

**APPENDIX B: ADNR ALASKA DAM SAFETY PROGRAM 2012
DEREGULATION REPORT**

STATE OF ALASKA

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF MINING, LAND AND WATER
DAM SAFETY AND CONSTRUCTION UNIT

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FIELD INSPECTION AND DEREGULATION REPORT EYAK LAKE DAM (AK00049)

Inspection Date: June 6, 2011
Report Date: March 21, 2012
Weather: Clear and Sunny
Inspection Objectives: Site visit
ADNR Personnel: Charles Cobb and Chandler Engel, ADNR
Documentation: Photos and field book notes were taken and are available for review at DNR-DMLW in Anchorage.

Field Inspection and Deregulation Notes



Eyak Lake Dam

Background: Eyak Lake Dam is a sheetpile structure spanning approximately 365 feet across the outlet of Eyak Lake near Cordova, Alaska. The structure was built in the early 1970s to maintain the stage and surface area of Eyak Lake which was changing due to land upheaval following the large earthquake of 1964. The dam is listed in the state's inventory as a jurisdictional dam with a Class II (significant) hazard potential classification. In 1985 a periodic safety inspection (PSI) was performed by the International Engineering Company.

Field Inspection Overview: The State Dam Safety Engineer and the Assistant State Dam Safety Engineer both visited the site on June 6, 2011 on a concurrent trip to the Meals Lake Dam, located in Cordova. The intention of the field visit was to evaluate the structure visually and make

measurements if necessary in an effort to determine if the structure met the statutory definition of a state jurisdictional dam.

Site Conditions: The weather was sunny and clear. The flow rate over the weir was significant enough to preclude any attempt to inspect the structure from the lake or from the river downstream without the aid of a boat.

Dam Description: The sheetpile weir is composed of two approximately linear sections joining in a shallow “V” shape pointed into the lake. A metal walkway platform is located near the center of the structure, but above the left span looking downstream. According to proposed drawings and a description found the 1985 PSI, a 12 foot wide, 1.5 foot deep slot was constructed to the left of the walkway to allow for the passage of small boats (see Figure 1).

Based on the proposed drawings, the maximum height of the weir is 3.5 feet from the low point of the original outlet of 14 feet above mean lower low water (MLLW), to the crest of the weir at 17.5 feet above MLLW.

During the 2011 site visit, it was not physically practical to make a measurement of the hydraulic height of the structure, but it was estimated to be approximately 1 foot. During the 1985 PSI the inspector measured a maximum hydraulic height of 2.5 feet. That inspection took place in December, when flow rates and the tail water were low.

The weir exhibits signs of deterioration, most obviously to the left of the walking platform, perhaps coincident or adjacent to the boat slot. The sheetpile in that section is bowed significantly downstream as much as 5 or 6 feet, estimated visually from the left abutment, shown in Figure 2. It was not immediately clear what the cause of the displacement was, but it seems likely that downstream material originally buttressing the sheetpile had been scoured by the overflow at the boat slot, resulting in a partial failure of the wier.

The maximum storage volume at the crest of the dam was estimated to be 13,000 acre-feet in the 1985 PSI report. The maximum surface area was estimated to be 2,432 acres, which would imply a storage depth of at least 5.3 feet so that storage value probably includes at least 1.8 feet of discharge head over the weir. During the site visit in June 2011, the structure had a hydraulic height of about 1 foot which would equate to around 2,432 acre-feet of live storage at that time.

Discussion of Failure Mode: Due to the driven sheetpile method used to construct the wier, the most likely failure mode is continued local erosion of buttress and embedment material, resulting in loss of downstream support and progressive failure of discrete segments of the structure. It appears unlikely that the structure would fail completely, other than during a large flood event when the effects of the failure would be significantly muted by the flood flows.

Jurisdictional Review: While the small weir impounds a significant amount of water, the structure is likely only around 3.5 feet tall in the absence of tailwater, and less than that normally. This combination of height and storage does not meet either minimum criteria of 10 feet and 50 acre-feet or over 20 feet regardless of storage set forth in AS 46.17.900, which provides the statutory definition of a dam.

A dam not meeting the geometric minimums can still be considered a dam, if the structure is assigned a Class II (significant) or Class I (high) hazard potential classification. In the case of Eyak Lake Dam, it was assigned a significant hazard potential classification based on a perceived threat to the road bridge and an unnamed business downstream. The 1985 PSI report paradoxically states in its conclusions that “Although a significant hazard potential classification is assigned to the dam, downstream damage resulting from its failure would be imperceptible.”

The Copper River Highway crosses the Eyak River directly downstream of the weir and below that is a residential neighborhood along the east bank of the Eyak River, shown in Figure 3

The Eyak River Bridge is unlikely to be damaged by an unexpected failure of the Eyak Lake Dam, due to the likely progressive failure mode of the weir, and the fact that the bridge has withstood significant natural flooding, as shown in Figure 4.

A significant flood event occurred in August 2006 that resulted in flooding of residences in the neighborhood downstream of the weir. The flood event was documented through photographs and stage measurements by the National Weather Service (NWS). Following the flood event, a table of flood stages and observable consequences was developed (see attached NWS report). This table uses an unknown datum that appears to be different than the MLLW datum used in the design drawings of the weir.

In the record of the flood event, the NWS included a photograph of the submerged weir at stage 24.52 feet (Figure 4). The caption of the photograph indicates that the handrail on the weir platform is just visible. According to the design drawings the bottom of the handrail was to be installed at approximately elevation 22 feet above MLLW, 4.5 feet above the crest of the weir, assumed to be at 17.5 feet above MLLW. Based on a review of photographs taken during the 2011 field visit, this value seems reasonable. Using this interpretation establishes a 2.5 foot differential between the NWS datum and the MLLW datum referenced in the design drawings.

According to the NWS table, 22.5 feet is bankfull stage in the Eyak River, which corresponds to 20 feet above MLLW, or 2.5 feet above the crest of the weir. Water is present in residential basements at stage 24.5 feet, which corresponds to 22 feet above MLLW or 4.5 feet above the crest of the weir. Based on this evaluation, a complete failure of the weir with 2.5 feet of discharge head would result in at most, a bankfull condition in the Eyak River.

Based on observations made during the field visit in 2011, the limited conveyance capacity of the Eyak River creates significant tailwater with only a few inches of discharge head over the weir (see Figure 2). It seems likely that the weir would be nearly completely submerged with 2.5 feet of water above the crest, thus reducing the potential marginal increase in downstream flooding from a failure.

This analysis shows that the Eyak Lake Dam appears to be a Class III (low) hazard potential structure, which is reflected in the attached Hazard Potential Classification and Jurisdictional Review form.

Summary and Conclusions: The structure does not meet the minimum geometric or hazard potential criteria, as defined in statute, to be considered a jurisdictional dam. It is recommended that the Eyak Lake Dam be removed from the state inventory of jurisdictional dams.

Attachment A – Figures

Attachment B – NWS Flooding Report

Attachment C – Hazard Potential Classification and Jurisdictional Review Form

* * * *End of Report* * * *

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ATTACHMENT A - FIGURES



Photo Date June 6, 2011

Boat Slot and Partially Failed Section

Figure 1 EYAK LAKE DAM

**Field Inspection Report
Eyak Lake Dam AK00049
3/21/2012**



**Alaska Department of Natural Resources
Dam Safety and Construction Unit**



Photo Date June 6, 2011

Partially Failed Sheetpile Section

Approximate Original Alignment

Figure 2
PARTIALLY FAILED SECTION



Alaska Department of Natural Resources
Dam Safety and Construction Unit

Field Inspection Report
Eyak Lake Dam AK00049
3/21/2012

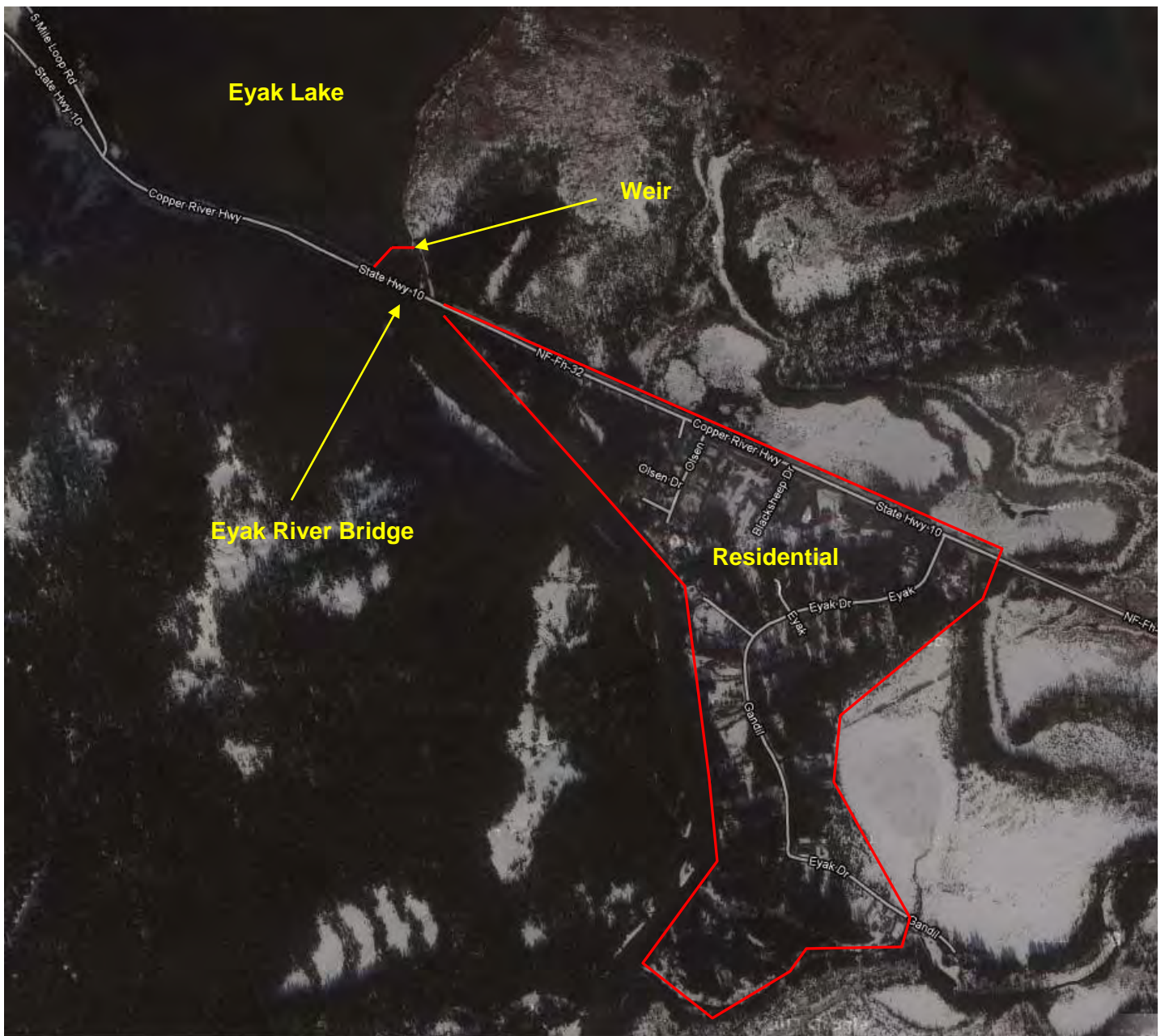


Figure 3
SATELLITE IMAGE

Field Inspection Report
Eyak Lake Dam AK00049
3/21/2012



Alaska Department of Natural Resources
Dam Safety and Construction Unit



Weir Submerged at Stage 24.52' Unknown Datum (Photo Courtesy of National Weather Service)

Figure 4 EYAK LAKE AT FLOOD STAGE



Alaska Department of Natural Resources
Dam Safety and Construction Unit

Field Inspection Report
Eyak Lake Dam AK00049
3/21/2012

ATTACHMENT B – NWS FLOOD REPORT

[Attachment B - National Weather Service Flood Report]

Cordova Flood Assessment Trip: 23-24 August 2006

Flood Levels

22.5ft (13.0' poormans): Bankfull: Estimated. Clay Koplín thinks a poorman's of 14.0ft, or 22.5ft would be bankfull, give or take a half foot. .

24.0ft (12.5' poormans): Action Stage: Closer monitoring of water levels draining the Gulf of Alaska coast. Copper River Highway out to Million Dollar Bridge carries lots of fisher people and tourist to the sites. Washout can be a serious problem near the Sheridan River where the bridge span is too short to carry the flow on a graded system.

24.5ft (12' poormans) : Flood Stage: Water in residences' yards, garages, crawl spaces and basements. Most of weir at Eyak Lake outlet underwater. Standing water on parts of Cordova's Municipal Airport's runway.

25.5ft (11' poormans) : Moderate Stage: Water surrounding a few houses, necessitating taking boats to homes. Septic fields flooded. All of Cordova's Municipal Airport's runways underwater. With any wind/wave action, Power Creek Road is flooded and eroded.

Contacts made – phone numbers added to contacts list and WHFS database

1. Scott Hahn – City Manager
2. Clay Koplín – Engineer with Cordova Electric. New observer
3. Mike and Joan Jackson – residence on Eyak Lake. Possible observer, great contact.
4. George Coval – retired fisheries biologist who is contracted out for low flow measurements on Power Creek and takes occasional staff gage readings.

Notes:

City Manager of Cordova (Scott Hahn) worried about the pressure being exerted on the Copper River Highway by water backing up behind it on the Eyak Lake side leading to undermining of the road. He mentioned there are numerous old culverts under the Copper River Highway here that are filled with dirt and was concerned of them being flushed free of their dirt and allowing flooding waters to get under the road and flow right into the neighborhood at the start of the Eyak River, just southeast of Eyak Lake.

8-yr resident of Cordova and resident along Eyak River mentioned a sunny day raises the river (when it's in its channel) faster than a moderate rain event because of the glacial nature of the watershed.

The 21 August 2006 flood crested ~5" lower at the Jackson's residence than the 1981 flood on Eyak Lake. But yet Ken Roemhildt estimated the the flooding in 2006 crested 1" lower than the 1981 flood.

A few residents mentioned that they can see the river rising and can monitor it, alluding to the fact that they don't need the government monitoring it for them.

Possibility of setting up a slope gauge at Mile 2 Power Creek Road residence.

Contracted Clay to be the Eyak River observer.

Questions that remain

1. Do we go after occasional staff gauge and flow measurement readings from George Coval on Power Creek?
2. Clay would like a staff gage located near his boat dock on Eyak River. This would require another trip.
3. The Jackson's are very interested in helping out the cause. Would the lake level elevations help our mission?



ATTACHMENT C – HPCJR FORM



Alaska Dam Safety Program

HAZARD POTENTIAL CLASSIFICATION AND JURISDICTIONAL REVIEW

This form is used to review and indicate the hazard potential classification of an artificial barrier in accordance with 11 AAC 93.157 and to determine if the barrier is a dam under the jurisdiction of the Alaska dam safety regulations, based on the definition articulated under Alaska Statute 46.17.900 (3), and summarized as follows:

"Dam" includes an artificial barrier, and its appurtenant works, which may impound or divert water and which...

- has or will have an impounding capacity at maximum water storage elevation of 50 acre-feet and is at least 10 feet in height measured from the lowest point at either the upstream or downstream toe of the dam to the crest of the dam; or
- is at least 20 feet in height measured from the lowest point at either the upstream or downstream toe of the dam to the crest of the dam; or
- poses a threat to lives and property as determined by the department after an inspection.

In accordance with 11 AAC 93.151, an artificial barrier with a Class I or Class II designation is determined to meet the third definition of a dam, regardless of its geometry.

Please complete items 1 through 21. Attach additional information as necessary. This form must be certified and stamped on page 3 by an Alaska-registered professional engineer, qualified in accordance with 11 AAC 93.193.

1. Name of barrier: Eyak Lake Dam

National Inventory of Dams (NID) number: AK00049 (Assigned by Department)

Name of stream: Eyak River

General location and region: Cordova

Legal location: Township 15S Range 2W Section 31 Meridian C

Purpose and type of barrier: Water Level Stabilization

This barrier is: Existing Proposed Under construction

Current hazard potential classification: I II III Not assigned

2. Owner: _____

Address: _____

Contact name: _____

Phone: _____

3. Is barrier federally owned, or regulated by the Federal Energy Regulatory Commission?

Yes (stop here)

No (complete form)

4. Maximum crest height of barrier: 3.5 feet
 Measured from: Upstream toe Downstream toe Offstream toe
 Basis of height: Conceptual design drawing Detailed design drawing
 As-built drawing Field measurement NID data
5. Maximum impoundment volume: 13,000 acre-feet
 Surface area of reservoir at maximum storage: _____ acres
 Average depth of reservoir above bottom of barrier: 3.5 Max(no tailwater) feet (live storage)
 Basis of volume estimate: Surface area multiplied by average depth
 Bathymetry
 NID data
 Other: Max 2.5 depth above tailwater in winter in 1985 report

6. Downstream development: Yes No Unknown
 Type of development (check all that apply):
 Homes Power or communication utilities
 School Water or wastewater treatment facilities or lines
 Community halls, churches, etc. Overnight campgrounds
 Industrial or commercial property Public parks or trails
 Major highway Fish hatchery or processor
 Primary roads Barrier owner's property or facilities
 Secondary or rural roads Other utilities: _____
 Railroads Other development: _____
- Basis of observations: Ground reconnaissance Aerial reconnaissance
 Aerial photo Other:
 Date of observations: 6/2011 and 3/2012

7. Proximity of development to downstream channel (add maps or other information as necessary):
 Distance downstream from barrier: Roadway ~200 Feet, Residential ~800 Feet
 Distance from stream bed: _____
 Relative elevation above streambed: Roadway 15'+, Residential 5-10'+

8. Is development in the inundation zone of a flood from an uncontrolled release of water from the barrier?
 Yes No Unknown

9. Was a dam break analysis conducted? Yes No
 Basis of determining inundation zone: Simplified DAMBRK model
 DAMBRK model
 (Please attach calculations) NWS FLDWAV model
 HEC-1 model
 Other: See 3/21/12 Field Report
 Maximum depth and velocity of flow through development: 0

10. Is development at risk from improper operation or a "sunny day" failure?
 Yes No Unknown

11. Is development at risk from an incremental increase in the flood if the barrier fails under flood conditions?
 Yes No Unknown
 Flood condition evaluated: 100 year 1/2 PMF PMF Other: Large 2006 Flood Event

12. Could an uncontrolled release cause other significant property damage or loss?
Description:
[] Yes [X] No [] Unknown

13. Could an uncontrolled release effect public health?
Description:
[] Yes [X] No [] Unknown

14. Is the reservoir created by the barrier the primary water supply for a community of more than 500 residents?
Is a backup water supply available?
[] Yes [X] No [] Unknown [X] N/A

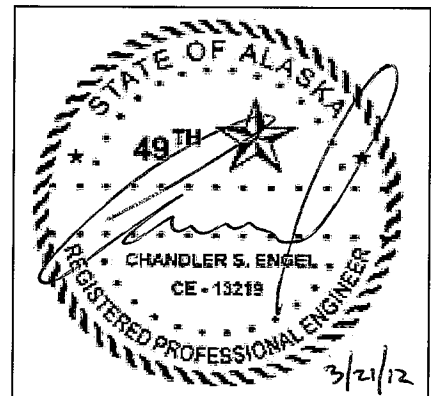
15. Is barrier located on waters important to anadromous fish?
Are anadromous fish waters at risk of damage or loss if an uncontrolled release occurs?
[X] Yes [] No [] Unknown [] N/A

16. Proposed hazard potential classification: [] Class I (High) [] Class II (Significant) [X] Class III (Low)

17. Basis of classification:
[] Quantitative - Numerical dam break analysis conducted
[X] Qualitative - Limited engineering calculations
[] Preliminary - No engineering calculations

18. Comments:
Structure does not meet minimum geometric criteria to be considered jurisdictional
Dam break flood would result in less than or equal to bankfull condition. See 3/21/12 field report for more detailed information.

19. Certified by: Chandler S. Engel (Print name)
Date: 3/21/12
Company: ADNR Dam Safety
Phone: (907) 269-8638



Notes:

- 1. This form must be certified and stamped by an Alaska-registered professional engineer qualified in accordance with 11 AAC 93.193.
2. The information presented in this form may be overruled based on current data that reveals a higher level of confidence in the quality of information necessary to make the appropriate determinations.
3. Anadromous fish waters are determined in accordance with 11 AAC 195.010 (a).
4. Alaska dam safety regulations are articulated under 11 AAC 93.151 through 11 AC 93.291 (Article 3).

FOR DEPARTMENT USE ONLY

Jurisdictional Status of Barrier:

Dam under state jurisdiction

Barrier is not a dam under state jurisdiction

Reasons:

- Height
- Height and storage volume
- Hazard potential classification
- Anadromous fish stream
- Other: _____

Reasons:

- Height
- Height and storage volume
- Hazard potential classification
- Federal ownership or regulation
- Other: _____

Concur with proposed hazard potential classification:

Yes No

Hazard potential classification based on current information:

Yes No

Official hazard potential classification:

Class I (High) Class II (Significant) Class III (Low)

Comments:

Change to Class III (low) hazard potential removes this structure from state dam safety jurisdiction under AS 46.17

Reviewed by:

Charles F. Cobb

Title:

State Dam Safety Engineer

Signature:

Chh F Cobb

Date:

9 May 19, 2014

**APPENDIX C: ADNR ALASKA DAM SAFETY PROGRAM 1985
PERIODIC SAFETY INSPECTION REPORT**

EYAK LAKE DAM



**Inventory No. AK 00049
Cordova, Alaska**

ALASKA DAM SAFETY PROGRAM

PERIODIC SAFETY INSPECTION REPORT No. 1



January 1985

Prepared for :

**STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF LAND AND WATER MANAGEMENT**

EYAK LAKE DAM

Inventory No. AK 00049
Cordova, Alaska

ALASKA DAM SAFETY PROGRAM

PERIODIC SAFETY INSPECTION REPORT No. 1



January 1985

Prepared for :

STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF LAND AND WATER MANAGEMENT



CONSULTING
ENGINEERS

INTERNATIONAL ENGINEERING COMPANY, INC.
A MORRISON-KNUDSEN COMPANY

ARCTIC DISTRICT OFFICE
813 "D" STREET
ANCHORAGE, ALASKA 99501
PHONE: (907) 274-6551

JOSEPH L. JORDAN, P.E.
DISTRICT VICE PRESIDENT

March 8, 1985

4715-004

State of Alaska
Department of Natural Resources
Division of Land and Water Resources
555 Cordova Street, Pouch 7-005
Anchorage, Alaska 99510

Attention: Mr. Kyle J. Cherry, P.E.
State Dam Safety Engineer
Eyak Lake Dam - AK 00049

Subject: Inspection Report

Gentlemen:

International Engineering Company, Inc. is pleased to submit herewith our final report on our inspection of the Eyak Lake Dam No. AK 00049. This inspection was conducted on December 12, 1984.

Sincerely,

JLJ:MS:hdl319e

APPROVAL SHEET

Periodic Safety Inspection Report No. 1

EYAK LAKE DAM
AK 00049

Longitude 145° 38.7'W Latitude 60° 31.0'N

Owner: State of Alaska
Department of Transportation & Public Facilities

Size Classification: Intermediate

Hazard Potential Classification: Significant

Inspectors:

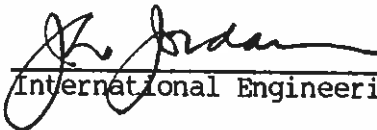


State Review Team:

Carl H. Steeby, P.E.
Civil Engineer

Charles D. Butler, P.E.
Engineering geologist

Approved:


International Engineering Co., Inc.

Kyle Cherry, P.E.
Dam Safety Engineer

Ken Hunt
Dam Safety Engineer

Carol Larson
Hydrologist

Approved:

Alaska Dept. of Natural Resources

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ALASKA STATE DAM SAFETY PROGRAM

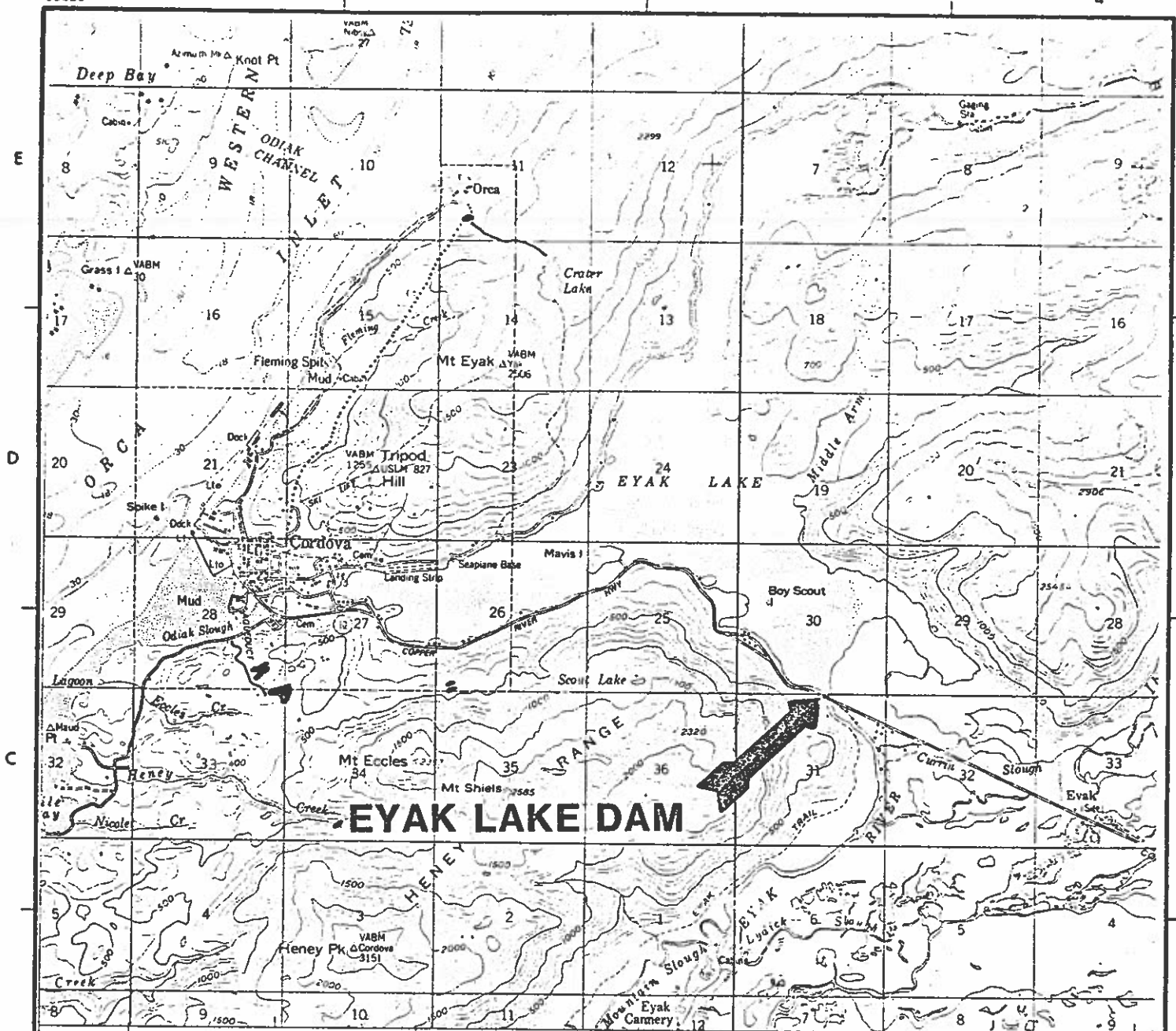
EYAK LAKE DAM

EXECUTIVE SUMMARY

On December 2, 1977, President Carter initiated a National Dam Safety Program by directing the Corps of Engineers to administer a program of inspection of all dams classified as high hazard potential by reason of their location. The National Dam Safety Program was completed in 1982. It was intended that each state would thereafter accept responsibility for non-federal dams located within their jurisdiction. In July 1966, Governor William Egan signed Alaska Statute AS 46.15 "Water Use Act" under which the Alaska State Dam Safety Program has been initiated.

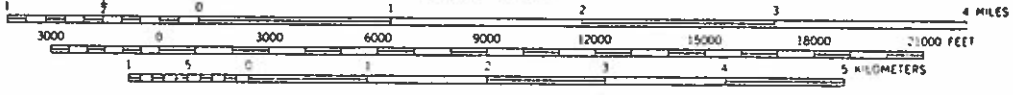
Under AS 46.15, Eyak Lake Dam was inspected on December 12 and 13, 1984 by International Engineering Company, Inc., under contract to State of Alaska Department of Natural Resources, Division of Land and Water Management. The dam was constructed by the Alaska Department of Public Works, Division of Water and Harbors in 1972 and repaired by the Alaska Division of Commercial Fisheries, Department of Fish and Game in 1978.

The purpose of the dam, or more appropriately "weir", is to stabilize Eyak Lake at levels relatively comparable to the pre-1964 Alaska earthquake levels; yet allowing passage of fish and small boats. The structure, as repaired in 1978, is sound and should perform its intended purpose for many years with minimum maintenance.



154000 FEET 45' 100000 FEET 35' (CORDOVA B-5/R 3 W 40) R 2 W

SCALE 1:63360



TRUE NORTH
MAGNETIC NORTH
APPROXIMATE MEAN DECLINATION, 1951

CONTOUR INTERVAL 100 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
DEPTH CURVES IN FEET - DATUM IS MEAN LOWER LOW WATER
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
THE AVERAGE RANGE OF TIDE IS APPROXIMATELY 30 FEET



FOR SALE BY U. S. GEOLOGICAL SURVEY
FAIRBANKS, ALASKA 99701, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

CORDOVA (C-5), ALASKA
N6030-W14530/15X22.5

1951
MINOR REVISIONS 1979



INTERNATIONAL ENGINEERING COMPANY, INC.
A MORRISON KNUDSEN COMPANY
ARCTIC DISTRICT
813 "D" STREET, P.O. BOX 6410, ANCHORAGE, ALASKA 99502, PHONE (907) 274-6551

**EYAK LAKE DAM
LOCATION MAP**

**ALASKA DEPT. OF NATURAL RESOURCES
DIV. OF LAND AND WATER MANAGEMENT**

NO.	DATE	REVISIONS	BY	CK'D	APP'D

PROJECT DATA

A. GENERAL

Name	Eyak Lake Dam
Location	Cordova, Alaska
Year Built	1972
Purpose	Lake Level Control
Inventory of Dams I.D. Number	AK 00049
Hazard Potential Classification	Significant
Size Classification	Intermediate
Owner	State of Alaska Dept. of Transportation and Public Facilities Division of Harbors Pouch A Juneau, Alaska 99811 Phone: (907) 586-2195

B. DAM

Type	Steel Sheet Pile
Crest Length	365 feet
Crest Width	3/8 inch
Crest Elevation	12 ft. @ Elev. 16.0 353 ft. @ Elev. 17.5
Height	2'-6"

C. SPILLWAY

Type	N/A
Location	N/A
Side Slopes	N/A
Crest Elevation	N/A
Bottom Width	N/A
Length	N/A
Discharge Capacity @ Dam Crest	N/A

D. OUTLET WORKS

Type	N/A
Location	N/A
Invert Elevation	N/A
Size	N/A
Length	N/A
Outlet Invert Elevation	N/A
Outlet Type	N/A
Discharge Capacity at Dam Crest	N/A

E. RESERVOIR

Normal Maximum Water Surface Elevation	17.0
Water Surface Elevation @ Dam Crest	17.0
Maximum Storage Volume at Dam Crest	13,000 Ac-Ft. Estimated
Maximum Surface Area at Dam Crest	2,432 Acres
Storage Volume @ Spillway Crest	13,000 Ac-Ft. Estimated
Surface Area @ Spillway Crest	2,432 Acres

F. HYDROLOGIC DATA

Drainage Area	41.6 Square miles
Average Annual Discharge	509 cfs
Flood of Record	11,000 cfs Estimated
Project Design Flood	Unknown
Probable Maximum Flood	88,500 cfs

ALASKA DAM SAFETY PROGRAM
INSPECTION REPORT
OF
EYAK LAKE DAM
AK 00049

1. GENERAL

1.1 Authority: Inspection authority is Alaska Statute AS 46.15 "Water Use Act" signed by Governor William Egan on 1 July 1966. Inspection procedures and criteria for a periodic inspection are set forth in the "Recommended Guidelines for Safety Inspection of Dams", Appendix D, Volume I, U.S. Army Corps of Engineers report to the U.S. Congress on National Program of Inspection of Dams, dated May 1975, and published under Title 33 CFT, Part 222.

1.2 Purpose and Scope: The purpose of the Alaska Dam Safety Program Periodic Safety Inspection is to assemble information and records on existing non-federal dams located within the State of Alaska and to insure continued public confidence in the integrity and safety of these important structures.

The scope of this report is to compile results of a visual inspection of the Eyak Lake Dam and an examination of currently available information relating to design, construction and performance history of the project. In addition, the potential risk to upstream and downstream residents is evaluated and preliminary structural stability assessments are made. Finally, adequacy of existing records and documents relating to the project are discussed and recommendations for additional studies and/or remedial actions are made.

1.3 Inspection Team: The inspection of the Eyak Lake Dam was conducted on December 12 and 13, 1984. The inspection team was composed of the following personnel:

International Engineering Company, Inc.

Carl H. Steeby, Project Manager/Civil

C. David Butler, Geotechnical

Mr. Malcom MacMaster of the City of Cordova accompanied the inspection team.

2. Project Description

2.1 Location: The Eyak Lake Dam is located at the mouth of Eyak Lake across the Eyak River at 60° 31.0' north latitude and 145° 38.7' west longitude. The dam is located approximately mile 5.5 on the Copper River Highway east of the City of Cordova, Alaska. The water level of this natural lake became unstable after the 1964 earthquake and a sheet pile weir was installed at the mouth in 1972 to stabilize the shoreline at the pre-1964 location. The dam is identified in the National Dam Inventory for Alaska as AK 000049. The reservoir is owned by the State of Alaska Department of Public Works, Division of Water and Harbors.

2.2 Size and Hazard Potential Classification

2.2.1 Size Classification: The maximum hydraulic height of the Eyak Dam is approximately 2-1/2 feet and the reservoir has a surface area of 2,432 acres. The storage capacity of the lake is estimated at 13,000 acre feet. The size classification is determined by the dam height or the maximum storage capacity, whichever gives the larger size category. The Corps of Engineers classifies an intermediate size dam as having a height of 40 to 100 feet and a storage capacity of 1,000 to 50,000 acre-feet. A large dam is 100 feet or greater in height or 50,000 acre-feet or greater of storage capacity. The Eyak Lake Dam is therefore classified as intermediate size based on the storage capacity.

2.2.2 Hazard Potential Classification: The Eyak Lake Dam is classified as having a significant hazard potential due to presence of a business establishment and the Copper River Highway Bridge downstream. Specification of hazard potential for a dam does not infer anything with regard to safety of the dam, it simply states the hazard to life and property should the dam fail for any reason.

2.3 Purpose of Dam: The Eyak Lake Dam was constructed in 1972 to stabilize the shoreline of the lake. Before the 1964 Alaska Earthquake, the shoreline of this natural lake was stable and the Eyak River was graded from the outlet of the lake to its discharge into the Gulf of Alaska. The land mass in the Cordova area was subjected to an uplift of approximately six feet during the earthquake. The Eyak River was no longer a graded stream after the uplift and the natural regrading process was slowly draining the lake. The Eyak Lake is an important water fowl habitat and fishery. Many homes are built around this scenic but shallow lake. The maximum depth was reported to be about eight feet. A lowering of five or six feet of the water level would have practically eliminated the lake. The dam has protected the water fowl habitat, fishery and property values around the lake.

2.4 Construction History: The Inventory of Dams lists the year of completion of the Eyak Dam as 1972. The only drawings available were obtained from the Alaska Department of Fish and Game. These drawings were part of the Alaska District Corps of Engineers' Public Notice No. NPA-72-23 to receive comments or objections to the issuance of a permit to construct. This notice, with drawings, and subsequent correspondence obtained relative to the project are contained in Appendix B. The exact depth of penetration of the sheet pile is unknown, however, Drawing Sheet 2 of 2, Appendix B states "11' max. pile penetration." It would seem more logical that the designer intended that a minimum of 11 feet penetration be obtained. Also, Photo No. 6 clearly shows an MZ type pile was used. From the contours and crest elevation given on the drawing, the hydraulic head at construction completion was about 3.5 feet.

Erosion of the fluvio-glacial and alluvial materials at the downstream toe reached the point where failure of the structure was imminent in 1978. The State Division of Harbors completed emergency work at the weir on September 12, 1978 by placing approximately 1100 cubic yards of quarry rock along the downstream side of weir. This quarry rock appears to be of sufficient size to resist the erosive forces of the stream. The maximum hydraulic head at the time of inspection was 2-1/2 feet. We are unable to explain the 1980 Inventory reporting a hydraulic height of 8 feet since no repairs subsequent to 1978 were reported.

2.5 Geology and Soils

- 2.5.1 Regional Geology: The general geology of the dam sites in the Cordova, Alaska region are characterized by a thick mantle of organics, overlying sedimentary argillites, calcareous argillites, sandstones, altered mafic pillow lava flows, breccias and shallow intrusives. The sparsely exposed bedrock is part of the Orca Group of Middle to Upper Eocene Age. Some metamorphism has probably occurred in the area giving rise to poorly developed phyllite characteristics within the thinly bedded argillites and changes of the sandstone into a greywacke.

Geological structure is characterized by faulting, some generally distorted tightly folded bedding and in some cases, overturned beds. Recent glaciation has left the area with a thin to moderate thickness of till and fluvio-glacial deposits. Stream bed alluvial deposits dominate the bottoms in most creeks and rivers, the depths of which are unknown but they are assumed to be relatively shallow because of a fairly young, past glacial scour over the area.

A more definitive description of the geological structure and site specific lithology could be obtained in the spring following melting of the present snow cover. This would entail some exploratory drilling and trenching. However, the location and limited size of the structure involved suggest this to be an impractical, costly solution that is not necessary.

Eyak Lake was formed by a glacier flowing down the Power Creek Valley and scooping out the bedrock thus creating a basin. The glacier was split as it abutted against the Heney Range into westerly and southeasterly outlets to tide water. The bedrock in the westerly arm was apparently more resistant to the glacial scour as the southeasterly area removed the valley bedrock to a much lower elevation and the eventual outlet of Eyak Lake. As the glacier receded, it

slowed enough to form a terminal moraine in the 3/4 mile wide valley at the present day lake outlet and formed Eyak Lake. Rain and melt water cut through the terminal moraine until the Eyak River became graded and the lake level stabilized. A five to six feet uplift of the ground mass resulted from the 1964 Alaska Earthquake disrupting the graded condition of the Eyak River. In the process of regrading, Eyak Lake depth was being diminished. Sheet pile and subsequent quarry rock was placed at the outlet to maintain the pre-1964 shoreline.

2.5.3 Seismicity: The Eyak Lake Dam is located less than 80 miles from the epicenter of the 1964 Alaska Earthquake which registered 8.4 on the Richter scale and the area is considered one of the most active zones in the Alaska (Zone 4). An earthquake map is included in Appendix B.

2.6 Basin Description:

The drainage basin consists of several watersheds with the Power Creek watershed being the largest. The basin is fed from precipitation in the form of rain, snow melt and melt from several glaciers. The headwater area of Power Creek begins on a glacier ice cap exceeding elevations of 4,000 feet above sea level.

Lower elevations of the watershed are covered with dense stands of conifer trees underlain by a thick blanket of low growing vegetation and a surface mantle of spongy peat. As elevation increases, vegetation decreases. At about 1,500 feet elevation, vegetation is near non-existent with the soil mantle removed to or near bedrock. Much of the area above 2,500 feet is covered with glacial ice. Prevailing maritime storms drench the area with heavy rain during the summer and cover the higher elevations with deep snow in winter.

The Eyak Lake basin lies within the area of maritime influence which prevails over coastal areas of south central Alaska and end in the path of most

cyclonic storms that cross the Gulf of Alaska. Consequently, the area has little sunshine, generally moderate temperature and abundant precipitation. The rugged mountain terrain exerts a fundamental influence upon local temperatures and the distribution of precipitation, which creates considerable variations in both weather elements within relatively short distances and elevation.

Climatic summaries of weather data for 36 years show Cordova has a mean annual temperature of 38⁰F, a maximum high of 84⁰F and a maximum minimum of -33⁰F. Average annual precipitation is 96 inches with maximum monthly amounts occurring during September (27.7 inches) and October (26.6 inches). Average monthly precipitation accumulations for September and October are 13 and 12 inches respectively. Precipitation intensities along the Alaskan coastline increase proportionately with elevation. Cordova has recorded 24 hour amounts frequently exceeding 6 inches and evidence indicates that the Eyak Lake drainage basin precipitation intensities would exceed those at Cordova.

2.7 Description of Project:

The dam is a driven steel sheet piling approximately 365 feet in length and buttressed with 1,100 cubic yards of quarry rock. The depth of penetration of the piles is unknown. The maximum hydraulic depths at the time of inspection was 30 inches. The steel sheet piling section is similar to MZ 32 as produced by United States Steel Corporation.

A 12 feet wide by 1-1/2 feet deep boat slot was constructed near mid channel. The slot is undoubtedly beneficial to the passage of anadromous fish but of questionable value for a boat passage. See Photo No. 4, Appendix A and Drawing sheet 2 of 2 in Appendix B.

2.8 Operation and Maintenance:

The only ascertainable maintenance was the installation of 1,100 cubic yards of quarry rock to buttress the sheet pile in 1978. There are no operating mechanisms or operations to perform.

3. Field Inspection

3.1 General: The field inspection of the Eyak Lake Dam was conducted on December 12 and 13, 1984 by Messrs. C. H. Steeby and C. D. Butler of International Engineering Company, Inc., accompanied by Mr. Malcom MacMaster of the City of Cordova. The Department of Fish and Game were invited to attend but declined. The ADF&G did provide us with the communications and drawings included in Appendix B. The inspection checklist is included as Appendix C.

3.2 Reservoir Area: At the time of the inspection, most of the lake was covered with ice. There was no evidence of shoreline slides upstream of the dam and the intended purpose of the dam is being fulfilled. Several swans were observed on the lake ice.

3.3 Dam: The quarry rock placed downstream of the sheet pile has stabilized the structure. The steel piling shows very little corrosion and the structure should continue to function satisfactorily for many years. Since this structure is more of an overflow weir than a dam, there are no outlet works, spillway and other features normally associated with a dam.

3.4 Downstream Channel: The downstream channel can best be described as being of "Old Age" in terms of geologic description. The floor of the valley below the dam has nearly reached sea level and erosion is confined to mass wasting of slopes along the meandering and braided channels.

4. Hydrology

4.1 History of Flooding: The only specific information obtained on flooding at the site is contained in the September 14, 1978 Memorandum where it stated that the quarry rock placement was finished just in time as the heavy rain and high water which occurred the following day most certainly would have caused complete failure of the structure. The date of the high water was September 13, 1978. The U.S.G.S. Flow Records for Power Creek on this date shows 1,350 cfs average flow. The maximum flow at the mouth of Eyak Lake probably exceeded 3,000 cfs on this date.

4.2 Probable Maximum Flood:

Determination of the probable maximum flood is based on rational consideration of the chances of simultaneous occurrence of the maximum of the several elements or conditions which contribute to the flood. A major consideration is the determination of the runoff that would result from an occurrence of a probable maximum storm based on meteorological factors. This is necessary because streamflow records are of relatively short duration. The U.S. Weather Bureau Technical Paper No. 47 gives general values of the probable maximum precipitation for the Eyak Lake Basin as follows:

6 hours - 16" 12 hours - 24" 24 hours - 32.5"

The hourly distribution of the Probable Maximum 6-hour precipitation was calculated in accordance with Chapter III, Figure 18, page 51 of the "U.S. Bureau of Reclamation Design of Small Dams" (1977).

Rainfall Distribution (Probable Maximum Storm)

Time Hours	Incremental Rain - in.	Accumulation Rain - in.	Incremental Runoff - in.	Accumulation Runoff - in.
0-1	3.84	3.84	3.84	3.84
1-2	1.60	5.44	1.60	5.44
2-3	4.16	9.60	4.16	9.60

Time Hours	Incremental Rain - in.	Accumulation Rain - in.	Incremental Runoff - in.	Accumulation Runoff - in.
3-4	2.08	11.68	2.08	11.68
4-5	2.24	13.92	2.24	13.92
5-6	2.08	16.00	2.08	16.00
6-12	8.00	24.00	8.00	24.00
12-24	8.50	32.50	8.50	32.50

It was assumed that all surface detentions would be full and there would be no infiltration due to previous rain before the storm.

The computation of a hydrograph for a watershed is dependent on an estimate of the time of concentration (Tc), defined as the travel time of water from the hydraulically most distant point of the watershed to the point of interest. This data is admittedly generalized because the concentration of runoff is affected by storm distribution and intensity as well as the watershed's hydraulic characteristics. The solution for the time of concentration for Eyak Lake was made by the following formula:

$$T_c = \left(\frac{11.9 L^3}{H} \right)^{0.385}$$

Where Tc = Time in hours
L = Length of Watercourse (miles)
H = Elevation Difference (feet)

For Eyak Lake:

$$L = 14 \text{ miles}$$

$$H = 4,160 \text{ ft.}$$

$$T_c = \left(\frac{11.9 \times 14^3}{4,160} \right)^{0.385} = 2.21 \text{ hours}$$

The general equation for computing the peak discharge resulting from a given amount of runoff is $q_p = \frac{484AQ}{T_p}$

in which $T_p = D/2 + 0.6 T_c$

where:

q_p = peak discharge (cfs)

A = Area (sq. mi.)

Q = 1.00 inch

T_p = Time to peak (hrs.)

D = Rainfall period (hrs.)

One hour $T_p = 1/2 + 0.6 \times 2.21 = 1.83$ hours

Six hour $T_p = 6/2 + 0.6 \times 2.21 = 4.33$ hours

Twelve hour $T_p = 12/2 + 0.6 \times 2.21 = 7.33$ hours

Base Time $T_b = 2.67 T_p$

Triangular Hydrograph Computations

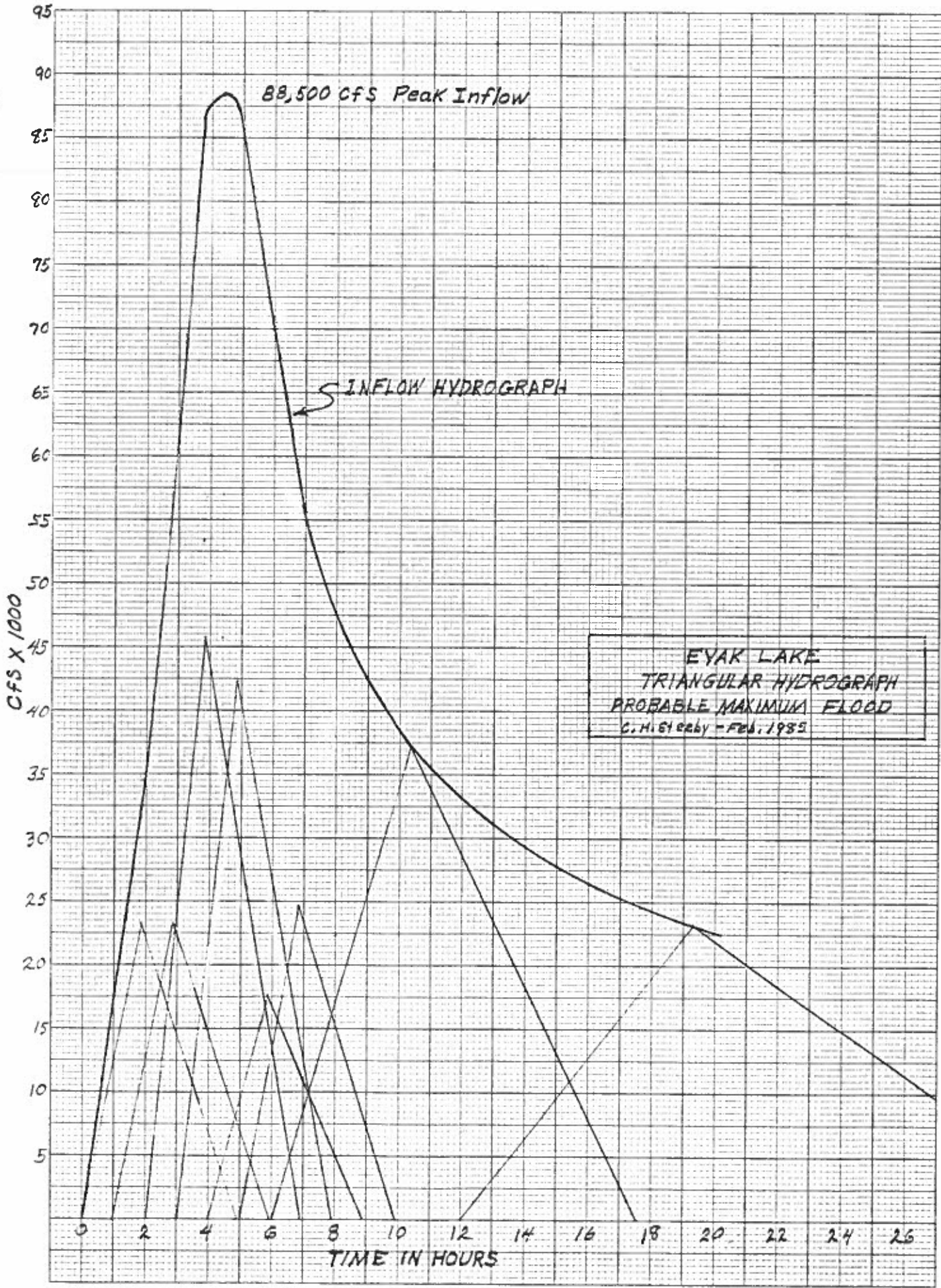
Time Hours	Inc. Run Off - in.	Q_p for 1.00"	Q_p for Inc. Runoff	Begin Time	T_p Peak Time	T_b End Time
0-1	2.08	11,002	22,884	0	1.83	4.89
1-2	2.08	11,002	22,884	1	2.83	5.89
2-3	4.16	11,002	45,768	2	3.83	6.89
3-4	3.84	11,002	42,248	3	4.83	7.89
4-5	1.60	11,002	17,603	4	5.83	8.89
5-6	2.24	11,002	24,644	5	6.83	9.89
6-12	8.00	4,650	37,200	6	10.33	17.56
12-24	8.50	2,747	23,350	12	19.33	31.57

The incremental rainfall during the maximum 6-hour period was rearranged in the following hours sequence: 6, 4, 3, 1, 2, 5. This judicial arrangement gives a computed flood greater than one based on the assumption that the greatest hourly increment of rain occurs during the first hour of a storm and a smaller flood than that computed by assuming the greatest hourly increment of rain occurs during the 6th hour of a storm. The hourly increments of a storm cannot be predicted.

No snow melt was allowed in the computations since the maximum storms occur in September. The maximum 38 years of recording on Power Creek, with a drainage area of 20.5 square miles, was 5,540 cfs on September 25, 1949. The 38-year average September flow at the Power creek gage is 482 cfs. Nearly all of the glaciers in the Eyak Lake basin is in the Power Creek watershed above the gaging station. Some glacier melt could be included in the PMF study, however, the calculated 88,500 cfs is considered to be conservative.

46 1320

K&E
U.S. 10 TO 1/2 INCH
7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.



5. Hydraulic Evaluation:

Sufficient topographic information is not available to perform an hydraulic analysis of the outlet of Eyak Lake. The U.S.G.S. topographic map Cordova (C-5) shows a low area to the east of the outlet and what must be an intermittant high water stream. The percentage of flow that would escape by this route for a flood approaching 1/2 PMF is impossible to estimate with the limited data and flood routing through Eyak Lake is not possible without this information. It is almost certain that the small height of the Eyak Dam would be submerged and failure would cause imperceptable downstream damage.

6. Structural Stability:

There are no design reports available and the available drawings do not show the depth of penetration of the steel sheet pile. With the addition of the quarry rock below the weir in 1978, the structure is presently stable. Seepage flows near the right abutment showed no signs of material removal or visible settlement.

There is doubt that the size of the quarry rock placed is sufficiently large to withstand the forces of a major flood, even though it has remained in place for the past six years. A flood of sufficient magnitude to remove the quarry rock would almost certainly cause complete failure of the sheet pile.

7. Prior Reports:

All prior reports, drawings, and correspondence is contained in Appendix B.

8. Conclusions:

From this inspection of the Eyak Lake Dam, IECO presents the following conclusions:

1. Although a significant hazard potential classification is assigned to the dam, downstream damage resulting from its failure would be imperceptible.
2. A potential exists for large amounts of flood water to escape from the lake approximately one-mile east of the existing outlet and possibly a new outlet channel develop.
3. The structure is fulfilling its intended purposes and should be maintained.

9. Recommendations:

1. The water seepage at the right abutment should be monitored each winter when there is low flow and the water clear from lack of glacial melt.
2. The quarry rock placed in 1978 should be monitored after each major storm and replaced as required.
3. Periodic inspections should be conducted during the winter season. Inspection of the dam cannot be properly accomplished when a large volume of water is passing over the structure.

APPENDIX A

INSPECTION PHOTOGRAPHS: 12 DECEMBER 1984

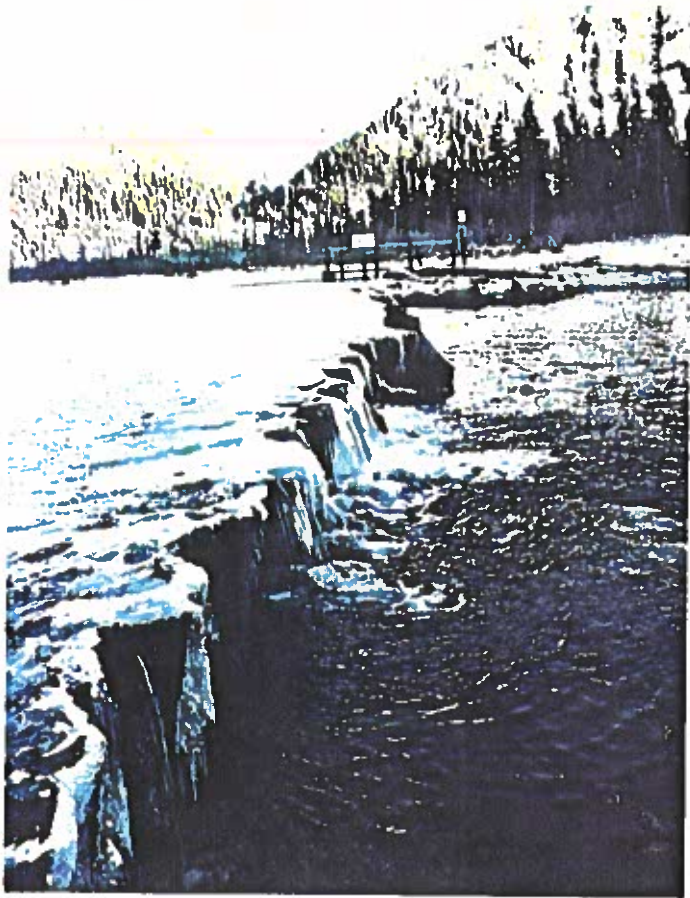


Photo No. 1
Easterly View of Dam



Photo No. 2
Westerly View of Dam
Boatway - Upper Left

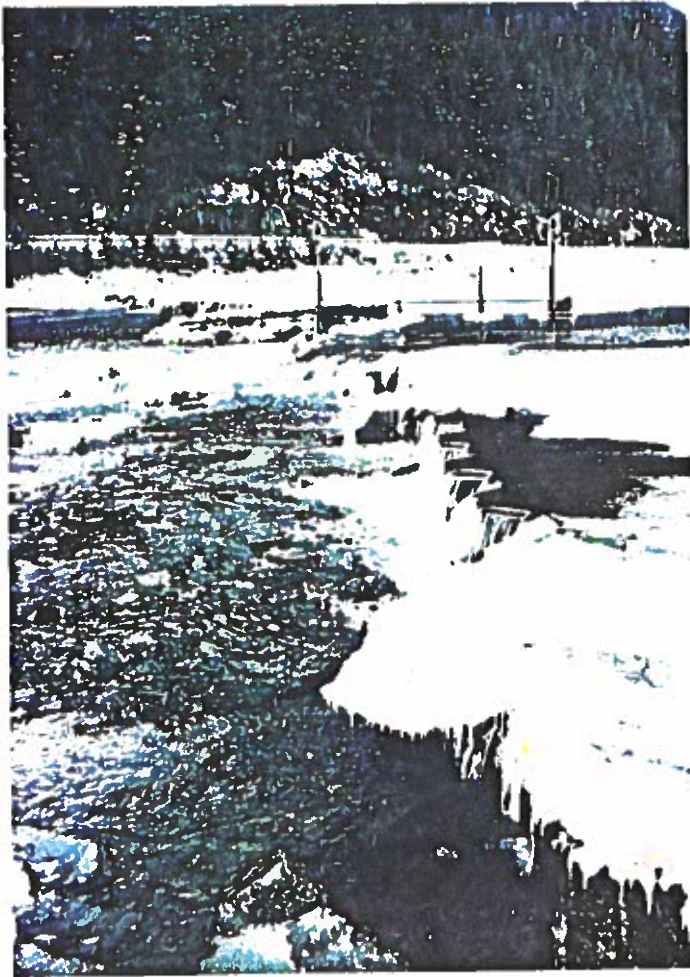


Photo No. 3
Westerly View of Dam
from left abutment.

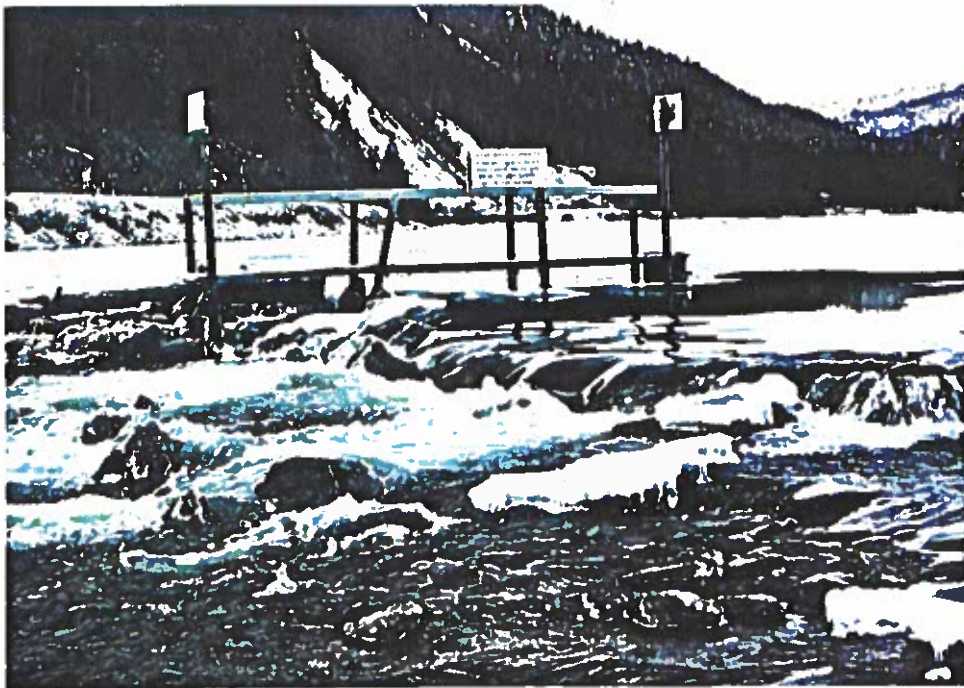


Photo No. 4
Close-up view of Boatway

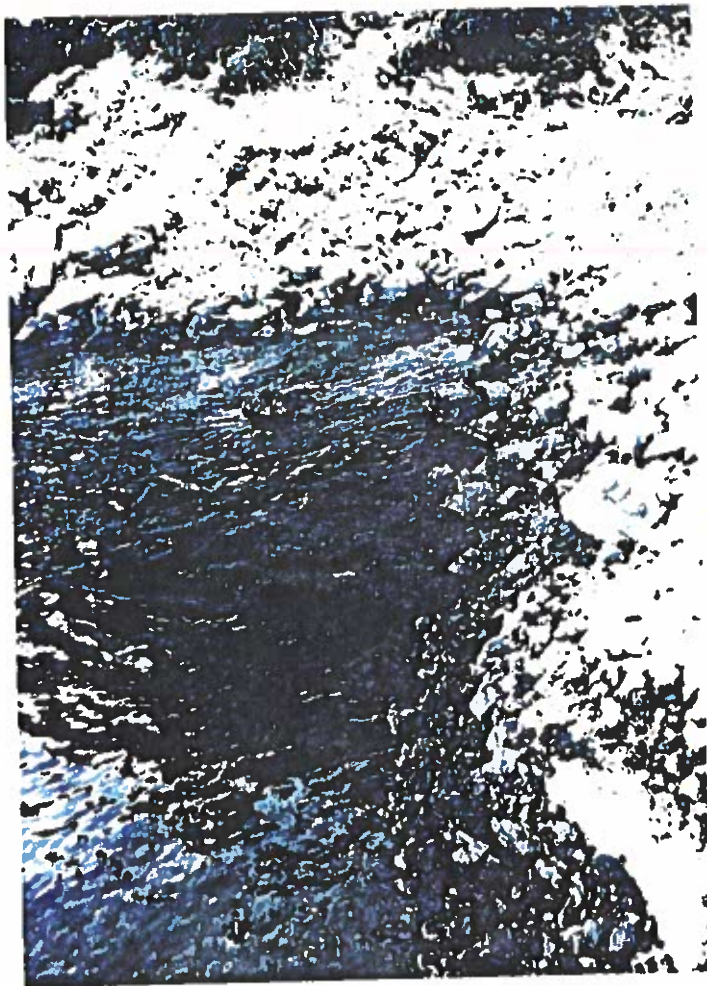


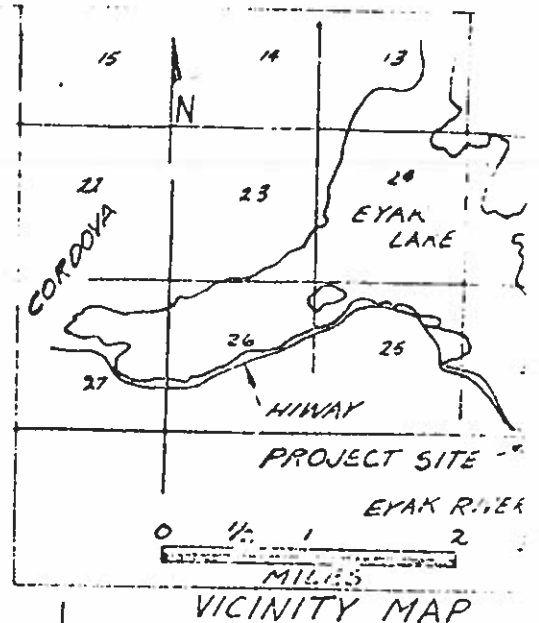
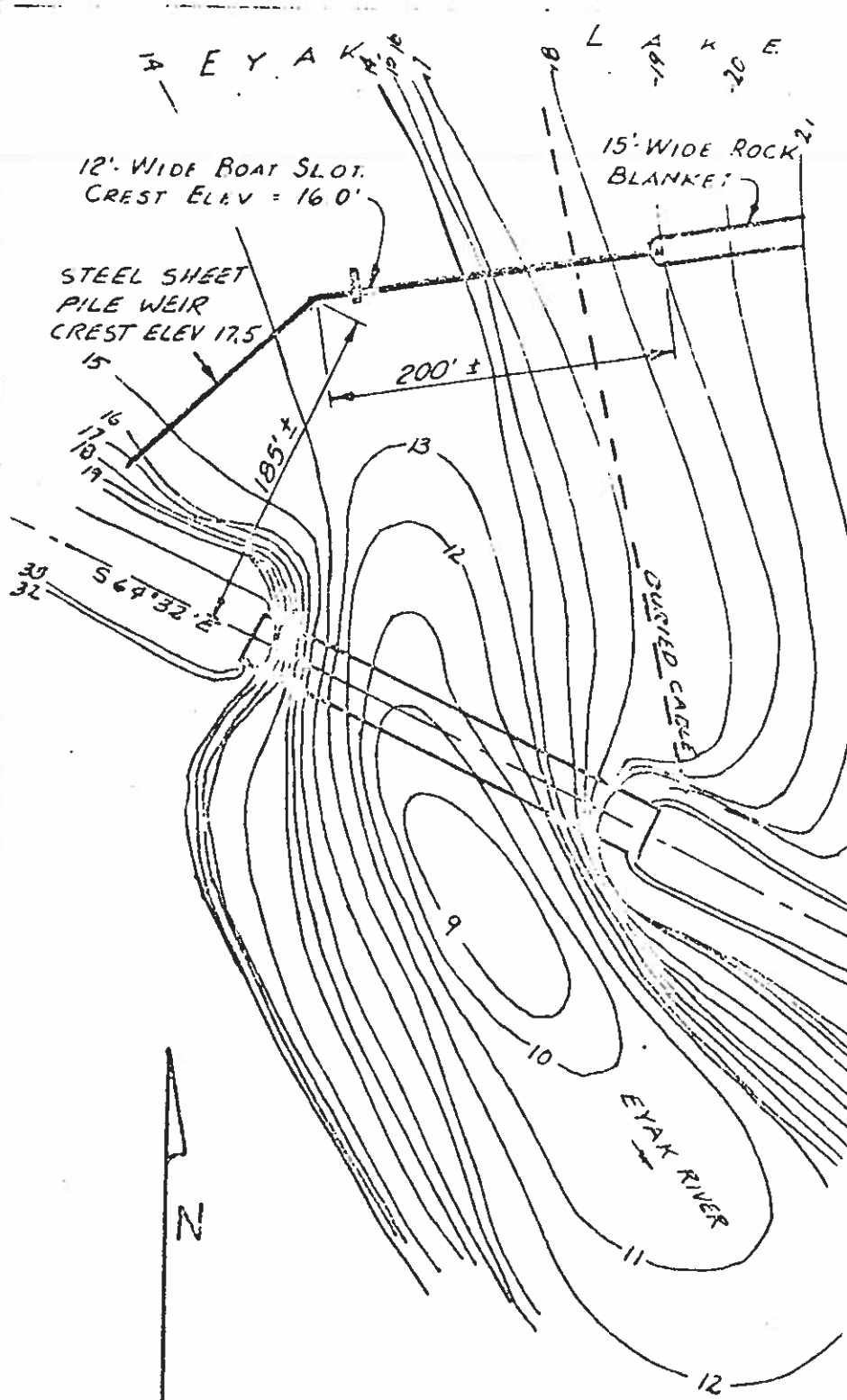
Photo No. 5
Seepage at right Abutment.



Photo No. 6
Close-up view showing
type of sheet pile used

APPENDIX "B"

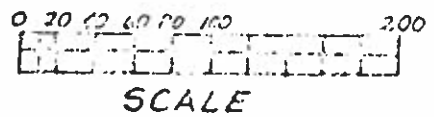
CORRESPONDENCE & DRAWINGS



EXISTING CONCRETE BRIDGE ON TIMBER PILE DECK ELEV APPROX 34.0

PURPOSE OF WEIR IS TO STABILIZE EYAK LAKE AT LEVELS RELATIVELY COMPARABLE TO PRE-QUAKE ELEV YET ALLOWING PASSAGE OF FISH AND EGGS

CONTOURS : FEET ABOVE MLLW = 0.0

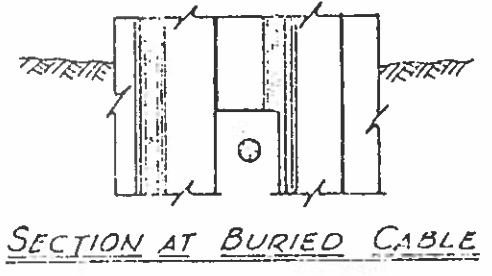
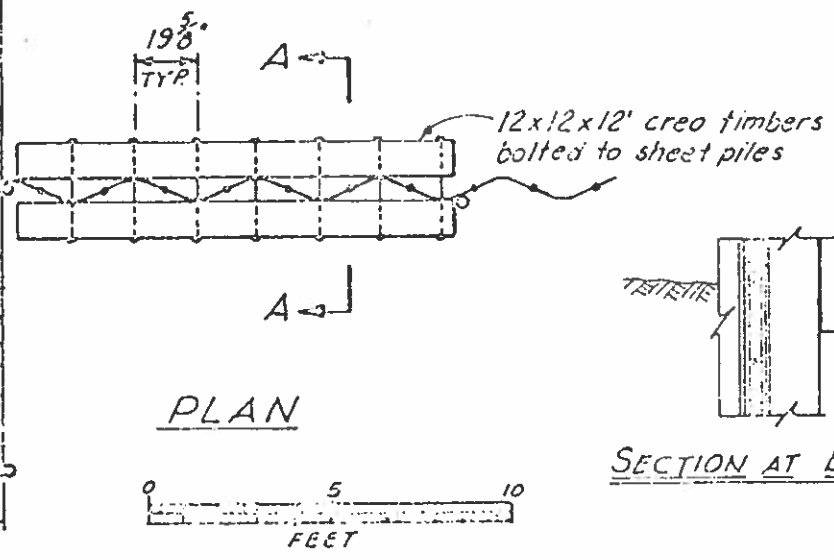
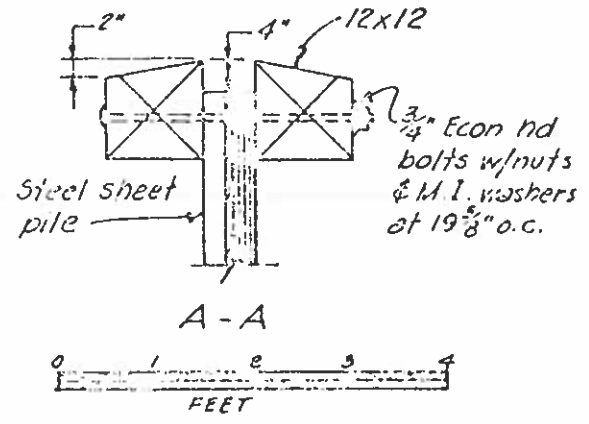
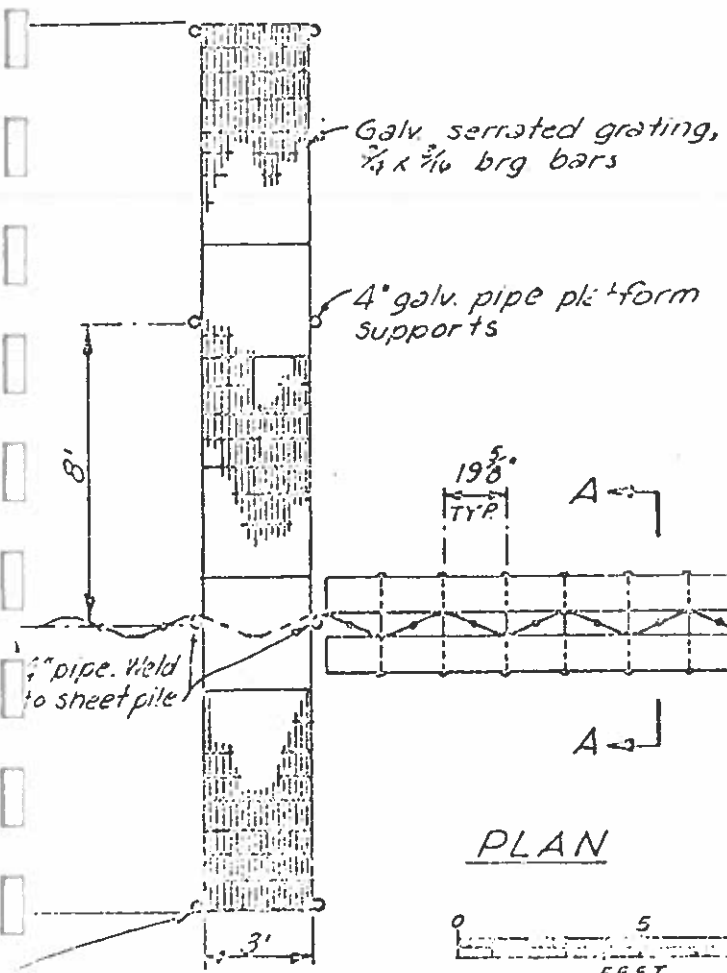


**PROPOSED WEIR
IN EYAK LAKE NEAR
CORDOVA, ALASKA**

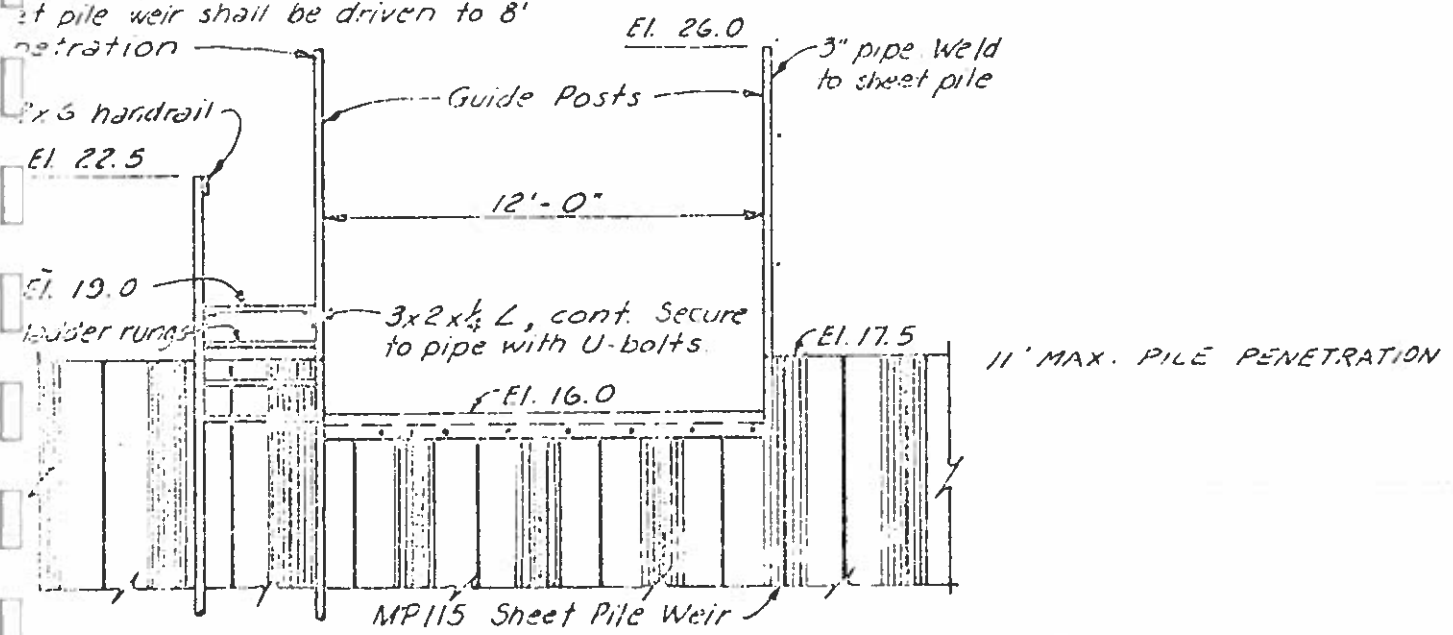
APPLICATION BY
ALASKA DEPT OF PUBLIC WORKS
DIVISION OF WATER & HARBORS
POUCH 2
JUNEAU, ALASKA

D.S. MILLER 27 JAN.

Revised 2-28-70 JET



All support pipes not welded to sheet pile weir shall be driven to 8' penetration



ELEVATION

EYAK LAKE WEIR
12'-WIDE BOAT SLOT DETAILS

STATE
of ALASKA

MEMORANDUM

RECEIVED

SEP 18 1978

TO: Carl Rosier, Director
Division of Commercial Fisheries
Department of Fish and Game

DATE: September 14, 1978 DEPT. OF FISH & GAME

FILE NO: 230H

TELEPHONE NO: 586-2195

FROM: *DS*
Don Statter, Director
Division of Harbors
DOT/PF

SUBJECT: Eyak Lake Weir Emergency Repairs

As you are probably aware the Eyak Lake Weir emergency repair project was completed September 12, 1978. Approximately 1100 cubic yards of quarry rock were placed in the eroded area and along the back side of the weir from the bank to the section nearest the highway where rock had previously been placed. Cost will probably run in the neighborhood of \$15,000. DOT/PF equipment and all available local trucks were utilized. Rock was obtained from a DOT/PF quarry at 11 mile.

Since we will undoubtedly be receiving billings from the locals shortly I will need to know how payment should be handled.

Also DOT/PF southcentral region will be looking for reimbursement for their efforts.

It appears that we finished just in time as the heavy rain and high water which occurred the following day most certainly would have caused complete failure of the structure.

cc: Jessie Dodson, Office of the Governor
H.D. Scougal, Deputy Commissioner, DOT/PF
R.B. Nickerson (F.R.E.D. Cordova)
Perry Lovett, City Manager Cordova
Herb Lehfelt, Director, Southcentral Regional Division

STATE OF ALASKA

DEPARTMENT OF HIGHWAYS

SOUTH CENTRAL DISTRICT

P. O. BOX 507

VALDEZ 99686

Cordova Station

Box 551

Cordova, Alaska 99574

May 24, 1979

Mr. Richard B. Nickerson
Department Fish & Game
FRED Division
Box 699
Cordova, Alaska 99574

Dear Mr. Nickerson,

Regarding the wier project on the Eyak River, located at approximately mile 5.5 on the Copper River Highway, we would offer the following suggestion:

At extreme low water, a base course should be run on the wier area with a 10° taper and then put a layer of cement on top in order to stop erosion and for improved appearance.

If you have further questions or comments feel free to contact me at the Cordova Station at (ph) 424-3202.

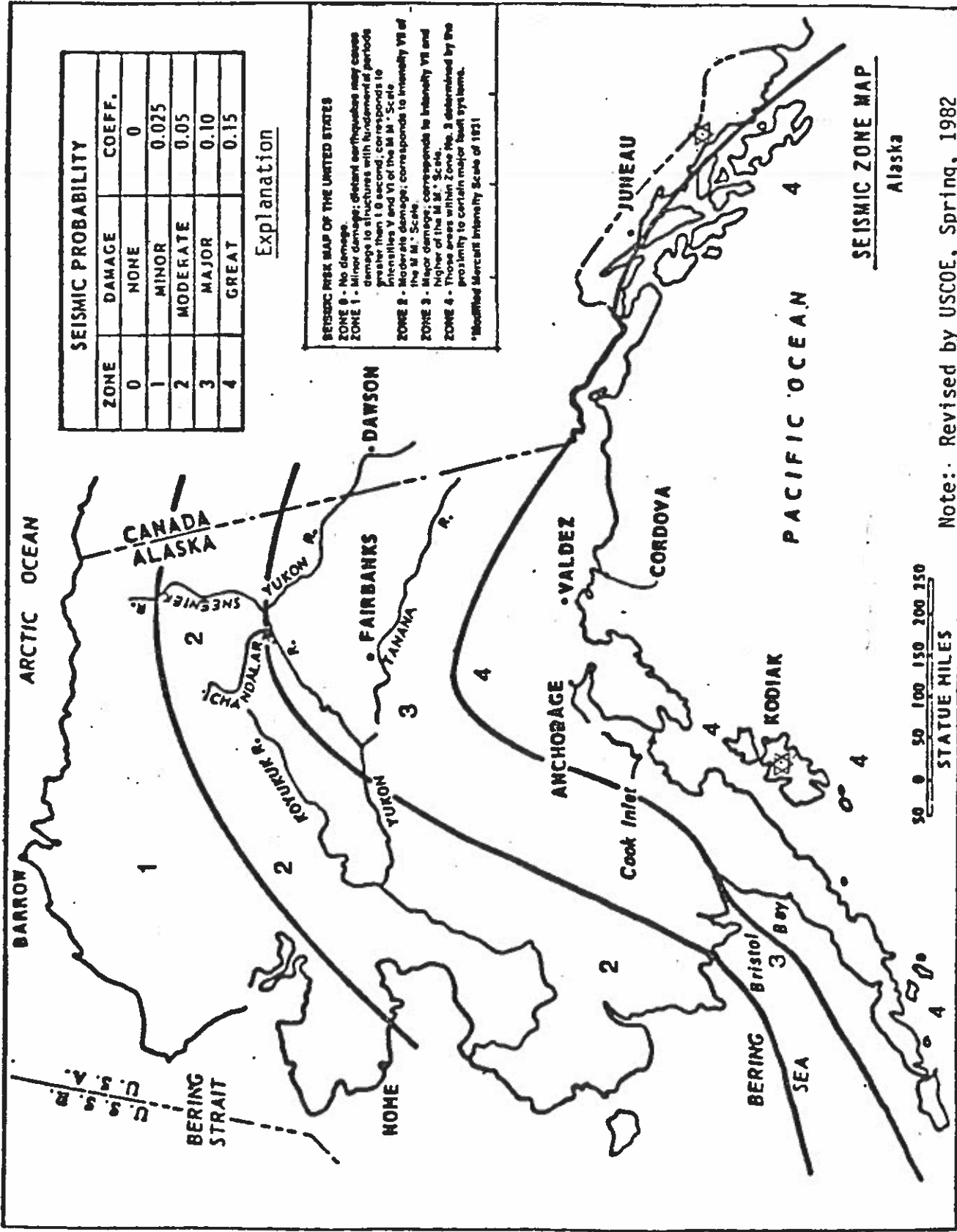
Sincerely,

Walter Mantila
Walter Mantila, HMF
DOT & PF
Cordova Station

RECEIVED

MAY 24 1979

DEPT. OF FISH & GAME



SEISMIC PROBABILITY		
ZONE	DAMAGE	COEFF.
0	NONE	0
1	MINOR	0.025
2	MODERATE	0.05
3	MAJOR	0.10
4	GREAT	0.15

Explanation

SEISMIC RISK MAP OF THE UNITED STATES
 ZONE 0 - No damage
 ZONE 1 - Minor damage; distant earthquakes may cause damage to structures with foundation at periods greater than 1.0 second; corresponds to intensities V and VI of the M.S. Scale
 ZONE 2 - Moderate damage; corresponds to intensity VII of the M.S. Scale
 ZONE 3 - Major damage; corresponds to intensity VIII and higher of the M.S. Scale
 ZONE 4 - Those areas within Zone 4, as determined by the proximity to certain major fault systems.
 *Modified Mercalli Intensity Scale of 1921

SEISMIC ZONE MAP
Alaska



Note: Revised by USCOE, Spring, 1982



INTERNATIONAL ENGINEERING COMPANY, INC.
 A MERRISON KNUDSEN COMPANY
 ARCTIC DISTRICT
 813 "D" STREET, P.O. BOX 6410, ANCHORAGE, ALASKA 99502, PHONE (907) 274-6551

SEISMIC ZONE MAP
ALASKA

NO.	DATE	REVISIONS	BY	CK'D	APP'D	DATE

Project	DAM SAFETY INSPECTION
Client	STATE OF ALASKA

PROJECT NO.	4715	REV.	
DRAWING NO.	0		

I N V E N T O R Y O F D A M S

FORM
4474

FORM
4474

ITEM	NOMENCLATURE	DATA	ITEM	NOMENCLATURE	DATA
1	ID	AK00049	28	(SEE BELOW)	
2	DIVISION	NPD	29	D/S HAZARD	3
3	STATE	C2	30	CREST LENGTH	00366
4	COUNTY	C80 (CORDOVA-MCCARTHY)	31	SPILLWAY TYPE	U
5	CONGR. DIST.	01	32	SPILLWAY WIDTH	0012
6	2ND STATE		33	MAX DISCHARGE	0000075
7	2ND COUNTY		34	VOLUME	000000050
8	2ND CONGR		35	POWER INSTALLED	
9	OFF. DAM NAME	EYAK LAKE	36	POWER PROPOSED	
10	LATITUDE	60-31.9	37	NO. OF LOCKS	
11	LONGITUDE	145-38.6	38-45	LOCK LEN/WID	
12	REPORT DATE	80/09/02.	46	OWNER NAME	STATE OF ALASKA
13	POPULAR NAME		47	ENGINEERING	AK. DIV. OF WATERS & HA
14	IMPOUND. NAME	EYAK LAKE	48	CONSTRUCTION	
15	REGION	19	49	REG. DESIGN	AK DNR
16	BASIN	05	50	REG. CONST	AK DNR
17	RIVER/STREAM	EYAK RIVER	51	REG. OPER.	AK DNR
18	D/S CITY-TOWN	NONE	52	REG. MAINT.	AK DNR
19	DISTANCE	002	53	INSPECTOR	DAEN NPA
20	POPULATION	00000000	54	INSP. DATE	78/06/28.
21	TYPE OF DAM	OT	55	INSP. AUTH.	
22	YEAR COMPLETED	1972	56	(SEE BELOW)	
23	PURPOSES	0	57	INSP. INIT.	
24	STR. HEIGHT	0015	58	UNSAFE	
25	HYD. HEIGHT	0008	59	URGENCY	
26	MAX CAPACITY	00098000	60	INSP. COMPL.	
27	NORMAL CAP.	00040000	61	RPT. APPR.	
27A	CORPS DIST.	NPA	62	GOV. NOTIF.	
27B	OWNER CODE	N	63	INSPECTOR	
27C	FED. REGULATED	N	64	GOV. RPT.	
27D	PVT. OR FED.	Y	65	DEFICIENCY	
27E	SCS AID	N			
27F	VERIFY DATE	80/01/01.			

28 REMARK 21-SHEET PILE 27-UNK BUT GREATER THAN 1000 23-TO STABILIZE LAKE
56. REMARK 33-DAM & SPILLWAY PASS ALL INFLOW 47-BORS 54-INCOMPLETE DUE TO HIGH WAT.

INSP. REMARK NO COMMENT

APPENDIX "C"

INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST

- | | |
|-------------------------|-------------------------|
| 1. Name of Dam: | 6. Date Inspected: |
| 2. Inventory No.: | 7. Pool Elevation: |
| 3. Hazard Category: | 8. Tailwater Elevation: |
| 4. Size Classification: | 9. Purpose of Dam: |
| 5. Owner: | 10. Weather: |

Directions: Mark an "X" in the "YES" or "NO" column.
If item does not apply, write "N/A" in "REMARKS" column.
Use "Other Comments" space to amplify "REMARKS".

ITEM	YES	NO	REMARKS
RESERVOIR			
1. Any Upstream Development?		X	
2. Any Upstream Impoundments?		X	
3. Shoreline Slide Potential?		X	
4. Significant Sedimentation?		X	
5. Any Trash Boom?		X	
6. Any Ice Boom?		X	
7. Operating Procedure Changes?		X	
DOWNSTREAM CHANNEL			
1. CHANNEL			
a. Eroding or Backcutting?		X	
b. Sloughing?		X	
c. Obstructions?		X	
d. Bridging?		X	
2. DOWNSTREAM FLOODPLAIN			
a. Occupied Housing?	X		
b. Farming?		X	
c. Recreation Areas?		X	
d. High or Significant Hazard?	X		
e. New Development?		X	
INSTRUMENTATION			
1. Are there			
a. Piezometers?		X	
b. Weirs?		X	
c. Settlement Pins?		X	
d. Observation Wells?		X	
e. Other?		X	
2. Are readings			
a. Available?		X	
b. Plotted?		X	
c. Taken Periodically?		X	

ITEM	YES	NO	REMARKS
STEEL DAMS			TYPE:
1. CREST			
a. Any misalignment?		X	
b. Any corrosion?	X		Minor
c. Any treatment?		X	
d. Any bent members?		X	
e. Adequate freeboard?			N.A
2. UPSTREAM FACE			
a. Deterioration?	X		Minor
b. Corrosion?	X		Minor
c. Open joints?		X	
d. Cracked welds			NA
3. DOWNSTREAM FACE			
a. Deterioration?	X		Minor
b. Corrosion?	X		Minor
c. Loose bolts?			NA
d. Cracked welds?			NA
e. Seepage from joints?	X		Only as expected
f. Displacement?		X	
4. ABUTMENT & FOUNDATION CONTACTS			
a. Exposed bedrock?		X	
b. Erosion?		X	
c. Visible displacement?		X	
d. Seepage from contacts?	X		Along the right abutment
e. Boils or springs downstream?	X		Not serious

Other Comments:

ITEM	YES	NO	REMARKS
INTAKES			<i>None</i>
1. EQUIPMENT			<i>Not Applicable</i>
a. Trash Racks?			
b. Trash Rake?			
c. Mechanical Equipment Operable?			
d. Intake Gates?			
e. Are Racks and Gates Maintained?			
f. Are Gate Operators Operable?			
2. CONCRETE SURFACES			
a. Any Cracking?			
b. Any Deterioration?			
c. Erosion?			
d. Exposed Reinforcement?			
e. Are Joints Displaced?			
f. Are Joints Leaking?			
3. CONCRETE CONDUITS			
a. Any Cracking?			
b. Any Deterioration?			
c. Erosion?			
d. Exposed Reinforcement?			
e. Are Joints Displaced?			
f. Are Joints Leaking?			
4. METAL CONDUITS			
a. Is Metal Corroded?			
b. Is Conduit Cracked?			
c. Are Joints Displaced?			
d. Are Joints Leaking?			
5. METAL APPURTENANCES			
a. Corrosion?			
b. Breakage?			
c. Secure Anchorages?			
6. PENSTOCKS			
a. Concrete Conduit?			
b. Steel Conduit?			
c. Wood Stave?			
d. Flume?			
e. Is Penstock Leaking?			✓

Other Comments:

ITEM	YES	NO	REMARKS
<u>SPILLWAYS</u>			TYPE: <u>None</u>
1. CREST			<u>Not Applicable</u>
a. Any Settlements?			
b. Any Misalignments?			
c. Any Cracking?			
d. Any Deterioration?			
e. Exposed Reinforcement?			
f. Erosion?			
g. Silt Deposit Upstream?			
2. CONTROL STRUCTURES			
a. Mechanical Equipment Operable?			
b. Are Gates Maintained?			
c. Will Flashboards Trip Automatically?			
d. Are Stanchions Trippable?			
e. Are Gates Remotely Controlled?			
3. CHUTE			TYPE:
a. Any Cracking?			
b. Any Deterioration?			
c. Erosion?			
d. Exposed Reinforcement?			
e. Seepage at Lift Lines or Joints?			
4. ENERGY DISSIPATORS			
a. Any Deterioration?			
b. Erosion?			
c. Exposed Reinforcement?			
5. METAL APPURTENANCES			
a. Corrosion?			
b. Breakage?			
c. Secure Anchorages?			
6. EMERGENCY SPILLWAY			TYPE:
a. Adequate Grass Cover?			
b. Clear Approach Channel?			
c. Erodible Downstream Channel?			
d. Erodible Fuse Plug?			
e. Stable Side Slopes?			

Other Comments:

Inventory No. AK00049

Sheet 5 of 5

ITEM	YES	NO	REMARKS
LOW LEVEL OUTLET			TYPE: <i>None</i>
1. GATES			<i>Not Applicable</i>
a. Mechanical Equipment Operable?			
b. Are Gates Remotely Controlled?			
c. Are Gates Maintained?			
2. CONCRETE CONDUITS			
a. Any Cracking?			
b. Any Deterioration?			
c. Erosion?			
d. Exposed Reinforcing?			
e. Are Joints Displaced?			
f. Are Joints Leaking?			
3. METAL CONDUITS			
a. Is Metal Corroded?			
b. Is Conduit Cracked?			
c. Are Joints Displaced?			
d. Are Joints Leaking?			
4. ENERGY DISSIPATORS			
a. Any Deterioration?			
b. Erosion?			
c. Exposed Reinforcement?			
5. METAL APPURTENANCES			
a. Corrosion?			
b. Breakage?			
c. Secure Anchorages?			

Other Comments:

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**APPENDIX D: STATE OF ALASKA MEMORANDA RELATING TO EYAK
LAKE WEIR**

M E M O R A N D U M

S t a t e o f A l a s k a

To: File - Eyak Lake
Waterbody No. 212-10-10060-0010

March 22, 1991

From: Dennis G. Gnath

We received an phone call of inquiry from Jack Stephenson, ADOT, (Cordova) concerning the Eyak Lake Dam. He was interested in finding out who built the dam, and who was responsible for its maintenance. After reviewing the Eyak Lake waters file I contacted Kyle J. Cherry, State Dam Safety Engineer and asked those questions. Mr. Cherry did not know for certain who built the dam or who was responsible for its maintenance. However, in his estimation ADOT in Cordova would be his first contact. I returned Mr. Stephenson's call and relayed that response.

**PRINCE WILLIAM SOUND
REGIONAL FISHERIES PLANNING TEAM**

*Using Biology, Finance, Land, Engineering and
Public Input to rehabilitate Prince William Sound
fisheries.*

Alaska Dept. of Fish and Game
P.O. Box 669

Prince William Sound Aquaculture Corporation
P.O. Box 1110

Cordova, Alaska 99574

May 24, 1979

Mr. Walter Mantilla
Highways Maintenance Foreman
D.O.T. and P.F.
Cordova Station

Dear Walt,

Thank you for your letter of May 24, 1979, in reference to the Eyak Lake weir. This project can be likened to somebody being passed a fine Idaho potato fresh from the oven. Most everyone wants a taste of it, but it's just too gol' durned hot to handle. Of course, if we had hot pads there'd be no problem handling the potato. Thing is, hot pads cost money. Besides, whose potato is it? Now, as you recall, Don Statter, Director, Division of Harbors and Waters indicated to Carl Rosier, Director, Division of Commercial Fisheries (now Deputy Commissioner), (memo dated Sept. 14, 1978) that emergency repairs to the weir would probably run in the neighborhood of \$15,000. Via a telephone conversation with Bob Beck (Harbors and Waters) on Sept. 22, 1978, a balance of approximately \$4,200 was designated for additional emergency repairs. During this time frame (late September, 1978), you and I discussed verbally the placement of additional rock in areas of concern expressed by Perry Lovette as well as dressing the rocked-in face of the weir and placing signs in the flume area (boat slot during low water) to warn boaters of hazardous conditions. Although we concluded that the emergency repair work alleviated our immediate concern and warning signs were subsequently placed by the boat slot, we recognized, from public input, that improved boat access to and from Eyak Lake and Eyak River was needed.

On Sept. 21, 1978, Bob Beck supplied me (at my request) with a plan for a boat passage. Bob's estimated contract cost came to \$77,100. F.R.E.D. Division did not have this kind of money to appropriate for the project. Hence, Perry Lovette sought avenues of funding with no success. Even though the site is outside Cordova City Limits, the City could act to administer funds.

As time inexorably marched on, fewer pennies remained in the piggy bank and belts became tight. I understand that FY '80 allocations will be significantly reduced from last year. Another point to reflect on is that "our" Eyak Lake weir is not unlike the Ugly Duckling in the concept that we all seem to benefit from it, but nobody seems to want to claim ownership and the responsibility for its maintenance.

309

*file: Eyak Lake
Waters*

ALASKA DEPT. OF
FISH & GAME
MAY 29 1979
HABITAT
REGIONAL OFFICE

September 11, 1978

FG 79-II-64

Mr. Don Statter
Division of Harbor Design & Construction
Department of Transportation & Public Facilities
Pouch 2
Juneau, Alaska 99811

Re: Emergency Corrective Measures to Preserve Integrity of Eyak Lake Weir -
Cordova, Alaska (Section 27, R3W, T15S, C.R.)

Dear Mr. Statter:

The Alaska Department of Fish and Game has reviewed the proposed measures needed to preserve the integrity of the Eyak Lake weir by construction of a riprap abutment along the downstream face of the sheet piling. Pursuant to Alaska Statute 16.05.870(b), the Anadromous Fish Act, this work is approved subject to the following stipulations:

1. Disturbed river banks shall be returned to their original configuration and be suitably protected to prevent erosion excepting those segments immediately downstream of the weir which will have been covered by the abutment.
2. Riprap shall be clean shotrock. No material that will contribute to sediment loading of the river shall be used.
3. There is to be no fuel storage or equipment fueling within one hundred (100) feet of Eyak Lake.

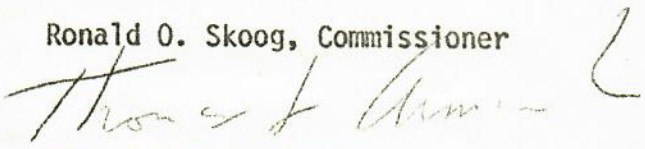
September 11, 1978

This letter is issued under the authority of the aforementioned statutory authority, constitutes a permit which expires 8 October 1978, and must be retained onsite. If there are any questions, please do not hesitate to contact us (telephone 344-0541).

Thank you for your cooperation.

Sincerely,

Ronald O. Skoog, Commissioner



for BY: Bruce M. Barrett
Projects Review Coordinator
Habitat Protection Section

cc: Officer W. Jones, FWP
ADEC, Anchorage
ADL, Anchorage

bcc: R. Logan
T. Trent
R. Nickerson
D. Daisy
~~Waters Fi~~e

ROS:BMB:TJA:kb

DRAFT

309

February 29, 1972

Miss Aurora Loss
Dept. of the Army
Corps of Engineers, Alaska Dist.
P.O. Box 7002
Anchorage, Alaska 99510

Re: NPA-72-22
Eyak River 4

Dear Miss Loss:

The Alaska Department of Fish and Game has reviewed the subject permit application by the Alaska Department of Public Works for a Department of the Army permit to construct a weir at the outlet of Eyak Lake near Cordova, Alaska.

This department has no objection to issuance of this permit.

We have the following comment: It would be desirable if this structure could be re-designed to allow monitoring and control of fish species passing through it.

Sincerely yours,

Sent Blm
2/29/72

COMMISSIONER'S OFFICE

	Initial	Copied	ASSIGNED TO:
<input type="checkbox"/> Commissioner	_____	_____	CO _____
<input type="checkbox"/> Executive Secty	_____	_____	PCS _____
<input type="checkbox"/> Deputy Comm	_____	_____	ADMIN _____
<input type="checkbox"/> Dep Comm/Fish	_____	_____	CFMD _____
<input type="checkbox"/> Director EIFA	_____	_____	H & R <input checked="" type="checkbox"/>
<input type="checkbox"/> Legislative Assist	_____	_____	SPORT FISH _____
<input type="checkbox"/> PSC Assist	_____	_____	SUBSISTENCE _____
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<input type="checkbox"/> Public Comm	_____	_____	

4850
State of Alaska

Department of Law

1995

0

w files prior to

legal value to us.
it.

DRAFT _____
RECOMMEND _____
REPLY DIRECT _____
COMMENTS _____

SIGNATURE: _____
GOV _____
COMM _____
DEP COMM _____
DEP COMM/FISH _____

LOG # 4850
DUE DATE _____
DEADLINE _____
Coord w/ _____
cc: _____

NR.

Special Instructions:

COMMENTS _____

FROM: COMMISSIONER'S OFFICE

5-25

MAY 19 1995

DEPARTMENT OF FISH & GAME
COMMISSIONER'S OFFICE

RECEIVED



MEMORANDUM

4850
State of Alaska

Department of Law

TO: Department of Fish & Game

DATE: May 17, 1995

FILE NO.:

TEL. NO.: 465-3600

SUBJECT: Files

BH
FROM: Beverly Haywood
Department of Law - Juneau

I am reviewing old Department of Law files prior to accession into archives or destruction.

The enclosed file has no historical or legal value to us. If you don't want the file, feel free to destroy it.

BH:prm

Enclosure

RECEIVED

MAY 19 1995

DEPT. OF FISH & GAME
COMMISSIONER'S OFFICE

Eyak Lake Project Datum.

10-23-70

Pre-earthquake

Post-earthquake

H.W. 1949 Flood

+10

+8

+6

+4

+2

0

-2

-4

-6

Eyak Lake
Water surface
range of
normal fluct.
recorded B.P.R.

H.W. 8/3/70

Recorded W.S.
range of
fluct. '69-'70

L.W. 5/4/70

Damages will occur
to private property
(many developments
constructed since '64
event on newly
exposed beaches)

Limits of
control as
proposed
by Consultant
Engineers.

Proposed dam
Collapsible section

Eyak Lake - Sea-level Datum

2
10-23-70

Base MLLW
Ocean Datum

Pre-earthquake

1964
Event

Post-earthquake

Land mass uplifted 6.20 ft.
in Eyak Lake area.

24

22

20

18

16

14

12

10

H.W. - 1949 Flood
(approx) 19.6

M.H.W. 15.0

Eyak Lake w.s.
Normal range of
fluctuations
recorded by
B. P. R.

M.L.W. 11.5

25.8

21.2

17.7

17.5

5/4/70 - 16.4

8/3/70 - 19.6

Proposed Dam
Collapse Section

Base of dam
11.5

Damages occur
to shore developments

STATE
of ALASKA

MEMORANDUM

TO:
Norman Gorsuch
Deputy Attorney General
Juneau

DATE :
April 26, 1972

FROM: *BRE*
B. Richard Edwards
Assistant Attorney General
AGO, Anchorage

SUBJECT: Your Request for current
assignment status

The assignment sheet which you attached to your request showed that I was assigned the Eyak Lake Dam Project and the case of Brown v. City of Anchorage, Workmen's Compensation appeal. Regarding the Eyak Lake Dam Project, it appears that the letters Exhibit "A" and Exhibit "B", attached hereto, from our file A22-06(71) explains that the project is bogged down because of lack of money. Thus, no further work has been required in this matter.

Regarding the Workmen's Compensation case, Brown v. City of Anchorage, it has been reassigned to Tim Middleton in our office.

In response to your request for a list of all other matters which I am assigned, please find attached hereto my personal docket sheet of cases for which I am responsible. In addition to these cases I am responsible for the following items:

1. Advising Division of Parks in rewriting and revising their entire set of regulations and on other matters;
2. Memorandum regarding price to be paid by the Division of Aviation to the City of Anchorage for Spenard Lake properties;
3. Advising Division of Lands on regulations and other matters;
4. Advising Division of Mines & Mineral's on regulations;
5. Advising the Alcoholic Beverage Control Board.

Attachments
BRE/jt

cc: John A. Reeder

STATE
of ALASKA

MEMORANDUM

TO: Cranston Haaland
Doyle Middleton
Edwards Wunnicke
Gibbs
Glennon

DATE : April 17, 1972

FROM: John Reeder SUBJECT: Current Assignment Status

Attached is a current assignment status request by Norm Gorsuch. I would appreciate your furnishing me with a copy of your response to Juneau.

JAR:me
Attach.

MEMORANDUM

TO: B. Richard Edwards

FROM: Norman C. Gorsuch
Deputy Attorney General

DATE : April 6, 1972

SUBJECT: Current Assignment Status

Attached hereto is a copy of your current assignments as reflected in our records.

I know that in some cases these assignments have been completed either through verbal or written communication. I also know that in some cases I was informed of the date on which these assignments were completed.

Please go over your assignment sheet and note thereon the date the assignment was completed and the method by which it was completed, (e.e., verbal, written).

Please give me a current status report on all assignments outstanding which have not as yet been completed.

In addition, please list any current assignments that are not listed in the assignment sheets.

I would like to have this information as soon as possible.

NCG:aw
Attachment

RECEIVED

Department of Law

APR 17 1972

Office of the Attorney General
Anchorage Branch
Anchorage, Alaska

B RICHARD EDWARDS

DATE	ATTORNEY	DUE	OUT	ASSIGNED BY	ASSIGNMENT	
129-71	✓ Edwards			Easley (F & G earlier request?)	Dam project Eyak Lake	Edwards
130-11	Edwards - Anch AGO			/ Labor WC Bd.	Brown vs. City of Anch. W C appeal	

Norman C. Gorsuch
Deputy Attorney General
AGO - Juneau

August 20, 1971

B. Richard Edwards
Assistant Attorney General
AGO - Anchorage

Eyak Dam Project - your letter
to The Honorable George Easley,
Commissioner, Department of
Public Works, dated Aug. 18, 1971

You have requested that I comment on the aforementioned letter. This letter appears to correctly and fully set out the situation of the Eyak Lake Dam project.

At this time it appears that it would be beneficial to the people around the Lake, and also the State, to inform those people by letter or news story, or some other means, that the State of Alaska does claim ownership to all Eyak Lake lands which were below the pre-earthquake mean high water mark. This might not only be beneficial, but may cause a lake riparian property owner to institute a lawsuit against the State to quiet his title. If that happened, it would be much cheaper for the State to determine the ownership of the subject land because the plaintiffs would have the burden of proving the issues involved. We could also move to have the remaining riparian owners joined as parties plaintiffs.

If you should have any questions on this matter, please contact me.

BRE:me
Encl.

AUG 20 1971

TO: [The Honorable George W. Easley
Commissioner
Department of Public Works

Office of the Attorney General
Anchorage Branch
Anchorage, Alaska

DATE: August 18, 1971

FROM: John E. Havelock
Attorney General

SUBJECT: Eyak Dam Project - Your
Letter to Mr. Lou Hasbrook,
July 13, 1971

By: Norman C. Gorsuch *mcg*
Deputy Attorney General

The department's current position with respect to this project is based upon the 1964 Attorney General's Opinion No. 6 and some additional research conducted by the staff.

It is our initial conclusion that the state is the probable owner of the land lying below the mean high water mark of Eyak Lake as that water mark was determined prior to the earthquake of 1964.

The only way to completely and definitively resolve this question is to institute a quiet title action. This type of lawsuit would be costly and time consuming. Absent such a lawsuit, no definitive determination can be made as to the ownership of the shorelands.

Such a lawsuit would require a request to the Department of Natural Resources to investigate and determine the extent of encroachments and claims on state lands below the high water mark of Eyak Lake. Although it is clear that the state's title is not diminished by any encroachments or claims, the evidence showing navigability on Eyak Lake, a necessary portion of the state's proof in establishing state title to the lands underlying the water of Eyak Lake, may be difficult to obtain. An additional issue in any such lawsuit would be the determination of the mean high water mark.

The evidentiary problem which would surface in any trial of this matter would be the question of whether or not Eyak Lake was a "navigable water" at the time of statehood and whether prior to statehood the federal government had conveyed any lands to the abutting owners which conveyance specifically included lands lying below the mean high water mark (this is unlikely). Of course, if the state could obtain a quitclaim deed to the lands which were below the pre-1964 mean high water mark, there would be no need for litigation.

The Honorable George W. Easley
Department of Public Works

August 18, 1971
- 2 -

Whether or not this project is ever constructed, a legal problem still exists if there are encroachments on our claims to the state land lying below the 1964 high water mark of Eyak Lake. It is clear that the state title to such land is not diminished by any encroachments or claims since it appears that state lands cannot be obtained by adverse possession, or any other involuntary means.

Until there is a specific appropriation and therefore specific funding available for the project, the department does not believe it would be a wise use of its resources to institute a long, costly quiet title to benefit a project that will either never be constructed or not constructed within the foreseeable future.

NCG:rw

cc: The Honorable Charles F. Herbert
The Honorable Wallace Noerenberg

Norman C. Gorsuch
Deputy Attorney General
AGO Juneau

August 6, 1971

B. Richard Edwards
Assistant Attorney General
AGO Anchorage

Eyak Lake Dam Project
Our File A22-06(71)
Your Memorandum dated
August 4, 1971

Enclosed please find the following items:

1. Letter dated January 12, 1971, from myself to Wallace H. Noerenberg, Commissioner, Department of Fish and Game, Juneau, regarding a meeting as to a plan to pursue the subject project;

2. A letter from Wallace H. Noerenberg to myself dated January 18, 1971, regarding the various problems involved in the Eyak Lake Water Stabilization Project;

3. Letter to John E. Havelock, Attorney General, from myself, dated February 3, 1971, requesting for his determination as to whether or not we should pursue a quiet title action on the lands surrounding Eyak Lake, notwithstanding the status of the water stabilization project;

4. Letter from John E. Havelock, Attorney General, dated February 8, 1971, answering my February 3, 1971 request; and

5. A copy of Attorney General Opinion No. 6, 1964, dated September 14, 1964.

Based upon the 1964 Attorney General Opinion and a week or two of my own research, it was my conclusion as of February 3, 1971, that the State was the probable owner of the land lying below mean high water of the Eyak Lake as that water mark was determined prior to the earthquake of 1964. The evidentiary problem which would surface in any trial of this matter would be whether or not Eyak Lake was a "navigable water" at the time of statehood and whether prior to statehood the Federal Government had conveyed any lands to the abutting owners which conveyance specifically included lands lying below the mean high water mark (this is unlikely). Of course, litigation would not be necessary in those cases where the State could obtain a quit-claim deed to the lands which were below the pre-1964 mean high water mark.

Norman C. Gorsuch
Deputy Attorney General
Page Two

Also at issue in such a lawsuit would be the determination of the mean high water mark. To say the least, this lawsuit could be very costly and time consuming.

In answer to my letter of February 3, 1971, it was the Attorney General's opinion that until we see that a State project is likely to be involved, we should not instigate a lawsuit in this matter.

If you should have any further questions on this project, please contact me.

Encls.

cc: Greg Papas
Assistant Attorney General

MEMORANDUM

State of Alaska

TO: B. Richard Edwards
Assistant Attorney General
Anchorage

DATE : August 4, 1971

FROM: Norman C. Gorsuch *NCG*
Deputy Attorney General
Juneau

SUBJECT: Eyak Dam Project

Please review and comment on status of this legal determination. Public Works and Fish and Game need some determination.

NCG:rw

Att: Papas' memo of 8/3/71

RECEIVED
Department of Law

AUG 6 1971

Office of the Attorney General
Anchorage Branch
Anchorage, Alaska

MEMORANDUM

State of Alaska

TO: [Norman C. Gorsuch
Deputy Attorney General

DATE: August 3, 1971

FROM: M. Gregory Papas *MGP*
Assistant Attorney General

SUBJECT: Eya~~g~~ Dam Project

The following information has been developed from Ed Huizer, Deputy Commissioner of Fish and Game and Gil Ziemer, Chief Engineer, Department of Fish and Game.

The project relates to a lake in the Cordova area whose level sank as a result of the earthquake. The lake itself had a history of somewhat wild fluctuation in water level and it was determined that a dam for water stabilization would be necessary. Following the earthquake the level of the lake sank considerably thereby exposing additional lands along the shoreline. Shoreline owners, claiming that they owned this additional exposed land, proceeded to utilize this newly created property. They have installed lawns and made other uses of this land. At least two rather costly homes have been constructed whose foundation abuts up against this newly created property. It is the intention of Fish and Game and the Department of Public Works to construct this dam which will raise the level of the lake, thereby possibly flooding these newly constructed improvements. The question then arose as to who was the owner of the new shorelines.

The question was originally submitted to Bill Spear of this office in July of 1970. It was his tentative conclusion that ownership of the new shoreline was in the abutting owner. However, he wished to have this conclusion confirmed and, therefore, the matter was submitted to the Anchorage Attorney General's office, Lands Division, for a final determination. Ziemer seems to recall that Dick Edwards in Anchorage was handling the problem. No final resolution has yet been obtained.

The matter is not presently crucial in that there are no time deadlines, contracts let, or bids about to be solicited. However, \$150,000 was appropriated by the 1970 Legislature of which about \$6,000 has been spent on feasibility studies. Naturally, both Fish and Game and the Department of Public Works are somewhat anxious to get started. However, the project will be delayed pending resolution of the legal problem. I, therefore, suggest that contact with Dick Edwards be made to determine his final conclusion in this matter.

MGP:rw

MEMORANDUM

State of Alaska

RECEIVED
Department of Law
FEB 11 1971

TO: B. Richard Edwards
Assistant Attorney General

Office of the Attorney General
Anchorage Branch
Anchorage, Alaska

DATE : February 8, 1971

SUBJECT: Eyak Lake Water Stabilization
Project, Your File A22-06(71)

FROM: John E. Havelock
Attorney General

Let's wait until we see whether any state project is likely to be involved before getting into a fight.

If there may be some evidentiary problem coming up, notify the Department(s) involved that they may wish to build a record.

JEH:jt

STATE OF ALASKA

WILLIAM A. EGAN, GOVERNOR

DEPARTMENT OF LAW

OFFICE OF THE ATTORNEY GENERAL / BOX 2170 - JUNEAU

1964 Opinions of the
Attorney General No. 6

September 14, 1964



The Honorable Phil R. Holdsworth
Commissioner
Department of Natural Resources
Juneau, Alaska

Re: Effect of Earthquake on Tideland Boundaries

Dear Commissioner Holdsworth:

You have requested our opinion on the ownership of shoreline property enlarged or reduced, gradually or suddenly, by the earthquake of March 27, 1964, and its after-effects.

Accretion is the increase of riparian land through the gradual deposit of various materials which create dry land out of that formerly covered by water.^{1/} Erosion is the gradual washing away of land bordering on a body of water by the action of that water.^{2/} Reliction is the uncovering, whether gradual or sudden, of land by the withdrawal of waters previously covering it.^{3/} Avulsion is a sudden and perceptible addition or loss to land by the action of water or otherwise.^{4/}

1/ St. Louis, I. M. and S. R. Co. v. Ramsey, 53 Ark. 314, 13 S.W. 931, 933 (1890)

2/ Oklahoma v. Texas, 268 U.S. 252, 45 S.Ct. 497, 69 L.ed. 937, 943 (1925)

3/ Jefferis v. East Omaha Land Co., 134 U.S. 178, 10 S.Ct. 518, 33 L.ed. 872, 875-6 (1890)

4/ Nebraska v. Iowa, 143 U.S. 359, 12 S.Ct. 396, 36 L.ed. 186, 187 (1892); Barakis v. American Cyanamid Co., 161 F.Supp. 25, 29 (1958)

The Honorable Phil R. Holdsworth
Juneau, Alaska

September 14, 1964

-2-

The means by which the change in shoreline occurs has significant legal consequences. If the location of the boundary of a tract of land at the mean high tide line is gradually and imperceptibly changed by accretion, erosion, or prolonged reliction, the margin of a tract at mean high tide, as so changed, remains the boundary. "Where . . . a boundary bank is changed by these processes, [accretion and erosion] the boundary, whether public or private, follows the change."^{5/} Lands eroded from a tract which, as a result, are below mean high tide are thereby revested in the State.^{6/}

On the contrary, if a tract undergoes sudden or violent change by reliction or avulsion, its boundaries remain the same and no change in ownership occurs.

"When land bordering a body of water is increased by accretion, . . . the new land thus formed belongs to the owner of the upland to which it attaches. . . . [Where] land [is] . . . lost by erosion, [it] returns to the ownership of the State. This is not the rule where the loss of the land occurs by avulsion, . . . the effect or extent of which is perceptible while it is in progress. In such cases, the boundaries do not change."^{7/}

In land precipitously lowered by the earthquake, the upland owner would have title out to the old high-water mark, regardless of the fact that the tract may now be partially submerged; if the owner previously owned the tidelands, he would still own the land out to his old low-water mark boundary. The character of the body of water as tidal, non-tidal, navigable or non-navigable is immaterial as respects the application of

^{5/} Oklahoma v. Texas, 268 U.S. 252, 45 S.Ct. 497, 69 L.ed. 937, 943 (1925)

^{6/} AS 44.03.020

^{7/} Arkansas v. Tennessee, 246 U.S. 158, 38 S.Ct. 301, 62 L.ed. 638, 647 (1918); In re City of Buffalo, 206 N.Y. 319, 99 N.E. 850, 852 (1912)

The Honorable Phil R. Holdsworth
Juneau, Alaska

September 14, 1964
-3-

the rules relating to sudden reliction and avulsion. The rules governing changes of boundaries of tidelands and uplands are equally applicable to the State and to private persons.^{8/}

When land shifts occur by earthquake-generated avulsion, then, the element of suddenness creates a situation where no change occurs in the limits of State boundaries or private tracts; the old State and private boundaries, submerged or otherwise, survive.^{9/}

Briefly, then, these are the answers to your specific questions:

(a) Boundaries follow accretion and erosion because the change is gradual; boundaries do not change where land displacement occurs suddenly, as through avulsion or some kinds of reliction.

(b) State ownership of tidelands is measured by the old boundaries where sudden earthquake displacement has occurred.^{10/}

(c) Yes, the boundaries of tidelands set by pre-earthquake survey are fixed. See (a) and (b).

(d) Where old tideland boundaries were surveyed and known, they must be followed. Presumably, unsurveyed tideland

^{8/} Waynor v. Diboff, 9 Alaska 230, 232 (1937). See also Footnote 5, supra.

^{9/} Louisiana v. Mississippi, 282 U.S. 458, 465, 51 S.Ct. 197 (1931)

^{10/} However, boundaries may be changed by State action and Congressional assent. Then, of course, the new mean high tide mark could be used to ascertain the extent of tidelands ownership. U. S. v. Louisiana, 363 U.S. 1, 8-9 (1960). c.f.: 43 U.S.C.A. 1311. Ownership of submerged lands.

Opinion No. 6

The Honorable Phil R. Holdsworth
Juneau, Alaska


September 14, 1964

-4-

boundaries may now be surveyed and specified according to presently existing land contours, as there are no previously established boundaries to recognize.

We trust this information will be of help to you.

Yours very truly,


WARREN C. COLVER
ATTORNEY GENERAL

WCC/rg

cc: William A. Egan
Governor

Floyd L. Guertin, Commissioner
Department of Administration

MEMORANDUM**State of Alaska**TO: **John E. Havelock
Attorney General**DATE : **February 3, 1971**

FROM:

**B. Richard Edwards
Assistant Attorney General**SUBJECT: **Eyak Lake Water Stabilization
Project, our File A22-06(71)**

Reference is made to the letter of Wallace H. Noerenberg, Commissioner of Fish and Game, a copy of which is attached hereto.

It appears from this letter that the subject project is awaiting proper funding and a decision as to which type of dam structure is to be used to refill Eyak Lake to its pre-earthquake level.

Regardless of whether this project is built, a legal problem may still exist if there are encroachments on or claims to the state lands lying below the pre-1964 earthquake high water mark of Eyak Lake. It is clear that the State's title to said land is not diminished by any encroachments or claims since it appears that state lands cannot be obtained by adverse possession, or any other involuntary method.

This memo is a request for you to determine whether or not we should pursue a quiet title action at this time, notwithstanding the status of the water stabilization project. Such a pursuit would require a request of the Department of Natural Resources to investigate and determine the extent of encroachments and claims on State lands below the high water mark of Eyak Lake. Although it is clear that the State's title is not diminished by any encroachments or claims, the evidence showing navigability of Eyak Lake, a necessary portion of the State's proof in establishing State title to the lands underlying the water of Eyak Lake, may become difficult to obtain.

**BRE:me
Encl.**

MEMORANDUM

State of Alaska

RECEIVED
Department of Law

JAN 20 1971

TO:

B. Richard Edwards
Assistant Attorney General
Department of Law
Anchorage

DATE : January 18, 1971

FROM:

Wallace H. Noerenberg *WHN*
Commissioner
Department of Fish and Game

SUBJECT: Eyak Lake Water Stabilization
Project (A. G. File A-22-06(71))

I refer to your letter of January 12, 1971 on the above subject.

Following receipt of the Consultant's report on the Eyak Lake project in October 1970, representatives of our department, Public Works, and Law did meet with the Administrative Assistant to the Governor, Mr. McMurtrey.

As I recall the meeting, its objective was primarily to inform the Governor's Office of the receipt of the report and the principal problem created, i. e. an engineers estimate for project costs which far exceeds the \$150,000 appropriated for said project by the 1970 legislature.

The problem points can be summed up simply: this watershed is subject to extremely high flows intermittently due to frequent heavy rains; while the installations, inhabitants, etc. surrounding the lake were adjusted to anticipate such lake level fluctuations prior to the 1964 earthquake, some inhabitants private installations encroached the lakeshore to lower elevations as the lake level dropped following the earthquake. In proposing to build a water regulating dam at the outlet to refill the lake to its pre-earthquake level, the State has been concerned from the start of its liability with regard to the "encroaching" land owners. The consultant report proposes to build a far more expensive installation than originally envisioned--i. e. one which has automatic dumping capabilities to eliminate the threat of pre-earthquake flood levels.

I expect the new administration will take another look at solutions to the dollar deficiency problem. The Department of Law should be prepared with answers to the liability problem under the construction options--low cost fixed structure vs high cost non-fixed structure.

Because the project is critical to viability of the specific fish stocks utilizing Eyak Lake, my department will continue to search for a solution. Several other "user" groups are also involved, most of which are for the project. I will contact you regarding a meeting, if necessary, following discussions with Mr. Easley, Mr. Havelock and others.

cc: Attorney General Havelock
Commissioner Easley, Public Works

MEMORANDUM**State of Alaska**BRE
1/12/71TO:

Wallace M. Noerenberg
 Commissioner
 Department of Fish and Game
 Juneau

DATE : January 12, 1971

FROM: JOHN E. HAVELOCK
 ATTORNEY GENERAL

SUBJECT: Eyak Lake Water Stabilization
 Project
 Our File A22-06 (71)

By: B. Richard Edwards
 Assistant Attorney General
 Attorney General's Office
 Anchorage

It appears at this time that I am the attorney in the Attorney General's Office assigned to handle the above referenced matter.

In reviewing the material which I have on the project, it appears that E. J. Huizer, Deputy Commissioner of the Department of Fish and Game, in a letter to former Lieutenant Governor Robert W. Ward, dated October 15, 1970, proposed a meeting with the Lieutenant Governor, representatives of the Departments of Fish and Game, Public Works, and Law to review the implications of the various problems involved in this project.

Apparently no such meeting was held. I feel that such a meeting is necessary to determine a suitable course to take on this project, especially in view of the legal problems involved.

If you still plan to pursue this project and wish to have the above referenced meeting, please inform me of the time and place and I will be there.

BRE/jt

cc: John E. Havelock, Attorney General
 George Easley, Commissioner
 Dept. of Public Works

STATE OF ALASKA
Inter-Department Route Slip

State Rep.

TO: _____
DEPT.: Law
ATTN.: G. Kent Edwards

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| <input type="checkbox"/> Prepare Reply | <input type="checkbox"/> Necessary Action |
| <input type="checkbox"/> For Your File | <input checked="" type="checkbox"/> Your Information |

Remarks:

Gotta
Please reply.
Not needed
Lead 7-13

From: _____
Dept.: Fish & Game Date 6-16
By: Warrenberg

MEMORANDUM**State of Alaska**RECEIVED
Department of LawTO: G. Kent Edwards
Attorney General
Department of LawJUN 17 1970
AM PM
7,8,9,10,11,12,1,2,3,4,5,6

DATE : June 15, 1970 ▲

FROM: Wallace H. Noerenberg *W.H.N.*
Commissioner
Department of Fish and GameSUBJECT: Alteration of Water Surface
Elevation Eyak Lake - Cordova
Area

The 1970 Legislature authorized and funded the construction of a water level control structure at the outlet of Eyak Lake near Cordova. An engineering consultant will be engaged by the State (Department of Public Works) to develop design critiques and to prepare construction estimates, plans and specifications. A 1969 preliminary report setting out pertinent items is attached.

What procedures are necessary to establish a legal water surface elevation for the lake level control structure proposed to be constructed?

Enclosure

Capital improvements :::

April 15, 1969
G. L. Ziener, Engineer

PRELIMINARY REPORT

EYAK LAKE - CORDOVA - SUMMARY

I. Problems and Conditions

- (1) Elevation change - contiguous area was uplifted approximately 6 1/2 feet by 1964 earthquake.
- (2) Lake elevation control - prior to 1964 event, was by backwater effect of tidewater in Eyak River.
- (3) Lake elevation control - presently is lowered due to uplift and removal of backwater effect, probably by as much as the 6 1/2 ft. change.
- (4) Results of lowered level - adverse effects probable in several fields including:
 - a) Recreation, boating, beaches, picnicking, etc.
 - b) Aviation - weed growth due to shallowing, haulout, etc.
 - c) Fisheries - brooding salmon due to uncovering of spawning beaches - rearing smolts due to weeds, loss of oxygen, etc.
 - d) Homesites - loss of value to shore property.
 - e) Arcawide vista - the lake-on-edge-of town value to whole community.
 - f) Commercial boating - to tidewater.

II. Hydrological Aspects

- (1) Eyak water surface level on 2-18-69 was lowest (to that date) in recent times at 3.3 feet lower than the recorded water level in 1950 (when the BPR bridge was built across outlet.)
- (2) The maximum flooding between 1964 earthquake and January 1969 occurred in 1966. That H.W.L. was 2.2 feet higher than 1950 Eyak Lake level and 6.5 feet higher than the 2-18-69 low surface level.

- (3) The maximum flood of record (Power Creek-tributary to the lake) occurred in 1958. A flood of that magnitude can be expected with a once-in-21 year frequency. Every recurrence of that, or greater, magnitude will flood existing shore properties and developments without existence of any dam or outlet control.
- (4) The floor level of Les Maxwell's house is less than 1.5 feet higher than the 1966 H.W.L. His sewerage system would be covered with water by recurrence of 1966 H.W.L. and his water supply might become contaminated. The neighboring house (Harold Pernula) might also be adversely affected. Recurrence of 1958 magnitude flood would probably cause significant damage to these (and other?) properties.
- (5) Backwater effects from a dam constructed at the outlet of Eyak Lake can be only roughly calculated with existing records.
- (6) Flooding of shore properties can be expected from natural causes and events without an outlet control dam. A spillway capacity and configuration can be designed which would not significantly increase the lake flood damage but proving that point might be outright impossible to a lay public. Accumulation of data to do such a design would require funding for gaging stations and take several years.
- (7) An outlet control structure with a normal crest elevation approximately equal to the recorded 1950 natural lake level would be a supportable goal. It would come short of reestablishing a pre-earthquake regimen but might avoid some very obvious legal tangles while affording some real benefits, albeit, a compromise.

III. Legal Aspects

- (1) Uplift (and lowered lake surface elevation) was a natural phenomenon.
- (2) Ownership of (freshwater) shore lands grants to the fee holder certain riparian rights among which may be the increase or extension of the boundaries of land by action of natural forces.

- (3) Some freeholders have constructed improvements on their properties since the earthquake which could be adversely affected by restoration wholly or in part, of pre-earthquake lake water levels.
- (4) Legal research and definition must be done to establish public interest, rights, procedures, and authority to alter, artificially, the presently existing natural regimen of the Eyak Lake complex.
- (5) Authority to proceed and designation of the agency to be responsible may require legislative action, provided flowage rights can be secured by or are extant in the public.

IV. Economic Aspects

- (1) An appraisal must be made of the realms of damage/depreciation and of costs/benefits to all of the several aspects (set out in I-(4) above), and the financial involvement for each determined.
- (2) Such an evaluation should help define the degree of restoration to be sought, if any.

V. Authorization and Funding

- (1) Definition and provision required:
 - a) Legislative (?)
 - b) Participation by all benefited parties (?)
 - c) Program leadership (?)

MEMORANDUM**State of Alaska**

TO: Robert W. Ward
 Lieutenant Governor
 State of Alaska

DATE : October 15, 1970

FROM: E. J. Huizer *EH*
 Deputy Commissioner
 Department of Fish and Game

SUBJECT: Eyak Lake Water Stabilization
 Project

Attached for your information is a copy of the Feasibility Study for the Eyak Lake Project which was recently completed by Mrs. Ryan of Lyon Associates, Inc. In addition to the involvements by the Departments of Public Works and Fish and Game with Eyak Lake Project, the Department of Law has been intensively reviewing the legal implications involved in the project.

Of immediate concern is the budget cost estimate on page 37 of Mrs. Ryan's report. The total estimated budget, excluding engineering design costs, is \$346,000. The addition of an estimated 10% engineering design cost will raise the total cost to \$380,600 which is more than twice as much as the \$150,000 approved by the legislature in the FY 70-71 Capital Improvement Program.

It is my recommendation that a meeting be called at the earliest opportunity with you and representatives of the Departments of Fish and Game, Public Works, and Law to review the implications of the engineering report and the legal problems involved so that a suitable course of action can be devised before the engineering report is released to the public. Pending your review of the report and action regarding a meeting as suggested in this memorandum, the Department of Fish and Game will hold all copies of the report and will not notify Representative Borer, who of course, is most directly concerned with the project.

cc: Dave Peterson, Public Works
 Bill Spear, A.G.'s Office
 Gil Ziemer, F&G Engineering

Enclosure

RECEIVED
 Department of Law

OCT 16 1970
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STATE OF ALASKA
Inter-Department Route Slip

TO: _____
DEPT.: Law

ATTN.: H Kent Edwards

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Remarks: 8-7
SPEAR

From: _____
Dept.: Fish & Game Date 8-6

By: Norrenberg

MEMORANDUM

State of Alaska

RECEIVED
Department of LawTO: G. Kent Edwards
Attorney General
Department of LawAUG 7 1970
AM
7,8,9,10,11,12,1,2,3,4,5,6 PM

DATE : August 5, 1970

FROM:

Wallace H. Noerenberg *WHN*
Commissioner
Dept. of Fish and GameSUBJECT: Procedures on Eyak Lake
Project I

The possibilities of conflicting interests developing in the construction planning for the water level control construction at Eyak Lake, Cordova, requires that our procedural approach be free of ^{legal}~~equal~~ error. We would very much appreciate your early attention and response to our June 15, 1970 request (copy attached).

Enclosure

MEMORANDUM

State of Alaska

TO: G. Kent Edwards
Attorney General
Department of Law

DATE : June 15, 1970

FROM: Wallace H. Noerenberg *W.H.N.*
Commissioner
Department of Fish and Game

SUBJECT: Alteration of Water Surface
Elevation Eyak Lake - Cordova
Area

The 1970 Legislature authorized and funded the construction of a water level control structure at the outlet of Eyak Lake near Cordova. An engineering consultant will be engaged by the State (Department of Public Works) to develop design critiques and to prepare construction estimates, plans and specifications. A 1969 preliminary report setting out pertinent items is attached.

What procedures are necessary to establish a legal water surface elevation for the lake level control structure proposed to be constructed?

Enclosure *2* *Apr 15-1969 Preliminary Report - Eyak Lake - Summary*

WHN:GZ:hb