

EXECUTIVE SUMMARY

Introduction

In 2007, the Denali Commission (Commission) partnered with the US Army Corps of Engineers, Alaska District (USACE) to develop a Statewide Barge Landing Assessment to analyze barge mooring and fuel/freight transfer needs at Alaska's coastal and riverside communities. This work was undertaken to further the general findings of three studies that had previously identified barge landing improvements as a critical need in rural Alaska.

The Commission provided funding, scoping, and general services to their partner USACE, who provided professional and technical services for the project. USACE hired Tryck Nyman Hayes, Inc. (TNH) to develop the barge landing needs analysis in concert with barge operators, freight and fuel companies, state and federal agencies, and community development groups. The Assessment reflects those findings. The Assessment contains:

- Catalog of existing facilities
- List of barge landing infrastructure improvement needs by community
- An assessment of potential design solutions to address the general categories of infrastructure need
- Concept-level design drawings for selected designs that address a wide range of site conditions expected in the regions covered by the study
- Project ranking system used to develop priority needs
- List of projects that ranked highest in the priority ranking system for a first generation of design and construction (Priority Sites)
- Site plans showing possible landing site improvements at each of the Priority Sites
- Estimates of probable construction costs associated with the proposed improvements at each of the Priority Sites

This Executive Summary consists of an outline of barge landing needs, design features that address those needs and a table identifying improvements selected for a first generation of projects.

For this first phase of the Assessment, the analysis team focused its attention on the Alaska Peninsula, the Yukon, Kuskokwim and Kobuk Rivers, and the Bering, Chukchi and Beaufort Sea coasts. Barging is the dominant re-supply method for communities throughout these areas of Alaska, and in most cases, the shore side receiving facilities are entirely absent or primitive. DOT&PF has requested that the remaining areas of the state be reviewed in a similar manner so that all community needs are identified in a single document. This work, funded in large part by DOT&PF, is being undertaken in a second phase of work, and the results will be incorporated into the Assessment.

The goal of the Assessment is to identify for construction, projects that will improve barge operations, increase worker and environmental safety and/or cumulatively improve fuel and freight delivery costs through system improvements. Shore side

improvements will also take into consideration other vessels at each community, including subsistence fishing fleets, commercial fleets represented by the Community Development Quota (CDQ) groups, other local fleets, and construction material supply operations. In addition, the Assessment identifies operational improvements that could be implemented by the communities themselves, including most importantly, consolidation of marine fuel header locations to facilitate a single stop/landing for delivering fuel in each community.

In some communities, especially at sites exposed to severe weather, or where the landing sites are unconsolidated beach materials and/or are subject to rapidly changing ocean conditions, barge operations will continue as they do now to land when and where practical, holding firm through tug maneuvering. In most communities however, some level of infrastructure improvements are both practical and cost-effective. For example, the Assessment illustrates that relatively inexpensive mooring points were identified as the greatest need in most communities.

The Assessment outlines improvements that barge operators and other users have identified for each community via an interview process. In addition, the study prioritizes the sites to identify those projects that would be suitable for a first generation of capital improvements (referred to as Priority Sites in this report). Conceptual landing facility improvement designs, site plans and associated construction cost estimates have been completed and are included to facilitate discussions with community and user groups, and to prepare a capital projects list for Commission funding.

Background

Fuel is the primary product delivered to rural communities. Deck freight, delivered along with fuel orders or separately on regular scheduled barges, is the second highest volume of products delivered. Deck freight is generally delivered as steel shipping containers and break-bulk cargo (loose non-containerized material such as long lengths of pipe and timber, vehicles, palletized cargo, etc.).

The third key delivery product is construction materials delivered by chartered barges. These products are generally associated with community construction projects like schools, fuel tank farms, health clinics and airports. In addition, commercial fishing vessels and tenders operate in the area of barge landing sites.

In general, barge operators and communities report that the larger communities such as Nome, Bethel, and St. Mary's have sufficient barge landing facilities in place and are in relatively good shape, with the exception that maintenance upgrades are needed at some sites. The barge operators also report that in general, the communities on the lower Yukon and Kuskokwim Rivers have the most difficult landings, and are most in need of improvements. Especially problematic are those that have marginal permafrost, soft soils and high erosion rates, and low-lying villages with boardwalks and utilities close to the shoreline that get in the way of offloading operations. The report finds that improvements at these sites would generally consist of gravel causeways or ramps, docks, stabilized staging pads, and/or barge mooring points.

Fuel deliveries are generally made by side tying to a dock, where available, or in most cases by pushing the front of the barge into the beach and holding it in place with the tug while product is pumped through hoses to shore-based fuel headers or tanks. The key issues that impede operational efficiency in fuel deliveries include:

- Multiple tanks and/or headers, each of which requires a separate barge landing within the same community. This extends delivery times, and at some tidally-influenced sites can halt operations for up to 24 hours.
- Tank farms that have no marine header, so fuel delivery operations require dragging hose up to 1,500 feet to the tank farm locations. This increases worker safety and environmental risks associated with longer hose runs. These circumstances also extend the time it takes to offload fuel.
- Barges cannot access the beach in front of a fuel header or tank due to shallow water or because of large boulders or other hazards near the shore. In these cases, fuel barges anchor offshore and float the hoses to shore. Although fuel transfers are done as safely as possible, floating hose to the shore increases operational risks, including environmental risk associated with potential spills.

Barge Landing Designs

Conceptual designs were developed to address barge landing facility improvement types recommended by user groups during the interview process. A drawing was created to illustrate each of the design concepts including:

- Several options for mooring points including gravity anchor deadmen, concrete block deadmen, buried navy anchor, and stake piles as well as mooring bollards associated with a dock or wharf.
- Gravel pads for use as staging areas to offload and store cargo and materials, ranging in size from 10,000 to 40,000 square feet depending on the size of community and volume of goods delivered.
- Gravel causeway or access ramp consisting of a gravel spit that juts out into the water, protected from erosion and ice on each side by armor rock, with smaller, sacrificial rock at the end to provide for a softer barge-landing surface. These facilities are appropriate in areas where access to deeper water is required; where ice-damming is not a significant issue and regular maintenance of the structure can be accomplished.
- Concrete plank ramp, including driven sheet pile to retain the gravel and planks on each side and to retain the upper slope. This type of structure can also include a geotextile filter fabric wrap around the gravel to protect the material from scouring. Additional armor rock may be added in areas where high erosion or ice damming is a concern. This is a more robust structure intended for use in areas where a permanent hard surface across the beach is needed and where appropriate slopes can be accomplished.
- The diaphragm cellular sheet pile bulkhead dock is chosen as the recommended dock design for appropriate sites within the study area. It is chosen because of the design's flexibility to the varying and remote conditions expected at the range of locations in western Alaska, and its high

performance in less stable conditions such as weak soils and erosion, which are known to exist at many sites as well as its relative ease of construction. During the design phase of each dock project it may be determined that existing site conditions allow for an alternate, more cost-effective dock design.

- A combination sheet pile bulkhead dock and earthen ramp structure has also been developed based on recommendations by the barge operators to allow flexibility for side, end and ramp offloading. This type of configuration is found in locations like St. Mary's and works especially well for sub region hubs where freight redistribution occurs.

Recommendations

The following recommendations are central to development of a barge landing design and construction program at the Commission.

Fuel Deliveries

The primary recommendation for improving fuel delivery operational efficiency is to consolidate marine fuel headers to a single landing site location at communities where multiple landings are currently required (i.e., power company, school, village corporation and/or stores all have separate tanks and headers).

A second recommendation is to improve environmental concerns associated with floating fuel hose to shore by providing barge access to the shore. This effort could include removing navigation hazards and/or relocating the barge landing to a site where shore side receiving is practical.

Fuel system improvements such as header and pipeline work are generally not included in the scopes of work emerging from this analysis, however the Commission will work with individual communities and tank farm operators to find opportunities to combine these improvements in individual projects where practical.

In some communities, a gravel causeway into the water may be a feasible approach to reaching sufficient water depth. In other cases, especially in areas of very shallow water, installing a new landing facility or dredging may not be practical. In these communities, relocating tanks and/or fuel headers may be the most feasible approach to improved delivery.

About 33 communities in the proposed project list have long hose runs and/or multiple stops at fuel tank farms in the community. About ten of these sites do not currently have marine fuel headers, resulting in the need for extensive fuel hose runs from the beach up to the tank farms. Fuel barge operators indicate all parties would benefit from providing marine fuel headers and consolidating the location of the headers at a single landing site. Future planning for locating headers should consider barge operators' recommendations for placement. They indicate that the header location is ideal if installed no more than 300 feet from the landing site, while about 100-feet from the landing is preferred.

It is often difficult to access the upper river villages and it would be ideal to go to these communities once a year instead of two times a year for fuel deliveries. Providing a centralized tank farm, capable of annual fuel storage, would facilitate this goal.

In addition, in many villages there is a need to consolidate tank farms or at a minimum, bring separate pipelines to a consolidated headers system. These shore side improvements offer significant opportunities to improve barge operations. Communities and the Commission will examine the potential to build new headers or consolidate existing headers to avoid the increased time/cost associated with multiple barge landings and long hose runs. Providing and properly co-locating marine fuel headers should also be a primary consideration for all future fuel tank and distribution project upgrades in these communities.

Freight Deliveries

Freight deliveries are generally accomplished by a tug and barge, or landing craft nosing into shore, lowering a ramp and using loaders or forklifts to offload or board goods. Another method of on/offloading used by some barges is to side-tie to a dock or land parallel to shore and side-load using a crane that is positioned either on the barge or onshore. Key difficulties associated with freight deliveries include:

- Soft soils on the beach make driving loaders difficult
- Environmental concerns associated with disturbing the river bottom and changing navigation channels when pushing into the beach as well as the additional fuel expenditure needed to do this
- Keeping position in areas with swift currents without dedicated mooring
- Limited dry storage areas located close to the landing site
- Roads may not be wide enough for bulk materials to pass

The foremost recommendation to improve landings at communities is to install mooring points to hold position and to provide upland storage pads/staging areas. Where practical and needed, the Commission program will seek to design and construct dedicated landings such as a bulkhead dock or ramp to improve and expedite freight transfers. At a number of sites, this work may also include single instance dredging or rock removal at the landing site.

Summary of Needs

All parties involved in the assessment including barge operators, transportation planning experts and engineering specialists agree that even small-scale practical improvements at most sites will significantly improve delivery services, help to contain costs, improve worker safety, lower environmental risk, and/or provide better product quality at the end destination. Landing facility improvements needs (not including fuel system upgrades) in order of priority are:

- (1) Installing mooring points with chains for tie-offs
- (2) Upland staging areas/gravel pads for freight operations,
- (3) Dredging for access to shallow areas or for navigation safety (i.e., removing specific boulder hazards)
- (4) A dedicated landing site including permanent ramps and/or bulkhead docks with erosion protection

- (5) Minor repairs to existing facilities such as dock repairs, widening, grading or repairing landings, erosion protection, road widening, and staging area improvements

More than 50 percent of the communities studied need mooring points that will allow barge operators to control position, which will increase safety during freight and fuel offloading and decrease the potential for environmental damage caused by prop wash while they are “pushing” onto the beaches.

At a minimum communities with multiple fuel tank farm and/or freight delivery points, need mooring points at each delivery site. . The ideal capital project in these cases would be to develop a single fuel header location at the landing for all fuel customers in a community. Until the ideal project can be realized, mooring points at separate landings would be relatively inexpensive and are considered the primary and immediate need.

The freight delivery companies and communities, in general expressed a desire for construction of stable, dedicated gravel storage pads located at or near the landing sites. About 40 communities would experience increased operational efficiency if these stable gravel pads were constructed. A gravel staging area would also provide a dedicated location to store shipping containers for fall pickup, which would improve operational efficiencies and minimize the chance of the containers sinking and freezing into the tundra or beaches.

Barge operators reported it would be beneficial for about 50 communities to have ramps and/or wharfs or docks to increase operational efficiency and improve worker and environmental safety. Of these communities, there are up to 20 communities that are experiencing increased activity levels and/or may have suitable site conditions and could benefit from a sheetpile dock structure.

Five or so communities in the proposed project list require minor dredging such as boulder/hazard removal to improve access to landing sites. An additional seven communities were identified as possibly benefiting from more involved dredging in order to maintain safe, all-tide access to the sites or to eliminate the need for lightering to shore. One of these sites, Quinhagak, was cited as needing immediate emergency dredging in order to allow continued fuel deliveries. While one-time boulder/hazard removal may well be practical in a Commission transportation program, dredging improvements need to be carefully considered for their long-term stability. Routine or repeat maintenance dredging is not practical under the Commission’s funding parameters. For these sites, a feasibility study of dredging and/or alternate landing sites was recommended as a first step to making a practical long-term improvement.

The Priority Projects

Thirty-Five Priority Sites, with a total preliminary cost estimate of about \$50 Million are recommended for the first round of barge landing facility improvements. The Priority Sites were chosen based on a scoring matrix that evaluated:

- the urgency of need/time frame in which a project can be completed
- frequency of use and impact for a community
- the relative simplicity for which the project can be planned and constructed

The goal of the scoring exercise is to determine which sites have the most positive impact for the funds expended and are projects that can reasonably be expected to be ready for near-term funding and construction.

Opinion of Probable Construction Cost (OPCC) estimates were prepared for each of the Priority Sites to assist the Commission with the planning and budgeting the first generation of work. These estimates were completed based on a stand-alone project and include budget-level estimates for mobilization, field investigation, design, and construction administration or for execution of a feasibility study. Reflecting a key program goal, there has also been an effort to recommend reasonable grouping, or bundling of projects to realize savings on costs associated with mobilization and materials purchases.

The result is 10 bundled projects, each less than \$10M and grouped together based primarily on geography. The following table summarizes the proposed projects and associated OPCCs.

Proposed Alaska Barge Landing Facility Improvements, Priority Sites

#	Region	Community	Brief Description of Recommended Barge Landing Facility Improvements	Total Estimated Cost	Bundled Project Cost
1	Norton Sound/ Bering Sea	Elim	Provide a ramp and staging area, preferably at a co-located fuel and freight landing site to reach deeper water and avoid rocks and sewer outfall. Site conditions and land availability may preclude a co-located site; and two separate ramps may be considered. Design should include mooring points.	\$3.12M	\$6.96M (3 sites)
		White Mountain	Provide 2 mooring points at each of 2 landing sites.	\$0.16 M	
		Savoonga	Fuel barge anchors and floats hose in to shore and freight barges land 2 miles west, in the bay. Provide a dock or gravel causeway to at the freight landing to allow them to drop their bow ramp while staying offshore to avoid rocks, and a ramp to the upland area. Design should include erosion protection and mooring points. Improvements at the fuel landing site may include mooring dolphins and/or coastal protection; however, this requires a site investigation to determine feasibility, siting, and other site specific information.	\$5.01M	
2	Lower Yukon River and Delta	Alakanuk	Provide a gravel causeway/ramp and 2 mooring points at a new barge landing site, plus mooring points at 3 other landing sites. Two optional locations for the gravel causeway are shown. Option A utilizes the existing landing near already developed upland staging areas; however it is at a highly erodible location. Option B shows an alternate location, with a new staging area.	A:\$1.03M B:\$2.01M*	\$3.92 M (4 sites)
		Mountain Village	Improve the existing gravel causeway/ramp at the City landing site and provide an upland staging area. Install 3 mooring points each at the Native Corporation landing and the City landing and provide 2 mooring points at the fuel barge landing for the School/AVEC tanks.	\$1.62 M	

#	Region	Community	Brief Description of Recommended Barge Landing Facility Improvements	Total Estimated Cost	Bundled Project Cost
3		Anvik	Provide a gravel or concrete ramp and 3 mooring points at the existing barge landing located adjacent to the fuel header.	\$1.19M	\$9.09 M (2 sites)
		Grayling	Install 2 new mooring points at the downriver landing site, located just south of the access road. In addition, replace the cable with chain at the three existing cable/deadmen mooring points located in the trees at the upriver fuel barge landing.	\$0.15M	
		Emmonak	Provide a sheet pile dock with a downstream ramp. Provide improvements to expand the existing staging area in the adjacent uplands. Also provide 2 mooring points both at this site as well as at the downstream fuel landing for the Store.	\$7.12M	
		Kotlik	Provide a sheet pile dock with a downriver loading ramp. Extend dock out 20-ft min. from shoreline and provide 50-ft min. width ramp. Provide gravel pad at the existing upland staging area and consider expansion of the staging area to the south.	\$2.63M	
4	Middle Yukon River	Nulato	Install 3 mooring points at the existing co-located fuel/freight barge landing site and one additional mooring point above the waterline at the upland AVEC fuel barge landing site.	\$0.13M	\$2.41 M (10 sites)
		Galena	Provide 3 mooring points at one fuel landing and 2 mooring points at an upriver fuel landing.	\$0.15M	
		Tanana	Install 2 mooring points at 2 upriver fuel barge landings and 4 mooring points along the beach landing in front of the runway.	\$0.19M	
	Upper Yukon River	Stevens Village	Provide total of 4 mooring points at 2 barge landing sites.	\$0.13M	
		Fort Yukon	Provide total of 8 mooring points at 3 barge landing areas.	\$0.19M	
	Kuskokwim River Delta	Quinhagak (Kwinhagak)	<p>A <u>feasibility study</u> is a priority to analyze alternatives for long-term access to this site. Some alternatives suggested include:</p> <p>A: Dredge an access channel to the existing City dock. Periodic maintenance dredging would likely be required.</p> <p>B: For a long term solution, consider providing a new dock at a landing site that is not experiencing problems with sediment accretion.</p> <ul style="list-style-type: none"> One alternate site is on a spit of land upriver. A residential house is nearby, and property ownership issues may need to be resolved. Another option would be to study whether Arolik Creek is accessible by barge and constructing a new landing facility at the end of the existing 3+ mile long Arolik Rd., on Arolik Creek. 	\$0.16M	
		Chefornak	Improve and widen existing gravel causeway with new armor rock and smaller 6" minus rock at landing end. Dredge boulders from shallow area (<6ft) around causeway.	\$0.78M	

#	Region	Community	Brief Description of Recommended Barge Landing Facility Improvements	Total Estimated Cost	Bundled Project Cost
5		Toksook Bay	Provide gravel ramp to extend 100-ft or more from shore to reach water deep enough to land. At a minimum, consider dredging out large rocks in shallow water near the landing site.	\$0.85M	
		Chevak	Provide three mooring points at the existing beach landing site.	\$0.12M	
		Goodnews Bay	Provide dedicated upland staging areas and 5 mooring points at the existing beach landing areas. Additionally, study the feasibility of deepening the existing channel from Platinum to allow passage of vessels drawing 6-ft or more.	\$0.70 M	
		Kongiganak	Provide a sheetpile dock and staging area. A 500 to 1000-ft long access road to the staging area may be required to reach uplands area (Another project is possibly underway to accomplish some of this work as part of airport work). Also, provide mooring points at two upriver fuel barge landing sites.	\$3.51M	\$8.74 M (3 sites)
		Kwigillingok	Provide a co-located fuel/freight landing at the downriver fuel landing area by installing an upland staging area using a thick layer of crushed rock and gravel to create dry ground. Install mooring points at this landing area as well as at the downriver fuel landing, located near the Native Corp. building.	\$3.30M	
		Kipnuk	Provide 3 mooring points at the fuel header/landing site. Provide a sheetpile dock and ramp, and a gravel pad at the existing upland staging area at the freight landing site.	\$2.93M	
6	Lower Kuskokwim River	Eek	Provide a causeway/ramp to reach deeper water and provide stable surface for offloading. Provide 2 mooring points and expand upland staging area.	\$2.49M	\$3.58 M (4 sites)
		Akiachak	Install 2 mooring points at the fuel/freight barge landing site.	\$0.10M	
		Nunapitchuk	Option A in the Site Plan presents one possible co-located fuel/freight ramp landing located on the same side of the river as the main part of the community. Requires a site investigation to determine whether there is sufficient depth available for barge access. Option B in the Site Plan presents an option for development of the existing landing site at the fuel barge landing area located north of the airport landing area, across the river from the community. For this option, provide a co-located fuel/freight barge ramp landing and staging area. This is low elevation and likely susceptible to flooding and would require more fill for a dry staging area.	A:\$1.36M* B:\$0.49M	

#	Region	Community	Brief Description of Recommended Barge Landing Facility Improvements	Total Estimated Cost	Bundled Project Cost
		Napaskiak	<p>A feasibility study is a priority to analyze alternatives. Some alternatives may include:</p> <p>Option A: Improvements to existing landing area. Provide a gravel ramp with erosion protection and expand and elevate the existing upland staging area. Dredge the washout area on the opposite bank and shallow area in front of the landing. A study is required to determine the feasibility of maintaining dredging before proceeding.</p> <p>Option B: Alternatively, a new landing site could be developed in an area of less sediment accretion. Provide a new concrete ramp and a new staging area. Three mooring points would be needed at this landing due to the swifter currents along the main branch of the Kuskokwim River.</p>	\$0.13 M	
7	Middle Kuskokwim River	Upper Kalskag	Install 2 mooring points at both the fuel and the freight barge landing sites.	\$0.13M	\$3.07 M (3 sites)
		Aniak	Provide a dock and upland staging area for freight, near the existing freight barge landing area. Although somewhat steep, a ramp could be provided on the downstream end of the dock. 25,000 to 30,000 sq. ft. of staging area is recommended for this small hub community. Also, provide 2 mooring points at the fuel barge landing area.	\$3.09M	
	Upper Kuskokwim	McGrath	Provide a gravel ramp and 3 mooring points to facilitate offloading from fuel barge/lighter vessel.	\$0.35M	
8	Bristol Bay	New Stuyahok	Create a new dedicated barge landing site, near the downriver end of the community. Provide a gravel or concrete plank ramp, a staging area, and access to the road system.	\$2.71M	\$2.71 M (1 site)
9	Kotzebue Sound	Buckland	Provide a new landing site and upland staging area located closer to the existing marine fuel header. Grading and/or a small gravel ramp may be needed to create room for landing at the new site. A site assessment is required to confirm that access to this area is feasible and/or whether rock hazards can be removed. At a minimum, install mooring points at the existing landing area.	\$1.73M	\$5.06 M (3 sites)
	Kobuk River	Noorvik	Install 2 mooring points at each of 4 landing sites. Provide a gravel ramp and upland staging area near the existing freight barge landing area.	\$2.07M	
		Kiana	Provide improvements and a dedicated barge landing upriver of the existing freight barge landing area, to alleviate the issues associated with mooring at the confluence of the rivers. Improvements include a new upland staging area, access road, and mooring points. In addition, mooring points are needed at the downriver fuel barge landing.	\$2.25M	
10	Aleutians	Pilot Point	Provide two mooring points at the fuel/freight barge landing site.	\$0.10M	\$0.10 M (1 site)
TOTALS:				\$45.6 M	\$52.6 M

*Where two project options are presented, the option with the higher estimated individual cost was used to estimate the bundled project cost.