SECTION 905(B) (WRDA 86) ANALYSIS
GASTINEAU CHANNEL – JUNEAU, ALASKA

1. Study Authority

This General Investigations study is authorized by the U.S. House of Representatives Public Works Committee Resolution for Rivers and Harbors in Alaska, adopted 2 December 1970. The resolution states in part:

> *Resolved by the Committee on Public Works of the House of Representatives, United States, that the Board of Engineers for Rivers and Harbors is hereby requested to review the report of the Chief of Engineers on Rivers and Harbors in Alaska, published as House Document Number 414, 83d Congress, 2d Session; ... and other pertinent reports, with a view to determine whether any modifications of the recommendations contained therein are advisable at the present time.*

2. Study Purpose

The purpose of this study is to determine the Federal interest in providing navigation improvements in the Gastineau Channel, Juneau, Alaska; to develop a Project Study Plan (PSP) for a feasibility-level study; and to identify a non-federal sponsor to share in the cost of the feasibility study.

3. Location of Project / Congressional District

Serving as the State capital, Juneau is the primary service and supply center for the surrounding region. With no effective land tie to the mainland, Juneau must rely heavily on water transportation. Marine facilities include a seaplane landing area at Juneau harbor, two deep draft docks, five small boat harbors, and a State ferry terminal. Juneau was first settled in 1881 by gold miners. It currently has a population of approximately 31,000 and is the third largest community in Alaska. The creation and growth of the community can be contributed to the full-scale gold mining operations on both the mainland and Douglas Island. Presently in the State capital, Federal, State, and local government agencies provide nearly half the employment in the community. Tourism, mining, and commercial fishing and processing are other major sources of employment.

The Gastineau Channel, a 16-mile long strait south of Juneau, separates Douglas Island from the mainland Alaska and connects Stephens Passage, east of Juneau, to Fritz Cove on the west side of Juneau. The narrow channel serves as a short cut for boats traveling north out of Juneau. It is subject to tidal action at both ends. The tides display a diurnal inequality typical of the Pacific Ocean. East of Juneau, the channel is naturally deep. The western portion has been described as a giant shoal centered on the meeting point of the tides. Several freshwater streams enter the channel: Sheep, Gold, Salmon, Lemon, Sweitzer and Fish Creeks. The Mendenhall River also empties into the western end of the channel.

The study area is located in the Alaska Congressional District, which has the following congressional delegation: Senator Ted Stevens (R); Senator Frank Murkowski (R); Representative Don Young (R).

4. Progression of Previous Work

1958 – Hydrographic survey and pre-design investigation.

1959 – Plans and specifications are completed and dredging begins.

1960 – Dredging is completed over the length of the channel.

1962 – Serious shoaling is apparent in the channel, particularly at the mouths of Jordon, Sweitzer and Lemon Creeks. The committee on tidal hydraulics begins an in-depth study of the problem.

1964 – A WES (Waterways Experiment Station) model study is undertaken over a three-year period through 1967.

1972 – Based on the results of previous studies, the Corps rejects a proposal to redredge the channel.

1978 – A survey report on the revised project, including new economic justification, determines the project is not feasible due to excessive costs of annual maintenance dredging.

1998 – The entire channel is surveyed in April.

5. Discussion of Prior Studies, Reports, and Existing Water Projects

Several congressionally authorized reports have been made by the Corps of Engineers concerning the need for improved navigation in the Juneau area. These reports resulted in the construction of three harbors along the Gastineau Channel; Harris Harbor in 1939, the Aurora Harbor in 1964, and Douglas Harbor in 1964. Two studies have specifically addressed channel improvements of the Gastineau Channel. The following reports were used as reference material in the preparation of this report.

- "Navigation Channel Improvement Gastineau Channel, Alaska. Hydraulic Model Investigation U.S. Army Engineer District, Alaska." U.S. Army Engineer Waterway Experiment Station Hydraulic Laboratory. November 1972.
- "Channel Deepening for Navigation, Gastineau Channel Juneau, Alaska." Late Stage Public Meeting. 9 June 1976.
- "Channel Deepening for Navigation, Gastineau Channel Juneau, Alaska." Feasibility Report November 1977.

The existing Federal project through the Gastineau Channel provides for a navigational channel with a depth of 0 MLLW and a bottom width of 75 feet. The channel was constructed in 1958-60 and soon experienced rapid shoaling at several locations. In 1963, the U.S. Army Corps of Engineers requested a hydraulic model study of Gastineau Channel. The conclusions of this study included the following: the Mendenhall River does not significantly contribute to the shoaling of

the channel. The heavy shoaling observed in the first year was caused primarily by the sloughing of the side slopes. Any of the dike plans will decrease shoaling and any increase in the channel size would significantly increase shoaling. The final recommendations of the report outlined the construction of a dike and channel improvement at Lemon Creek.

The 1977 feasibility study conducted by the U.S. Army Corps of Engineers looked at determining justification for increasing the channel depth. The four alternative plans analyzed by the study consisted of various channel alignments and dike locations. Based on the desired channel depths and initial channel dredging experience in 1958-60, the committee recommended isolation of the navigation channel by means of a continuous dike as being the only solution giving promise as a permanent improvement. The summary of the study concluded that, with the high cost of maintenance, project costs exclusive of environmental losses would exceed the benefits over the entire range of depths required to accommodate anticipated traffic.

6. Plan Formulation

6.1 Existing Conditions

The Juneau area is a steadily developing region that has historically benefited from its location adjacent to the Gastineau Channel. From its founding as a mining center, Juneau has become a trading and service center to the surrounding communities, which are accessible only by water or air. While government is now the principal industry, transportation, tourism, commercial fishing, and other water related activities are economically important to the community.

The Gastineau Channel is currently an unreliable passageway that can only be traveled at the highest tides. This forces the majority of marine traffic to head south around the southern tip of Douglas Island. Making a trip from downtown Juneau to Auke Bay is an additional 20 miles one way in more exposed waters.

6.2 Expected Future Conditions

Without improved navigation through the Gastineau Channel, vessels will continue to experience time delays, increased fuel consumption, and increased crew and maintenance costs. Marine traffic will continue to travel around the southern tip of Douglas Island where vessels are exposed to greater winds and waves, and longer travel times. The fishing industry will continue to experience delays in delivering their catch to the processor, who in turn have delays to their customers.

6.3 Alternative Plan

Although numerous alternatives have been studied in the past to address the shoaling problem and more may be developed during the feasibility study, the study team selected one alternative as the basis for determining whether there is a Federal interest. This alternative was to obtain 90% access for a 7-ft draft, 18-ft beam vessel.

6.4 Economic Analysis

Benefits. Benefits data is based on information provided by Mr. Joseph Graham, Juneau Port Director. In addition, three U.S. Army Corps of Engineers feasibility reports were referenced: The November 1977 "Channel Deepening for Navigation, Gastineau Channel Juneau, Alaska"; the April 1992 "Southeast Alaska Harbors Interim Feasibility Report"; and the September 1999 "Wrangell, Alaska: Navigation Improvements Final Interim Feasibility Report and Environmental Assessment."

The proposed project would allow boats to travel north-south without traveling the additional 20 miles around Douglas Island. Fishermen using Lynn Canal and Icy Straits, located to the north of Juneau, utilize the city's services and cold storage facilities. The channel trip would result in substantial annual savings to the commercial fleet that reaches approximately 470 vessels during the salmon and halibut season. Tugboats that serve the Juneau area would also realize substantial savings from the proposed improvement, as would other types of boats that operate in the area. It is estimated that one-half of the sport and dual-purpose boats—approximately three-fourths of the boats harbored in the area—would use the channel on a regular basis and all other craft on an intermittent basis.

An improved passage would allow small boats to avoid the Stephens Passage on the west side of Douglas Island. These benefits are difficult to measure, but can be expressed in terms of time and money saved by rescue operations.

The primary benefit of dredging the channel is associated with the difference in the amount of time required to make a round trip from Juneau to a common point north of Douglas Island via the channel as compared to the same trip made around the Island. The difference is 40 miles round trip; the journey by way of Douglas Island is approximately 62 miles while the same trip via the channel is only 22 miles. The proportionate savings in time is less than the associated distance saving, because reduced speeds would generally be required in negotiating the dredged portion of the channel.

Information regarding the number of trips anticipated through the channel was obtained from the previous Juneau Port Director. The average cruising speed by boat class was obtained from the 1977 feasibility study based on data developed by boat operators, two Juneau harbormasters, and other government agencies.

6.5 Vessels Harbored in Juneau

The following table presents an estimate of vessels presently harbored in the Juneau area. The Juneau Port Director provided this information. Currently, a shortage of moorage space exists, resulting in approximately 2,150 pleasure craft being trailered within the City and Borough of Juneau.

Total Vessels Harbored in Project Area			
	Local Boats		2,956
	Transient		450
		Total	**3,406**[a]
Vessels by Class	Commercial Local		120
	Commercial Transient		350
	Sport Local		2,500
	Sport Transient		100
	Sport/Commercial		200
	Working (Tug, Charter)		125
	Research		7
	Coast Guard		4
		Total	**3,406**

[a]Excludes about 2,150 trailered boats

Benefits Computation. In presenting an analysis of the present and potential benefits to the proposed channel improvement project, craft using the channel are divided into categories, and the benefits to each category are computed. This includes the following: Commercial fishing vessels, both local and transient; dual-purpose boats used both for commercial fishing and recreation; sport boats which are used primarily for recreational purposes; tug operations; Coast Guard activity; charter boats; fisheries research boats; and search and rescue boats.

For purpose of this discussion, the term "trip" refers to a round trip unless otherwise indicated.

Vessel Operating Costs. Fuel consumption estimates are based on the Wrangell Navigation Improvements Feasibility Report, dated September 1999. In that report, gillnet and purse seine vessels typically have 200 to 300 hp rated engines, with fuel consumption rates of 8 to 12 gallons per hour. Based on current local fuel prices of $1.20 per gallon and lube oil expenses estimated at 7 percent of fuel costs, or 8 cents; $1.28 per gallon is used in the calculations. Therefore, fuel costs averages $12.80 per hour (10 gallons times $1.28).

Opportunity Cost of Time (OCT). Travel of any type imposes costs on the fleet and crew. These costs include additional operating expenses for the vessel as well as the crew's opportunity costs. Crew-members incur an opportunity cost of time (OCT) associated with down time. Opportunity cost of time is the value of work or leisure activities forgone due to spending time traveling. For OCT calculations, a value of next best use of time has been assigned and given a minimum (or leisure time) value.

According to Engineering Regulation (ER) 1105-2-100, in lieu of a project specific estimate of the opportunity cost of leisure time, a value equal to one-third the wage rate is used. It was estimated in the Wrangell report that the average fishers wage is $15 per hour. Therefore, the cost of time is $5 per hour ($15 divided by 3) per crewmember.

1. Commercial Fishing Boats. The fishing grounds for the Juneau area are broadly described as west and north of Douglas Island and Lynn Canal as far north as Haines. The greatest amount of activity by recorded movement is in the Auke Bay-Tee Harbor area in direct line with the

proposed channel improvements. The salmon season for the districts involved, as described by the Alaska Board of Fish and Game, varies, but is generally from April through September, and involves, to varying degrees, purse seiners, gillnetters, and trolling vessels. In addition, a few boats are involved in the herring catch. In the early part of the season, fishing occurs both north and south of Juneau, but from June on, the majority of fishing is to the north and west. The season in the north is four months.

The commercial local fleet harbored in Juneau is 120 vessels, but during the fishing season, 350 transient vessels increase the fleet to 470 boats. In order to get to the fishing area north of Juneau, boats harbored in the Juneau area must travel around Douglas Island—a distance of roughly 31 miles one way. If Gastineau Channel were improved, this distance would be reduced to about 11 miles, a one-way saving of some 20 miles. Use of the channel, then, would result in a round trip of about 40 miles less than that around Douglas Island. At an estimated cruising speed of 10 miles per hour and an average channel speed of 7.5 miles per hour, use of the channel would save an average of 3-3/4 hours per trip. (Note: 4.5 miles of the 11-mile shorter route would have to be traveled at the reduced channel speed).

It is estimated that during the 4-month season, the average use of the channel would be three round trips per month per local vessel and one-third that number for transient vessels. This is because transient boats call only intermittently at Juneau during the fishing season for supplies, fuel, repairs, or to see their catch. Therefore, 120 local commercial vessels x 3 trips x 4 months = 1,440 trips; 116 (or one-third) transient commercial vessels x 3 trips x 4 months = 1,392 trips. This results in an estimated total of 2,832 boat trips during the 4-month season.

- Operating costs for vessels average $32.80 per hour--$12.80 per hour for fuel and $20 per hour for labor (crew of four at $5 per hour). The total benefit from use of the channel during the fishing season, on the basis of the foregoing assumptions is 2,832 boat trips x 3-3/4 x $32.80 = **$348,336**.

2. Dual-Purpose Boats. Many boats, by nature of their size and design are classified as sport or recreational boats. Normally, these boats would be used only for recreation, but in an area that has a fishing economy as does Juneau, many of these boats are used part-time to catch fish for sale to the local canneries. This, according to the fishing regulations of the State, puts them into the commercial fishing classification.

   Approximately 200 vessels of the sport and recreation type were classified as dual-purpose boats. It is estimated that about 50 percent of the time they are used for commercial fishing and are used for recreation purposes the rest of the time. On the average, these boats would use the channel three times a month for four months. At a cruising speed of 15 miles per hour and a channel speed of 10 miles per hour, this would save about 2.3 hours on each trip. Fuel costs in this class average $6.40/hr (one-half of $12.80) and when fishing, labor costs average $10 per hour (crew of two at $5 each).

   - Commercial fishing benefits to boats would total $16.40 (fuel and labor) x 3 trips x 2.3 hours x 200 boats = $22,632. Recreational benefits would amount to $6.40 (fuel only) x 3 trips x 2.3 hours x 200 boats = $8,832. The grand total is **$31,464**.

3. Sport Boats. About 2,600 pleasure boats (2,500 local and 100 transient) are moored within the Juneau area. So, 2,600 sport boats x 3 trips x 4 months is 31,200 trips per year. It is estimated that these boats travel 20 miles per hour at a cruising speed, and at 12.5 miles per hour in the restricted channel, have 1.75 hours of travel time per trip by using the channel. Operating costs for boats are estimated at $5.30 per hour (fuel only). This is $1.10 per hour less than the same fuel costs for boats in the dual-purpose class because boats in the sports class tend to average slightly smaller in vessel size. Sport boat benefits from use of the Gastineau Channel for all travel to the north is $5.30 x 31,200 trips x 1.75 hours = $289,380.

   As indicated, Juneau has a significant number of recreational vessels. Benefits associated with annual local recreation are estimated as a net user day value of $3.83; for transient recreational benefits, it is $2.66. This data was obtained from the Southeast Alaska Harbors feasibility report where the value differential was calculated between the with- and without-project. There are an estimated 2,500 local sport boats x 3 trips x 4 months x $3.83 ($114,900) + 100 transient sport vessels x 3 trips x 4 months x $2.66 ($3,192) = $118,092 in recreational sport benefits.

   - The total benefits to sport recreational vessels is **$407,472** ($289,380 + $118,092).

4. Tug Operations. There are presently six tug operators working in the Juneau area on a regular basis. Such cargo as construction equipment and materials, modular units, and household goods are typically delivered throughout southeast Alaska to such communities as Haines, Hoonah, Pelican, and Gustavus. With operating costs estimated between $225 and $325 per hour, depending upon the size of the vessel and average speeds of 10 miles per hour, tugs would save about 3-3/4 hours per round trip. In the 1977 report, operators and freight tonnage records indicated that approximately 230 trips would be made through an unrestricted channel. Of this number, 37 percent (85 trips) would represent the larger size vessels and the remaining (145 trips) number by the smaller size tugboats.

   - Total savings to tugboats are calculated as follows: $225 x 145 trips x 3-3/4 hours/trip (or $122,344) + $325 x 85 trips x 3-3/4 hours/trip (or $103,594) = **$225,938** annually.

5. Coast Guard Operations. Of the four Coast Guard vessels, only two vessels would realize benefits from channel improvements. One Juneau-based patrol boat makes about 45 trips per year through the channel and would save 1-1/2 hours per trip at an estimated operating cost of $415 per hour. Therefore, $415 x 45 trips x 1-1/2 hours/trip = $28,012 per year.

   The other Coast Guard vessel is based at Auke Bay and has an estimated operating cost of $75/hour. This vessel would also save 1-1/2 hours per trip and would make about 30-channel trips/year. Therefore, $75 x 30 trips x 1-1/2 hours/trip = $3,375 per year.

   - Total Coast Guard savings for both vessels are **$31,387** annually.

6. Charter Boats. In the 1977 Gastineau Channel study, there were approximately 15 charter boat operators in the Juneau vicinity. This number is estimated to have increased four-fold (60 charters); five currently operate on a full-time basis out of downtown Juneau. Increased depth would allow an average of 20 trips per year through the channel. Average operating costs are estimated at the same hourly rate as commercial fishing boats, $12.80. At cruising

speeds of 10 miles per hour and channel speeds averaging 7.5 miles per hour, 3-3/4 hours per round trip would be saved.

- Annual savings to owners of these boats would be $12.80 x 20 trips x 3-3/4 hours x 60 boats = **$57,600.**

7. Fisheries Research. There are presently seven research vessels in the Juneau area. However, only the largest one of these would benefit significantly from an improved channel. The operating costs for this vessel averages $125 per hour. The boat makes approximately 12 trips per year to the Auke Bay area and would save 3.5 hours per round trip.

   - This research vessel would amount to an annual savings of $125 x 12 trips x 3.5 hours = **$5,250.**

8. Search and Rescue Efforts. It is estimated that $30,000 in boat damage, 200 hours of rescue boat time at $50 per hour ($10,000), 80 hours of flying time at $150 per hour ($12,000), and an average of somewhat less than one death results each year from small boats foundering enroute around Douglas Island. It is also estimated that about 75 percent of the above losses could be prevented by full utilization of an improved channel.

   - Annual benefits from these savings total 75 percent of the combined boat damage, rescue boat time, and flying time. This is $52,000 x .75 = **$39,000.**

The table below summarizes the total potential annual savings/benefit:

Summary of Potential Benefits

	Annual Savings ($)
Commercial Fishing	348,336
Dual-Purpose Boats	31,464
Sport Vessels	407,472
Tug Operations	225,938
Coast Guard Operations	31,387
Charter Boats	57,600
Fisheries Research	5,250
Search and Rescue	39,000
Total	**1,146,447**

Cost. For the alternative identified, the estimated first cost is $11,000,000. Given an interest rate of 6-5/8 percent and a 50-year period of analysis, the annual project cost is estimated to be $768,870. The estimated operation and maintenance cost is $2,000,000 a year, with maintenance carried out every year. Therefore, the total annual project cost is estimated at $2,768,870. Annual benefits are expected in the range of $1,146,447, giving a Benefit to Cost ratio in the range of .35 to .45.

7. Engineering Design Issues

The channel considered in this report was designed as a near full-time access (90%) for a 7-ft draft, 18-ft beam vessel. This resulted in a 100-foot bottom width channel at elevation –7-ft MLLW. Side slopes were designed at 1 on 10 to avoid the channel slope sloughing that occurred when the channel was first constructed. However, there is no design data to support the assumption that the channel will not shoal in immediately. The survey data collected in 1998 was used to estimate an initial dredge quantity of 2,222,000 cubic yards for the 6 miles of the channel. Maintenance quantities were optimistically estimated at 10% of the initial dredge. The channel was physically modeled by U.S. Army Engineer Waterways Experiment Station, and a dike was the only way the channel could be kept open for more than a few months. The dike would prevent material from the surrounding area from entering the channel due to wave action and stream transport. Cost of the dike shown in the 1970's report was updated to 2000 to include a 25% increase, and extended to cover the full 6 miles of the channel. The cost estimate of the dike was about $16 million and pushed needed maintenance dredging out to about every 3-5 years. Therefore we can not determine at this level of a study that the channel design would be achievable or maintainable.

8. Environmental Issues

When the Corps of Engineers dredged a navigation channel through Gastineau Channel to Fritz Cove/Stephens Passage, the channel silted in by 1971, and a natural equilibrium between sedimentation and erosion was established. The channel is now navigable only at high tide by small craft. The dredged material spoil islands have become vegetated, forming an upland habitat in the Mendenhall Wetland area.

When Alaska Statute 16.20.034 was passed in 1976, the primary values of the Gastineau Channel/Mendenhall Wetlands were recognized as fish and wildlife habitat, and the associated human uses of these resources. The Mendenhall Wetlands, including Gastineau Channel, are part of the Mendenhall Wetlands State Game Refuge and is under the stewardship of the Alaska Department of Fish and Game. The general goals of the Mendenhall Wetlands State Game Refuge are to (1) maintain and enhance fish and wildlife populations and their habitat, (2) minimize the degradation and loss of habitat values due to habitat fragmentation, and (3) recognize cumulative impacts when considering effects of small incremental development and actions affecting refuge resources. Gastineau Channel is known to be important nursery habitat for several species of marine and anadromous fish species of economic importance. National Marine Fisheries Service will be conducting surveys of the Mendenhall Wetlands under their Essential Fish Habitat responsibility. Dredging of the channel will have some unknown (at this time) effect on Essential Fish Habitat and on the Mendenhall Wetlands State Game Refuge. The magnitude of the effect could be biologically substantial.

Disposal of dredged material will also have an impact wherever the dredged material is disposed. Disposal in the Game Refuge or into Essential Fish Habitat will be biologically damaging and contrary to the guidelines established for the Game Refuge and Essential Fish Habitat as established by the Magnuson-Stevens Act. It appears that disposal of the dredged material for

initial channel formation and maintenance dredging would not be onsite. Initial construction and maintenance dredging would also require close coordination with the appropriate parties. Construction timing windows could be restrictive, allowing in-water work only for short periods of the year.

The proposed project is in a sensitive biologically important area. Any success with channel construction and maintenance will require close coordination with the proper State and Federal agencies. Efforts will include, but not be limited to, coordination with the following:

U.S. Fish and Wildlife Service, SAES, Juneau, Alaska.

National Marine Fisheries Service Field Office, Juneau, Alaska.

National Marine Fisheries Service, Auke Bay Laboratory, Juneau, Alaska.

U.S. Environmental Protection Agency, Dredging Operations, Region X, Seattle, Washington.

Alaska Department of Fish and Game, Douglas, Alaska

Alaska Department of Environmental Conservation, Juneau, Alaska.

Alaska Department of Governmental Coordination, Juneau, Alaska.

9. Federal Interest

The alternative considered during this investigation appears to demonstrate that there is not a Federal interest in a feasibility study. Benefits to the Nation include reduced time delays, travel cost savings, exploitation of fisheries, reduced fuel consumption, and increased safety. However, based on the alternative used for this report, a navigation system through Gastineau Channel is not economically feasible. The engineering design considerations and environmental issues were not factored into the cost-benefit analysis, however act as deterents to the project.

10. Preliminary Financial Analysis

The City and Borough of Juneau would sponsor the feasibility study if a Federal project could be implemented. The sponsor is aware of the 50-percent cost-sharing requirement of the study. The sponsor is also aware of the responsibility for sharing the implementation costs. The sponsor can provide the necessary funding to initiate the feasibility study, as stated in the enclosed letter, and is willing to share the cost of construction.

11. Recommendation

I recommend that no further study to determine the feasibility of providing navigation improvements for Gastineau Channel at this time. The total annual benefits do not equal or exceed the total annual costs.

The recommendations contained herein reflect the policies governing formulation of individual projects and the information available at this time. They do not necessarily reflect program and budget priorities inherent in the local and State programs, or the formulation of a national Civil

Works water resources program. Consequently, the recommendations may be modified at higher levels within the executive branch before they are used to support funding. However, prior to initiating the feasibility study, the local sponsor will be advised of any modifications and will be afforded an opportunity to comment further.

12. Project Area Map

A map is enclosed.

Steven T. Perrenot
Colonel, Corps of Engineers
District Engineer

2 Encl.
1. Letter of Support
2. Project Area Map

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