.00	30,000,000
Core Rock	240,000	CY	120.00	28,800,000
Causeway Bridge	1	LS	1,650,000	1,650,000
Deepwater Dock	1	LS	$4,300,000	4,300,000
Subtotal				**$ 159,500,000**
Contractor Overhead, Profit, Bond			25%	39,875,000
Contingency			25%	49,844,000
Construction Subtotal				**$ 249,219,000**
Plans and Specifications				$ 500,000
Construction Supervision and Administration				$ 2,000,000
Environmental Coordination & NEPA Compliance				$ 500,000
Total Implementation Cost				**$ 252,219,000**
Annual O&M Cost				**$ 250,000**

Alternative 2 - Jetties and Dredged Channel

Alternative 2 consists of two 8,600-foot jetties which would stabilize a dredged channel from the mouth of the Kanektok River to naturally deep water (depth of -14 feet MLLW) of Kuskokwim Bay. Nearshore gaps in the causeway would be included to facilitate the migration of anadromous fish and minimize disruption of longshore sediment transport. A plan view and cross section of the causeway are shown in Figure 6 and 7. A 9.75 foot depth limited wave was assumed for sizing the seven-ton armor stone. The cost of this alternative is $372.5 million. The annual maintenance cost is $3.6 million. Quantity and cost information is provided in Table 5.

Construction would be performed over three seasons requiring three mobilizations and demobilizations. Operation and maintenance costs assumed annual maintenance dredging of the channel and breakwater repair at a 15-year interval. Required maintenance dredging volume may significantly fluctuate based on an annual basis. Annual dredging volume was estimated at 120,000 to 180,000 cubic yards.

Figure 6. Alternative 2 – Jetties and Dredged Channel

Figure 7. Typical Jetty Cross Section

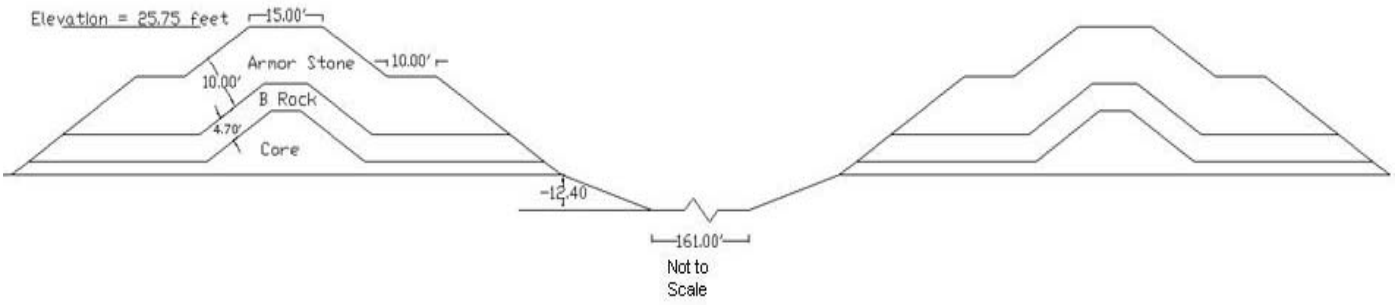


Table 5. Alternative 2 - Quantities and Costs

Type	Quantity	Unit of Measure	Unit Cost	Total Cost
Mob/Demob (Season 1, 2, & 3)	1	LS	$11,000,000	$ 11,000,000
Armor Rock	519,000	CY	250	129,750,000
B Rock	310,000	CY	150	46,500,000
Core Rock	266,000	CY	120	31,920,000
Dredging	722,000	CY	$ 24	17,328,000
Subtotal				**$ 236,498,000**
Contractor Overhead, Profit, Bond			25%	59,125,000
Contingency			25%	73,906,000
Construction Subtotal				**$ 369,529,000**
Plans and Specifications				$ 500,000
Construction Supervision and Administration				$ 2,000,000
Environmental Coordination & NEPA Compliance				$ 500,000
Total Implementation Cost				**$ 372,529,000**
Annual O&M Cost				**$ 3,600,000**

Alternative 3 –Dredged Channel

Alternative 3 consists of ½-mile long channel dredged to a depth of -14 feet MLLW (Figure 8). The channel would extend from the dock face to main channel of the Kanetok River. Duration to dredge the ½-mile and 2 ½-mile channels are shown in Table 6. The channel would have a width of 75 feet and under average weather and tidal conditions allow barge operators to operate without delays. An infilling study was not performed to determine the maintenance requirements for the channel. However, because the channel would be located at the river mouth within a large tidal flat area it is assumed that the channel would completely infill and need to be dredged every year. The cost of this alternative is $6.0 million. The annual maintenance cost is $2.5 million. Quantity and cost information is provided in Table 7.

Operation and maintenance costs assumed annual maintenance dredging of the channel.

Figure 8. Alternative 3 – Dredged Channel

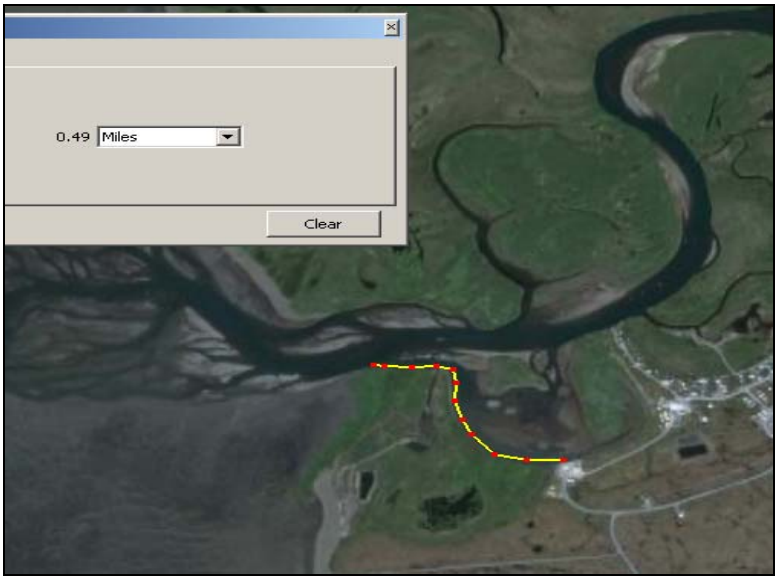


Table 6. Dredge Channel Construction Durations

Length of Channel	Dredge Volume	Estimated Time to Completion
0.5 mile	100,000 cy	24 days
2.5 miles	1,200,000 cy	3.5 months

Table 7. Alternative 3 - Quantities and Costs

Type	Quantity	Unit of Measure	Unit Cost	Total Cost
Mob/Demob	1	LS	$1,500,000	$ 1,500,000
Dredging	100,000	CY	$ 20	2,000,000
Subtotal				**$ 3,500,000**
Contractor Overhead, Profit, Bond			25%	875,000
Contingency			25%	1,094,000
Construction Subtotal				**$ 5,469,000**
Plans and Specifications				$ 150,000
Construction Supervision and Administration				$ 200,000
Environmental Coordination & NEPA Compliance				$ 150,000
Total Implementation Cost				**$ 5,969,000**
Annual O&M Cost				**$ 2,500,000**

Alternative 4 – 2 ½-Mile Dredged Channel

This dredged channel would extend from the dock face to a natural depth of -14 feet MLLW in Kuskokwim Bay (Figure 9). The channel would accommodate the Crowley fuel barge that currently services Quinhagak and allow transit across the delta at a lower tide range. An infilling study was not performed to determine the maintenance requirements for the channel, but since it is at the mouth of a mud flat it is assumed that the channel will completely infill and need to be redredged every year. The cost of this alternative is $40.7 million. The annual maintenance cost is $7 million. Quantity and cost information is provided in Table 8. Operation and maintenance costs assumed annual maintenance dredging of the channel.

Figure 9. Alternative 4 - Dredged Channel

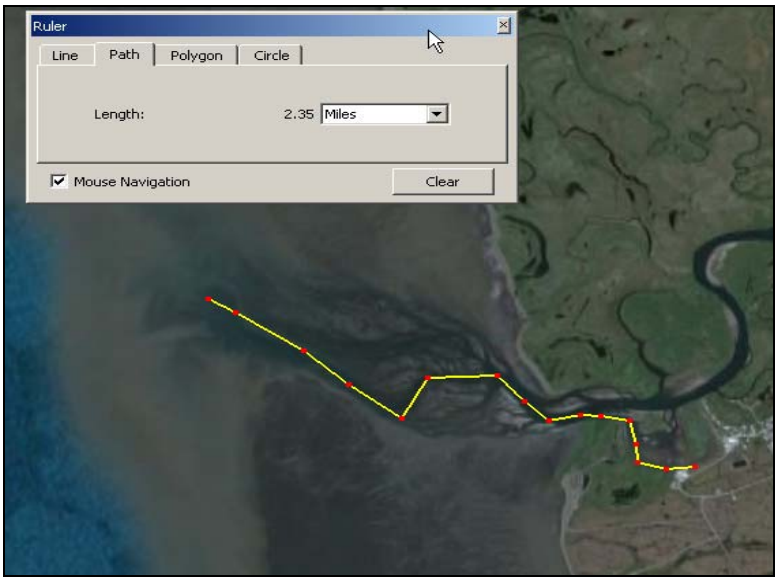


Table 8. Alternative 4 - Quantities and Costs

Type	Quantity	Unit of Measure	Unit Cost	Total Cost
Mob/Demob	1	LS	$ 1,500,000	$ 1,500,000
Dredging	1,200,000	CY	20	24,000,000
Subtotal				**$ 25,500,000**
Contractor Overhead, Profit, Bond			25%	6,375,000
Contingency			25%	7,969,000
Construction Subtotal				**$ 39,844,000**
Plans and Specifications				$ 200,000
Construction Supervision and Administration				$ 400,000

Environmental Coordination & NEPA Compliance	$ 300,000
Total Implementation Cost	**$ 40,744,000**
Annual O&M Cost	**$ 7,000,000**

Alternative 5 – Dock Relocation

This alternative consists of relocating the city dock. The proposed site is on the main channel of the river, labeled "New Dock Site" in Figure 10. This alternative is dependent on tidal fluctuations and does not solve issues related to damages to vessels transiting the mouth of the Kanektok River. The cost of this alternative is $11.9 million. The annual maintenance cost is $43,000. Quantity and cost information is provided in Table 9.

Figure 10. Alternative 5 - Dock Relocation

Table 9. Alternative 5 - Quantities and Costs

Type	Quantity	Unit of Measure	Unit Cost	Total Cost
Mob/Demob	1	LS	$1,750,000	$ 1,750,000
Bulkhead	1	LS	5,000,000	5,000,000
Haul & Place Fill for Storage Area	4,000	CY	31	124,000
Compact Fill for Storage Area	87,500	SF	0.82	72,000
Stream bank protection	100	CY	300	30,000
Fuel & Infrastructure	1	LS	225,000	225,000
Subtotal				**$ 7,201,000**
Contractor Overhead, Profit, Bond			25%	1,800,000
Contingency			25%	2,250,000
Construction Subtotal				**$ 11,251,000**
Plans and Specifications				$ 200,000
Construction Supervision and Administration				$ 300,000
Environmental Coordination & NEPA Compliance				$ 150,000
Total Implementation Cost				**$ 11,901,000**
Annual O&M Cost				**$ 43,000**

Alternative 6 – Airport Repair

This alternative consists of rehabilitating the surface at Quinhagak's airport (see Figure11). The new airport at Quinhagak was opened in November 2004. However, frost heaving has resulted in an uneven runway surface including a large heave that has restricted takeoff and landing weights, causing inefficiencies. Smoothing the runway surface would require grading the surface and resurfacing with gravel. Performing this task would require coordination with the State of Alaska Department of Transportation and Public Facilities. The cost of this alternative is $5.7 million. No additional operation and maintenance cost would be incurred from repair of the airport. Quantity and cost information is provided in Table 10.

Figure 11. Alternative 6 - Airport Repair

Table 10. Alternative 6 - Quantities and Costs

Type	Quantity	Unit of Measure	Unit Cost	Total Cost
Mob/Demob	1	LS	$2,000,000	$2,000,000
Haul and Place	21,000	CY	50	1,050,000
Materials	21,000	CY	25	525,000
Subtotal				**$ 3,575,000**
Contractor Overhead, Profit, Bond			25%	894,000
Contingency			25%	1,117,000
Construction Subtotal				**$ 5,586,000**
Plans and Specifications				$ 50,000
Construction Supervision and Administration				$ 50,000
Environmental Coordination & NEPA Compliance				$ 0
NOTE: Work overseen by ADOT staff. Work occurs within airport right of way				
Total Implementation Cost				**$ 5,686,000**
Annual O&M				**$ 0**

Alternative 7 – Channel Marking and Buoy Upgrades

Coastal Villages Seafoods currently marks the channel of the Kanektok River in Kuskokwim Bay to the best of their abilities as shown in Figure 12. Storms often move the buoys and the channel migrates so quickly that the buoys need to be relocated multiple times per season. The channel is still fairly shallow due to tidal conditions and the ability of watercraft to access the city dock appears to depend more on the depth of the channel than how well it is marked. Upgraded buoys and positioning equipment may assist in better navigation of the channel.

This alternative consists of placing ten navigation buoys to mark the channel. A vessel capable of operating in shallow waters and placing and pulling the buoys would be purchased and operated by local labor. The cost of this alternative is $124,000. The annual maintenance cost is $23,000. Quantity and cost information is provided in Table 11.

Operation and maintenance cost assumed biannual replacement of one buoy, anchor, and one anchor hardware assembly due to wear every two years. Buoy placement assumed annual placing and pulling of the buoys and repositioning of the buoys four times during the summer. Vessel maintenance would be performed annually.

Figure 12. Alternative 7 - Channel Marking and Buoy Upgrades

Table 11. Alternative 7 - Quantities and Costs

Type	Quantity	Unit of Measure	Unit Cost	Total Cost
Buoy	10	EA	$ 450.00	$ 4,500
Anchor Hardware	10	EA	100.00	1,000
Anchors	10	EA	200.00	2,000
Shipping	5,000	LBS	2.50	12,500
Purchase vessel with bow winch	1	LS	100,000	100,000
Initial Placement				3,500
Total Construction (initial placement)				**$ 124,000**
No design or construction administration costs				
No NEPA - Buoys installed under Corps nationwide permit				
Operation and Maintenance (buoy repositioning and replacement)				
Annual Buoy Setting	1/year			3,500
Annual Buoy Pulling	1/year			3,500
Buoy Repositioning	4/year			12,000
Annual Vessel O&M				2,000
Annual Buoy/Anchor Replacement				2,000
Annual O&M				**$ 23,000**

Alternative 8 - Hovercraft

This alternative involves putting a hovercraft into service for use of ferrying fish, fuel, and goods between Kuskokwim Bay and the city dock. A hovercraft is currently in use in Bethel and the surrounding villages (see Figure 13). It provides cargo and passenger service, has been more reliable and cost-effective than air service, and has had a negligible environmental impact. The craft in use in Bethel has a payload of 12,500 pounds with cargo space depending on passenger configuration. Alaska Hovercraft Ventures also owns and operates 15 larger LACV-30 hovercrafts with a payload of 30 tons. These larger hovercrafts are 76.5 feet long and have 1,600 square foot cargo decks capable of carrying containers and vehicles. Hovercraft purchase and lease cost information is provided in Tables 12 and 13.

Figure 13. Alternative 8 - Hovercraft

Table 12. Alternative 8 – Hovercraft Purchase Costs

Type	Quantity	Unit of Measure	Unit Cost	Total Cost
Initial Purchase Cost	1	LS	$2,000,000	**$2,000,000**
Annual Cost				
Annual Operation	2,160	HRS	1,120	2,426,000
Annual Ownership Expense				237,000
Annual Owning/Operating Cost				**$ 2,663,000**

Table 13. Alternative 8 – Hovercraft Lease Costs

Type	Quantity	Unit of Measure	Unit Cost	Total Cost
Annual Lease	1	LS	$1,326,000	$ 1,326,000
Annual Fuel	2,160	HRS	$798.30	1,724,000
Annual Leasing/Operating Cost				**$ 3,050,000**

Dock and Marine Infrastructure Improvements
Quinhagak, Alaska

Appendix C – Real Estate

REAL ESTATE SUMMARY

Project Summary: The purpose of this summary is to determine real estate requirements for the project planning document for the potential harbor entrance improvements at Quinhagak, Alaska. The document includes an outline of reasonable alternative locations and marine transfer needs. Real estate at this point has been tasked to:

- Determine ownership of land and tidelands of existing harbor entrance and reasonable alternate locations.
- Identify rights of way required for the existing harbor improvements.
- Prepare a map that illustrates ownership for the dock and proposed alternative locations.

Current Ownership: Site 1, where the existing City Dock is presently located, the uplands and tidelands are owned by the City of Quinhagak. Alaska Statue 38.05.825 provides for conveyance to municipalities of tidelands that are occupied or suitable for occupation and development. The Division of Mining, Land and Water conveyed to the City of Quinhagak 4.7 acres, more or less, tide submerged land situated on Kanektok River.

Qanirtuuq Incorporated owns the 257.05 acres of uplands tide and submerged lands identified on U.S. Survey 876. Alternative sites 2 through 6 are all located within U.S Survey 876. Attached is a community map identifying surveys and ownership.

Real Property Interests required for the project: Initial information indicates all lands required for construction, operation, and maintenance of the project on Site 1, are owned by the City of Quinhagak. The Denali Commission is funding this project and has indicated that the City of Quinhagak has a vested interest in the repair of the dock and will be responsible for operating and maintaining the project.

Real estate requirements for all five (5) alternatives would require the City of Quinhagak to obtain ownership from Qanirtuuq Incorporated.

Required Rights of Way: An access Agreement for Construction from the City of Quinhagak would have to be obtained before construction on land owned by the city.


AREA LOG MAP
QUINHAGAK
Legend & Notes
KUSKOKWIM BAY
KANEATOK RIVER
TOKOMAHLIR LAKE

Dock and Marine Infrastructure Improvements

Quinhagak, Alaska

Appendix D – Site Visit Trip Report March 2009

DISTRICT TRIP REPORT

DATE REPORT SUBMITTED: August 3, 2009

NAME: Lorraine Cordova//Jason Norris/Dee Ginter

LOCATION OF TDY: Quinhagak, Alaska

DATE OF TRAVEL: July 29 - 31, 2009

PURPOSE: to investigate options related to relocation of the city dock and dredging.

EXECUTIVE SUMMARY: Met with Felipe Hernandez, Tribal Administrator, Native Village of Quinhagak, as well as various commercial fishermen and tribal leaders in order to become familiar with channel and tidal conditions and how they affect commercial fishing and subsistence operations on the Kanektok River at its confluence with Kuskokwim Bay. Felipe took us to the current city dock site as well as the identified alternative project sites including the point along the current main channel of the Kanektok River and a site approximately 3 miles south of town along the Arolik River.

We also met with Tim Hillyer, Operations Manager, Coastal Villages Seafoods to become familiar with the Quinhagak processing plant's operations. Tim was able to give us an idea of how channel and tidal conditions at the mouth of the Kanektok River affect Coastal Villages Seafoods and the commercial fishermen from whom Coastal Villages Seafoods purchases fish. Tim arranged for an excursion in a skiff onto the Kanektok River and into Kuskokwim Bay. We took photographs while on the water. We were also able to meet with Neil Rodriguez of Coastal Villages Region Fund to get an idea of the bigger picture of the CDQ's operations in the region.

We also met with Warren Jones, General Manger, Qanirtuuq Corporation. He shed further light on the situation as the corporation counts on fuel barges being able to access Quinhagak for deliveries twice per year. Warren said that channel conditions have created a situation where it is cheaper to fly goods into the community rather than barge them.

ACTION ITEMS: We plan to complete a report for Section Chiefs review by the end of September. We will be contacting barge operators for information about their operations and speaking to Mike McKinnon to gauge whether involvement in purchasing a dredge is something the Denali Commission would be interested in.

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