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DRAFT

B. Rogers

SUSITNA STUDIES

Alt Hydro Sites

REVIEW OF SOUTHCENTRAL ALASKA HYDROPOWER POTENTIAL FAIRBANKS AREA

Prepared For:

Department of the Army
Alaska District
Corps of Engineers

Prepared By:

CH2M HILL
Anchorage, Alaska

October, 1978

TABLE OF CONTENTS

INTRODUCTION

An alternative to meeting future energy needs in Alaska is hydroelectric power. To study this hydroelectric alternative, the Alaska Power Administration and the U.S. Army Corps of Engineers identified 29 potential hydroelectric sites in the Southcentral Railbelt area of Alaska in the Fairbanks area north of Talkeetna.

The U.S. Corps of Engineers retained CH2M HILL to complete this preliminary study of the identified sites. The work consisted of gathering reconnaissance level data from various pertinent sources, correlating the information, and identifying the degree of potential acceptability of the sites relating to environmental and land use constraints.

APPROACH

Governmental agencies who were asked for evaluation input to this study include the Alaska Department of Fish and Game, the U.S. Fish and Wildlife Service, the Joint Land Use Planning Commission of Alaska, and Alaska State Division of Lands. Input was also requested from conservation/environmental groups. Each agency or group was asked to evaluate environmental concerns in areas of their expertise.

Coordination meetings with these groups were held to establish rating criteria for the environmental and land use subjects concerned. From these initial meetings a final evaluation package for the 29 sites was prepared (Appendix A). This package included the following:

- A list of potential hydroelectric sites.
- Index map that showed general site locations.
- 1:250,000 maps showing more specific site location with project information such as dam height. (Appendix B)
- Evaluation sheets for specific environmental evaluations.

When completed, the evaluation sheets were returned to CH2M HILL. Each of the 29 potential hydroelectric sites was then categorized for environmental potential and summarized in this report.

RATING CRITERIA

CH2M HILL met with the U.S. Fish and Wildlife Service, the Alaska Department of Fish and Game, the Joint Land Use Planning Commission, and the Alaska Department of Natural Resources, Division of Lands. From discussions with these groups, rating criteria and evalution scales were established for each agency. These criteria are listed here to give a broad view of the topics involved in the evaluation.

Fisheries and Wildlife:

- Effects on resident and anadromous fisheries.
- Pressure to threatened or endangered species.

- Critical habitat for significant populations of fishes and wildlife.

- Unique natural features or ecosystems.

- Likely major adverse environmental impacts.

- Other specific impacts as determined during the study.

- Evaluation scale: unacceptable, conditional, least conflict.

Division of Lands:

- Sociological impacts of project locations.

- Water rights and land ownership status.

- Other specific impacts as determined during the study.

- Evaluation scale: acceptable, conditional, unacceptable.

Joint Land Use Planning Commission of Alaska:

- Land use and classification of locations.

- Length and route of power transmission lines and access roads.

- Increased access to wilderness areas.

- Other specific impacts as determined during the study.

- Evaluation scale: acceptable, conditional, unacceptable. (This was determined by CH2M HILL based on the above information provided by the Commission.)

List of Study Participants and Contacts -- Fairbanks Area

Agency	Contact
Alaska Department of Fish & Game	Bruce Barrett Scott Grundy
U.S. Fish & Wildlife Service	Mike Smith Mel Munson Jerald Stoebele
National Marine Fisheries Service	Brad Smith Ron Morris
Land Use Planning Commission	Tom Hawkins Sue LeFever
Alaska Division of Lands	Brent Petrie John Morris Mike Steele Vince McQuillan
Trustees for Alaska	Bill Rice
Alaska Center for the Environment	Paul Lowe

METHOD OF EVALUATION OF LAND USE CONFLICTS

The Alaska Land Use Planning Commission provided the information on land use status for the sites. The relative evaluation was made from this data by CH2M HILL. (Appendix D)

The evaluation scale was determined as follows:

a. Scale Increment: Unacceptable

A site was rated "unacceptable" for one of two possible reasons: (1) the site was within a park, where such development would not be permitted. This condition would make a site unacceptable, no matter the other factors involved; (2) the site was located in lands withdrawn by Secretary of Interior Morton under section D-2. These lands have yet to be established by U.S. Congressional legislation. As the boundaries have changed somewhat since Morton's action, and will probably be altered further before the issue is resolved, the "unacceptable" rating under D-2 does not eliminate a site completely, but since the chances of acceptability are dubious, the low rating was given.

b. Scale Increment: Conditional

The rating of "conditional" was given a site for the following reasons: (1) access by road was difficult or distant, or (2) the location was on Native selected lands. Twice as much land has been selected than will be transferred to the native population. In some areas, the native interest is a percentage of the total. In areas which are transferred to native control, the corporations must be involved in the decision of whether or not to develop the given hydroelectric site(s).

c. Scale Increment: Acceptable

The term "acceptable" in this case, means that no major objections have been voiced about the site at the time of this report. In most instances, further research is required to determine the land use status of the site. For example, the State of Alaska Division of Lands was not able to provide information on the state lands involved within the time frame of this report. Hence, all state lands were indicated as "acceptable".

The Alaska Division of Lands (Land and Management) was not able to contribute to this report (letter in Appendix E).

METHOD OF EVALUATION OF ENVIRONMENTAL CONDITIONS

Fish and wildlife habitat conflicts with the potential hydroelectric sites were evaluated by Alaska Fish and Game and National Marine Fisheries Service; these evaluations were used to determine the ranking groups of the various sites. The U.S. Fish and Wildlife Service was not able to complete a portion of the evaluations for this report due to unfortunate internal circumstances. Two environmental groups, Trustees for Alaska and Alaska Center for the Environment, also made evaluations and comments; these have been included in the individual site sheets in Appendix D. It must be noted that the emphasis in these evaluations was on elimination of poor sites and that those sites which were found "least conflict" or "conditional", are expected to be researched further before the agency gives approval to any site in this study.

EXPLANATION OF RANKING GROUPS

To determine a relative order of projects from most likely potential to least likely potential, the general evaluations of "unacceptable", "conditional", and "least conflict" were assigned numerical magnitudes of "0", "5", and "10", respectively. The ranking groups were based on an average of input from the Alaska Fish & Game (FG), the U.S. Fish & Wildlife Service (FW), the National Marine Fishery Service (NMF) and information from the Land Use Planning Commission. Order within the groups was determined from input from the Alaska Center for the Environment, Trustees for Alaska and transmission access.

The lowest ranking group (6) includes all sites which were found unanimously unacceptable by fish and wildlife agencies or sites where such projects would doubtlessly be in conflict with proposed land uses. In these cases, the site was given a "0" in the overall results. All other sites were ranked according to the overall average of the various inputs calculated for each site, as indicated in Appendix C.

POTENTIAL ACCEPTABILITY OF SELECTED SITES
FAIRBANKS AREA

LIST OF RANK GROUPS

Rank Group	Site	Comments
1	59 Totatlanika	Large size may be problem. Assumes operation with poorly rated Carlo (57)
2	19 Iron Creek	Access may be a problem.
3	29 Deadman Creek	Access and large size could be obstacles.
	56 Healy	May have some fisheries difficulty.
	58 Bruskasna	Assumes operation with poorly rated Carlo (57).
	8 Lake Creek Upper	May have access and fisheries difficulties.
4	55 Yanert #2	On native selected lands with possible fisheries conflict.
	52 Teklanika River	On D-2 land with access and fisheries difficulties.
	53 Browne	Fisheries difficulties.
	54 Walker Creek	Fisheries difficulties.
5	48 Gulkana River	On D-1 land with size, access and fisheries problems.
6	15 Lower Chulitna	Very poor sites from environmental and land use aspects.
	16 Tokichitna	
	17 Talkeetna River (Sheep)	
	18 Keetna	
	20 Granite Gorge	

21 Greenstone

22 Trapper

23 Lucy

24 Coal

25 Ohio

26 Chulitna Hurricane

27 Gold

49 Vachon Island

50 Junction Island

51 Kantishna River

57 Carlo

60 Salcha River

61 Tanana River (Little Delta)

CONCLUSIONS & RECOMMENDATIONS

The Table of Potential Acceptability of Selected Sites indicates the ranking of the various sites. Those in rank group 6 are unacceptable. Those in rank groups 1, 2 and 3 have the greatest probability of being acceptable for environmental and land use reasons. Final ratings and/or suitability would require additional research and evaluations. These must of necessity consider other factors which are beyond the scope of this report.

Agencies and groups who could give significant input to further investigation are the following:

State of Alaska Department of Fish & Game
U.S. Fish & Wildlife Service
State of Alaska Division of Parks
National Marine Fisheries Service
State of Alaska Division of Lands
National Parks & Recreation
Alaska Center for the Environment
Trustees for Alaska
Alaska Conservation Society (Fairbanks)
Fairbanks Environmental Center
Denali Citizens Council (Talkeetna)

APPENDIX A
EVALUATION PACKAGE

INTRODUCTION TO EVALUATION PACKAGE

An alternative to meeting future energy needs in Alaska is hydro-electric power. To study the hydro-electrical alternative, the Alaska Power Administration and the U.S. Army Corps of Engineers have identified 61 potential hydro-electric sites. These sites are located in the South-central Railbelt area of Alaska, with 29 sites in the Fairbanks-Tanana Valley area and 32 sites in the Anchorage-Cook Inlet area.

The objective of this study is to collect reconnaissance grade data on each site; the scope of this work is only concerned with environmental and land use considerations and land use aspects. Various governmental agencies and concerned citizens have been asked to evaluate these sites. From these evaluations each of the 61 potential sites will be categorized as to its environmental and land use acceptability.

Governmental agencies being asked for evaluation input to this study include the Alaska Department of Fish and Game, the U.S. Fish and Wildlife service, the Joint Land Use Planning Commission of Alaska, Alaska State Division of Lands, and the U.S. Army Corps of Engineers' environmental permit section. Input is also being requested from conservation/environmental groups in both the Anchorage and Fairbanks areas. Each agency or group is being asked to evaluate environmental concerns in areas of their expertise. The range of information being evaluated includes the following:

1. Pressure to threatened or endangered species
2. Effects on resident and anadromous fisheries
3. Critical habitat for significant populations of wildlife
4. Unique natural features or ecosystems
5. Length and route of power transmission lines and access roads
6. Increased access to wilderness areas
7. Sociological impacts of project locations
8. Likely major adverse environmental impacts
9. Land use and classification of locations
10. Other site specific impacts as determined during this study.

Coordination meetings with various groups were held to establish criteria for rating each of the specific information listed above. From these initial meetings a final evaluation package for the 61 sites was prepared. Attached is this package, which includes:

- A list of potential hydro-electric sites.
- Index map that shows general site locations.
- 1:250,000 maps showing more specific site location with project information such as dam height.
- Evaluation sheets for specific environmental evaluations.

When completed, the evaluation sheets are to be returned to CH2M HILL. Each of the 61 potential hydro-electric sites will then be categorized for environmental acceptability and a report prepared for the Corps of Engineers.

CH2M HILL's contract schedule requires that the evaluation study be completed by 17 October 1978. Based on this deadline, the following is the tentative study schedule:

• Initial agency or group contact	2 October
• Meeting with agencies to establish rating criteria	4 October
• Evaluation package sent to each agency or group	9 October
• Agency or group evaluations completed	13 October
• Final report submitted	17 October

The above schedule is very tight and will require considerable effort by all groups. The efforts of those involved will be deeply appreciated. Time permitting, and as desired, the final study will be reviewed with those interested.

RATING CRITERIA

CH2M HILL met on 4 October 1978 with the U.S. Fish and Wildlife Service and the Alaska Department of Fish and Game, and later that day with the Joint Land Use Planning Commission and the Alaska Department of Natural Resources, Division of Lands. From the discussions with these groups, a rating criteria and evaluation scale have been established for each agency. These criteria are listed here to give a broad view of the topics involved in the evaluations.

The importance of input in the "Comment" columns must be emphasized. These remarks will play an important part in the evaluation by CH2M HILL combining the input from all the various agencies.

Fisheries:

- Effects on resident and anadromous fisheries.
- Pressure to threatened or endangered species.
- Critical habitat for significant populations of fishes.
- Unique natural features or ecosystems.
- Likely major adverse environmental impacts.
- Other specific impacts as determined during the study.
- Evaluation scale: unacceptable, conditional, least conflict.

Game & Wildlife:

- Pressure to threatened or endangered species.
- Critical habitat for significant populations of wildlife.
- Unique natural features or ecosystems.
- Likely major adverse environmental impacts.
- Other specific impacts as determined during the study.
- Evaluation scale: unacceptable, conditional, least conflict.

Division of Lands:

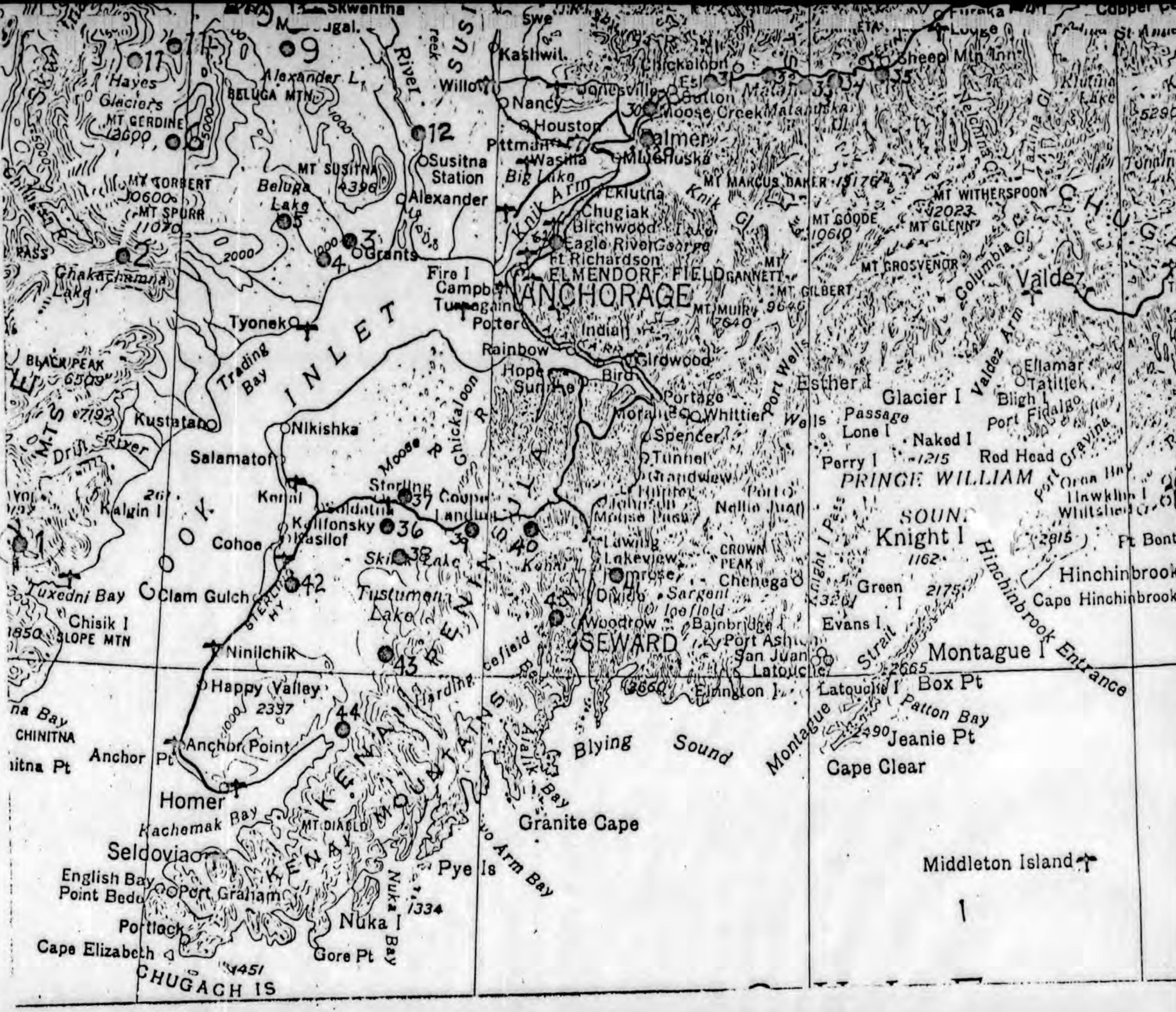
- Sociological impacts of project locations.
- Water rights and land ownership status.
- Other specific impacts as determined during the study.
- Evaluation scale: acceptable, conditional, unacceptable.

Joint Land Use Planning Commission of Alaska:

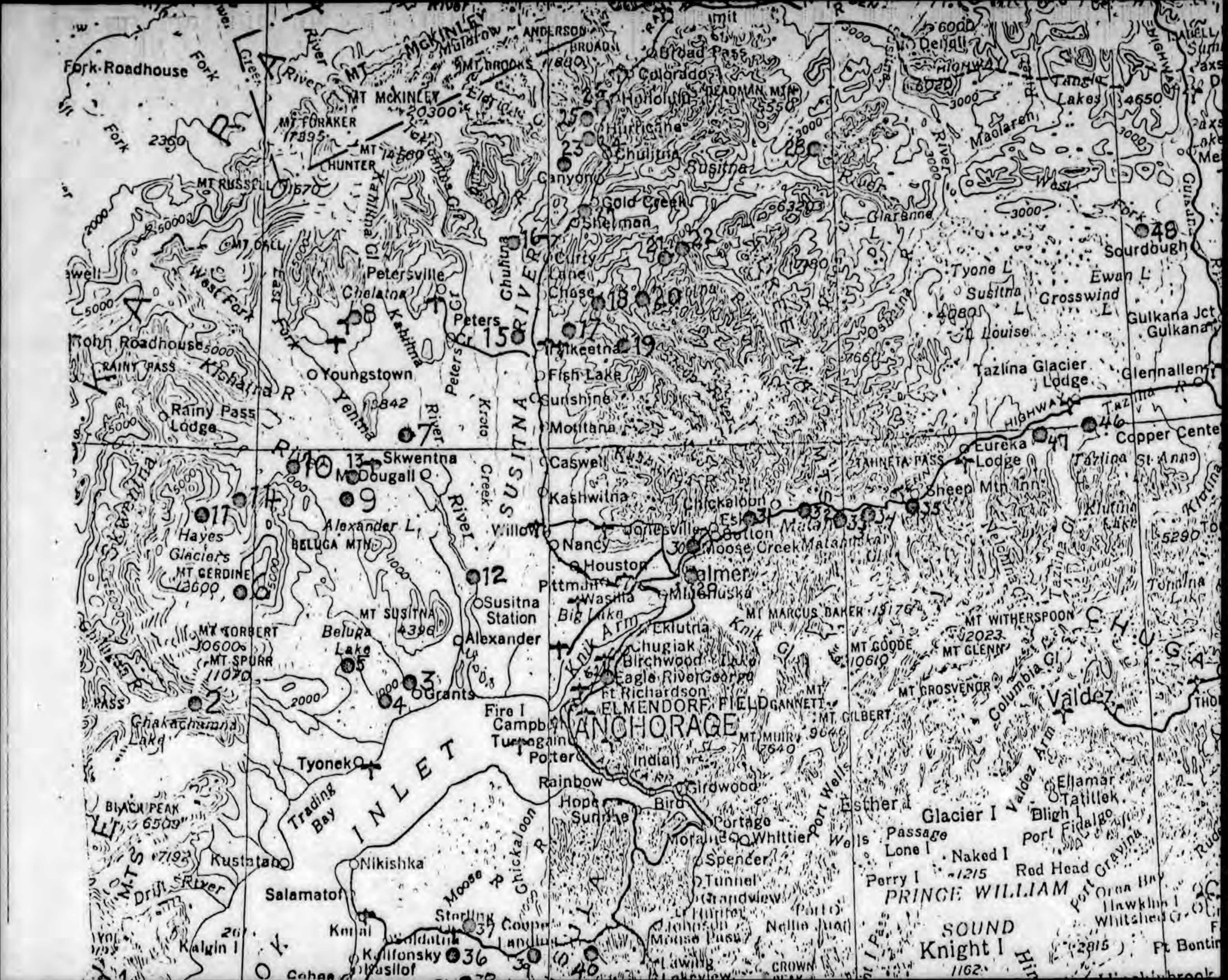
- Land use and classification of locations.
- Length and route of power transmission lines and access roads.
- Increased access to wilderness areas.
- Other specific impacts as determined during the study.
- Evaluation scale: acceptable, conditional, unacceptable.

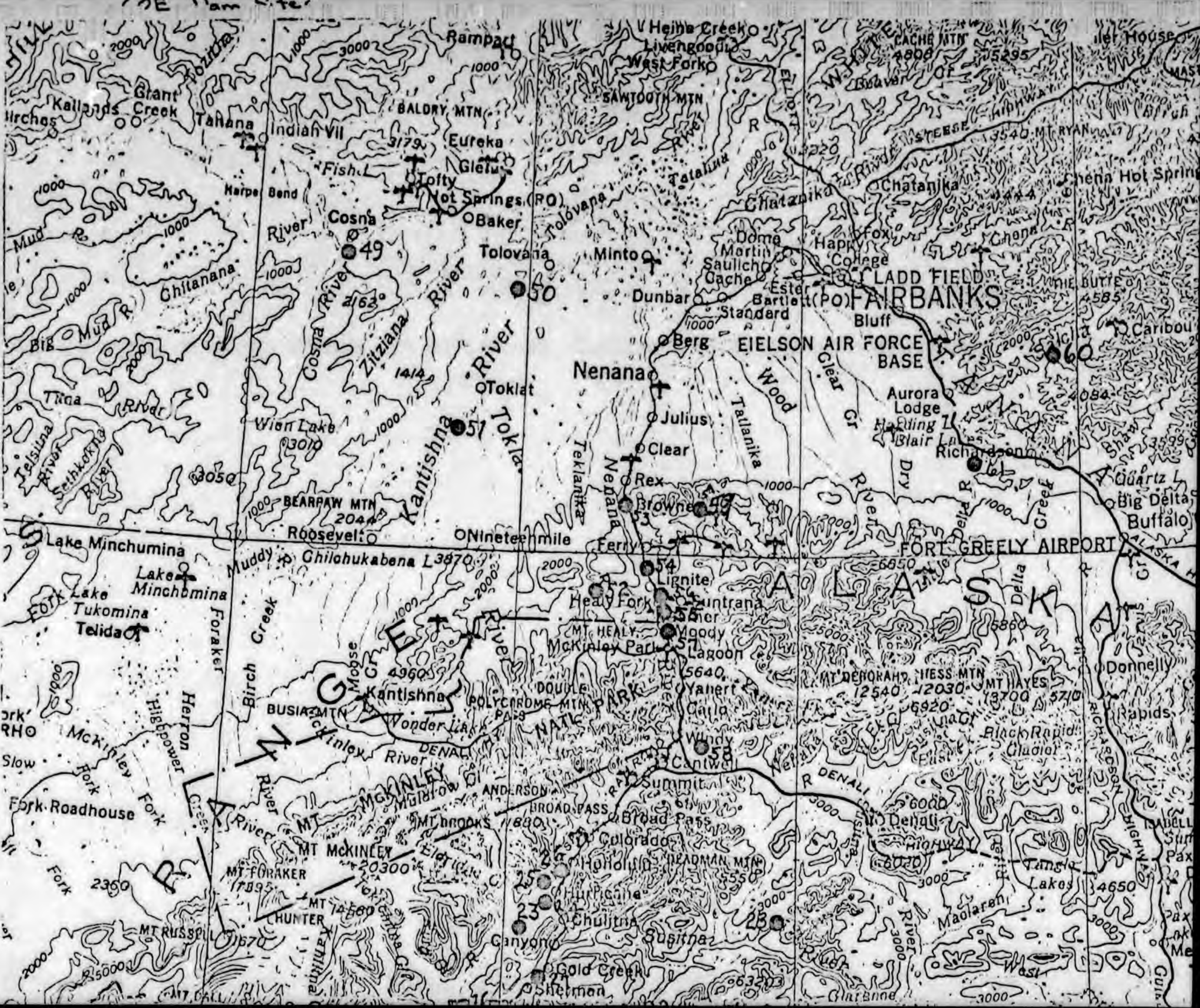
INDEX MAPS

(Showing Approximate Site Locations)



Skwentha
Kashwit
Chickaloon
Sutton
Moose Creek
Sheep Mtn Inn
Lodge
Hayes Glaciers
MT GERDINE
Alexander L.
BELUGA MTN
Willow
Nancy
Houston
Palmer
Pittman
Wasilla
Matanuska
Susitna Station
Alexander
MT SUSITNA
Beluga Lake
Big Lake
Knik Arm
MT TORBERT
MT SPURR
Eklutna
Chugiak
Birchwood
Eagle River
Ft Richardson
ELMENDORF FIELD
ANCHORAGE
MT MARCUS BAKER
MT WITHERSPOON
MT GOODE
MT GLENN
MT GROSVENOR
MT GILBERT
MT MUIR
Columbia Gl
Valdez
Grants
Fire I
Tyonek
Trading Bay
INLET
Potter
Rainbow
Indian
Girdwood
Hope
Sunrise
Bird
Portage
Whittier
Port Wells
Esther I
Ellamar
Tatitlek
Bligh I
Port Fidalgo
Valdez Arm
Glacier I
Passage
Lone I
Naked I
Perry I
Red Head
PRINCE WILLIAM
SOUND
Knight I
Chickaloon
Nikishka
Kustatan
Salamatof
Kenai
Sterling
Kalgin I
Cohoe
Kasilof
Spencer
Tunnel
Moose Pass
Lawing
Lakeview
Divide
Woodrow
SEWARD
Chenega
CROWN PEAK
Sargent Icefield
Bainbridge I
Port Ashton
San Juan
Latouche
Evans I
Green I
Hinchinbrook
Cape Hinchinbrook
Hinchinbrook Entrance
Montague I
Montague Strait
Box Pt
Patton Bay
Jeanie Pt
Cape Clear
Skilak Lake
Tustumena Lake
Luxedni Bay
Clam Gulch
Chisik I
SLOPE MTN
Ninilchik
Happy Valley
CHINITNA
Anchor Pt
Anchor Point
Homer
Kachemak Bay
MT DIABLO
KENAI MOUNTAINS
Harding Icefield
Aialik Bay
Blying Sound
Granite Cape
Seldovia
English Bay
Point Bede
Port Graham
Pye Is
Nuka Bay
Nuka I
Portlock
Cape Elizabeth
Gore Pt
CHUGACH IS
Middleton Island


Fork Roadhouse
MT McKINLEY
MUIDROW
ANDERSON
BROAD PASS
Broad Pass
MT BROOKS
Colorado
DEADMAN MTN
Honolulu
MT McKINLEY
20300
MT FORAKER
17395
Hurricane
Chulitna
Susitna
Denali
HIGHWAY
Tangle Lakes
4650
Maclaren
MT HUNTER
14580
MT RUSSELL
11670
Canyon
Gold Creek
Sherman
West Fork
Sourdough
MT DALL
Petersville
Curry
Lane
Chase
Chelatna
Kahiltna
Peters Cr
Talkeetna
Tyone L
Susitna L
Crosswind L
Ewan L
Gulkana Jct
Gulkana
Rohn Roadhouse
RAINY PASS
Kichatna R
Youngstown
Yentna
Fish Lake
Sunshine
Montana
L Louise
Tazlina Glacier Lodge
Glennallen
Rainy Pass Lodge
SUSITNA RIVER
HIGHWAY
Copper Center
Eureka Lodge
TAHNETA PASS
Skwentna
McDougall
Caswell
Kashwitna
Sheep Mtn Inn
Chickaloon
Hayes Glaciers
Alexander L
BELUGA MTN
Willow
Nancy
Houston
Jonesville
Sutton
Moose Creek
Matanuska
Palmer
MT GERDINE
12600
Pittman
Wasilla
Big Lake
Matanuska
Susitna Station
MT MARCUS BAKER
MT WITHERSPOON
MT TORBERT
10600
MT SPURR
11070
MT SUSITNA
4396
Beluga Lake
Alexander
Eklutna
Knik Arm
Chugiak
Birchwood
Eagle River
Ft Richardson
ELMENDORF FIELD
MT GOODE
10610
MT GLENN
MT GROSVENOR
Columbia Gl
Valdez
Grants
Fire I
Campbell
Turnagain
Potter
ANCHORAGE
MT GILBERT
MT MUIR
Chakachamna Lake
Tyonek
INLET
Rainbow
Hope
Sunrise
Indian
Girdwood
Bird
Portage
Whittier
Port Wells
Esther
Glacier I
Ellamar
Tatitlek
Bligh I
Port Fidalgo
Valdez Arm
BLACK PEAK
6509
Trading Bay
Passage
Lone I
Naked I
Perry I
Red Head
Kustatan
Nikishka
Moose R
Chickaloon R
Spencer
Tunnel
Grandview
PRINCE WILLIAM
SOUND
Drift River
Salamatof
Kenai
Sterling
Kalgin I
Kalifonsky
Kasilof
Cohoe
Knight I
Pt Bentinck
Moose Pass
Lawing
Lakeview
Nellie Juan
CROWN
Whitshed
Hawkins I



FAIRBANKS
LADD FIELD
EIELSON AIR FORCE BASE
FORT GREELY AIRPORT
ALASKA
Nenana
Rampart
Heine Creek
Livengood
West Fork
SAWTOOTH MTN
BALDRY MTN
CACHE MTN
4800
5295
Beaver Cr
STEESE HIGHWAY
MT RYAN
Chena Hot Springs
Chatanika
Grant Creek
Kallands
Birches
Tanana
Indian Vll
Eureka
Glenn
Tofty
Hot Springs (PO)
Baker
Fish L
Harper Bend
Cosna
River
Tolovana
Minto
Dome
Martin
Saulich
Cache
Dunbar
Ester
Bartlett (PO)
Happy
College
Fox
Bluff
Standard
Berg
Aurora Lodge
Harding L
Blair Lakes
Richardson
Chena R
THE BUTTE
4585
Caribou
Quartz L
Big Delta
Buffalo
Shaw Cr
4084
Chitanana
Big Mud R
Mud R
Tlaga River
Telsitna River
Sethkokna River
Wien Lake
3010
3050
Zitziana River
Cosna River
Kantishna River
Toklat
Tokla
1414
2163
BEARPAW MTN
2044
Roosevelt
Nineteenmile
Julius
Clear
Rex
Browne
Ferry
Teklanika
Tatlanika
Wood
Clear Cr
Dry Cr
Delta R
Delta Creek
Little Delta R
Lake Minchumina
Lake Minchumina
Muddy R
Chilchukabena L
3870
Fork Lake
Tukomina
Telida
Foraker
Birch Creek
Herron
Highpower
McKinley Fork
Fork Roadhouse
Slow
Moose Cr
4960
Kantishna
BUSIA MTN
Wonder Lake
McKinley River
POLYCHROME MTN PASS
DOUBLE
NAT'L PARK
DENALI
MT HEALY
McKinley Park
Healy Fork
Lignite
Suntrana
Moody
Lagoon
Yanert
Carlo
Windy
Cantwell
Summit
5640
6850
5860
MT DEBORAH
12540
HESS MTN
12030
MT HAYES
13700
5710
6920
Black Rapids Glacier
Donnelly
Rapids
RICHARDSON HIGHWAY
MT McKINLEY
20300
MT FORAKER
17395
MT HUNTER
14580
MT RUSSELL
11670
MT BROOKS
11880
ANDERSON
Muldrow Gl
BROAD PASS
Broad Pass
Colorado
Honolulu
DEADMAN MTN
5550
Hurricane
Chulitna
Canyon
Susitna
Gold Creek
Sherman
Kahiltna
Chulitna
Nenana
DENALI R
6000
Denali
DENALI HIGHWAY
Maclaren
West
Tangle Lakes
4650
RANGE
2350
1000
2000
3000
5000
49
50
51
53
54
57
58
60
61
23
25
26
27

1:250,000 TOPOGRAPHIC MAPS

(Showing Specific Site Locations)


Lake Creek Upper
H=560
Lake Creek Lower
H=305'
Example
Petersville
Sunset
Hansen Bar
Landing Strip
Chelatna Lodge
Chelatna Lake
Fairview Mtn
Collinsville
Camp Creek
Sunflower Creek
Peters Creek
Peters Hills
Willow Mtn
Mt Yenlo
Donkey Creek Lake
Donkey Creek
Gold Hill
Schneider Lake
Shulin Lake
YENTNA RIVER
KAHILTNA
GLACIER
Hewitt
Cabin
Cabins
Dollar Creek
Granite Creek
Whiskey Creek
Cache Creek
Treasure Creek
Dutch Creek
Black Creek
WINTER TRAIL
Shovel Lake

EVALUATION SHEETS

Site Number	EVALUATION SCALE			COMMENTS
	Unacceptable	Conditional	Least Conflict	
35				
36				
37				
38				
39				
40				
41				

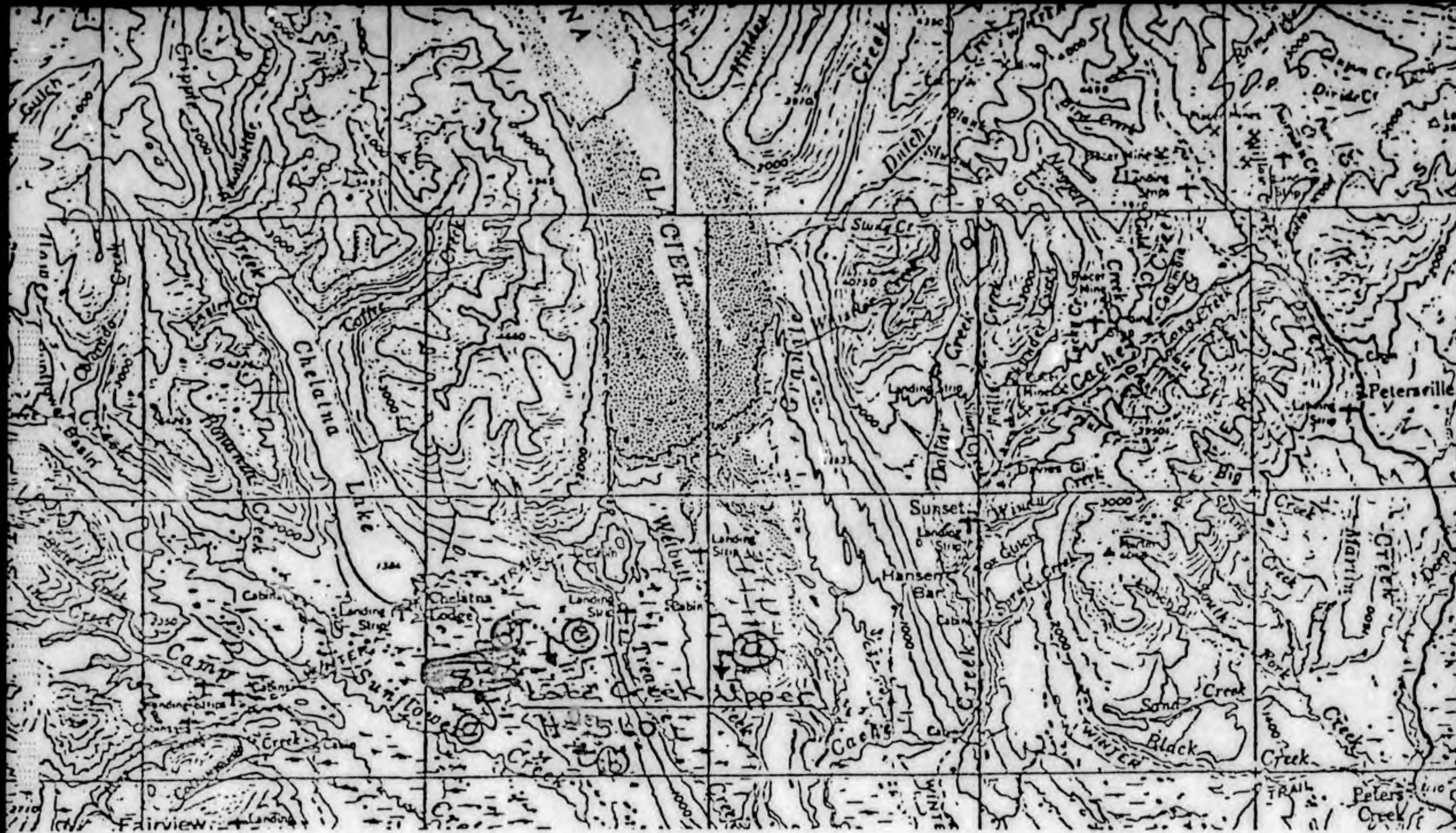
EXAMPLE

APPENDIX B
1:250,000 TOPOGRAPHIC MAPS

1:250,000 TOPOGRAPHIC MAPS

(Showing Specific Site Locations)

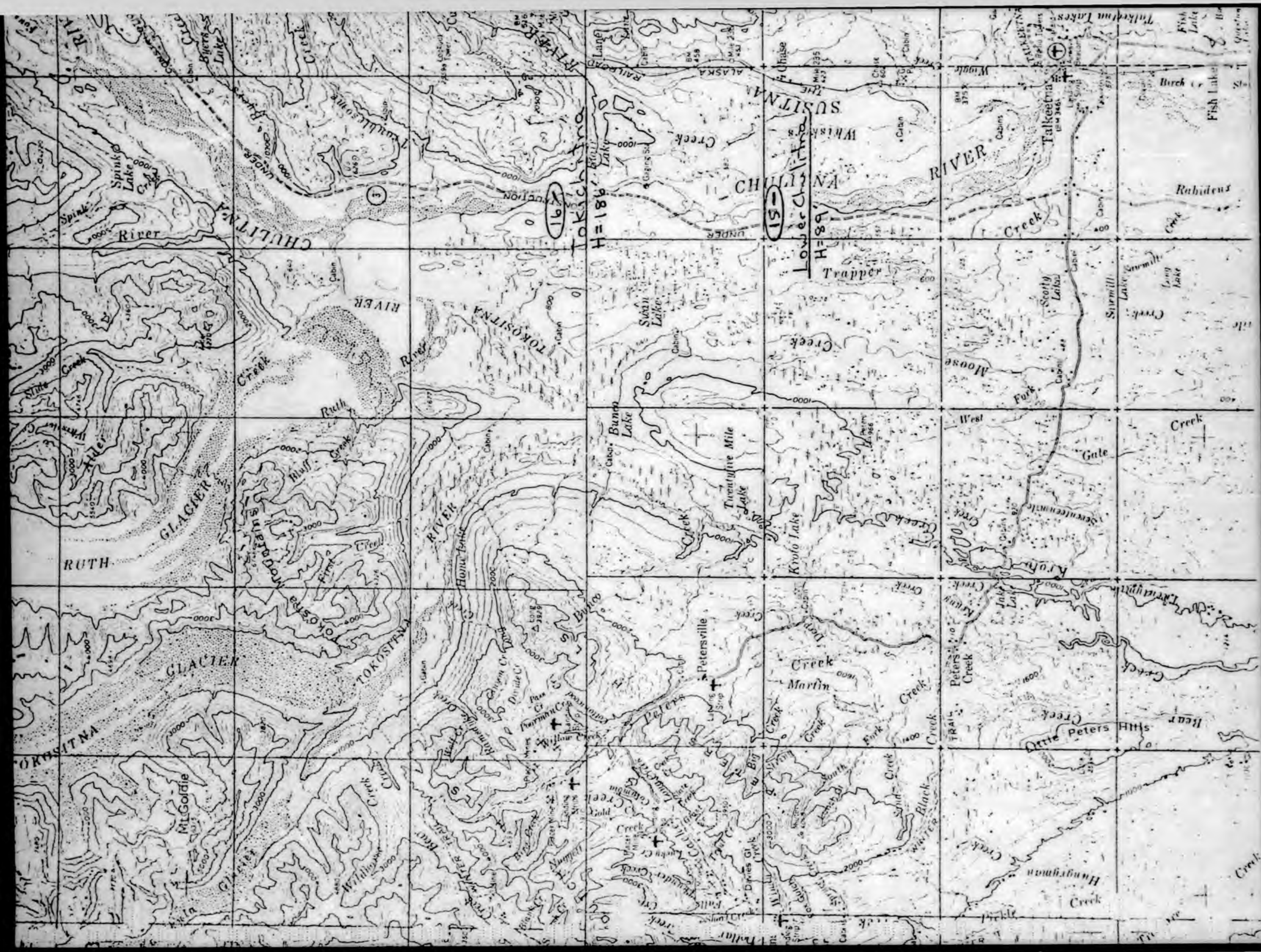
INDEX FOR TOPOGRAPHIC MAPS
Fairbanks Area



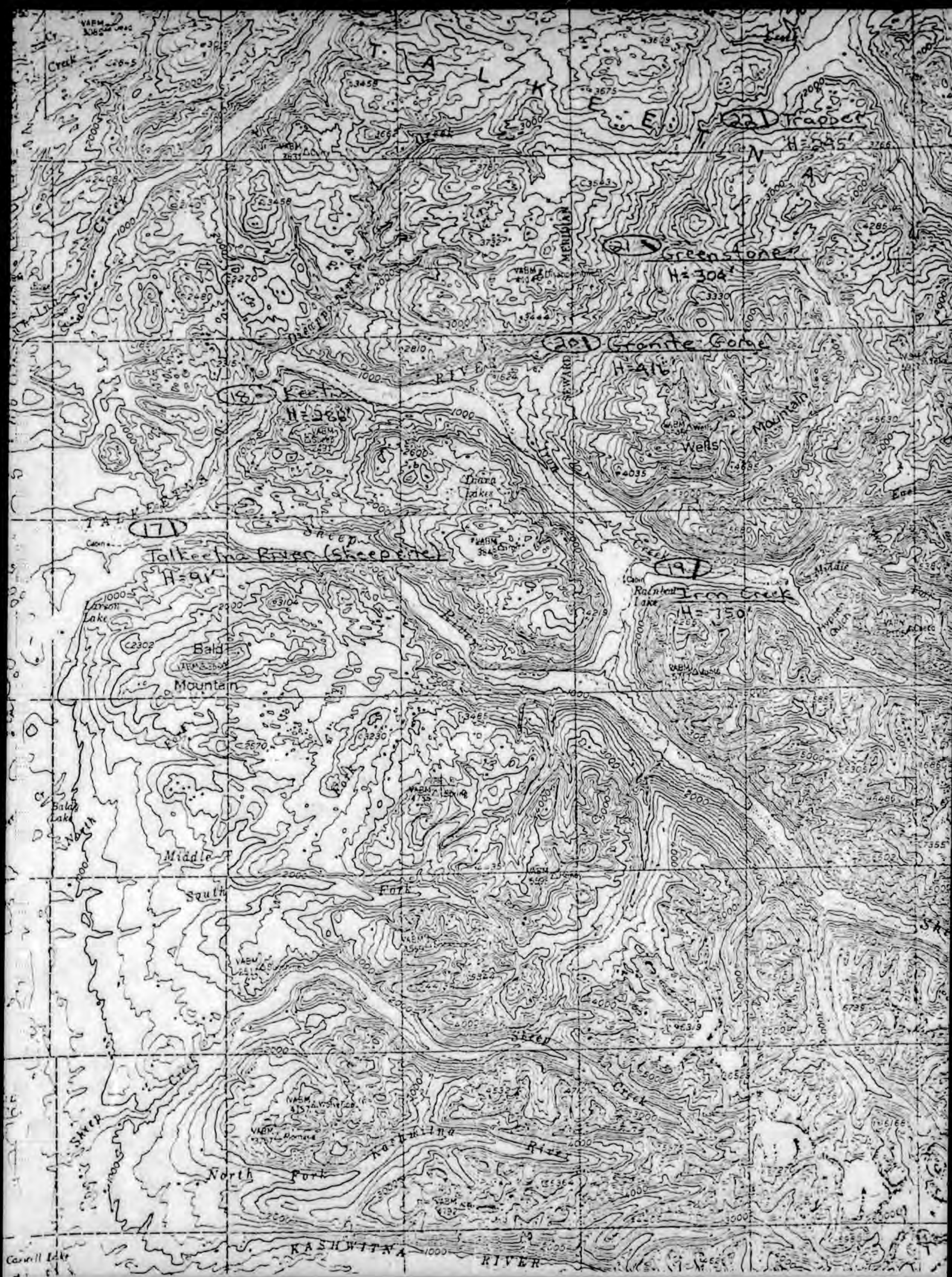
Explanation of Terms

a. Name of site
b. Normal net power head (ft)
c. Site number
d. Dam location on stream
e. Penstock

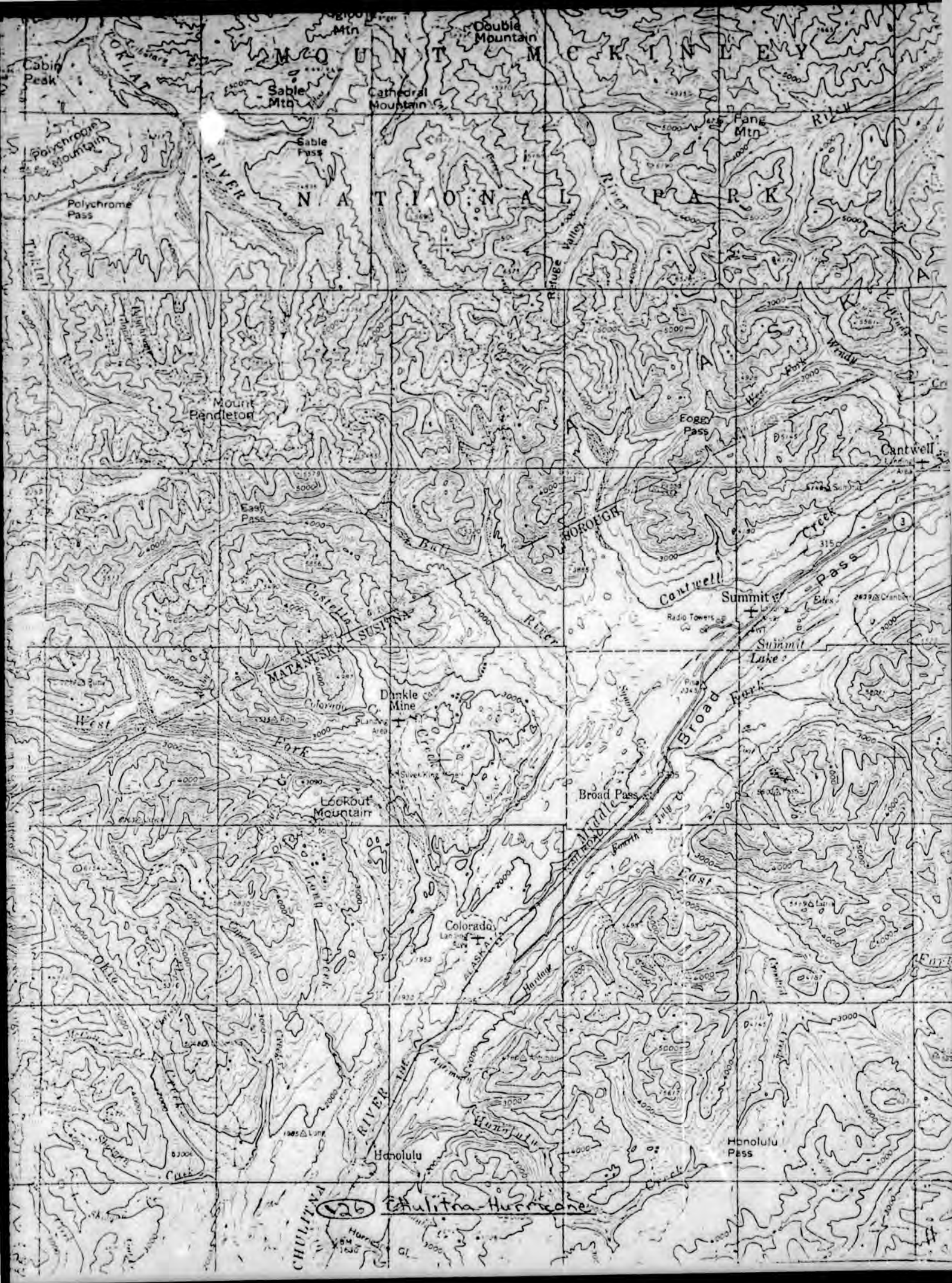
8
Lake Creek Upper
H=560'
7
Lake Creek Lower
H=305'
GLACIER
Petersville
Sunset
Hansen Bar
Chelatna Lodge
Chelatna
Lake
Fairview
Mtn
Collinsville
KAHILTNA
Willow
Mtn
Mt Yenlo
Donkey Creek
Lake
Gold
Hill
YENTNA
RIVER
Peters
Creek
Shulin
Lake
Hewitt



CHULITNA RIVER
SUSITNA
Talkeetna
Fish Lake
Birch Cr
Rabideux
Trapper Creek
Scotty Lake
Swan Lake
Moose Creek
West Fork
Gate Creek
Bunco Lake
Twentyfive Mile Lake
Kroto Lake
Kroto
Spink Lake
Byers Lake
River
TOKOSITNA RIVER
Ruth
RUTH GLACIER
Tokositna Mountains
TOKOSITNA GLACIER
Petersville
Peters Creek
Martin Creek
Peters Hills
Mt. Goldie
Tokichitna
H=186'
Lower Chulitna
H=89'
16
15

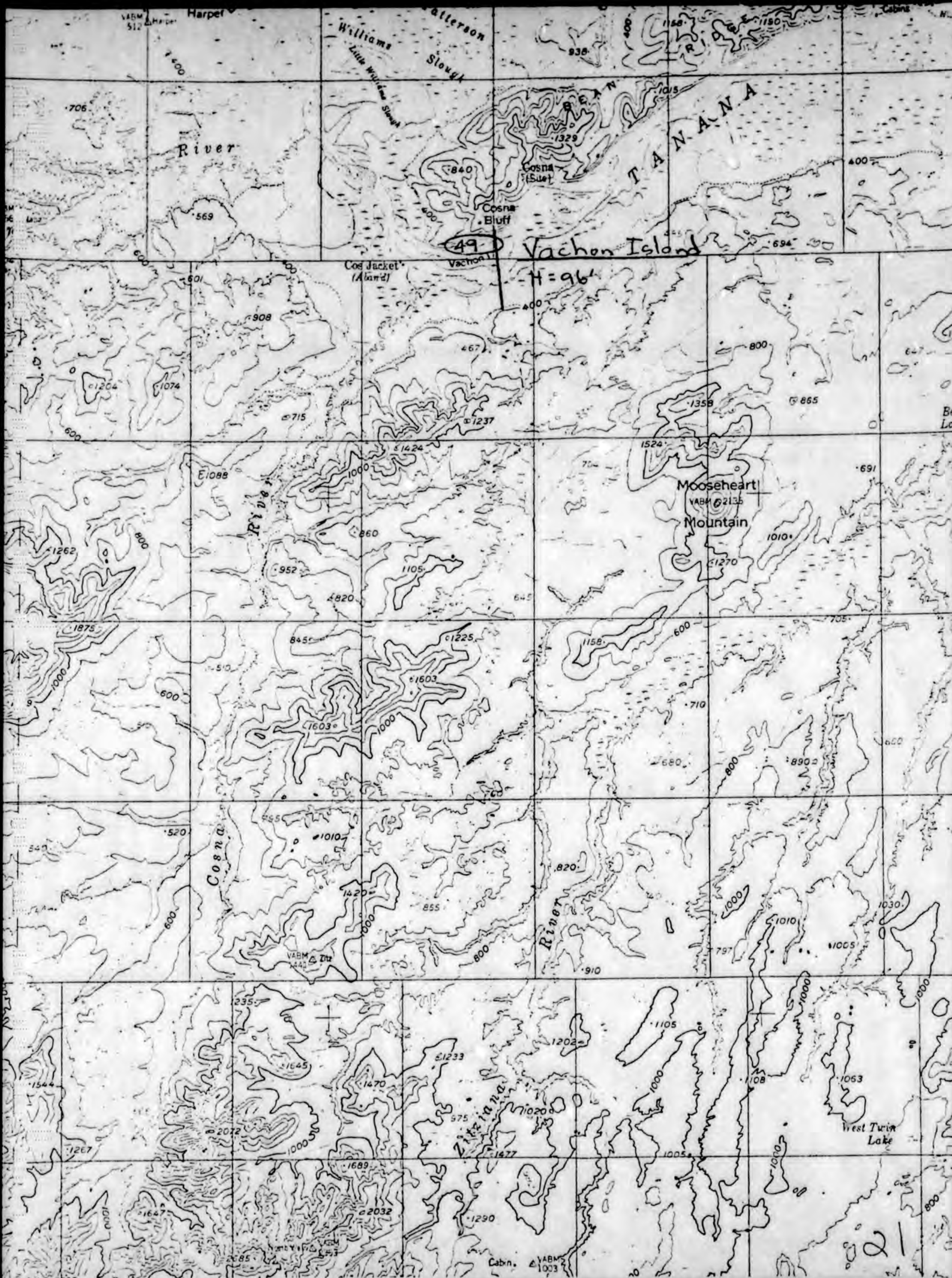

T A L K E E T N A
(22) Trapper
(21) Greenstone
H=304
(20) Granite Gorge
(18)
(17)
Talkeetna River (Sheep site)
H=91
(19) Iron Creek
H=350
SEWARD MERIDIAN
Wells Mountain
Bald Mountain
Diana Lakes
Rainbow Lake
Larson Lake
South Fork
North Fork
Middle Fork
Sheep Creek
Kashwitna River
K A S H W I T N A
R I V E R

Hurricane
H=224'
Coal
H=241
Chulitna Butte
Chulitna Pass
Summit Lake
Chulitna
Lucy Lake
Lucy
H=166
UNDER CONSTRUCTION
RAILROAD
Indian
RIVER
Portage
Devils Canyon
High Lake
Canyon
Mile 265
Gold Creek
Gold
H=184'
Sherman
Chunilna Creek
Cache Creek
Prairie Creek
T A L K E E T N A
Trapper
H=245'
Greenstone
H=304'
MERIDIAN
SEWARD
Granite Gorge
H=416'
Talkeetna
H=286'
RIVER
Iron
Diana Lakes
Mountains
Wells


MOUNT McKINLEY
NATIONAL PARK
ALASKA
Cabin Peak
Igloo Mtn
Double Mountain
Sable Mtn
Cathedral Mountain
Sable Pass
Polychrome Mountain
Polychrome Pass
Fang Mtn
TOKLAT RIVER
Refuge Valley
Mount Pendleton
Foggy Pass
Cantwell
East Pass
BOROUGH
MATANUSKA
SUSITNA
Costello
Bull
River
Cantwell Creek
Summit
Radio Towers
Pass
Summit Lake
Broad Fork
Broad Pass
Dunkle Mine
Colorado
West Fork
Lookout Mountain
Middle
Fourth of July Cr
East
Colorado
ALASKA
Long Creek
Ohio
Honolulu
Honolulu Pass
Hurricane
CHULITNA RIVER
426 Chulitna-Hurricane

28
Deadman Creek
H = 962
NORTH
BOUNDARY
SEWARD
MERIDIAN
Tsusena
Butte
Tsusena Creek
Deadman Creek
Watana Creek
SUSITNA RIVER
Fog Lakes
Fog Creek
Mt Watana
Watana Lake
Kosina Creek
Gilbert
Tsisi Creek
Jay Creek
John Creek
George Creek
Kosina
Black
TALKEETNA MOUNTAINS

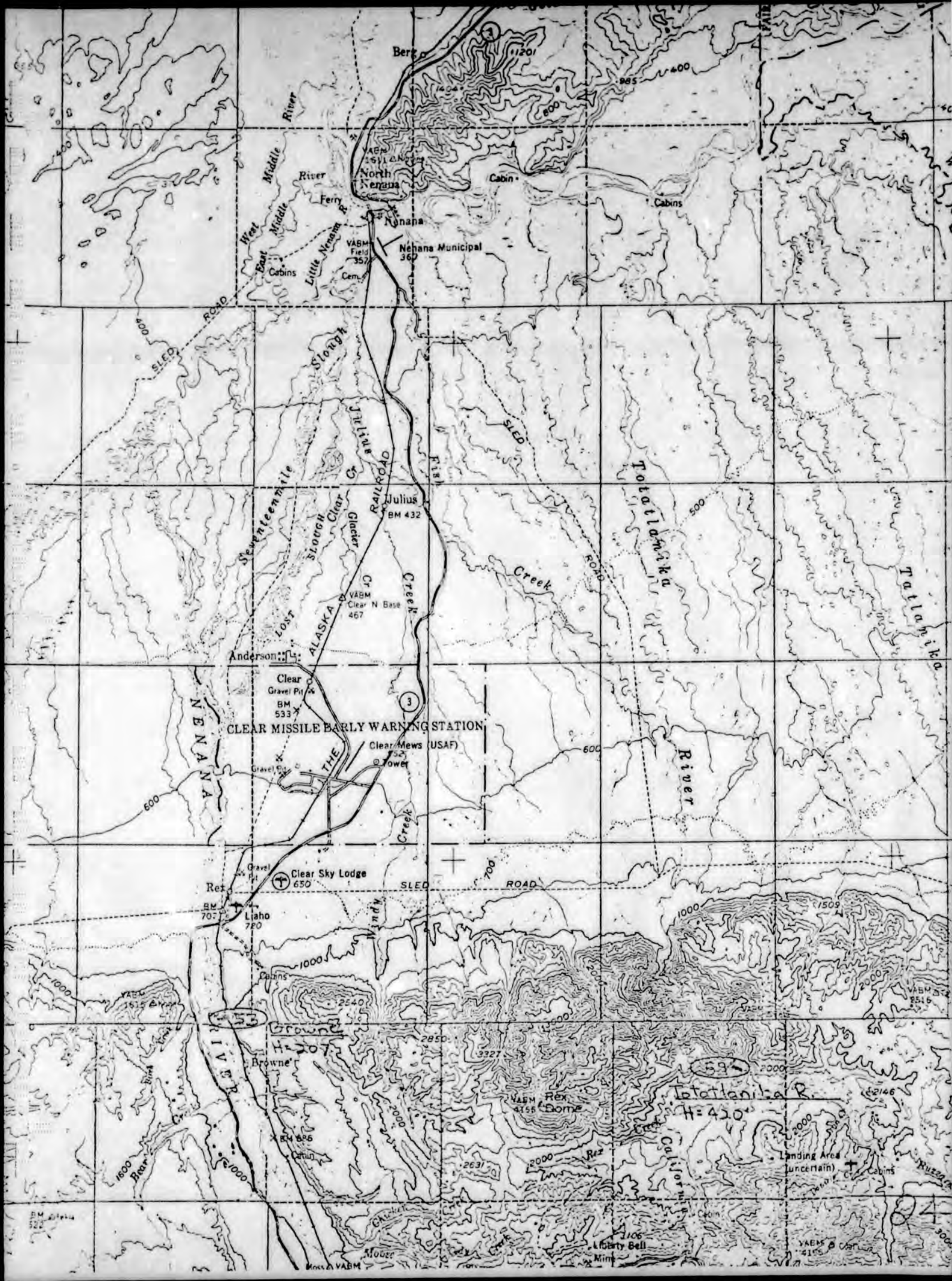
Gulkana R.
H = 405
48
Round Top
Mountain
Hogan
Hill
Sourdough
Campground
Twin
Lakes
Twelvemile
Creek
WINTER
RICHARDSON
HIGHWAY
COPPER
RIVER
MERIDIAN
Otter
Creek
Spring
Gulkana
Fork
Fish Lake
Middle
Lake
Dog
Lake
Boulder
Lake
Cabins
Ewan Lake
Birch
Lake
Landing
Area
Cabins
Crosswind Lake
Round
Lake
Gakona
River
River
Gakona
20



Harper
Williams
Little Williams Slough
Slough
BEAN
TANANA
River
Cosna (Sue)
Cosna Bluff
49
Vachon Island
H=96'
Cos Jacket (Aland)
Mooseheart Mountain
River
Cosna
River
Zitziana
West Twin Lake
Cabin
821


BASE LINE
Junction Island
50
H=114'
Kindanina Lake
Bear Lake
Zitziana
Mooseheart Mountain
Geskakmina Lake
Creek
Dry
KANTISHNA
RIVER
Cabin
Toklat (Aban'd)
Cabins
West Twin Lake
East Twin Lake
TOKLAT
Kantishna R.
51
H=95'
Clear
Creek
RIVER

Walker Cr.
Ferry H=166
54
Teklanika
H=457
52
Healy
H=291
56
Carlo
H=212
57
Yanert #2
H=232
55
Liberty Bell Mine
Eva Creek
Jumbo Dome
Walker Dome
NENANA
Lignite
Eightmile Lake
Fish Cr.
RIVER
Healy
Suntrana
Usibelli
Dora Peak
Moody
Sugar Loaf Mountain
Mount Healy
Mount Margaret
Mount Wright
McKinley Park
Mt Fellows
Savage River Campground
PARK ROAD
TEKLANIKA
Lagoon
Yanert
Igloo Mtn
Double Mountain
Cathedral Mountain
Fang Mtn
Carlo
Sable Pass
MOUNT MCKINLEY
NATIONAL PARK



Berg
1201
985
400
800
North
Nenana
Cabin
Cabins
West
Middle
River
Middle
East
Little Nenana R
Ferry
Nenana
VABM
Field
357
Nenana Municipal
360
Cabins
Cem.
SLED
ROAD
Slough
Julius
Cr.
RAILROAD
Fish
SLED
Seventeenmile
SLOUGH
Clear
Glacier
Cr
Julius
BM 432
500
ROAD
Totatlanika
Tatlanika
Creek
Creek
VABM
Clear N Base
467
LOST
ALASKA
Anderson
Clear
Gravel Pit
BM
533
3
CLEAR MISSILE EARLY WARNING STATION
NENANA
THE
Tower
600
River
Creek
Windy
Clear Sky Lodge
650
Rex
BM
707
720
SLED
ROAD
700
1000
1509
Cabins
2540
2850
3327
2000
Browne
H=707
Browne
VABM
4155
Rex
Dome
Totatlanika R.
H=420
Rex
Creek
California
Landing Area
(uncertain)
Cabins
2631
Bear
Cr
1600
RIVER
Cabin
Liberty Bell
Mine

55 Yanert #2
H=232'
58 Bruskasna
H=212'
Panorama Mountain
Windy
Reindeer Hills
Pyramid Peak
MATANUSKA - SUSITNA
DENALI HIGHWAY
NENANA
RIVER
Monahan
Brushkana Campground
Caribou Pass
Brushkana
Creek
Deadman Mountain
Deadman
FORK
G
E
R
A
N
25

Little
Salcha
River
Ninetyeight Creek
SALCHA
160 Salcha R.
H=136'
Cabins
Cabin
WINTER
RIVER
Klat
Five Mile Cr
Creek
TRAIL
Salcha Bluff
Aurora Lodge
Gaging Sta
RICHARDSON
Campground
Harding Lake
Little Harding Lake
Lenant
Uncle Sam Creek
McCoy
Gold Run
Monte Cristo Creek
THE TRANS ALASKA PIPELINE (UNDER CONSTRUCTION)
Redmond Creek
Shamrock Cr
Mosquito Cr
Junction Creek
HIGHWAY
Campbell Cabin
Caribou
BM 735
Birch Lake
Canyon
Mine
Banner
Buckeye
Keystone Creek
Scout Camp
Lost Lake
TANANA
61 Tanana R.
H=107'
Richardson
Tenderfoot
Shaw Creek Lodge
Gravel Pit
BOROUGH
FAIRBANKS NORTH STAR
RIVER
Shaw Cr
TRAIL
WINTER
RIVER
Cabins
Clear Creek
CREEK
RICHARDSON
DELTA
LITTLE DELTA RIVER
FORT GREELY
Rainbow Lake
Big Delta
(BM 935)
26

APPENDIX C
RECKONING OF EVALUATIONS AT EACH SITE

Site Number	INDIVIDUAL EVALUATIONS				Reckoning of Evaluations	Result
	FG	NMF	LU	FW		
8	0	5	10	—	ON STATE LAND, NEAR EXISTING TRAIL AND LANDING STRIPS SOME FISH AND GAME CONFLICT ∴ USE AVERAGE: $\frac{0+5+10}{3} = 5$	5
15	0	0	10	—	ON STATE LAND, NEAR EXISTING ROAD AND RAILROAD UNANIMOUS ON FISH & GAME - UNACCEPTABLE ∴ CONSIDER SITE UNACCEPTABLE AT "0"	0
16	0	0	10	—	ON STATE LAND, NEAR EXISTING ROAD AND RAILROAD UNANIMOUS ON FISH & GAME - UNACCEPTABLE ∴ CONSIDER SITE UNACCEPTABLE AT "0"	0
17	0	0	10	—	ON STATE LAND, NEAR EXISTING TRAIL UNANIMOUS ON FISH & GAME - UNACCEPTABLE ∴ CONSIDER SITE UNACCEPTABLE AT "0"	0
18	0	0	10	—	ON STATE LAND, NEAR EXISTING TRAIL, NEAR D-1 LAND UNANIMOUS ON FISH & GAME - UNACCEPTABLE ∴ CONSIDER SITE UNACCEPTABLE AT "0"	0
19	5	5	10	—	ON STATE LAND, NEAR EXISTING TRAIL SOME FISH & GAME CONFLICT ∴ USE AVERAGE: $\frac{5+5+10}{3} = 6.67$	6.67
20	0	0	10	—	ON STATE LAND, NEAR EXISTING TRAIL, NEAR D-1 LAND UNANIMOUS ON FISH & GAME — UNACCEPTABLE ∴ CONSIDER SITE UNACCEPTABLE AT "0"	0
21	0	0	10	—	ON STATE LAND, ACCESS TO EXISTING TRAIL, NEAR D-1 LAND UNANIMOUS ON FISH & GAME - UNACCEPTABLE ∴ CONSIDER SITE UNACCEPTABLE AT "0"	0
22	0	0	5	—	ON NATIVE SELECTED LANDS, ACCESS TO EXISTING TRAIL UNANIMOUS ON FISH & GAME — UNACCEPTABLE ∴ CONSIDER SITE UNACCEPTABLE AT "0"	0
23	0	0	10	—	ON STATE LAND, NEAR EXISTING ROAD UNANIMOUS ON FISH & GAME - UNACCEPTABLE ∴ CONSIDER SITE UNACCEPTABLE AT "0"	0

Site Number	INDIVIDUAL EVALUATIONS FG	NMF	LU	FW	Reckoning of Evaluations	Result
24	0	0	10	—	ON STATE LAND, NEAR EXISTING ROAD AND RAILROAD UNANIMOUS ON FISH & GAME — UNACCEPTABLE ∴ CONSIDER SITE UNACCEPTABLE AT "0"	0
25	0	0	10	—	ON STATE LAND, NEAR EXISTING ROAD AND RAILROAD UNANIMOUS ON FISH & GAME — UNACCEPTABLE ∴ CONSIDER SITE UNACCEPTABLE AT "0"	0
26	0	0	10	—	ON STATE LAND, NEAR EXISTING ROAD AND RAILROAD UNANIMOUS ON FISH & GAME — UNACCEPTABLE ∴ CONSIDER SITE UNACCEPTABLE AT "0"	0
27	0	0	10	—	ON STATE LANDS, NEAR EXISTING RAILROAD & D-1 LANDS UNANIMOUS ON FISH & GAME — UNACCEPTABLE ∴ CONSIDER SITE UNACCEPTABLE AT "0"	0
28	5	5	5	—	D-1 FEDERAL LANDS — POSSIBLE ACCESS TO EXISTING RAILROAD SOME FISH & GAME CONFLICT ∴ USE AVERAGE: $\frac{5+5+5}{3} = 5$	5
48	0	5	5	—	PENSTOCK RUNS FROM D-1 LANDS TO UTILITY CORRIDOR NEAR EXISTING ROAD. SOME FISH & GAME CONFLICT ∴ USE AVERAGE: $\frac{5+5}{3} = 3.33$	3.33
49	0	0	5	0	ON D-1 LAND, NEAR PROPOSED RAILROAD AND EXISTING TRAIL UNANIMOUS ON FISH & GAME — UNACCEPTABLE ∴ CONSIDER SITE UNACCEPTABLE AT "0"	0
50	0	0	10	0	ON STATE LAND, NEAR PROPOSED HIGHWAY AND RAILROAD AND EXISTING TRAIL UNANIMOUS ON FISH & GAME — UNACCEPTABLE ∴ CONSIDER SITE "0"	0
51	0	0	5	0	ON D-1 LAND, CLOSE TO NATIVE CLAIMS, DISTANT ACCESS UNANIMOUS ON FISH & GAME — UNACCEPTABLE ∴ CONSIDER SITE UNACCEPTABLE AT "0"	0
52	5	5	0	5	INTAKE ON D-1 LAND, DAM ON D-2 LANDS, DISTANT ACCESS SOME FISH & GAME CONFLICT ∴ USE AVERAGE: $\frac{5+5+0+5}{4} = 3.75$	3.75

Site Number	INDIVIDUAL EVALUATIONS FG	NMF	LU	FW	Reckoning of Evaluations	Result
53	0	0	10	5	ON STATE LAND, NEXT TO EXISTING ROAD AND RAILROAD. SOME FISH & GAME CONFLICT ∴ USE AVERAGE: $\frac{0+0+10+5}{4} = 3.75$	3.75
54	0	0	10	5	ON STATE LAND, NEXT TO EXISTING ROAD AND RAILROAD SOME FISH & GAME CONFLICT ∴ USE AVERAGE: $\frac{0+0+10+5}{4} = 3.75$	3.75
55	5	0	5	5	ON NATIVE SELECTED LANDS, NEXT TO EXISTING ROAD AND RAILROAD SOME CONFLICT ON FISH & GAME ∴ USE AVERAGE: $\frac{5+0+5+5}{4} = 3.75$	3.75
56	5	0	10	5	ON STATE LAND, NEXT TO EXISTING ROAD AND RAILROAD SOME FISH AND GAME CONFLICT ∴ USE AVERAGE: $\frac{5+0+10+5}{4} = 5$	5
57	5	0	0	5	IN MT. MCKINLEY NATIONAL PARK ∴ SITE IS UNACCEPTABLE AT "0"	0
58	5	0	10	5	ON STATE LAND (RESERVOIR MAYBE ON D-1 AND NATIVE LANDS) Close to existing HIGHWAY SOME FISH & GAME CONFLICT ∴ USE AVERAGE: $\frac{5+0+10+5}{4} = 5$	5
59	10	5	10	5	ON STATE LAND, NEAR EXISTING LOCAL ROAD AND TRAIL SOME FISH & GAME CONFICT ∴ USE AVERAGE: $\frac{10+5+10+5}{4} = 7.5$	7.5
60	0	0	10	0	ON STATE LAND NEAR PROPOSED ROAD AND EXISTING TRAIL UNANIMOUS ON FISH & GAME — UNACCEPTABLE ∴ CONSIDER SITE UNACCEPTABLE AT "0"	0
61	0	0	10	0	ON STATE LAND NEAR EXISTING ROAD AND PROPOSED RAILROAD UNANIMOUS ON FISH & GAME — UNACCEPTABLE ∴ CONSIDER SITE UNACCEPTABLE AT "0"	0

APPENDIX D
INDIVIDUAL SITE INFORMATION SHEETS

Site No. 8

Group Rank 3

Name Lake Creek Upper

Stream Lake Creek

Power Potential (kW) 15,000

Transmission Access Severe

U.S.G.S. Topographic Map (Scale 1:250,000) Talkeetna

COMMENTS:

EVALUATIONS:

CH2M HILL Utilizing Land Use Planning Commission Information:

Scale	Comments
10	State lands -- existing trail -- airport landing strips.

Alaska Department of Fish & Game:

Scale	Comments
0	Important fisheries habitat involved. Chelatna Lake is a nursery system for sockeye salmon, and Lake Creek provides spawning and rearing habitat for rainbow trout, Arctic grayling and also five salmon species.

National Marine Fisheries Services:

Scale	Comments
5	Some loss of fish habitat likely and loss of moose habitat. Red salmon enter Chelatna Lake area.

U.S. Fish & Wildlife Service:

Scale	Comments
-	None.

Trustees for Alaska:

Scale	Comments
0	Heavy recreational use; fisheries conflict.

Alaska Center for the Environment:

Scale	Comments
0	Fish -- project would or might impact "obvious" fisheries resource (usually salmon).
	Recreation -- adverse impact on present or potential recreation uses (tourism, floating rivers, rafting, canoing, kayaking, etc.).

Site No. 15

Group Rank 6

Name Lower Chulitna

Stream Chulitna River

Power Potential (kW) 90,000

Transmission Access Moderate

U.S.G.S. Topographic Map (Scale 1:250,000) Talkeetna

COMMENTS:

EVALUATIONS:

CH2M HILL Utilizing Land Use Planning Commission Information:

Scale	Comments
10	State lands -- existing road and railroad.

Alaska Department of Fish & Game:

Scale	Comments
0	Important migrational corridor for several species of Pacific salmon.

National Marine Fisheries Services:

Scale	Comments
0	Impacts on anadromous fish -- important game habitat.

U.S. Fish & Wildlife Service:

Scale	Comments
-	None.

Trustees for Alaska:

Scale	Comments
-	?

Alaska Center for the Environment:

Scale	Comments
5	Recreation -- adverse impact on present or potential recreation uses (rafting, canoing, kayaking)?
	Fish -- project would or might impact "obvious" fisheries resource (usually salmon)?

Site No. 16

Group Rank 6

Name Tokichitna

Stream Chulitna River

Power Potential (kW) 184,000

Transmission Access Moderate

U.S.G.S. Topographic Map (Scale 1:250,000) Talkeetna

COMMENTS:

EVALUATIONS:

CH2M HILL Utilizing Land Use Planning Commission Information:

Scale	Comments
10	State lands -- existing road and railroad.

Alaska Department of Fish & Game:

Scale	Comments
0	Upstream area important for anadromous fish production and provides notable big game habitat.

National Marine Fisheries Services:

Scales	Comments
0	Impacts on anadromous fish -- important game habitat.

U.S. Fish & Wildlife Service:

Scale	Comments
-	None.

Trustees for Alaska:

Scale	Comments
-	?

Alaska Center for the Environment:

Scale	Comments
5	Recreation -- adverse impact on present or potential recreation uses (rafting, canoing, kayaking)(?) Fish -- project would or might impact "obvious" fisheries resource (usually salmon)(?) Also depends on size of lake created.

Site No. 17

Group Rank 6

Name Talkeetna River (Sheep)

Stream Talkeetna River

Power Potential (kW) 31,000

Transmission Access Moderate

U.S.G.S. Topographic Map (Scale 1:250,000) Talkeetna Mountains

COMMENTS:

EVALUATIONS:

CH2M HILL Utilizing Land Use Planning Commission Information:

Scale	Comments
10	State lands -- existing trail.

Alaska Department of Fish & Game:

Scale	Comments
0	Several major anadromous fisheries systems upstream of the site and important big game habitat involved.

National Marine Fisheries Services:

Scale	Comments
0	Impacts on anadromous fish -- important game habitat.

U.S. Fish & Wildlife Service:

Scale	Comments
-	None.

Trustees for Alaska:

Scale	Comments
0	Potential high use area.

Alaska Center for the Environment:

Scale	Comments
5	Access -- maintenance of roads, etc., would encourage new and excessive (usually motorized) access to remote areas, with attendant damage to wildlife and nonmotorized recreation values. Recreation -- adverse impact on present or potential recreation uses (tourism, floating rivers, etc.). Preferable to #19, #20, #21 because of proximity to market; less "access" problems.

Site No. 18

Group Rank 6

Name Keetna

Stream Talkeetna River

Power Potential (kW) 74,000

Transmission Access Moderate

U.S.G.S. Topographic Map (Scale 1:250,000) Talkeetna Mountains

COMMENTS:

EVALUATIONS:

CH2M HILL Utilizing Land Use Planning Commission Information:

Scale	Comments
10	State lands -- existing trail -- near D-1 Federal land.

Alaska Department of Fish & Game:

Scale	Comments
0	Several major anadromous fisheries systems upstream of the site and important big game habitat involved.

National Marine Fisheries Services:

Scale	Comments
0	Impacts on anadromous fish -- important game habitat.

U.S. Fish & Wildlife Service:

Scale	Comments
-	None.

Trustees for Alaska:

Scale	Comments
0	Potential high use area.

Alaska Center for the Environment:

Scale	Comments
5	Access -- maintenance roads, etc. would encourage new and excessive (usually motorized) access to remote areas, with attendant damage to wildlife and nonmotorized recreation values. Recreation -- adverse impact on present or potential recreation uses (tourism, floating rivers, etc.). Preferable to #19, #20, #21 because of proximity to market; less "access" problems.

Site No. 19

Group Rank 2

Name Iron Creek

Stream Iron Creek

Power Potential (kW) 31,000

Transmission Access Moderate

U.S.G.S. Topographic Map (Scale 1:250,000) Talkeetna Mountains

COMMENTS:

EVALUATIONS:

CH2M HILL Utilizing Land Use Planning Commission Information:

Scale	Comments
10	State land -- existing trail.

Alaska Department of Fish & Game:

Scale	Comments
5	Minor fish and wildlife problems anticipated.

National Marine Fisheries Services:

Scale	Comments
5	Some loss of fish and game habitat.

U.S. Fish & Wildlife Service:

Scale	Comments
-	None.

Trustees for Alaska:

Scale	Comments
0	Potential high use area.

Alaska Center for the Environment:

Scale	Comments
5	Recreation -- adverse impact on present or potential recreation uses (tourism, floating rivers, etc.). Distance -- undesirable due to distance from markets, and length/cost of transmission facilities needed. Access -- maintenance roads, etc., would encourage new and excessive (usually motorized) access to remote areas, with attendant damage to wildlife and nonmotorized recreation values. Would need overriding superiority for other reasons to be preferable to #17, #18.

Site No. 20

Group Rank 6

Name Granite Gorge

Stream Talkeetna River

Power Potential (kW) 72,000

Transmission Access Moderate

U.S.G.S. Topographic Map (Scale 1:250,000) Talkeetna Mountains

COMMENTS:

EVALUATIONS:

CH2M HILL Utilizing Land Use Planning Commission Information:

Scale	Comments
10	State land -- existing trail -- near D-1 Federal land.

Alaska Department of Fish & Game:

Scale	Comments
0	Major conflict with Prairie Creek/Stephan Lake anadromous fish runs. Important big game habitat involved.

National Marine Fisheries Services:

Scale	Comments
0	Impacts on anadromous fish -- loss of game habitat.

U.S. Fish & Wildlife Service:

Scale	Comments
-	None.

Trustees for Alaska:

Scale	Comments
0	Potential high use area.

Alaska Center for the Environment:

Scale	Comments
5	Would need overriding superiority for other reasons to be preferable to #17, #18.

Distance -- undesirable due to distance from markets, and length/cost of transmission facilities needed.

Access -- maintenance roads, etc., would encourage new and excessive (usually motorized) access to remote areas, with attendant damage to wildlife and nonmotorized recreation values.

Recreation -- adverse impact on present or potential recreation uses (tourism, floating rivers, etc.).

Site No. 21

Group Rank 6

Name Greenstone

Stream Talkeetna River

Power Potential (kW) 51,000

Transmission Access Moderate

U.S.G.S. Topographic Map (Scale 1:250,000) Talkeetna Mountains

COMMENTS:

Alternative to Granite Gorge (20).

EVALUATIONS:

CH2M HILL Utilizing Land Use Planning Commission Information:

Scale	Comments
10	State land -- possible access along river to existing trail; near D-1 land.

Alaska Department of Fish & Game:

Scale	Comments
0	Major conflict with Prairie Creek/Stephan Lake anadromous fish runs. Important big game habitat involved.

National Marine Fisheries Services:

Scale	Comments
0	Impacts on anadromous fish -- loss of game habitat.

U.S. Fish & Wildlife Service:

Scale	Comments
-	None.

Trustees for Alaska:

Scale	Comments
0	Potential for high recreational use.

Alaska Center for the Environment:

Scale	Comments
5	Would need overriding superiority for other reasons to be preferable to #17, #18.

Distance -- undesirable due to distance from markets, and length/cost of transmission facilities needed.

Access -- maintenance roads, etc., would encourage new and excessive (usually motorized) access to remote areas, with attendant damage to wildlife and nonmotorized recreation values.

Recreation -- adverse impact on present or potential recreation use (tourism, floating rivers, etc.).

Site No. 22

Group Rank 6

Name Trapper

Stream Talkeetna River

Power Potential (kW) 45,000

Transmission Access Moderate

U.S.G.S. Topographic Map (Scale 1:250,000) Talkeetna Mountains

COMMENTS:

EVALUATIONS:

CH2M HILL Utilizing Land Use Planning Commission Information:

Scale	Comments
5	Village corporation selection -- possible access along river to existing trail.

Alaska Department of Fish & Game:

Scale	Comments
0	Major conflict with Prairie Creek/Stephan Lake anadromous fish runs. Important big game habitat involved.

National Marine Fisheries Services:

Scale	Comments
0	Impacts on anadromous fish -- loss of game habitat.

U.S. Fish & Wildlife Service:

Scale	Comments
-	None.

Trustees for Alaska:

Scale	Comments
0	Potential high recreational use.

Alaska Center for the Environment:

Scale	Comments
0	Distance -- undesirable due to distance from markets, length/cost of transmission facilities needed.
	Lake -- based on available information, dam would create lake of excessive size, given local conditions (settlement, wildlife habitat, etc.).
	Access -- maintenance roads, etc., would encourage new and excessive (usually motorized) access to remote areas, with attendant damage to wildlife and nonmotorized recreation values.

Site No. 23

Group Rank 6

Name Lucy

Stream Chulitna River

Power Potential (kW) 15,000

Transmission Access Good

U.S.G.S. Topographic Map (Scale 1:250,000) Talkeetna Mountains

COMMENTS:

EVALUATIONS:

CH2M HILL Utilizing Land Use Planning Commission Information:

Scale	Comments
10	State lands -- existing road.

Alaska Department of Fish & Game:

Scale	Comments
0	Important big game and anadromous fisheries habitat involved. Annually, several thousand king salmon spawn upstream of the site.

National Marine Fisheries Services:

Scale	Comments
0	Loss of anadromous fish habitat and big game habitat.

U.S. Fish & Wildlife Service:

Scale	Comments
-	None.

Trustees for Alaska:

Scale	Comments
0	Scenic drive visually connected with Denali/ McKinley parks.

Alaska Center for the Environment:

Scale	Comments
5	Recreation -- adverse impact on present or potential recreation uses (tourism, floating rivers, etc.)(?)
	Reasonable Size -- size of project seems more in keeping with our general views that smaller, decentralized sources of energy are desirable.
	Impact on Denali State Park?

Site No. 24

Group Rank 6

Name Coal

Stream Chulitna River

Power Potential (kW) 40,000

Transmission Access Good

U.S.G.S. Topographic Map (Scale 1:250,000) Talkeetna Mountains

COMMENTS:

Would be inundated by development of Ohio (25).

EVALUATIONS:

CH2M HILL Utilizing Land Use Planning Commission Information:

Scale	Comments
10	State lands -- existing road and railroad.

Alaska Department of Fish & Game:

Scale	Comments
0	Impoundment would conflict with important fish and wildlife habitat. A major king salmon spawning area would be involved.

National Marine Fisheries Services:

Scale	Comments
0	Loss of anadromous fish habitat and big game habitat.

U.S. Fish & Wildlife Service:

Scale	Comments
-	None.

Trustees for Alaska:

Scale	Comments
0	Scenic drive visually connected with Denali/ McKinley Parks.

Alaska Center for the Environment:

Scale	Comments
5	Recreation -- adverse impact on present or potential recreation uses (tourism, floating rivers, etc.).
	Reasonable Size -- size of project seems more in keeping with our general views that smaller, decentralized sources of energy are desirable.
	Impact on Denali State Park?
	Too Big -- sheer magnitude of project causes us to question its desirability(?)

Site No. 25

Group Rank 6

Name Ohio

Stream Chulitna River

Power Potential (kW) 30,000

Transmission Access Good

U.S.G.S. Topographic Map (Scale 1:250,000) Talkeetna Mountains

COMMENTS:

EVALUATIONS:

CH2M HILL Utilizing Land Use Planning Commission Information:

Scale	Comments
10	State lands -- existing road and railroad.

Alaska Department of Fish & Game:

Scale	Comments
0	Impoundment would conflict with important fish and wildlife habitat. A major king salmon spawning area would be involved.

National Marine Fisheries Services:

Scale	Comments
0	Loss of anadromous fish habitat and big game habitat.

U.S. Fish & Wildlife Service:

Scale	Comments
-	None.

Trustees for Alaska:

Scale	Comments
0	Scenic drive visually connected with Denali/ McKinley Parks.

Alaska Center for the Environment:

Scale	Comments
5	Recreation -- adverse impact on present or potential recreation uses (tourism, floating rivers, etc.)(?)
	Reasonable Size -- size of project seems more in keeping with our general views that smaller, decentralized sources of energy are desirable.
	Impact on Denali State Park?
	Too Big -- sheer magnitude of project causes us to question its desirability(?)

Site No. 26

Group Rank 6

Name Chulitna Hurricane

Stream Chulitna River

Power Potential (kW) 34,000

Transmission Access Good

U.S.G.S. Topographic Map (Scale 1:250,000) Healy

COMMENTS:

Would be inundated by development of Ohio (25).

EVALUATIONS:

CH2M HILL Utilizing Land Use Planning Commission Information:

Scale	Comments
10	State land -- existing road, railroad and power.

Alaska Department of Fish & Game:

Scale	Comments
0	Impoundment would conflict with important fish and wildlife habitat. A major king salmon spawning area would be involved.

National Marine Fisheries Services:

Scale	Comments
0	Loss of anadromous fish habitat and big game habitat.

U.S. Fish & Wildlife Service:

Scale	Comments
-	None.

Trustees for Alaska:

Scale	Comments
0	Scenic drive visually connected with Denali/ McKinley Parks.

Alaska Center for the Enviornment:

Scale	Comments
5	No head given!
	Size?
	Recreation -- adverse impact on present or potential recreation uses (scenic, etc.).
	Proximity good -- project is apparently desirable because of closeness to markets for electricity or existing corridors.

Site No. 27

Group Rank 6

Name Gold

Stream Susitna River

Power Potential (kW) 260,000

Transmission Access Good

U.S.G.S. Topographic Map (Scale 1:250,000) Talkeetna Mountains

COMMENTS:

EVALUATIONS:

CH2M HILL Utilizing Land Use Planning Commission Information:

Scale	Comments
10	State land -- existing railroad -- near D-1 Federal lands.

Alaska Department of Fish & Game:

Scale	Comments
0	Important big game habitat involved. Impoundment would destroy several streams and sloughs important to resident and anadromous fish.

National Marine Fisheries Services:

Scale	Comments
0	Major anadromous fish stream -- loss of spawning/rearing habitat.

U.S. Fish & Wildlife Service:

Scale	Comments
-	None.

Trustees for Alaska:

Scale	Comments
0	Wild river study area.

Alaska Center for the Environment:

Scale	Comments
0	Lake -- based on available information, dam would create lake of excessive size, given local conditions (settlement, wildlife habitat, etc.). Recreation -- adverse impact on present or potential recreation uses (tourism, floating rivers, etc.).

Site No. 28

Group Rank 3

Name Deadman Creek

Stream Deadman Creek

Power Potential (kW) 34,000

Transmission Access Moderate

U.S.G.S. Topographic Map (Scale 1:250,000) Talkeetna Mountains

COMMENTS:

EVALUATIONS:

CH2M HILL Utilizing Land Use Planning Commission Information:

Scale	Comments
5	D-1 Federal lands -- possible access through Susitna Valley to existing railroad.

Alaska Department of Fish & Game:

Scale	Comments
5	No major fisheries conflict anticipated. Some wildlife habitat would be lost.

National Marine Fisheries Services:

Scale	Comments
5	Some loss of fish and wildlife habitat.

U.S. Fish & Wildlife Service:

Scale	Comments
-	None.

Trustees for Alaska:

Scale	Comments
0	Hunting and other recreation use.

Alaska Center for the Environment:

Scale	Comments
0	Distance -- undesirable due to distance from markets, and length/cost of transmission facilities needed.
	Too Big -- sheer magnitude of project causes us to question its desirability.
	Access -- maintenance roads, etc., would encourage new and excessive (usually motorized) access to remote areas, with attendant damage to wildlife and nonmotorized recreation values.

Site No. 48

Group Rank 5

Name Gulkana River

Stream Gulkana River

Power Potential (kW) 34,000

Transmission Access Good

U.S.G.S. Topographic Map (Scale 1:250,000) Gulkana

COMMENTS:

EVALUATIONS:

CH2M HILL Utilizing Land Use Planning Commission Information:

Scale	Comments
5	Penstock runs from D-1 to utility corridor (dam on utility corridor). Accessible to existing road and pipeline.

Alaska Department of Fish & Game:

Scale	Comments
0	Major anadromous and resident fisheries producing system. Important big game habitat involved.

National Marine Fisheries Services:

Scale	Comments
5	None.

U.S. Fish & Wildlife Service:

Scale	Comments
-	None.

Trustees for Alaska:

Scale	Comments
0	Fisheries conflict; heavy recreation use, proposed wild river.

Alaska Center for the Environment:

Scale	Comments
0	Distance -- undesirable due to distance from markets, and length/cost of transmission facilities needed.
	Lake -- based on available information, dam would create lake of excessive size, given local conditions (settlement, wildlife habitat, etc.).
	Recreation -- adverse impact on present or potential recreation uses (proposed wild and scenic river).
	Access -- maintenance roads, etc., would encourage new and excessive (usually motorized) access to remote areas, with attendant damage to wildlife and nonmotorized recreation values.

Site No. 49

Group Rank 6

Name Vachon Island

Stream Tanana River

Power Potential (kW) 426,000

Transmission Access Severe

U.S.G.S. Topographic Map (Scale 1:250,000) Kantishna River

COMMENTS:

Alternative to Junction Island (50).

EVALUATIONS:

CH2M HILL Utilizing Land Use Planning Commission Information:

Scale	Comments
5	D-1 land. Limited access -- next to proposed railroad and existing trail.

Alaska Department of Fish & Game:

Scale	Comments
0	Whitefish, Arctic grayling, sculpins, suckers, possibly sheefish (numbers unknown) 50,000+ chum, 5,000+ silver, 4,000+ kings. Moose habitat would be flooded in Unit 20A, an already depressed population. Raptor nesting and hunting perches would be impacted.

National Marine Fisheries Services:

Scale	Comments
0	None.

U.S. Fish & Wildlife Service:

Scale	Comments
0	Waterflowl nesting/molting habitat and migration route. Tanana River has a major run of anadromous fish (50,000 chums; 5,000 silver, 4,000 kings). Moose overwintering habitat.

Trustees for Alaska:

Scale	Comments
0	Heavy recreation and commercial use; transportation system.

Alaska Center for the Environment:

Scale	Comments
0	Distance -- undesirable due to distance from markets, and length/cost of transmission facilities needed. Access -- maintenance roads, etc., would encourage new and excessive (usually motorized) access to remote areas, with attendant damage to wildlife and nonmotorized recreation values. Lake -- based on available information, dam would create lake of excessive size, given local conditions (settlement, wildlife habitat, etc.)(?)

Site No. 50

Group Rank 6

Name Junction Island

Stream Tanana River

Power Potential (kW) 532,000

Transmission Access Severe

U.S.G.S. Topographic Map (Scale 1:250,000) Kantishna River

COMMENTS:

EVALUATIONS:

CH2M HILL Utilizing Land Use Planning Commission Information:

Scale	Comments
10	On state land -- close to proposed railroad and highway and existing trail.

Alaska Department of Fish & Game:

Scale	Comments
0	More than 50,000 chum salmon migrate through, more than 5,000 silver salmon migrate through, more than 4,000 king salmon migrate through plus sheefish and whitefish move through. Overwintering impacts on Northern pike, Arctic grayling, burbot and whitefish. Would flood extensive areas of moose habitat. Raptor nesting and hunting perches would be impacted.

National Marine Fisheries Services:

Scale	Comments
0	None.

U.S. Fish & Wildlife Service:

Scale	Comments
0	Waterfowl nesting/molting habitat and migration route. Tanana River has a major run of anadromous fish (50,000 chums; 5,000 silver; 4,000 kings). Moose overwintering habitat.

Trustees for Alaska:

Scale	Comments
0	Heavy recreation and commercial use; transportation system.

Alaska Center for the Environment:

Scale	Comments
0	Distance -- undesirable due to distance from markets, and length/cost of transmission facilities needed. Access -- maintenance roads, etc., would encourage new and excessive (usually motorized) access to remote areas, with attendant damage to wildlife and nonmotorized recreation values. Lake -- based on available information, dam would create lake of excessive size, given local conditions (settlement, wildlife habitat, etc.).

Site No. 51

Group Rank 6

Name Kantishna River

Stream Kantishna River

Power Potential (kW) 82,000

Transmission Access Severe

U.S.G.S. Topographic Map (Scale 1:250,000) Kantishna River

COMMENTS:

EVALUATIONS:

CH2M HILL Utilizing Land Use Planning Commission Information:

Scale	Comments
5	On D-1, close to native selected lands. Dubious access -- no mountains (but miles away with swamp and streams).

Alaska Department of Fish & Game:

Scale	Comments
0	Chum, king and silver salmon spawning, rearing and migratory routes interrupted, flooded are impacted. Moose habitat flooded. Raptor nesting and hunting perches would be impacted.

National Marine Fisheries Services:

Scale	Comments
0	None.

U.S. Fish & Wildlife Service:

Scale	Comments
0	Waterfowl nesting/molting habitat. Transmission corridor and dam project would cause significant disturbance to moose and other wildlife habitat.

Trustees for Alaska:

Scale	Comments
5	Some use for transport.

Alaska Center for the Environment:

Scale	Comments
0	Distance -- undesirable due to distance from markets, and length/cost of transmission facilities needed. Access -- maintenance roads, etc., would encourage new and excessive (usually motorized) access to remote areas, with attendant damage to wildlife and nonmotorized recreation values. Lake -- based on available information, dam would create lake of excessive size, given local conditions (settlement, wildlife habitat, etc.). Possible interference with proposed northern extension of McKinley Park.

Site No. 52

Group Rank 4

Name Teklanika River

Stream Teklanika River

Power Potential (kW) 57,000

Transmission Access Moderate

U.S.G.S. Topographic Map (Scale 1:250,000) Healy

COMMENTS:

EVALUATIONS:

CH2M HILL Utilizing Land Use Planning Commission Information:

Scale	Comments
0	Intake on D-1, dam on D-2 -- access could be difficult.

Alaska Department of Fish & Game:

Scale	Comments
5	Fisheries -- a grayling impacted resident fish in trib. Wildlife habitat. Raptor nesting and hunting perches would be impacted.

National Marine Fisheries Services:

Scale	Comments
5	None.

U.S. Fish & Wildlife Service:

Scale	Comments
5	Loss and/or disturbance of habitat for following species: grizzly bear, moose, caribou (winter range).

Trustees for Alaska:

Scale	Comments
5	May conflict with National park proposal.

Alaska Center for the Environment:

Scale	Comments
0	Distance -- undesirable due to distance from markets, and length/cost of transmission facilities needed.
	Access -- maintenance roads, etc., would encourage new and excessive (usually motorized) access to remote areas, with attendant damage to wildlife and nonmotorized recreation values.
	Lake -- based on available information, dam would create lake of excessive size, given local conditions (settlement, wildlife habitat, etc.).
	Possible interference with proposed northern extension of McKinley Park.

Site No. 53

Group Rank 4

Name Browne

Stream Nenana River

Power Potential (kW) 80,000

Transmission Access Good

U.S.G.S. Topographic Map (Scale 1:250,000) Fairbanks

COMMENTS:

EVALUATIONS:

CH2M HILL Utilizing Land Use Planning Commission Information:

Scale	Comments
10	State land -- next to existing road, railroad and power.

Alaska Department of Fish & Game:

Scale	Comments
0	Block to silver salmon migration to spawning area. Raptor nesting and hunting perches impacted.

National Marine Fisheries Services:

Scale	Comments
0	None.

U.S. Fish & Wildlife Service:

Scale	Comments
5	Migration route for waterfowl. Riparian willow along river provides critical winter range for moose. Silver salmon migrate through this point. Grayling and round white fish overwintering area.

Trustees for Alaska:

Scale	Comments
0	Recreation use; scenic drive.

Alaska Center for the Environment:

Scale	Comments
10	Proximity -- project is apparently desirable because of closeness to markets for electricity or existing corridors.

Site No. 54

Group Rank 4

Name Walker Creek

Stream Nenana River

Power Potential (kW) 35,000

Transmission Access Good

U.S.G.S. Topographic Map (Scale 1:250,000) Fairbanks

COMMENTS:

EVALUATIONS:

CH2M HILL Utilizing Land Use Planning Commission Information:

Scale	Comments
10	State lands -- next to existing road and power.

Alaska Department of Fish & Game:

Scale	Comments
0	Would block silver salmon migration to spawning areas. Whitefish movements. Raptor nesting and hunting perches impacted.

National Marine Fisheries Services:

Scale	Comments
0	None.

U.S. Fish & Wildlife Service:

Scale	Comments
5	Migration route for waterfowl. Riparian willow along river provides critical winter range for moose. Silver salmon migrate through this point. Grayling and round white fish overwintering area.

Trustees for Alaska:

Scale	Comments
0	Recreation use; scenic drive.

Alaska Center for the Environment:

Scale	Comments
10	Proximity -- project is apparently desirable because of closeness to markets for electricity or existing corridors.

Site No. 55

Group Rank 4

Name Yanert #2

Stream Nenana River

Power Potential (kW) 62,000

Transmission Access Good

U.S.G.S. Topographic Map (Scale 1:250,000) Healy

COMMENTS:

Alternative to Upper Nenana system; inundate Carlo (57) and Bruskansna (58).

EVALUATIONS:

CH2M HILL Utilizing Land Use Planning Commission Information:

Scale	Comments
5	On native selected lands -- next to existing road, railroad and power.

Alaska Department of Fish & Game:

Scale	Comments
5	Whitefish movements(?) Raptor nesting and hunting perches impacted.

National Marine Fisheries Services:

Scale	Comments
0	None.

U.S. Fish & Wildlife Service:

Scale	Comments
5	Migration route for waterfowl. Winter and fall moose habitat. Grayling and whitefish probably overwinter in pools along this section of water.

Trustees for Alaska:

Scale	Comments
0	Recreation use; scenic drive.

Alaska Center for the Environment:

Scale	Comments
0	Recreation -- adverse impact on present or potential recreation uses (tourism, floating rivers, etc.). Impact on McKinley Park area. Distance -- undesirable due to distance from markets, and length/cost of transmission facilities needed?

Site No. 56

Group Rank 3

Name Healy

Stream Nenana River

Power Potential (kW) 130,000

Transmission Access Good

U.S.G.S. Topographic Map (Scale 1:250,000) Healy

COMMENTS:

EVALUATIONS:

CH2M HILL Utilizing Land Use Planning Commission Information:

Scale	Comments
10	State land -- next to existing road, railroad and power.

Alaska Department of Fish & Game:

Scale	Comments
5	Whitefish movements(?) Resident fish spawn in tributaries; overwintering? Raptor nesting and hunting perches impacted.

National Marine Fisheries Services:

Scale	Comments
0	None.

U.S. Fish & Wildlife Service:

Scale	Comments
5	Migration route for waterfowl, winter and fall moose habitat. Grayling and whitefish over-wintering area.

Trustees for Alaska:

Scale	Comments
0	Recreation use; scenic area.

Alaska Center for the Environment:

Scale	Comments
10	Proximity -- project is apparently desirable because of closeness to markets for electricity or existing corridors.

Site No. 57

Group Rank 6

Name Carlo

Stream Nenana River

Power Potential (kW) 30,000

Transmission Access Good

U.S.G.S. Topographic Map (Scale 1:250,000) Healy

COMMENTS:

Assumes operation as a system with Bruskasna (58) and Totatlanika River (59).

EVALUATIONS:

CH2M HILL Utilizing Land Use Planning Commission Information:

Scale	Comments
0	In Mt. McKinley National Park. Next to existing road, railroad and power. Raptor nesting and hunting perches impacted.

Alaska Department of Fish & Game:

Scale	Comments
5	Whitefish movements (?) Resident fish in tributary.

National Marine Fisheries Services:

Scale	Comments
0	None.

U.S. Fish & Wildlife Service:

Scale	Comments
5	Migration route for waterfowl. Winter and fall moose habitat. Grayling and whitefish probable overwintering area. Raptor eyries common in this area.

Trustees for Alaska:

Scale	Comments
0	Recreation use; scenic area.

Alaska Center for the Environment:

Scale	Comments
0	Recreation -- adverse impact on present or potential recreation uses (tourism, floating rivers, etc.).

Impact on McKinley Park area.

Distance -- undesirable due to distance from markets, and length/cost of transmission facilities needed?

Site No. 58

Group Rank 3

Name Bruskasna

Stream Nenana River

Power Potential (kW) 40,000

Transmission Access Good

U.S.G.S. Topographic Map (Scale 1:250,000) Healy

COMMENTS:

Assumes operation as a system with Carlo (57) and Totatlanika River (59).

Note that (57) is a very poor site because of location in Mt. McKinley Park.

EVALUATIONS:

CH2M HILL Utilizing Land Use Planning Commission Information:

Scale	Comments
10	On state land; reservoir may be on native selected and D-1 land. Close to existing highway.

Alaska Department of Fish & Game:

Scale	Comments
5	Whitefish, Arctic grayling wintering(?) and movements(?) Resident. Raptor nesting and hunting perches impacted.

National Marine Fisheries Services:

Scale	Comments
0	None.

U.S. Fish & Wildlife Service:

Scale	Comments
5	Some waterfowl nesting occurs in this area. Minor waterfowl migration route. Caribou winter range. Grizzly bear and moose present throughout project area.

Trustees for Alaska:

Scale	Comments
0	Recreation use; scenic area.

Alaska Center for the Environment:

Scale	Comments
0	Distance -- undesirable due to distance from markets, and length/cost of transmission facilities needed.
	Access -- maintenance roads, etc., would encourage new and excessive (usually motorized) access to remote areas, with attendant damage to wildlife and nonmotorized recreation values.

Site No. 59

Group Rank 1

Name Totatlanika River

Stream Totatlanika River

Power Potential (kW) 24,000

Transmission Access Good

U.S.G.S. Topographic Map (Scale 1:250,000) Fairbanks

COMMENTS:

Assumes operation as a system with Carlo (57) and Bruskasna (58).

Note that Carlo (57) has a very poor rating.

EVALUATIONS:

CH2M HILL Utilizing Land Use Planning Commission Information:

Scale	Comments
10	On state land -- reasonably near trails, local road.

Alaska Department of Fish & Game:

Scale	Comments
10	Resident Arctic grayling, whitefish. Wildlife habitat flooding (?) Raptor nesting and hunting perches impacted.

National Marine Fisheries Services:

Scale	Comments
5	None.

U.S. Fish & Wildlife Service:

Scale	Comments
5	Grayling fishery. Project and transmission corridor would affect significant amounts of moose habitat. This area extensively used for trapping.

Trustees for Alaska:

No information.

Alaska Center for the Environment:

Scale	Comments
0	Distance -- undesirable due to distance from markets, and length/cost of transmission facilities needed.
	Access -- maintenance roads, etc., would encourage new and excessive (usually motorized) access to remote areas, with attendant damage to wildlife and nonmotorized recreation values.
	Too Big -- sheer magnitude of project causes us to question its desirability.

Site No. 60

Group Rank 6

Name Salcha River

Stream Salcha River

Power Potential (kW) 25,000

Transmission Access Good

U.S.G.S. Topographic Map (Scale 1:250,000) Big Delta

COMMENTS:

EVALUATIONS:

CH2M HILL Utilizing Land Use Planning Commission Information:

Scale	Comments
10	State land -- on existing trail, proposed road.

Alaska Department of Fish & Game:

Scale	Comments
0	King salmon, chum salmon, Arctic grayling, movements, rearing and spawning. Flood moose habitat, recreation sites, routes, gold mining. Raptor nesting and hunting perches impacted.

National Marine Fisheries Services:

Scale	Comments
0	None.

U.S. Fish & Wildlife Service:

Scale	Comments
0	Chum and king salmon spawning and/or migration would be significantly affected by this project. Some waterfowl nesting. Winter moose habitat.

Trustees for Alaska:

Scale	Comments
0	Fisheries conflict; heavy recreation use.

Alaska Center for the Environment:

Scale	Comments
5	Proximity -- project is apparently desirable because of closeness to markets for electricity or existing corridors. Lake -- based on available information, dam would create lake of excessive size, given local conditions (settlement, wildlife habitat, etc.)?

Site No. 61

Group Rank 6

Name Tanana River (Little Delta)

Stream Tanana River

Power Potential (kW) 65,000

Transmission Access Good

U.S.G.S. Topographic Map (Scale 1:250,000) Big Delta

COMMENTS:

EVALUATIONS:

CH2M HILL Utilizing Land Use Planning Commission Information:

Scale	Comments
10	State land -- existing road, power, pipeline, proposed railroad.

Alaska Department of Fish & Game:

Scale	Comments
0	Chum, king and silver salmon migration route would be blocked, spawning and rearing habitat flooded. Moose habitat flooded, trapping areas would be lost. Fish overwintering impacted as well as sheefish, whitefish, Arctic grayling movements.

National Marine Fisheries Services:

Scale	Comments
0	None.

U.S. Fish & Wildlife Service:

Scale	Comments
0	Chum, king and silver salmon migration would be significantly impeded by this project. Waterfowl migration route. Peregrine falcon nest was observed in 1978 less than 2 miles upstream from dam site.

Trustees for Alaska:

No information.

Alaska Center for the Environment:

Scale	Comments
5	Proximity -- project is apparently desirable because of closeness to markets for electricity or existing corridors. Lake -- based on available information, dam would create lake of excessive size, given local conditions (settlement, wildlife habitat, etc.)?!?

APPENDIX E
PERTINENT CORRESPONDENCE

STATE OF ALASKA

JAY S. HAMMOND, GOVERNOR

DEPARTMENT OF NATURAL RESOURCES

LAND AND WATER MANAGEMENT

323 E. 4TH AVENUE – ANCHORAGE 99501

October 20, 1978

Mr. Ron Reiland
CH2M Hill
310 "K" Street, Suite 602
Anchorage, AK 99501

Dear Mr. Reiland:

During the week of October 9, 1978, we received a ringbinder identifying 61 potential dam sites along with a request for input from the Division of Lands on a variety of issues including land classification, water rights, and socioeconomic impacts. We understand that this document is a first-cut at site evaluation. However, given the time deadline of October 20, it is impossible to divert our staff from other high priority ongoing projects on such short notice to provide any reasonable input.

We are interested in providing information on these sites and could, in fact, do so if the timeframe is extended to December 15. Therefore we reserve any judgment until sufficient review time and more specific site information is available. Additional site information should include: 1) type and major components (reservoirs, penstocks, powerhouses) of the hydroelectric projects anticipated at the various sites; 2) more specific site locations, preferably on USGS 1:63360 quad sheets, 3) power generation potential of the sites, 4) anticipated storage capacity of the impoundments, 5) and potential markets to be served by the projects (to help determine powerline and highway right-of-way needs).

Again, we are interested in providing information to your project, but we require a more reasonable review time.

Sincerely,

Brent N. Petrie

Brent N. Petrie
Acting Chief, Water Management

cc: Steve Reeve - Planning and Classification
Dave Hanson - Planning and Research
John Morris - SCDO

10-J4LH

United States Department of the Interior

FISH AND WILDLIFE SERVICE

NORTHERN ALASKA ECOLOGICAL SERVICES
Room 266, Federal Building, Box 20
101 12th Avenue
Fairbanks, Alaska 99701
October 20, 1978

Corby Howell
CH2M Hill
Anchorage Office
310 K Street
Anchorage, Alaska 99501

Dear Mr. Howell:

Enclosed is our evaluation of 13 of the 61 dam sites proposed by the U.S. Army Corps of Engineers. These dam sites, 49 through 61, are all that fall within our jurisdiction. The remaining 48 should be evaluated by our Western Alaska Ecological Services office in Anchorage. If you have any questions, please contact Jerry Stroebele or myself.

Sincerely yours,

Michael W. Smith
Michael W. Smith
Fish and Wildlife Biologist

CONSERVE
AMERICA'S
ENERGY

Save Energy and You Serve America!

"WE ARE NOT HERE TO MAKE A LIVING. WE ARE HERE TO MAKE A LIFE."
W. E. RUSSELL

ALASKA CENTER FOR THE ENVIRONMENT

913 WEST 6TH AVENUE ANCHORAGE, ALASKA 99501 (907) 274-3621

October 25, 1978

Ms. Corby Howell
CH2M-Hill
310 K Street
Anchorage, AK 99501

Dear Ms. Howell,

This letter is part of our response to your Evaluation Package for 61 proposed alternative hydroelectric sites.

Given the data available to us, our comments are necessarily very general. We have not attempted to address fish/wildlife impacts, except in obvious cases. Our primary concerns have been the impacts each proposal might have in terms of encouraging unnecessary access to remote areas and loss of significant habitat, scenic or recreation values, due to size or location of the dams/lakes.

We will be preparing a more detailed response, based on proposed impoundment areas, better maps, etc., as soon as we can obtain these. Therefore, the enclosed comments should be regarded as very preliminary, as a starting point for further work, and subject to modification in the light of new information.

The format for seeking comment is quite good particularly given the time constraints involved.

We appreciate the opportunity to comment, and to look forward to a continuing and active role in this process.

Thank you,

Paul Lowe
Executive Director

P.S. Please note the key to abbreviations used in our Comments, on the title page for that section.

RECYCLED PAPER

PLEASE NOTE: THE PRECEDING PAGES WERE TREATED AS A UNIT IN THE ORIGINAL DOCUMENT.

UPPER SUSTINA RIVER PROJECT
ALASKA

ANALYSIS OF
POTENTIAL
ALTERNATIVE HYDROELECTRIC SITES
TO SERVE RAILBELT AREA

November, 1978

DRAFT

U.S. Department of Energy
Alaska Power Administration
Juneau, Alaska

Contents

I. PURPOSE AND SCOPE

This analysis presents an evaluation of possible hydroelectric generation alternatives to the Upper Susitna ~~River~~ Basin Project. Specifically, the concern exists that supplying projected electric power demands in the central and southcentral "Railbelt" areas of Alaska (the market area of the project) may be better accomplished by development of several projects of less generation capability than the Susitna project. Analysis of the possible alternatives is based on consideration of potential hydropower projects near the Railbelt area.

More than 2,000 potential hydroelectric generation sites distributed throughout the State have been identified by various agencies over the past years. most are in the central and southcentral areas. Subsequently, the majority of possible sites have been eliminated from more detailed consideration by judgment evaluation of available topographic, geologic, hydrologic, and land use data. Although some of the data were limited, comparable evaluations of primary factors could be made because of the scope involved (limited runoff, large reservoirs with unacceptable environmental impacts, unfavorable geology in wide glacial valleys, and national parks and monuments limitations). (7)

An eventual list of 252 sites worthy of appraisal level analysis was assembled by Alaska Power Administration (APA) in the late 1960's. The list and a map of site locations are enclosed. This is refered to as the "list of 252 sites."

Further analysis was made of sites with at least 2,500 kilowatts (kW) electric power generation potential. This included field topographic, geologic, and hydrologic investigation of some of the sites, and appraisal estimates of potential power generation costs of all of the sites. The result was a list of the 76 best sites that has been the baseline pool of the most economic potential hydropower sites for consideration by State and Federal agencies during the past several years. (These 76 sites are also identified on the list of 252 sites, and are referred to as the "76 sites.")

In this analysis various combinations of the 76 sites are compared with Susitna power demand projections and costs. Also considered are large potential projects that could singly supply Susitna market area demands.

II. CONCLUSION

The conclusion of this analysis is that there are no combinations of small projects, or single large projects, that can satisfy projected Railbelt electric power requirements as ecomonically as the Upper Susitna River Project. The primary reasons are that (1) the large sites are unavailable because of designated land uses (national parks and monuments, etc.), and (2) combinations of small sites are more costly per unit of energy produced. Only a few small sites could provide power at costs comparable with Susitna, but would supply only a fraction of the projected power demands of the Railbelt area.

III. BASIS OF COMPARISON

Two bases are used for comparing other potential hydropower sites with the Susitna project: (1) selection of single or multiple sites with the potential of as much power generation capability as Susitna, and (2) comparison of costs in mills per kilowatt-hour (kwh) of average annual energy produced.

A. Power Requirements

The projected power requirements for the Upper Susitna River Project market area (Anchorage-Fairbanks "Railbelt" area) are:

	1980		1990		2000	
	MW 1/	GWH 2/	MW	GWH	MW	GWH
High	890	3,930	2,360	10,680	4,650	20,940
Medium	830	3,660	1,590	7,080	2,850	12,740
Low	770	3,390	1,180	5,220	1,780	7,890

These projections include the total utility, industrial, and national defense needs, and are based on Institite of Social and Economic Research (ISER) 1978 population and employment estimates.

The earliest online date of the project, or an alternative, would be the early 1990's. Consequently, comparison is based on load requirement increase after 1990, which would be from 600 MW (low range) to 2,290 MW (high range). Alternative sites or groups of sites with potential

1/ MW (megawatt) = 1000 kw
2/ GWH (gigawatt-hour) = 1,000,000 kwh

production in this range are considered. The Susitna project would generate about ~~1,390~~ 1573 MW. Correspondingly, annual firm annual energy requirements would range from 2,670 GWH to 10,260 GWH, with Susitna planned to provide ~~6,100~~ 6787 GWH.

B. Cost

Estimates of the cost of power generation (mills per kwh) were prepared for each of the 252 sites. This is the index cost (last column) of the list of 252 sites, which is the basis of economic comparision of the sites (generation only--no transmission). (Costs are based on 1965-66 prices, 50 year repayment at 3 3/4 3 1/8 percent interest rate, and complete utilization of average annual energy.)

The combination of the four Susitna River sites (127 - Devil Canyon, 128 - Watana, 129 - Vee, 130 - Denali) resulted in an index of 6.3 (mills per kwh). This is the basis of economic comparison of possible alternatives.

For information purposes, possible alternatives are discussed that are within twice the cost range of Susitna (12.6 mills per kwh). This is to allow some flexibility for contingencies and unknowns should more detailed consideration become warranted, and, ~~frankly~~ candidly, because very few sites are within the cost range.

Even though economic comparison is based on work that is several years old, it is concluded to be valid. More recent estimates of the Susitna

River sites correspond generally with costs that would be obtained by indexing earlier costs to present levels. More specifically, cost estimates for energy from the four Susitna River sites, by the Corps of Engineers in the December 1975 Interim Feasibility Report Southcentral Railbelt Area, Alaska - Upper Susitna River Basin, are within 10 percent of the index cost escalated to 1975 by construction cost trends. Therefore, economic comparison of possible alternatives is based on relative costs from the list of sites rather than updating all costs on the list.

IV. SELECTION OF ALTERNATIVES Potential alternatives were selected in two catagories--large single sites that could provide about 600 MW minimum at approximatly 6.3 mills/kwh, and combinations of smaller sites grouped by geographic area (River Basin). Finding no suitable alternatives from this procedure, the best small single sites from the combinations were combined and evaluated. (The first reference number applies to the list of 252 sites, and the parenthesized number applies to the best 76 sites. The reference numbers do not indicate economic ranking--they are for list reference only.)

A. Large Capacity Single Sites

Six large capacity single sites have the potential of meeting the minimum capacity requirements and cost requirements, and one site has slightly less than minimum capacity potential. The sites are:

No.	Site	Stream	Firm Energy GWH/yr	Capacity MW	Cost Mills/KWH
16 (6)	Holy Cross	Yukon R.	12,300	2,800	9.0
29 (11)	Ruby	Yukon R.	6,400	460	3.9
54 (20)	Rampart	Yukon R.	34,200	5,040	2.0
59 (21)	Procupine	Porcupine R.	2,320	530	5.0
60 (22)	Woodchopper	Yukon R.	14,200	3,200	4.5
64 (24)	Yukon-Taiya	Yukon R.	21,000	3,200	3.3
173 (54)	Wood Canyon	Copper R.	21,900	3,600	3.2

The Ruby and Porcupine sites are too small to be effective single projects, and distantly located from the service area. Rampart and Wood Canyon are too large, and again because of distant location would require extensive transmission to the service area. Yukon-Taiya would require rights-of-way ~~within a~~ ~~-way~~ within an international park, and agreement with Canada. Power from Holy Cross would be about 50 percent more costly than from Susitna. The remaining site--Woodchopper--is not located conveniently to the service area, and has excess capacity.

Additionally, all sites are within areas that have been designated as Ntional Monuments, are being considered for either the Wild and Scenic Rivers or National Park systems, or are on large rivers where severely objectionable environmental impacts would result.

Sites within the Nenana River basin have also been identified in past

(Small capacity)

work, but all would be precluded by Mount McKinley National Park.

It is therefore concluded that no single large hydro generation sites are available as alternatives to the Upper Susitna River Project.

B. Combinations of Small Capacity Sites (Geographic Areas)

Combinations of single sites with less capacity than Susitna requirements can be compared with the generation capacity and cost criteria. Combinations consist of sites within a river basin or other geographically bounded area, and scattered small sites within the Railbelt area. A more detailed description of the sites within each basin is presented in the attached ~~in V.~~ Appendix. The combinations are:

Area	Firm Energy GWH/yr	Capacity MW	Cost Range Mills/KWH
1. Matanuska R.B.	935	194	21.7 - 124.2 ~~124.2 145.5~~
2. Tanana R.B.	5,806	136	15.1 - 69.4
3. Cook Inlet-N.Northwest Drainage	2,221	507	6.5 - 83.4 ~~19.1~~
4. Skwentna-Yentna R.B.	2,312	609	10.1 - 72.8
5. Talkeetna R.B.	1,107	237	11.3 - 68.6
6. Chultina R.B.	1,542	245	8.1 - 366 ~~122.2~~
7. Kenai Peninsula	2,360	646	11.2 - 122.2 ~~128.0~~

(1) → ¶ from p. 8.

¶ There are no combinations of sites within a geographic area (primarily river basin) that have sufficient potential generation capability to be considered

(Skwentna-Yentna Rivers Basin and Kenai Peninsula are marginal). In addition only a few individual sites are within the economic range of the cost of Susitna project power.

The scattered Railbelt sites are widely distributed and could not be reasonably developed as an intergated system. (Additional discussion is presented in Appendix paragraph 8.) Discussion of individual sites is included in the following paragraph (C.).

C. Distributed Best Small Capacity Sites

The third approach to evaluating a possible alternative to the Susitna project is to combine the economically best small sites from each of the geographic areas. Only one site (Chakachamna) is within the economic range of Susitna. Twelve sites are within twice the cost range, and are included in the following tabulation of the best small sites within the Railbelt area.

No.		Site (acceptability rating)	Stream	Firm Energy GWH/yr	Capacity MW	Cost Mills/KWH
93	(32)	Crescent Lake (5)	Crescent R.	179	41	9.9
94	(33)	Chakachamna (2)	Chakachatna R.	1,600	366	6.5
97	(34)	Coffee (6)	Beluga R.	160	37	11.5
98	(35)	Upper Beluga (6)	Beluga R.	210	48	11.1
105	(36)	Yentna (6)	Yentna R.		145)	
106	(37)	Talachulitna (6)	Skwentna	1,390	75)	10.1
107	(38)	Skwentna (6)	Skwentna		98)	
		(Yentna, Talachulitna, and Skwentna operated as a system)				
109	(39)	Lower Chulitna (6)	Chulitna	394	90	8.1
110	(40)	Tokichitna (6)	Chulitna	806	184	8.8
112	(41)	Keetna (6)	Talkeetna R.	324	74	11.3
150	(49)	Snow (2)	Snow R.	278	63	11.2
158	(51)	Lowe (not rated)	Lowe R.	254	55	11.2
	Total			5,595	1,276	

Another site-- Lane (no. 124, 240 MW) with an index cost of 8.9 could also be included based on the less than 12.6 criteria. However, it is actually a part of the Susitna River system because it is immediately downstream from the Devil Canyon site.

The Lowe site has the severe disadvantage that it would block the major land access route to Valdez; it would also involve relocating the Trans-Alaska oil pipeline and a highway, and a planned transmission line between Valdez and Glennallen.

Sites that are in designated National Monuments or are included in proposed Federal land withdrawals include Crescent Lake and Chakachamna in the Lake Clark area, and Tokichitna in the Denali area. These sites represent approximately half of the total potential power from the sites, leaving 685 MW capacity and 3,010 GWH energy.

Bradley Lake (no. 154-Kenai Peninsula) with an index cost of 8.0 is not included because it is already an authorized project (Corps of Engineers).

D. Results

Based on examination of indivdual sites and combinations of sites, there are no hydro generation opportunities available to generate power in sufficient quantity to be alternative to the Susitna project. Small indivdual sites may be available, but would satisfy only a small portion of the market area demand. Other sites with apparently acceptable ~~quantity~~ capacity and economic capabiltiy have been or will be precluded by land status designation.

APPENDIX

~~Detailed~~ Description of Small Capacity Sites

Within ~~of~~ Geographic Areas

Following are tabulations of parameters of sites within each of the geographic areas examined, and descriptions of some of the particular factors of each area. The site number refers to the list of 252 sites while the number in parenthesis refers to the list of (best) 76 sites The comparison is to a Susitna project energy cost index of 6.3 mills/kwh and generation capability of 6,100 GWH/yr (range from 2,670 to 10,260 GWH/yr).

1. Matanuska River Basin

No.	Site	Stream	Firm Energy GWH/yr	Capacity MW	Cost Mills/KWH
133	Palmer	Matanuska R.	79	16	195.5
134	Moose Creek (Alternative to Palmer)	Matanuska R.	100	21	124.2
135	King Mountain	Matanuska R.	210	44	37.6
136	Coal Creek (Alternative to King Mountain)	Matanuska R.	307	64	78.5
137	Boulder Creek	Boulder Cr.	69	14	57.0
138	Rush Lake	Boulder Cr.	45	9	92.7
139	Purinton Creek (Alternative to Hicks)	Matanuska R.	324	67	108.1
140	Hicks Site	Matanuska R.	286	59	37.2
141	Caribou Creek	Caribou Cr.	90	19	21.7
	Total (excluding Palmer, King Mountain, and Hicks)		935	194	

The small Caribou Creek site, which has the lowest index cost, was determined to be infeasible because it is located in a broad glaciated valley with poor foundation, and probable severe reservoir sedimentation.

2. Tanana River Basin

No.	Site	Stream	Firm Energy GWH/yr	Capacity MW	Cost Mills/KW
31	Vachon Island	Tanana R.	2,050	426	29.0
	(Alternative to Junction Island)				
32 (12)	Junction Island	Tanana R.	2,330	532	15.1
45	Salcha River	Salcha R.	123	25	69.4
46	Tanana River (Little Delta)	Tanana R.	315	65	43.1
47 (16)	Big Delta	Tanana R.	987	226	16.8
48 (17)	Gerstle	Tanana R.	438	100	17.0
49 (18)	Johnson	Tanana R.	920	210	16.1
50 (19)	Cathedral Bluffs	Tanana R.	693	158	15.3
	Total (excluding Vahcon Island)		5,806	1,316	

Three of the sites-- Vachon Island, Salcha River, and Tanana River (Little Delta)-- are significantly more costly than the others. All sites except Salcha River involve regulation of the main stem of the Tanana River.

Additional geologic investigation after development of cost estimates revealed that Cathedral Bluffs would require extensive foundation treatment, which is not reflected in the cost estimate.

3. Cook Inlet - Northwest Drainage

There are several sites northwest of Cook Inlet, most of which are smaller than 50 MW.

No.	Site	Stream	Firm Energy GWH/yr	Capacity MW	Cost Mills/KW
90 (32)	Crescent Lake	Cresecent R.	179	41	9.9
94 (33)	Chakachamna	Chakachatna R.	1,600	366	6.5
95	Chuitna	Chuitna R.	45	9	83.4
96	Lower Beluga	Beluga R.	72	15	19.1
97 (34)	Coffee	Beluga R.	160	37	11.5
98 (35)	Upper Beluga	Beluga R.	210	48	11.1
99	Strandline Lake	Beluga R.	81	17	30.8
	(Upper Beluga would reduce Stadline Lake energy 12 GWH/yr.)				
	Total		2,347	533	

Two of the sites, Chuitna and Strandline Lake, are very costly. Chakachamna has an index cost comparable to Susitna (6.5 versus 6.3). Chakachamna could supply 60 percent of the low estimate 1990-2000 power requirement, 30 percent of the medium estimate, and 15 percent of the high estimate. Part of Lake Chakachamna is included in the recently designated Lake Clark National Monument, and it may not be available for development. Crescent Lake is also in the Lake Clark National Monument.

4. Yentna-Skwnetna River Basin

No.	Site	Stream	Firm Energy GWH/yr	Capacity MW	Cost Mills/KWH
100	Lake Creek (Lower)	Lake Creek	105	22	32.6
101	Upper Lake Creek	Lake Creek	74	15	20.3
102	Talachulitna River	Talachulitna R.	137	28	41.6
103	Hayes, Skwentna R.	Skwentna R.	429	89	72.8
104	Emerald	Skwentna R.	177	37	69.7
105 (36)	Yentna	Yentna R.		145)	
106 (37)	Talachulitna	Skwentna R.	1,390	75)	10.1
107 (38)	Skwentna	Skwentna R.		98)	
	(Yentna, Talachulitna, and Skwentna operated as a system)				
Total			2,312	609	

The cost of the Yentna-Skwentna system includes 70 miles of access road. This system is the lowest cost potential hydro development other than authorized projects and those that would be precluded by land use designations. The capacity of the system would be 318 MW.

5. Talkeetna River Basin

No.	Site	Stream	Firm Energy GWH/YR	Capacity MW	Cost Mills/KWH
108	Chunilna Creek	Chunilna Cr.	25	5	50.9
111	Talkeetna R. (Sheep)	Talkeetna R.	149	31	40.4
112 (41)	Keetna	Talkeetna R.	324	74	11.3
113	Iron Creek	Iron Creek	147	31	63.9
114	Granite Gorge	Talkeetna R.	345	72	43.8
115	Greenstone (Alternative to Granite Gorge)	Talkeetna R.	246	51	38.6
116	Trapper	Talkeetna R.	216	45	68.6
	Total (excluding Granite Gorge)		1,107	237	

Most of the sites in this basin require large dams (from 300 to 565 feet high and more than 3,000 feet long).

6. Chulitna River Basin

No.	Site	Stream	Firm Energy GWH/yr	Capacity MW	Cost Mills/KW
109 (39)	Lower Chulitna	Chulitna R.	394	90	8.1
110 (40)	Tokichitna	Chulitna R.	806	184	8.8
117	Lucy	Chulitna R.	71	15	19.3
118	Coal	Chulitna R.	193	40	36.6
119	Ohio (would inundate Coal and Chulitna-Hurricane)	Chulitna R.	144	30	21.0
120	Chulitna-Hurricane	Chulitna R.	166	34	26.7
121	West Fork Chulitna	W.F. Chulitna R.	68	14	33.4
122	East Fork Chulitna	E.F. Chulitna R.	59	12	31.3
	Total (excluding Coal and Chulitna-Hurricane)		1,542	345	

Two sites (Coal and Chulitna-Hurricane) are eliminated by a more economical third site (Ohio) which would involve the same reach of river. Only the Lower Chulitna and Tokichitna sites are near the economic range of Susitna. Part of the Tokichitna reservoir would be included in the new Denali National Monument.

7. Kenai Peninsula

The Kenai Peninsula has several sites, most of which are small and at best marginally economical.

No.		Site	Stream	Firm Energy GWH/yr	Capacity MW	Cost Mills/KW
143		Sunrise	Sixmile Cr.	52	11	122.2
144		Lower Kenai	Kenai R.	263	55	18.2
145		Moose Horn	Kenai R.	290	60	18.8
146		Killey River	Killey R.	100	21	38.1
147		Stelters Ranch	Kenai R.	403	84	17.9
148		Kenai Lake (Alternative to Stelters Ranch site)	Kenai R.	552	115	22.3
149		Crescent Lake	Crescent L.	29	55	31.4
150	(49)	Snow	Snow R.	278	63	11.2
152		Tustumena	Tustumena Gla.	102	21	17.1
153		Sheep Creek	Sheep Cr.	94	20	23.8
154	(50)	Bradley Lake (Authorized Project)	Bradley Cr.	410	94	8.0
155		Resurrection R.	Resurrection R.	86	18	58.5
156		Nellie Juan River	Nellie Juan R.	47	10	32.0
157		Upper Nellie Juan	Nellie Juan R.	57	12	17.6
	Total (excluding Kenai Lake)			2,404	515	

For comparison purposes Bradley Lake energy cost on a January 1977 price basis is 36 mills per kilowatt-hour compared to the index cost of 8.0. This factor of 4.5 includes several plan modifications and refinements to reduce costs. Bradley Lake is an authorized project with final planning, design, and construction funding pending. It is a supplement to the Susitna project and not a signifigant alternative.

An average of two to five of these sites would have to be developed each year to meet the Anchorage-Kenai area projected power growth of 200 MW annually during the 1990's. Environmental impacts for development of the Kenai River sites would be signifigant, primarily due to extensive fishery.

8. Scattered Railbelt Sites

Scattered sites and small basins within the Railbelt area include:

No.		Site	Stream	Firm Energy GWH/yr	Capacity MW	Cost Mills/KW
33		Kantishna River	Kantishna R.	394	82	22.2
34		McKinley River	McKinley R.	201	42	42.3
35		Chatanika River	Chatanika R.	32	7	63.0
36		Teklanika River	Teklanika R.	272	57	24.2
43		Totatlanika River	Totatlanika R.	114	24	33.1
44		Chena River	Chena R.	46	10	128.0
51		Nabesna	Nabesna R.	320	66	33.9
52		Chisana River	Chisana R.	797	170	21.8
53		Rock Lake	Ptarmigan Cr.	58	12	56.5
126		Deadman Creek	Deadman Cr.	165	34	22.7
131		McLaren River	McLaren R.	263	55	45.2
132		Boulder Creek	Boulder Cr.	35	7	55.6
142		Eagle River	Eagle R.	45	9	38.8
158	(51)	Lowe	Lowe R.	254	55	11.2
159		Allison Creek	Allison Cr.	18	4	19.5
160		Solomon Gulch	Unnamed	11	2	27.0
161		Silver Lake	Duck R.	48	10	15.6
	Total			3,073	646	

Most of these sites are small - less than 100 MW. Their scattered locations are not conductive to intertieing energy supplies of a large area such as the Railbelt. Several sites are in designated National Monuments or in proposed National Park areas. The Lowe site is in a canyon occupied by the Trans-Alaska oil pipeline and the only highway access to Valdez, and the route of a planned Valdez-Glennallen transmission line.

The Solomon Gulch project, under ~~proposed for~~ construction by the Copper Valley Electric Association at an estimated cost of 5.4 times the inventory cost, is an example of a rather expensive site that has been determined locally to be the best available alternative power source.

The Silver Lake site with an index cost of 2.5 times the Susitna index has a possibility of serving a part of the local power needs of the Valdez area, but would not be a significant alternative or contributor to meeting the larger Railbelt area needs.

ALASKA POW[illegible]ON
Inventory of Potential [illegible] ites in Alaska
size criteria is generally 2[illegible]us power) and larger

No.	Power Site	Stream	USGS Map sheet	Drainage Area (sq. mi.)	Maximum Regulated Water Surface (ft.)	Average Head (ft.)	Average Annual Runoff (1000 AF)	Per Cent Regulation	Firm Energy (million Kwh)	Installed Capacity (1000 KW)	1/ (plant factor %)	Index Cost 2/	
ARCTIC REGION													
1	Killik Bend	Colville R.	Killik R.	9,780	700	218	4,100	97	718	148	55	26.6	
2	Awuna River	Awuna R.	Lookout Ridge	605	1,000	528	230	100	101	21	55	62.9	
3	Kucher Creek	Colville R.	Killik R.	6,240	975	120	2,600	100	254	53	55	35.4	
NORTHWEST REGION													
4 (1)	Agashashok	Noatak R.	Noatak A-2	12,700	150	132	7,500	100	820	186	50	8.7	
5 (2)	Misheguk	Noatak R.	Baird Mtn. D-6	8,700	550	199	5,600	83	760	174	50	10.8	
6 (3)	Nimiuktuk	Noatak R.	Baird Mtn. D-3	7,000	750	166	4,500	100	613	140	50	12.7	
7 (4)	Kobuk River	Kobuk R.	Baird Mtn. A-1	7,840	150	114	5,700	100	526	120	50	15.8	
8	Kogoluktuk	Kogoluktuk R.	Shungnak D-2	412	400	129	351	100	37	8	55	27.2	
9	Upper Kobuk River	Kobuk R.	Shungnak	2,970	275	62	2,200	99	114	23	55	39.5	
10	Buckland River	Buckland R.	Candle D-5	2,410	130	103	930	100	79	16	55	42.0	
11 (5)	Tuksuk Gorge	Tuksuk Channel	Teller A-2	4,275	190	187	1,880	100	289	66	50	19.0	
12	Kuzitrin River (Bunker Hill site)	Kuzitrin R.	Bendleben A-6	1,790	150	95	860	100	67	14	55	49.4	Would be inundated by a Tuksuk Gorge project, or would reduce Tuksuk to elevation 50 and 77 million Kwh.
13	Salmon Lake	Kruzgamepa R.	Solomon D-6	107	500	155	267	70	24	5	55	126.0	
14	Fish River	Fish R.	Solomon D-3	1,120	150	103	720	100	60	13	55	48.0	
YUKON (INTERIOR) REGION													
15	Upper Chuilnak River	Atchuilnak R.	Holy Cross D-5	162	625	103	140	95	11	2	55	422.0	
16 (6)	Holy Cross	Yukon R.	Holy Cross A-1&2	320,000	137	94	160,000	100	12,300	2,800	50	9.0	
17	Kaltag	Yukon R.	Nulato	296,000	200	117	137,000		13,100	3,000	55		An alternative to Holy Cross.
18 (7)	Dulbi	Koyukuk R.	Kanteel R. B-1	25,660	225	68	19,200	100	1,070	244	50	14.8	
19	Fry Island	Koyukuk R.	Melozitna D-4	19,950	270	54	14,000	100	622	114	55		Alternative to Dulbi, cost was not calculated.
20 (8)	Hughes	Koyukuk R.	Hughes A-3	18,700	320	49	12,300	100	482	110	50	11.2	
21 (9)	Kanuti	Koyukuk R.	Hughes	17,970	500	166	11,900	100	1,612	368	50	12.2	
22	Alatna River	Alatna R.	Hughes	2,860	725	109	2,000	100	175	36	55	23.1	
23	Alatna River, Upper	Alatna R.	Survey Pass	1,325	1,050	158	920	100	123	25	55	64.5	
24	Jim River	Jim R.	Bettles D-2	470	975	162	320	100	43	9	55	42.6	
25	Jack White	Koykuk R.	Bettles	4,350	800	136	3,000	---	315	65	55	18.1	
26	John River	John R.	Wiseman A-4	2,695	800	107	1,900	90	149	31	55	38.8	
27 (10)	Melozitna	Melozitna R.	Ruby D-6	2,659	550	270	1,400	91	282	64	50	11.2	
28	Melozitna River	Melozitna R.	Melozitna B-4	2,020	700	129	1,100	100	117	13	55	48.5	
29 (11)	Ruby	Yukon R.	Ruby D-5	256,200	210	72	109,000	100	6,400	460	50	3.9	3/ Inventory plan is premised on development of Rampart.
30	Nowitna River	Nowitna R.	Ruby B-2	2,570	450	180	1,900	100	280	58	55	16.1	
31	Vachon Island	Tanana R.	Kantishna R. D-3	44,500	350	96	26,000	96	2,050	426	55	29.0	Alternative site to Junction Island.
32 (12)	Junction Island	Tanana R.	Kantishna R. D-1	42,490	400	114	25,000	100	2,330	532	50	15.1	
33	Kantishna River	Kantishna R.	Kantishna R. B-1	5,440	500	95	5,200	99	394	82	55	22.2	
34	McKinley River	McKinley R.	Mt. McKinley B-3	710	1,775	297	910	90	201	42	55	42.3	
35	Chatanika River	Chatanika R.	Livengood A-4	770	500	91	420	99	32	7	55	63.0	
36	Teklanika River	Teklanika R.	Healy D-6	520	1,800	457	728	100	272	57	55	24.2	
37	Browne	Nenana R.	Fairbanks A-5	2,450	1,000	207	3,400	66	385	80	55	58.0	
38	Walker Creek	Nenana R.	Fairbanks A-5	2,330	1,200	166	3,300	35	166	35	55	87.5	Alternative for upper Nenana River System. It would inundate
39	Yanert No. 2	Nenana R.	Healy C-4	1,190	2,200	232	1,670	93	298	62	55	37.2)	(Carlo and Bruskansna sites.
40 (15)	Healy	Nenana R.	Healy D-4	1,900	1,700	291	2,675)			130)			
41 (14)	Carlo	Nenana R.	Healy C-4	1,190	1,900	166	1,670)	83	840	30)	50	10.7	Assumes operation as a system.
42 (13)	Bruskansna	Nenana R.	Healy B-4	650	2,330	212	826)			40)			
43	Totatlanika River	Totatlanika R.	Fairbanks A-4	250	1,600	420	320	100	114	24	55	33.1	
44	Chena River	Chena R.	Big Delta D-5	950	900	107	523	99	46	10	55	128.0	
45	Salcha River	Salcha R.	Big Delta C-5	1,990	975	136	1,170	95	123	25	55	69.4	
46	Tanana River (Little Delta)	Tanana R.	Big Delta B-6	18,080	900	107	14,500	25	315	65	55	43.1	
47 (16)	Big Delta	Tanana R.	Big Delta A-4	15,300	1,100	99	12,500	98	987	226	50	16.8	
48 (17)	Gerstle	Tanana R.	Mt. Hayes D-2	10,700	1,290	59	9,500	---	438	100	50	17.0	
49 (18)	Johnson	Tanana R.	Mt. Hayes C-2	10,450	1,470	149	7,830	97	920	210	50	16.1	
50 (19)	Cathedral Bluffs	Tanana R.	Tanacross B-6	8,550	1,650	146	5,800	100	693	158	50	15.3	
51	Nabesna	Nebesna R.	Nebesna D-3	2,145	2,025	191	2,300	88	320	66	55	33.9	
52	Chisana River	Chisana R.	Nebesna A-3	732	3,250	883	1,100	100	797	170	55	21.8	
53	Rock Lake	Ptarmigan Creek	McCarthy D-1	93	3,600	514	140	98	58	12	55	56.5	
54 (20)	Rampart	Yukon	Tanana B-3	200,000	665	445	81,000	100	[illegible]4,200	5,040	75	2.0	
55	East Fork Chandalar River, Afterbay	E.F. Chandalar R.	Chandalar	5,500	900	99	1,500	100	122	25	55	21.1	
56	East Fork Chandalar River, Zimmerman Creek	E.F. Chandalar R.	Chandalar	5,500	1,100	169	1,500	100	210	44	55	29.3	
57	East Fork Chandalar River, Little Rock	E.F. Chandalar R.	Christian	4,200	1,600	132	1,150	95	119	25	55	70.3	
58	East Fork Chandalar River	E.F. Chandalar R.	Arctic	2,500	2,025	162	680	100	90	19	55	56.0	
59 (21)	Porcupine	Porcupine R.	Coleen B-1	23,400	975	313	9,100	100	2,320	530	50	5.0	
60 (22)	Woodchopper	Yukon	Charley R. B-5	122,000	1,020	300	57,600	100	14,200	2,160	75	4.5	
61 (23)	Fortymile	Fortymile	Eagle B-1	6,060	1,550	324	3,230	84	723	166	50	8.9	
62	No. Fork Fortymile	N.F. Fortymile	Eagle B-2	2,065	1,800	249	1,400	85	245	51	55	17.2	
63	So. Fork Fortymile	S.F. Fortymile	Eagle A-2	2,800	1,775	228	1,500	88	245	51	55	24.9	
64 (24)	Yukon-Taiya	Yukon	Skagway C-1	25,700	2,200	1,913	13,500	100	21,000	3,200	75	3.3	Yukon-Taiya would reduce downstream potential.

No.	Power Site	Stream	USGS Map sheet	Drainage Area (sq. mi.)	Maximum Regulated Water Surface (ft.)	Average Head (ft.)	Average Annual Runoff (1000 AF)	Regula- tion	Energy (million Kwh)	Installed Capacity (1000 KW)	1/ (plant factor %)	Index Cost 2/	
SOUTHWEST REGION													
65 (25)	**Crooked Creek**	**Kuskokwim R.**	Sleetmute D-6	31,100	500	352	32,400	100	9,400	2,140	50	5.0	
66	**So. Fork Kuskokwim River**	S.F. Koskokwim R.	McGrath A-1	870	2,000	174	840	60	72	15	55	112.0	
67	**Lake Kulik**	Wind R.	Dillingham	236	123	30	3,800	100	95	20	55	40.6	
68 (26)	**Nuyakuk Lake**	Nuyakuk R.	Dillingham D-6	1,530	342	176	4,300	90	555	127	50	15.9	
69	Chikuminuk	Allen R.	Taylor Mtns.	286	630	262	800	90	154	32	55	22.8	Would be reduced 11 million Kwh by development of Nuyakuk.
70	Upnuk Lake	Tikchik R.	Taylor Mtns.	100	830	170	280	100	39	8	55	46.6	
71 (27)	Iliamna Lake	Kuichak R.	Dillingham A-2	6,440	150	114	14,600	100	1,370	313	50	11.1	
72	Kakhonak Lake	Kakhonak R.	Iliamna B-4	145	300	200	275	100	45	9	55	53.8	
73	Newhalen River	Newhalen R.	Iliamna D-6	3,319	325	74	6,675	100	411	85	55	11.9	New mapping indicates Newhalen could be included on list of lower priced hydro.
74 (28)	Tazimina	Tazimina R.	Iliamna D-5	346	725	393	724	96	224	51	50	15.0	
75	Kontrashibuna	Tanalian R.	Lake Clark A-4	200	510	226	461	99	83	17	55	17.6	
76 (29)	Ingersol	Kijik R.	Lake Clark B-3	300	1,460	1,120	695	99	630	144	50	14.2	
77	Alagnak River	Alagnak R.	Iliamna A-8	530	775	170	960	35	47	10	55	53.5	
78	Nonvianuk Lake	Nonvianuk R.	Iliamna A-7	370	631	115	670	100	63	13	55	22.6	
79 (30)	Kukakluk Lake	Alagnek R.	Iliamna A-7	480	825	326	870	100	232	53	50	10.9	
80 (31)	Naknek	Naknek R.	Naknek C-2	2,720	150	124	4,600	100	473	108	50	13.2	
81	American Creek	American Creek	Mt. Katmai D-4	100	1,625	861	180	95	120	25	55	22.7	
82	Ukak River	Ukak R.	Mt. Katmai B-4	194	375	145	330	75	30	6	55	164.0	
83	Contact Creek	Contact Creek	Mt. Katnai A-6	54	1,050	274	92	65	13	3	55	354.0	
84	Becharof	Eggegik R.	Naknek A-3	1,280	70	58	1,600	100	76	16	55	21.3	
85	Ugashik Lakes	Ugashik R.	Ugashik C-3	830	50	33	1,100	100	30	6	55	50.2	
SOUTHCENTRAL REGION													
86	Olga Bay	Olga Narrows	Karluk A-1	335	70	64	710	100	37	8	55	68.6	Alternative to Fraser Lake.
87	Fraser Lake	Dog Salmon Creek	Karluk A-1	72	353	302	130	100	32	7	55	33.0	
88	Ayakulik	Ayukulik	Karluk A-2	181	200	181	330	100	49	10	55	42.6	
89	Karluk Lake	Karluk	Karluk C-1	165	400	344	300	100	85	18	55	24.9	
90	Terror Lake	Unnamed	Kodiak C-4	15	1,325	1,057	72	94	85	12	55	24.9	
91	McNeil River	McNeil River	Iliamna A-4	102	150	112	180	50	8	2	55	145.0	
92	Paint River	Paint R.	Iliamna A-4	205	150	115	370	80	28	6	55	115.0	
93 (32)	Crescent Lake	Crescent R.	Kenai B-8	200	599	517	454	98	179	41	50	9.9	
94 (33)	Chakachamna	Chakachatna R.	Tyonek A-7	1,120	1,127	793	2,460	100	1,600	366	50	6.5	
95	Chuitna	Chuitna R.	Tyonek A-4	66	800	552	140	70	45	9	55	83.4	
96	Lower Beluga	Beluga R.	Tyonek A-3	950	100	49	1,790	100	72	15	55	19.1	
97 (34)	Coffee	Beluga R.	Tyonik A-4	860	210	109	1,800	100	160	37	50	11.5	
98 (35)	Upper Beluga	Beluga R.	Tyonek B-4	840	375	142	1,800	100	210	48	50	11.1	
99	Strandline Lake	Beluga R.	Tyonek B-6	54	1,300	852	115	100	81	17	55	30.8	Development of Upper Beluga would reduce energy 12 million Kwh.
100	Lake Creek (Lower)	Lake Creek	Talkeetna A-2	335	800	305	710	60	105	22	55	32.6	
101	Upper Lake Creek	Lake Creek	Talkeetna B-3	85	1,400	560	180	90	74	15	55	20.3	
102	Talachulitna River	Talachulitna R.	Tyonek C-4	360	700	231	720	100	137	28	55	41.6	
103	Hayes, Skwentna R.	Skwnetna R.	Tyonek D-5	1,730	575	187	3,500	80	429	89	55	72.8	
104	Emerald	Skwentna R.	Tyonek D-8	370	1,900	366	790	74	177	37	55	69.7	
105 (36)	Yentna	Yentna R.	Tyonek C-2	6,400	150	82	12,750)			145)			
106 (37)	Talachulitna	Skwetna R.	Tyonek D-4	2,250	350	124	4,500)	79	1,390	75)	50	10.1	Assumes operation as a system.
107 (38)	Skwentna	Skwetna R.	Tyonek D-6	950	1,000	291	1,900)			93)			
108	Chulina Creek	Chulina Creek	Talkeetna B-1	240	800	198	380	40	25	5	55	50.9	
109 (39)	Lower Chulitna	Chulitna R.	Talkeetna B-1	2,600	500	89	6,350	84	394	90	50	8.1	
110 (40)	Tokichitna	Chulitna R.	Talkeetna C-1	2,560	725	186	6,700	85	806	184	50	8.8	
111	Talkeetna River (sheep)	Talkeetna R.	Talkeetna Mt. B-6	1,790	605	91	4,400	50	149	31	55	40.4	
112 (41)	Keetna	Talkeetna R.	Talkeetna Mt. B-6	1,260	950	286	1,690	82	324	74	50	11.3	
113	Iron Creek	Iron Creek	Talkeetna Mt. B-5	210	1,750	750	400	60	147	31	55	63.9	
114	Granite Gorge	Talkeetna R.	Talkeetna Mt. B-5	865	1,500	416	1,160	87	345	72	55	43.8	
115	Greenstone	Talkeetna R.	Talkeetna Mt. C-5	790	1,575	304	1,150	65	246	51	55	38.6	Alternative to Granite Gorge.
116	Trapper	Talkeetna R.	Talkeetna Mt. C-5	760	1,700	245	1,140	94	216	45	55	68.6	
117	Lucy	Chulitna R.	Talkeetna Mt. D-5	1,080	1,100	166	2,600	20	71	15	55	19.3	
118	Coal	Chulitna R.	Talkeetna Mt. D-6	985	1,450	241	2,400	40	193	40	55	36.3	Would be inundated by development of Ohio site.
119	Ohio	Chulitna R.	Talkeetna Mt. D-6	916	1,500	224	2,220	35	144	30	55	21.0	
120	Chulitna-Hurricane	Chulitna R.	Healy A-6	795	1,600	207	1,900	50	166	34	55	26.7	Would be inundated by development of Ohio site.
121	West Fork Chulitna	W.F. Chulitna R.	Healy A-6	355	1,900	287	640	45	68	14	55	33.4	
122	East Fork Chulitna	E.F. Chulitna R.	Healy A-5	135	2,500	380	240	80	59	12	55	31.3	
123 (42)	Whiskers	Susitna R.	Talkeetna B-1	6,320	490	59	7,500	100	368	84	50	11.5	
124 (43)	Lane	Susitna R.	Talkeetna C-1	6,280	660	169	7,500	100	1,052	240	50	8.9	
125 (44)	Gold	Susitna R.	Talkeetna Mt. C-6	6,160	850	189	7,327	100	1,139	260	50	13.1	
126	Deadman Creek	Deadman Dr.	Talkeetna Mt. D-3	160	3,000	962	350	60	165	34	55	22.7	
127 (45)	Devil Canyon	Susitna R.	Talkeetna Mt. D-5	5,810	1,450	575	6,840)			738)			
128 (46)	Watana	Susitna R.	Talkeetna Mt. D-4	5,180	1,905	425	6,040)	100	7,000	478)	50	6.3	Assumes operation as a system.
129 (47)	Vee	Susitna R.	Talkeetna Mt. C-2	4,140	2,355	430	4,730)			386)			
130 (48)	Denali	Susitna R.	Talkeetna Mt. D-1	1,260	2,552	---	2,310)			---)			
131	McLaren River	McLaren R.	Gulkana D-6	485	2,875	263	1,410	85	263	55	55	45.2	
132	Boulder Creek	Boulder Cr.	Healy B-1	42	3,575	917	67	70	35	7	55	55.6	
133	Palmer	Matanuska R.	Anchorage C-6	2,070	400	166	2,918	20	79	16	55	195.5	
134	Moose Creek	Matanuska R.	Anchorage C-6	2,070	500	166	2,918	25	100	21	55	124.2	Alternative to Palmer site.
135	King Mountain	Matanuska R.	Anchorage D-5	1,635	1,050	276	2,300	40	210	44	55	37.6	

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136	Coal Creek	Matanuska R.	Anchorage D-4	1,128	1,300	291	1,600	60	307	64	55	78.5	Alternative to King Mtn. site.
137	Boulder Creek	Boulder Cr.	Anchorage D-4	90	2,600	1,317	82	80	69	14	55	57.0	
138	Rush Lake	Boulder Cr.	Anchorage D-4	89	1,950	892	78	79	45	9	55	92.7	
139	Purinton Creek	Matanuska R.	Anchorage D-4	1,082	1,450	291	1,500	90	324	67	55	108.1	Alternative to Hick site.
140	Hicks Site	Matanuska R.	Anchorage D-3	950	1,675	281	1,300	90	286	59	55	37.2	
141	Caribou Creek	Caribou Cr.	Anchorage D-2	260	2,450	527	220	93	90	19	55	21.7	
142	Eagle River	Eagle R.	Anchorage B-7	194	450	167	397	82	45	9	55	38.8	
143	Sunrise	Sixmile Cr.	Seward D-7	238	450	327	350	55	52	11	55	122.2	
144	Lower Kenai	Kenai R.	Kenai B-3	1,650	160	84	4,300	98	263	55	55	18.2	
145	Moose Horn	Kenai R.	Kenai C-2	1,540	275	95	4,000	93	290	60	55	18.8	
146	Killey River	Killey R.	Kenai B-2	160	725	358	380	90	100	21	55	38.1	
147	Stelters Ranch	Kenai R.	Kenai B-1	849	500	199	2,600	97	403	84	55	17.9	
148	Kenai Lake	Kenai R.	Seward B-8	660	650	341	2,030	97	552	115	55	22.3	Alternative to Stelters Ranch site.
149	Crescent Lake	Crescent L.	Seward B-7	23	1,454	934	38	100	29	6	55	31.4	
150 (49)	Snow	Snow R.	Seward B-7	85	1,250	653	535	97	278	63	50	11.2	
151	Kasilof River	Kasilof R.	Kenai B-4	738	200	136	1,729	100	193	40	55	15.8	
152	Tustumena	Tustumena Glacier	Kenai A-2	57	1,496	1,100	133	85	102	21	55	17.1	
153	Sheep Creek	Sheep Cr.	Seldovia D-2	101	725	382	460	54	94	20	55	23.8	
154 (50)	Bradley Lake	Bradley Cr.	Seldovia D-3	88	1,195	1,155	445	93	410	94	50	8.0	Authorized Project.
155	Resurrection River	Resurrection R.	Seward A-7	141	425	233	600	75	86	18	55	58.5	
156	Nellie Juan River	Nellie Juan R.	Seward B-5	130	400	240	708	34	47	10	55	32.0	
157	Upper Nellie Juan	Nellie Juan R.	Seward B-6	35	1,189	421	190	90	57	12	55	17.6	
158 (51)	Lowe	Lowe R.	Valdez A-6	190	800	334	1,400	66	254	55	50	11.2	
159	Allison Creek	Allison Cr.	Valdez A-7	6	1,380	1,191	32	55	18	4	55	19.5	
160	Solomon Gulch	Unnamed	Valdez A-7	18	660	608	100	20	11	2	55	27.0	
161	Silver Lake	Duck R.	Cordova D-7	25	390	346	180	95	48	10	55	15.6	
162	Power Creek	Power Cr.	Cordova C-5	21	560	490	182	90	66	14	55	20.9	
163 (52)	Million Dollar	Copper R.	Cordova C-2	24,200	200	89	38,000	71	1,927	440	50	14.8	
164	Van Cleve	Unnamed	Cordova C-1	17	1,450	475	95	25	10	2	55	234.0	
165	Little Bremner River	Little Bremner R.	Valdez A-2	182	600	272	503	62	70	15	55	67.8	
166	Bremner R., Salmon Site	Bremner R.	Valdez A-1	660	525	166	,100	30	86	18	55	46.7	
167	So. Fork Bremner River	S.F. Bremner R.	Cordova D-1	148	1,150	537	470	75	156	32	55	32.5	
168	Three Mile Canyon	Bremner R.	Cordova D-1	526	725	228	1,660	41	127	26	55	51.5	Alternative to Salmon site.
169	No. Fork Bremner River	N.F. Bremner R.	Bering Glacier	150	1,625	490	470	87	166	35	55	56.0	
170 (53)	Cleave	Copper R.	Valdez A-3	21,500	420	165	28,000	96	3,600	820	55	13.3	
171	Tsina	Tsina	Valdez A-5	104	1,750	360	220	90	58	12	55	64.2	
172	Tiekel River	Tiekel R.	Valdez A-3	421	950	400	900	35	105	22	55	37.8	
173 (54)	Wood Canyon	Copper R.	Valdez B-2	20,600	1,400	950	26,700	100	21,900	3,600	69.4	3.2	
174	Hanagita Lake	Hanagita R.	McCarthy A-8	100	2,575	1,010	228	85	160	33	55	27.0	
175	Tebay Lakes	Tebay R.	Valdez A-1	105	1,875	1,007	240	95	193	40	55	23.6	
176	Kuskulana River	Kuskulana R.	McCarthy C-8	260	2,050	508	550	50	114	24	55	66.9	
177	Young Creek	Young Cr.	McCarthy A-4	40	3,475	2,017	110	45	82	17	55	60.3	High Wood Canyon plan would reduce potential by about 5%.
178	Canyon Creek	Canyon Cr.	McCarthy A-4	100	3,100	1,308	270	45	131	27	55	46.1	
179	Kiagna River	Kiagna R.	McCarthy A-4	185	2,500	970	490	50	193	40	55	77.9	High Wood Canyon plan would reduce potential by about 10%.
180	Kotsina River	Kotsina R.	Valdez C-1	209	2,075	524	440	70	133	28	55	47.9	
181	Klutina	Klutina R.	Valdez D-5	670	1,800	335	950	100	263	54	55	17.6	
182	Tolsona Creek	Tolsona Cr.	Gulkana A-4	174	2,025	460	200	70	53	11	55	52.5	
183	Tazlina	Tazline R.	Gulkana A-5	1,970	1,875	273	2,300	100	503	104	55	15.6	
184	Nelchina River	Nelchina R.	Gulkana A-6	820	2,250	285	940	99	219	45	55	53.3	
185	Lower Gulkana River	Gulkana R	Gulkana B-3	1,850	1,700	232	2,000	11	42	9	55	84.8	
186	Upper Gulkana River	Gulkana R.	Gulkana B-3	1,770	1,850	124	1,900	23	45	9	55	86.8	
187	Gulkana River	Gulkana R.	Gulkana C-4	575	2,475	405	620	80	164	34	55	27.5	
188	West Fork Gulkana River	W.F. Gulkana R.	Gulkana C-5	398	2,375	192	440	100	69	14	55	58.7	
189	Summit Lake	Gulkana R.	Mt. Hayes A-4	83	3,210	500	88	100	36	8	55	19.9	
190	Gakona Site	Copper R.	Gulkana B-3	3,965	1,750	266	4,400	75	727	150	55	35.2	Alternative to Sanford site.
191	Sanford	Copper R.	Gukana B-3	3,365	1,825	178	3,700	70	385	80	55	29.3	
192	White River	White R.	Bering Glacier A-4	29	375	282	210	80	39	8	55	51.3	
SOUTHEAST REGION													
193	Alsek River	Alsek R.	Yakutat B-1	11,000	450	166	12,000	90	1,490	310	55	17.9	Major portion of reservoir area is in Canada.
194	Endicott River	Endicott R.	Juneau D-5	56	800	483	270	97	105	21	55	25.9	
195	Chilkoot	Chilkoot R.	Skagway B-2	130	175	136	780	90	78	16	55	35.8	
196 (55)	Chilkat	Chilkat R.	Skagway C-3	190	600	320	870	80	180	41	50	10.6	
197	West Creek	West Creek	Skagway C-2	40	800	625	268	75	105	21	55	25.9	
198	Goat Lake	Pitchfork Falls	Skagway C-1	4	2,915	2,017	30	95	46	10	55	16.5	
199	Lace River	Lace R.	Juneau D-3	363	200	166	2,300	97	298	62	55	51.8	
200	Unnamed Lake near Lace R.	Unnamed	Juneau D-3	3	3,160	3,003	20	100	48	10	55	19.4	
201	Antler River	Antler R.	Juneau D-3	5	1,950	1,813	29	100	43	9	55	17.8	
202	Nugget Creek	Nugget Cr.	Juneau B-2	16	725	607	151	40	30	6	55	52.9	
203	Carlson Creek	Carlson Cr.	Juneau B-1	24	450	344	246	66	46	10	55	27.5	
204	Boundary Lake	Boundary Cr.	Taku R. C-6	23	925	795	170	85	95	20	55	22.2	
205	Yehring Creek	Yehring Cr.	Taku R. B-6	16	1,100	1,077	112	26	26	5	55	29.0	
206 (56)	Lake Dorothy	Dorothy Cr.	Taku R. A-6	11	2,422	2,248	81	100	150	34	50	7.3	
207 (57)	Speel Division Snettisham Project	Speel R.	Taku R. A-5	194	325	273			275	63	50	8.1	

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208	(58)	Tease Creek	Tease Cr.	Taku R. A-5	11	1,100	1,034	110	75	70	16	50	14.9	
209	(59)	Sweetheart Falls	Sweetheart Falls Cr.	Sumdum D-5	35	634	612	250	100	125	29	50	9.6	
210	(60)	Houghton	Unnamed	Sumdum D-3	39	550	457	370	98	136	31	50	11.0	
211		Farragut	Farragut R.	Sumdum A-3	64	525	493	480	56	163	37	50	13.8	Recent calculations indicate Farragut could be included on list of lower priced hydros.
212	(61)	Scenery Creek	Scenery Cr.	Sumdum A-3	21	957	620	147	90	67	15	50	10.8	
213	(62)	Thomas Bay	Cascade Cr.	Sumdum A-3	19	1,514	1,442	160	88	166	38	50	8.1	
214		Ruth Lake	Delta Cr.	Petersburg D-3	8	1,550	1,449	59	90	63	13	55	18.1	
215	(63)	Stikine River	Stikine R.	Petersburg C-1	20,000	350	291	45,000	90	9,900	2,260	50	9.0	
216	(64)	Goat	Goat Cr.	Bradfield Canal C-6	14	1,298	1,056	112	90	87	20	50	13.9	
217		Katate River	Katate R.	Bradfield Canal C-6	73	650	249	594	82	99	21	55	18.3	
218		Aaron	Aaron Cr.	Bradfield Canal C-6	81	300	187	652	56	58	12	55	86.0	
219		Harding River	Harding R.	Bradfield Canal C-5	68	250	207	548	92	85	18	55	49.2	
220		No. Bradfield River	N. Bradfield R.	Bradfield Canal B-5	150	250	157	1,200	61	131	27	55	71.0	
221	(65)	Tyee Creek	Tyee Cr.	Bradfield Canal A-5	15	1,387	1,275	123	93	120	27	50	8.9	
222		Anan Creek	Anan Cr.	Bradfield Canal A-6	27	325	230	200	89	33	7	55	34.4	
223	(66)	Spur	Unnamed	Bradfield Canal A-4	10	1,889	1,776	83	87	105	24	50	10.7	
224		Saks Cove	Saks Cr.	Ketchikan D-4	22	675	621	150	93	72	15	55	18.7	
225	(67)	Leduc	Leduc R.	Ketchikan	7	1,384	1,241	61	100	62	14	50	14.5	
226		Chickamin River	Chickamin R.	Bradfield Canal A-2	562	325	228	4,800	82	727	150	55	26.1	
227		Granite Creek	Granite Cr.	Ketchikan C-3	9	945	863	82	67	39	8	55	17.2	
228	(69)	Punchbowl Creek	Punchbowl Cr.	Ketchikan C-3	14	650	622	126	99	64	15	55	10.6	
229	(68)	Rudyerd	Unnamed	Ketchikan C-2	8	1,775	1,600	63	100	83	19	50	10.6	
230		Wilson River	Wilson R.	Ketchikan B-2	70	400	196	560	93	71	15	55	30.7	
231	(70)	Red	Red R.	Ketchikan A-2	44	400	347	410	89	104	24	50	12.2	
232		Davis River	Davis R.	Ketchikan D-1	78	450	367	667	67	131	28	55	17.4	
233		Kelp	Unnamed	Sitka B-4	21	675	612	161	82	66	16	50	15.1	
234	(75)	Takatz Creek	Takatz Cr.	Sitka A-3	11	1,040	991	129	87	97	20	50	12.5	
235		Baranof Lake	Baranof R.	Sitka A-3	32	145	108	316	42	11	2	55	19.1	
236		Carbon Lake	Unnamed	Sitka A-3	27	300	260	350	65	49	10	55	24.8	
237		Milk Lake	Unnamed	Port Alexander D-3	11	700	666	167	36	33	7	55	19.0	
238		Brentwood Creek	Brentwood Cr.	Port Alexander C-3	7	950	655	98	71	38	8	55	27.7	
239	(74)	Deer	Unnamed	Port Alexander C-3	7	374	339	114	96	31	7	50	14.8	
240	(73)	Maksoutof River	Maksoutof R.	Port Alexander C-3	24	600	570	272	93	117	24	50	12.6	
241		Plotnikof Lake	Unnamed	Port Alexander D-3	20	350	315	24	76	44	9	55	17.7	
242	(76)	Green Lake	Vodopad R.	Port Alexander D-4	29	400	353	212	84	52	11	50	12.4	
243		Hasselborg Creek	Hasselborg Cr.	Sitka C-1	83	331	306	343	90	77	16	55	22.3	
244		Thayer Creek	Thayer Cr.	Sitka C-2	61	407	377	252	100	78	16	55	22.1	
245		Kathleen Creek	Kathleen Cr.	Sitka D-3	29	525	502	126	94	48	10	55	33.7	
246		Towers Creek	Towers Cr.	Petersburg D-5	81	275	259	300	100	64	13	55	108.7	
247		Orchard Creek	Orchard Cr.	Ketchikan D-5	60	200	170	420	75	44	9	55	17.8	
248	(71)	Lake Grace	Grace Cr.	Ketchikan C-3	29	500	456	281	90	99	20	50	10.1	
249		Manzanita Lake		Ketchikan C-4	63	300	269	620	91	124	26	55	17.5	
250	(72)	Swan Lake	Falls Cr.	Ketchikan C-4	36	326	275	336	91	69	15	50	12.8	
251		Thorne	Thorne R	Craig C-2	166	125	103	1,100	85	80	17	55	17.6	
252		Reynolds Creek	Reynolds Cr.	Craig A-2	7	---	---	54	99	54	11	55	19.7	Three power plants and lakes involved.

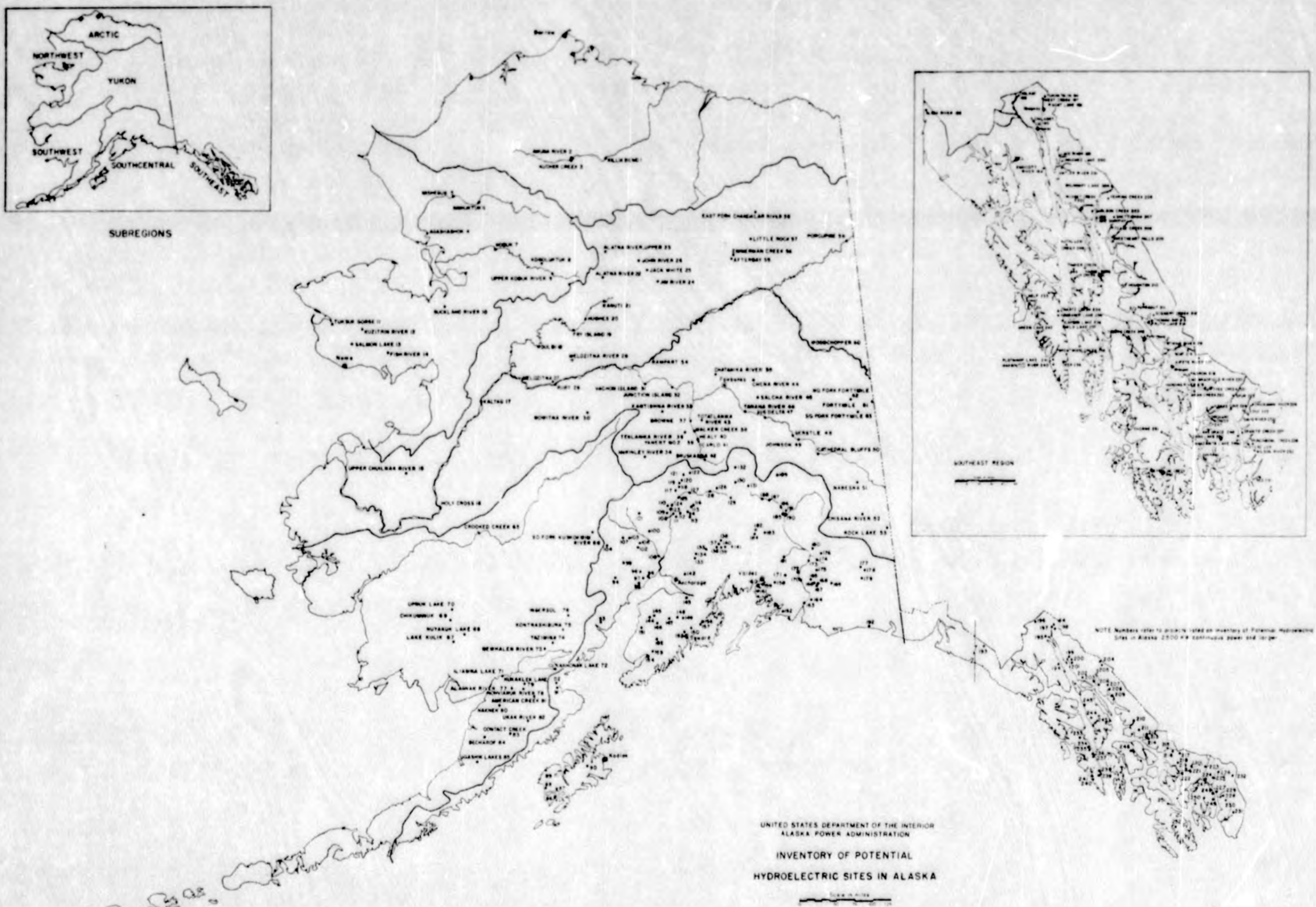
Power site numbers refer to map locations.

Numbers in parentheses refer to the published list and map of lower priced hydroelectric potentials 2500 kw continuous power and larger.

1/ The size and cost of the power plants for the inventory study was based on 55% plant factor. The list of the 76 lower priced sites assumes 50% plant factor with no significant change in cost. There are exceptions for the larger sites which were considered base load plants. Specific plant factors are noted.

2/ The index cost is a relative comparison cost of energy at the power plant bus bar. Substation and transmission costs are not included.

3/ An alternative development of the Ruby site to elevation 325 would inundate the Rampart dam site. Power production at Ruby would increase to 14.2 billion kwh annually and 3,250,000 kw.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ALASKA POWER ADMINISTRATION
INVENTORY OF POTENTIAL
HYDROELECTRIC SITES IN ALASKA

Hydroelectric Alternatives For The Alaska Railbelt

February,1980

U.S. Department Of Energy
Alaska Power Administration
Juneau, Alaska, 99802

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HYDROELECTRIC ALTERNATIVES FOR THE ALASKA RAILBELT

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CONTENTS

PART I. INTRODUCTION

For the last several years, hydroelectric investigations for the Alaska Railbelt have focused on the Upper Susitna and Bradley Lake hydroelectric projects. Many other potential projects, larger and smaller, have been identified which are accessible to the Railbelt, thus there are important questions to ask as to how these projects were selected and whether some other project or group of projects might offer a more sensible hydroelectric development plan for the Alaska Railbelt.

This report provides a review of the data and studies that brought about the selection of the two projects, and a current appraisal as to whether that selection remains appropriate.

In Alaska the electric power demands are greater in the winter than in summer. This is due to the long winter nights and the cold dominated climate. Streamflow characteristics are opposite of the power demands. Streamflows are greater in summer when the power demands are less and subject to fall freeze up or very minimal flows in winter. Typically only about 20 percent of the average annual runoff occurs between October and May. Because of this need for firm energy, "run-of-the-river" (non-storage) sites were not considered as alternatives to Susitna.

In addition to references within the text, this report is based on those publications listed as references within the appendix.

PART II. SUMMARY

In connection with the power market analyses for the Corps of Engineers (Corps) 1979 supplemental feasibility studies of the Upper Susitna Project, Alaska Power Administration (APA) conducted a review of alternative potential hydroelectric development plans for the Alaska Railbelt. The purpose of the review was to examine whether selection of the Upper Susitna Project remains appropriate.

The principal findings are:

There are no hydro generation opportunities available to generate power in sufficient quantity to be alternative to the Susitna project. Small individual sites may be available, but would satisfy only a small portion of the market area demand. Other sites with apparently acceptable capacity and economic capability have been, or may be, precluded by restrictive land use designations such as national parks, national monuments, national wildlife refuges, and wild and scenic rivers.

PART III. PREVIOUS STUDIES

This section has a few notes on the principal investigations of alternative hydroelectric power projects for the Alaska Railbelt.

Except in Southeast Alaska, very little was known about the extent of Alaskan hydroelectric resources prior to World War II. During the war, and in the immediate post-war period, serious interest in the hydro developed. It appears that there were two primary motivating factors: (1) the world-wide search for large low-cost hydroelectric projects that could be used in aluminum production, and (2) intensive interest in providing a viable economy in the then Territory of Alaska.

Key events included initiatives by the Territorial government and private studies on both the Wood Canyon and Yukon-Taiya projects. A comprehensive inventory of Southeast Alaska hydroelectric resources was published by the Forest Service and Federal Power Commission in 1947 covering an accumulation of studies in that region since the early part of the century.

The Bureau of Reclamation conducted its first field reconnaissance of several Alaskan hydro projects in the fall of 1946. This led to a statewide reconnaissance completed in 1948, which first brought attention to the hydroelectric potentials of the Upper Susitna and other hydro projects in the Susitna River basin. That reconnaissance triggered the studies that led to authorization of the Eklutna Project in 1950, Reclamation's Susitna River basin investigations which were completed in 1953, U.S. participation in the first Canadian-U.S. investigation of the Yukon-Taiya Project, as well as investigation of several smaller projects in other parts of the State.

Reclamation's Susitna basin report recommended feasibility investigation for the Upper Susitna Project based on the results of comparative studies, including initial fish and wildlife evaluations, for more than 20 potential hydroelectric projects in the Susitna River basin. The detailed studies confirmed viability of the project, and Reclamation's 1960 feasibility report recommended project authorization. This process of statewide reconnaissance, a comprehensive river basin study, and then detailed investigations of specific sites brought about the initial Susitna Project construction proposal.

A separate series of regional water resources investigations by the Corps of Engineers brought about alternative strategy keyed to the Rampart Project on the Yukon River. Reconnaissance studies on Rampart in the late 1950's indicated an immense potential for low-cost power, leading to a determination that further action on the proposal for Susitna authorization be deferred pending completion of: (1) feasibility reports on Rampart by the Corps of Engineers, and (2) investigations by the Interior Department of the power market and natural resources aspects of Rampart. That action was set in the March 14, 1962 agreement between the Secretaries of Army and Interior.

At the time, Susitna and Rampart were the apparent alternatives for long-term major power supplies in the Railbelt. Interim solutions were also needed, and the options included a number of smaller projects, including Bradley Lake near Homer for which the Corps had completed its review report in 1961. Bradley Lake was authorized for construction in the 1962 Flood Control Act, and the aforementioned studies concerning Rampart proceeded.

As a part of the Interior Department Rampart investigations, the Bureau of Reclamation prepared a comprehensive inventory of statewide hydroelectric resources during the period 1962 to 1967 (APA has updated portions of that inventory since that time). The inventory benefited from a great deal of information that was simply not available for previous inventory and basic studies by the Corps and the Bureau:

- The extensive work on regional and basin studies had, by now, accomplished an essentially complete identification of available sites.

- Post World War II data collection efforts, principally in topographic mapping and hydroelectric data, provided a much firmer basis for assessing the potential.

- Individual project studies had been completed providing specific field information of reconnaissance or higher level for several potential projects.

The actual processes for conducting the inventory are discussed in more detail subsequently. They included a comprehensive search for physical potential based on all previous studies; an exhaustive examination of available mapping to identify new sites; screening processes to focus in on sites having apparent potential; inventory-grade site studies including hydrology, reservoir and power production studies, cost estimates, and field checks of the better sites on geologic; and engineering suitability.

The initial inventory results were summarized and published in the June 1967 Interior Department Report, Alaska Natural Resources and the Rampart Project. That report also summarized more detailed evaluations of the Susitna, Wood Canyon, Yukon-Taiya, and Woodchopper Projects which were found to be the principal major project alternatives to Rampart. These studies reaffirmed the previous general findings concerning Susitna and Bradley Lake.

Similar findings appeared in the 1969 and 1976 Alaska Power Surveys of the Federal Power Commission (FPC). The evaluation of hydroelectric resources for the two FPC reports was again premised on the statewide inventory.

For a time during the 1960's and early 1970's, natural gas and fuel oil dominated thinking in Alaskan power supply planning. Thus, while action on Upper Susitna was deferred pending the Rampart outcome, interest in smaller projects such as Bradley Lake was diminished because of the availability and low cost of natural gas. The Corps completed its report on Rampart in 1971 with the recommendation that the project not proceed. This led directly to the renewed interest in Upper Susitna. Further impetus to the hydroelectric initiatives came about with the 1973 oil embargo and the new round of project investigations was launched.

PART IV. HYDROELECTRIC POWER INVENTORY

The term "inventory" means different things to different people. The APA-USBR inventory included assessment of physical potential and screening and evaluation process to provide appraisals of engineering and geologic suitability, sizing studies to approximate the optimum levels of development, estimates of probable construction costs, and relative cost of power for the more promising sites. There are two published summaries of the inventory:

- The list of 76 "more economical" potential projects which, with minor variations, has appeared in numerous reports.

- A longer list of 252 sites for which inventory-grade plans and cost estimates were prepared during the inventory process. The list of 252 includes the 76.

The steps in the inventory were as follows:

1. The search for possible sites.

2. The screening to identify those with reasonable possibility of economic and engineering viability.

3. Specific site studies.

4. Field check of the promising sites.

5. Coordination.

The inventory process was designed specifically to examine projects with potential of 2,500 kW or more prime power capacity (equivalent to 22 million kilowatthours per year, or roughly one-half of 1 percent of the 1977 electric power use in Alaska).

Site Identification

This was accomplished by assembling information from all available previous studies supplemented by a careful map search to identify additional possible sites. The map search involved examination of each drainage area on the available topographic maps for possible dam and reservoir sites or diversion schemes that could possibly produce power. In all, some 2,000 sites were identified in this process.

Screening Processes

The screening processes used several techniques. Very rough estimates of power potential were prepared using regional interpretations of runoff characteristics, measured drainage areas, and estimates of available head based on the topographic maps. The initial group of around 2,000 sites was reduced to about 700 in this preliminary screening, which eliminated the very small sites and those which, by judgment, would involve excessively expensive construction costs for the amount of power available.

The second level of screening produced rough indications of relative cost of major features--volume of dam or size and length of major waterways. This process identified projects for which excessive costs of obtaining necessary reservoir storage and head would rule out a significant chance of feasibility. The second screening left a residual list of 252 sites for which inventory-grade plans and estimates were prepared.

Site Studies

Inventory-grade plans and estimates were prepared for each of the 252 remaining sites. To assure a reasonable level of consistency, a series of procedures for sizing and cost estimating was developed.

As appropriate to each project, the following steps were followed:

1. Water supply available for power production was estimated using all available streamflow records supplemented by climate data and correlations.

2. Reservoir area-capacity values were determined by map measure.

3. Alternative plans for project development were determined using the topographic maps (i.e., alternative heights of dam or length of penstocks and waterways).

4. Preliminary estimates of reservoir sedimentation were developed.

5. Sizing studies were prepared to approximate the optimum scale of development for each project. This included evaluation of reservoir regulation capability (usually by mass diagram techniques) and comparison of project costs and firm power capability.

The site studies are quite accurate for those projects which had the benefit of considerable previous field data. For other projects, particularly those in remote areas of the State, the inventory-grade site studies are probably much less reliable. By judgment, the largest single variable is actual foundation conditions for major features, especially dams.

Some field reconnaissance work, including observations of surface geology, was accomplished for purposes of verifying the site studies. This focused on the projects that appeared to have good physical potential, but for which foundation information was lacking.

The inventory produced few surprises. It located a few new projects (relatively small) that had not been found in earlier studies. It eliminated many projects that had been listed in earlier studies by reason of excessive costs or evident engineering or geologic problems. The net result was a reasonably consistent evaluation of the State's hydroelectric resources including appraisal of engineering and economic viability.

Coordination

A major step in the coordination was reconciliation of data and project assumptions arising from Bureau of Reclamation inventory studies and the series of Corps of Engineers river basin reports. This was accomplished on a project-by-project basis so that the end result of the inventory reflected the best available data on each site.

Portions of the inventory have been modified from time to time as new data became available through specific project studies or new mapping.

PART V. ALTERNATIVE HYDROELECTRIC PLANS

There are a number of significant new facts that are relevant to deciding which project makes most sense and when. Substantially better information is available on likely environmental aspects of the projects; construction costs and interest rates have risen dramatically, as have levels of demand for power; fuel costs have skyrocketed; major changes in land ownership and management are affecting the availability of individual projects.

As a part of the most recent round of Susitna investigations (1979 Supplemental Feasibility Report), APA again reviewed the available hydroelectric alternatives to see if a different selection of projects would be more appropriate under present conditions.

Considering present hydroelectric proposals, the current strategy involves development of the authorized Bradley Lake Project with power on line in about 1987, followed by Watana in 1994 and Devil Canyon in 1998. This timing is consistent with the APA mid-range power demand estimates. Actual timing would depend on load expectations at the time when construction decisions are reached on each unit of each project. For example, if lower load growth occurs through the 1980's, it would follow that construction start on Devil Canyon would be deferred somewhat.

The range of possible alternatives can be summarized about as follows:

1. Early construction of one of the major Alaskan hydro projects such as Wood Canyon or Rampart.

2. Pursue regional or river basin development using smaller individual projects and attempt to optimize development in each area.

3. Pursue a strategy of constructing the most economical smaller projects available anywhere in the Railbelt area.

4. A strategy of very small hydro projects (say small river basins, with project capacity up to about 30 MW, where minimal environmental costs are expected).

Each of these strategies is examined in subsequent parts of this report.

Bases of Comparison

There are four general bases of comparison:

1. Demand for the power (in lieu of the Upper Susitna Project, to what extent would the alternative strategy meet the needs).

2. Relative costs; i.e., would the alternative strategy result in lower or higher costs to the consumer.

3. Land use and management aspects as they affect availability of the alternative sites.

4. Environmental aspects, anticipated impacts.

Power Demands

The projected power demands (APA) for the Upper Susitna River Project market area (Anchorage-Fairbanks "Railbelt" area) are:

	1980		1990		2000	
	MW*	GWH**	MW	GWH	MW	GWH
High	890	3,930	2,360	10,680	4,650	20,940
Medium	830	3,660	1,590	7,080	2,850	12,740
Low	770	3,390	1,180	5,220	1,780	7,890

* MW (Megawatt) equals 1,000 kW

** GWH (Gigawatthour) equals 1,000,000 kWh

These projections include the total utility, industrial, and national defense needs, and are based on Institute of Social and Economic Research (ISER) 1978 population and employment estimates.

For the purposes of this study, it was assumed that the hydro strategy would focus on requirements between 1990 and 2000. Under the low and high load projections, alternative hydro plans were analyzed that would tie to those demands.

Costs

Estimates of the cost of power generation (mills per kWh) were prepared for each of the 252 sites. This is the index cost (last column) of the list of 252 sites, which is the basis of economic comparison of the sites (generation only--no transmission). (Costs are based on 1965 to 1966 prices, 50-year repayment at 3 1/8-percent interest rate, and complete utilization of average annual energy.)

The combination of the four Susitna River sites (127--Devil Canyon, 128--Watana, 129--Vee, 130--Denali) resulted in an index of 6.3 (mills per kWh). This is the basis of economic comparison of possible alternatives.

For information purposes, possible alternatives are discussed that are within twice the cost range of Susitna (12.6 mills per kWh). This is to allow some flexibility for contingencies and unknowns should more detailed consideration become warranted, and candidly, because very few sites are within the cost range.

Even though economic comparison is based on work that is several years old, it is concluded to be valid. More recent estimates of the Susitna River sites correspond generally with costs that would be obtained by indexing earlier costs to present levels. More specifically, cost estimates for energy from the four Susitna River sites, by the Corps of Engineers in the December 1975 interim feasibility report Southcentral Railbelt Area, Alaska - Upper Susitna River Basin, are within 10 percent of the index cost escalated to 1975 by construction cost trends. Therefore, economic comparison of possible alternatives is based on relative costs from the list of sites rather than updating all costs on the list.

Land Use and Management

Of specific concern are present and pending designations of wilderness, national parks, refuges, and wild and scenic rivers since hydroelectric development is not compatible with such designations.

Environmental Aspects

Based on published materials of ADF&G, the Land Use Planning Commission, and others, we are able to offer general statements of likely major fish and wildlife implications of alternative hydroelectric projects, with particular reference to anadromous fish. Significant potential for impact lies with the Tanana, Yentna, Skwentna, and Talachulitna River basins.

In addition, the extreme recreation development and use of the Kenai River would likely preclude serious consideration of identified powersites on that river.

Larger Capacity Single Sites

Aside from Upper Susitna, the best known major hydro potentials of Alaska are Rampart on the Yukon River, Wood Canyon on the Copper River, and the Yukon-Taiya diversion from the head of the Yukon in Canada to Tidewater near Skagway in Alaska. Yukon-Taiya and Wood Canyon each have a power potential about three times that of the Upper Susitna Project; Rampart is about five times as large as Susitna.

Other large projects of possible interest include Woodchopper and Ruby on the mainstem Yukon, and Porcupine which is on a major Yukon tributary.

A final large project--the downstream Holy Cross site--would be of interest only in connection with development of major upstream storage projects.

These large projects are not considered to be available alternatives in the time frame proposed for the Upper Susitna Project for a variety of reasons.

No.		Site	Stream	Firm Energy GWH/yr.	Capacity MW	Cost Mills/kWh
16	(06)	Holy Cross	Yukon R.	12,300	2,800	9.0
29	(11)	Ruby	Yukon R.	6,400	460	3.9
54	(20)	Rampart	Yukon R.	34,200	5,040	2.0
59	(21)	Porcupine	Porcupine R.	2,320	530	5.0
60	(22)	Woodchopper	Yukon R.	14,200	3,200	4.5
64	(24)	Yukon-Taiya	Yukon R.	21,000	3,200	3.3
173	(54)	Wood Canyon	Copper R.	21,900	3,600	3.2

On the cost aspect, several projects have potential equivalent to or lower than Susitna. Present and pending land use designations preclude consideration now of the mainstem Yukon sites as well as Wood Canyon; Yukon-Taiya is affected by legislation creating the Klondike Gold Rush National Park, although it should be noted that all of the field studies indicated the park and the hydro project were basically compatible.

On the demand side, the larger projects would substantially exceed anticipated Railbelt area demands through 2000 and beyond. However, they could be designed to serve larger power markets through interconnection with Canada.

Serious environmental problems have been documented with regard to Rampart, and Wood Canyon is known to have major anadromous fishery problems. Of the large projects, Yukon-Taiya would likely have the least severe environmental problems.

Combinations of Smaller Sites by Geographic Area

In addition to the larger capacity single sites discussed in the preceeding section, combinations of individual, small capacity sites were also considered as possible alternatives. These sites were grouped by eight geographic areas and compared with the projected power demands and with the Upper Susitna Project generation capacity and 1966 cost criteria. The areas are listed on the following page:

Area	Capacity MW	Firm Energy GWH/yr	% of Projected, Low Level, Power Demands 1980	1990	2000	Weighted Cost Mills/kWh *
1. Matanuska River Basin	194	935	25	18	12	87.5
2. Tanana River Basin	1,316	5,806	171	111	74	18.5
3. Cook Inlet - West Drainage	533	2,347	69	45	30	10.3
4. Skwentna-Yentna River Basin	509	2,312	68	44	29	29.6
5. Talkeetna River Basin	237	1,107	33	21	14	40.4
6. Chultina River Basin	345	1,542	46	30	20	12.3
7. Kenai Peninsula	475	2,211	71	46	31	19.9
8. Scattered Sites, Tributary to Railbelt	462	2,207	65	42	28	31.6

* Does not include transmission system cost.

Sites within the Nenana River Basin have also been identified in the past, but all are precluded by Mt. McKinley National Park.

A brief description of each area follows while specific information on each site may be found in the appendix.

1. Matanuska River Basin

This basin lies to the immediate northeast of Palmer, Alaska, and drains the southern slopes of the Talkeetna Mountains and the northern slopes of the Chugach Mountains. The basin contains primarily State and private lands, is bisected by the Glenn Highway, and is easily accessible to the Anchorage area.

The basin contains six small, potential hydroelectric sites that range in capacity from 9 MW to 67 MW with total generation capability of 935 GWh per year. Costs, not including provision for transmission, would be in the magnitude of 14 times that of the Upper Susitna Project.

The basin contains a variety of wildlife including moose, bear, caribou, and Dall sheep, as well as furbearers, waterfowl, and upland game birds. Five species of salmon are found in the basin, principally in the lower reaches, in addition to trout, grayling, whitefish, and burbot. The Alaska Coastal Zone extends into the basin and includes half of the sites, representing 78 percent of the potential capacity.

Even though no major environmental impacts have been identified, there is possibility for conflict. Principal, potential impacts include disruption of anadromous fish passage, loss of fish and wildlife habitat, and degradation of aesthetics.

2. Tanana River Basin

This basin is located in the east-central part of the State and stretches southeast from the Yukon River to Canada. Lands in the Tanana River Valley are principally State and private; however, there are several major Federal land withdrawals in the basin for military reservations, Mt. McKinley National Park, the Alaska Pipeline, and settlement of the terms of the Alaska Native Claims Settlement Act. The Richardson and Alaska Highways are located within the basin and provide access to Fairbanks and a number of smaller communities.

The basin contains seven potential hydroelectric sites that range in capacity from 25 MW to 532 MW with total generation capability of 5,806 GWh per year. Costs without provision for transmission, would be in the magnitude of 2.9 times that of the Upper Susitna Project.

The basin contains a wide variety of wildlife including moose, bear, caribou, Dall sheep, and one of the State's two bison herds, as well as furbearers and upland game birds. The Tanana River Valley provides extensive waterfowl nesting areas. Three species of salmon are present with the majority of spawning located in the lower half of the basin. Trout, grayling, whitefish, burbot, and sheefish are also present.

Principal potential impacts include major highway relocation; disruption of anadromous fish passage; loss of fish and wildlife habitat, particularly waterfowl; loss of bison calving grounds; and loss of recreation use of natural waters.

3. Cook Inlet-Western Drainage

This area is located immediately to the west of Cook Inlet between Tuxedni Bay on the south and Mt. Susitna on the north. Lower lying lands are mostly State and private while the higher elevation lands to the west and south are Federally withdrawn for the Lake Clark National Monument and settlement of terms of the Alaska Native Claims Settlement Act. The area lies within the Alaska Coastal Zone.

The area contains seven potential hydroelectric sites that range in capacity from [illegible]9 MW to 366 MW with total generation capability of 2,347 GWh per year. Costs, not including provision for transmission, would be in the magnitude of 1.6 times that of the Upper Susitna Project.

A variety of wildlife are found in the area including moose, bear, sea mammals, furbearers, upland game birds, and water fowl. Five species of salmon use the area and the Alaska Department of Fish and Game has identified several major salmon fishing areas along the shores of Cook Inlet. Whitefish and trout are also present. The area is scenic with the lofty, ice clad Mt. Spurr and other mountains forming a picturesque backdrop for the forest clad lowlands. Even though there is no road network, recreation use is heavy.

Principal, potential impacts include reduction in anadromous fish passage and habitat, conflict with bear in intensive use and denning areas, and degradation of aesthetics.

4. Yentna-Skwentna River Basin

This basin lies across Cook Inlet to the northwest from Anchorage and drains a large area into the lower reaches of the Susitna River. Lands are nearly all State and private with some Federal withdrawals at the higher elevations of the mountains to the west. The basin lies within the Alaska Coastal Zone. While there is no road network and access is by air and boat, recreational use is intense.

The basin contains eight potential hydroelectric sites that range in capacity from 15 MW to 145 MW with total generation capability of 2,312 GWh per year. Costs, without provision for transmission, would be in the magnitude of 4.7 times that of the Upper Susitna Project.

The basin supports numerous wildlife including moose, bear, Dall Sheep, furbearers, upland game birds, and migrating water fowl, as well as a significant part of the Cook Inlet anadramous fish resource. Five species of salmon are present and use the basin extensively. Trout, grayling, whitefish, burbot, and Northern Pike are also present.

Principal, potential impacts include loss of recreation use of natural waters; disruption of anadromous fish passage; loss of fish, wildlife, and waterfowl habitat; conflicts with bear denning and concentration use areas; and degradation of aesthetics.

5. Talkeetna River Basin

This basin lies to the east of the community of Talkeetna and drains the central and western portions of the Talkeetna Mountains. Lands are mostly in State ownership, while Federal land withdrawals lie along the northern rim of the basin and just east of the junction of the Talkeetna River and Iron Creek. There is no road network in the basin, and access is mostly by air.

The basin contains six potential hydroelectric sites that range in capacity from 5 MW to 74 MW with total generation capability of 1,107 GWh per year. Costs, without provision for transmission, would be in the magnitude of 6.4 times that of the Upper Susitna Project.

Wildlife in the basin include moose, bear, Dall Sheep, mountain goat, caribou, furbearers, upland game birds, and migratory waterfowl. Five species of salmon use the basin, principally below the confluence of the Talkeetna River and Prairie Creek. In addition, trout, burbot, grayling, and whitefish are found in various parts of the basin.

The major potential impacts would relate to disruption to, and possible loss of, anadromous fish and passage to spawning areas; loss of big game intensive use areas; and loss of the relatively unchanged, natural condition of the basin.

6. Chulitna River Basin

This basin lies to the southwest of Cantwell and drains the southeast slopes of Mt. McKinley into the Susitna River at Talkeetna. Lands at the lower elevations of the river valleys are mostly State and private, while Federal withdrawals cover the higher lands to the north and south. The Parks Highway and Alaska Railroad bisect the basin and provide easy access for the Railbelt population. The basin is quite scenic with Mt. McKinley serving as a spectacular backdrop.

The basin contains six potential hydroelectric sites that range in capacity from 12 MW to 184 MW with total generation capability of 1,542 GWh per year. Costs, without provision for transmission, would be in the magnitude of double that of the Upper Susitna Project.

Wildlife in the basin include moose, bear, caribou, Dall Sheep, furbearers, upland game birds, and migratory waterfowl. Four species of salmon are found in the basin in addition to trout, grayling, whitefish, and burbot.

No major environmental impacts have been identified; however, there is potential for disruption, and possible loss of the anadromous fish resource and degradation of aesthetics.

7. Kenai Peninsula

This area is just south of Anchorage and joins Cook Inlet on the west and the Pacific Ocean on the east and south. The area contains a significant part of the State's highway and road network and includes several of the State's larger communities. The majority of the lands are within Federal withdrawals for a national wildlife refuge, national forest, national monument, and settlement of terms of the Alaska Native Claims Settlement Act. State, and some private, lands are located around the western and southern rims of the Peninsula and in the Seward area. The area lies within the Alaska Coastal Zone.

The area contains 13 potential hydroelectric sites that range in capacity from 6 MW to 94 MW with total generation capability of 2,211 GWh per year. Costs, not including provision for transmission, would be in the magnitude of 3.2 times that of the Upper Susitna Project.

The area supports a wide variety of wildlife including moose, bear, Dall Sheep, mountain goat, caribou, sea mammals, furbearers, upland game birds, seabirds, and waterfowl. Five species of salmon are found within the area and several major salmon fishing areas along the shores of Cook Inlet have been identified by the Alaska Department of Fish and Game. The area is highly scenic, ranging from ocean fjords to rugged ice clad mountains. Recreation use is intensive.

Major potential environmental impacts would include disruption of the intense recreation use, reduction of anadromous fish resources, and degradation of aesthetics.

8. Scattered Sites, Tributary to Railbelt

These sites are scattered all the way from east of Fairbanks to Anchorage and the Valdez areas. The sites are generally small, widely separated, and interconnection would be extremely expensive. Lands involved include State, private, and Federal, dependent on the specific site location. In some cases, Federal withdrawals would preclude development.

Thirteen potential hydroelectric sites are included that range in capacity from 4 MW to 82 MW with total generation capability of 2,207 GWh per year. Costs, not including provision for transmission, would be in the magnitude of 5 times that of the Upper Susitna Project.

The general variety of wildlife found in the areas discussed previously is representative of these site locations. A number of the streams and rivers support salmon in addition to trout and other resident fish. No major environmental impacts have been identified; however, there is potential with each project, particularly those that involve the larger streams and rivers with anadromous fish, are in highly scenic areas, or would extinguish extensive wildlife habitat areas.

Combinations of the Most Economical Smaller Sites

The third approach to evaluating a possible alternative to the Susitna Project is to combine the economically best small sites from each of the geographic areas. Only one site (Chakachamna) is within the economic range of Susitna. Twelve sites are within twice the cost range, and are included in the following tabulation of the best small sites within the Railbelt area.

No.		Site	Stream	Firm Energy GWH/year	Capacity MW	Cost Mills/kWh
93	(32)	Cresent Lake	Cresent R.	179	41	9.9
94	(33)	Chakachamna	Chakachatna R.	1,600	366	6.5
97	(34)	Coffee	Beluga R.	160	37	11.5
98	(35)	Upper Beluga	Beluga R.	210	48	11.1
105	(36)	Yentna	Yentna R.		145)	
106	(37)	Talachulitna	Skwentna	1,390	75)	10.1
107	(38)	Skwentna	Skwentna		98)	
		(Yentna, Talachulitna, and Skwentna operated as a system)				
109	(39)	Lower Chulitna	Chulitna	394	90	8.1
110	(40)	Tokichitna	Chulitna	806	184	8.8
112	(41)	Keetna	Talkeetna R.	324	74	11.3
150	(49)	Snow	Snow R.	278	63	11.2
158	(51)	Lowe	Lowe R.	254	55	11.2
	Total			5,595	1,276	

The Lowe site has the severe disadvantage that it would block the major land access route to Valdez; it would also involve relocating the Trans-Alaska Oil Pipeline and a highway, and a planned transmission line between Valdez and Glennallen.

Sites that are in designated national monuments or are included in proposed Federal land withdrawals include Cresent Lake and Chakachamna in the Lake Clark area, and Tokichitna in the Denali area. These sites represent approximately half of the total potential power from the sites, leaving 685 MW capacity and 3,010 GWh energy.

Bradley Lake (no. 154--Kenai Peninsula) with an index cost of 8.0 is not included because it is already an authorized project (Corps of Engineers).

Another site, Lane (no. 124, 240 MW), with an index cost of 8.9 could also be included based on the less than 12.6 criteria. However, it is actually a part of the Susitna River system because it is immediately downstream from the Devil Canyon site.

Cost: This would involve smaller increments of new investment, [illegible] uniformly and progressively higher costs per installed kW. Transmission system needs would be substantially greater also.

The program would very quickly move into significant fisheries problems--by judgment substantially more significant than those of Upper Susitna. Expect significant impacts on game habitats, primarily moose.

The "Small" Hydro Approach

The existing hydroelectric projects near Anchorage (APA's Eklutna Project and Chugach Electric Copper Lake Project) are examples of smaller projects including relatively small drainage basins and generally favorable environmental aspects. If a large number of small projects (say size range up to 30 MW or so) with favorable environmental aspects could be located, an alternative small hydro approach would make a great deal of sense. The viability of the strategy depends on the extent of the resources of good small projects, their cost, availability, and cumulative environmental impacts.

Sites smaller than 2.5 MW would likely have to be fully automated operations because a significant part of the revenue would be required for personnel to attend the plant. For example, operation costs alone for a five-person staff would cost $200,000 per year, which would amount to 4.5 cents per kWh for a 1-MW plant operating at 50 percent plant factor. Sites of 2.5 MW and smaller cannot support transmission lines for very long distances; hence, to contribute positively to a power system, sites have to be close to the power market or an existing grid power system. A 50-mile transmission line costing $40,000 per mile would add 3.7 cents per kWh to the cost for a 1-MW plant.

To meet Railbelt power needs by small hydros alone in the 1990 decade, 200 of the 1-MW powerplant sites would need to be developed annually. It is doubtful that 1/10 to 1/20 of this number of sites would be available every year as an alternative to meet the full power needs of the Railbelt area.

The criteria and examination procedure for evaluating cumulative environmental effects of developing several small hydro project sites will be the same criteria and procedure used in evaluating larger powersites. Sites that need only relatively short access roads, short transmission lines, and small dams could meet the criteria. Conversely, development of dozens of the small sites that each need roads, transmission lines, and dams, or long roads and transmission lines, could have accumulative environmental impacts that may exceed the effect of a single large project. Logic suggests that several of the more economical smaller sites having a minimum of environmental effects could be constructed as supplemental local energy sources to large projects which meet major city utility requirements.

ALASKA POWER ADMINISTRATION
Inventory of Potential Hydroelectric Sites in Alaska
site criteria is generally 2500 KW (continuous power) and larger

No.	Power Site	Stream	USGS Map sheet	Drainage Area (sq. mi.)	Maximum Regulated Water Surface (ft.)	Average Head (ft.)	Average Annual Runoff (1000 AF)	Per Cent Regula-tion	Firm Energy (million Kwh)	Installed Capacity (1000 KW)	1/ (plant factor %)	Index Cost 2/	
ARCTIC REGION													
1	Killik Bend	Colville R.	Killik R.	9,780	700	218	4,100	97	718	148	55	26.6	
2	Awuna River	Awuna R.	Lookout Ridge	605	1,000	528	230	100	101	21	55	67.9	
3	Kucher Creek	Colville R.	Killik R.	6,240	975	120	2,600	100	254	53	55	35.4	
NORTHWEST REGION													
4 (1)	Agashashok	Noatak R.	Noatak A-2	12,700	150	132	7,500	100	820	186	50	8.7	
5 (2)	Mishegak	Noatak R.	Baird Mtn. D-6	8,700	550	199	5,600	83	760	174	50	10.8	
6 (3)	Nimiuktuk	Noatak R.	Baird Mtn. D-3	7,000	750	166	4,500	100	613	140	50	12.7	
7 (4)	Kobuk River	Kobuk R.	Baird Mtn. A-1	7,840	150	114	5,700	100	526	120	50	15.8	
8	Kogoluktuk	Kogoluktuk R.	Shungnak D-2	412	400	129	351	100	37	8	55	17.2	
9	Upper Kobuk River	Kobuk R.	Shungnak	2,970	275	62	2,200	99	114	23	55	19.5	
10	Buckland River	Buckland R.	Candle D-5	2,410	130	103	930	100	79	16	55	42.0	
11 (5)	Tuksuk Gorge	Tuksuk Channel	Teller A-2	4,275	190	187	1,880	100	289	66	50	19.0	
12	Kuzitrin River (Bunker Hill site)	Kuzitrin R.	Bendleben A-6	1,790	150	95	860	100	67	14	55	49.4	Would be inundated by a Tuksuk Gorge project, or would reduce Tuksuk to elevation 50 and 77 million Kwh.
13	Salmon Lake	Kruzgamepa R.	Solomon D-6	107	500	155	267	70	24	5	55	126.0	
14	Fish River	Fish R.	Solomon D-3	1,120	150	103	720	100	60	13	55	48.0	
YUKON (INTERIOR) REGION													
15	Upper Chulinak River	Atchulinak R.	Holy Cross D-5	162	625	103	140	95	11	2	55	422.0	
16 (6)	Holy Cross	Yukon R.	Holy Cross A-1&2	320,000	137	94	160,000	100	12,300	2,800	50	9.0	
17	Kaltag	Yukon R.	Nulato	296,000	200	117	137,000		13,100	3,000	55		An alternative to Holy Cross.
18 (7)	Dulbi	Koyukuk R.	Kanteel R. B-1	25,660	225	68	19,200	100	1,070	244	50	14.8	
19	Fry Island	Koyukuk R.	Melozitna D-4	19,950	270	54	14,000	100	622	114	55		Alternative to Dulbi, cost was not calculated.
20 (8)	Hughes	Koyukuk R.	Hughes A-3	18,700	320	49	12,300	100	482	110	50	11.2	
21 (9)	Kanuti	Koyukuk R.	Hughes	17,970	500	166	11,900	100	1,612	368	50	12.2	
22	Alatna River	Alatna R.	Hughes	2,860	725	109	2,000	100	175	36	55	23.1	
23	Alatna River, Upper	Alatna R.	Survey Pass	1,325	1,050	158	920	100	123	25	55	64.5	
24	Jim River	Jim R.	Bettles D-2	470	975	162	320	100	43	9	55	42.6	
25	Jack White	Koykuk R.	Bettles	4,350	800	136	3,000	---	315	65	55	18.1	
26	John River	John R.	Wiseman A-4	2,695	800	107	1,900	90	149	31	55	38.8	
27 (10)	Melozitna	Melozitna R.	Ruby D-6	2,659	550	270	1,400	91	282	64	50	11.2	
28	Melozitna River	Melozitna R.	Melozitna B-4	2,020	700	129	1,100	100	117	13	55	48.5	
29 (11)	Ruby	Yukon R.	Ruby D-5	256,200	210	72	109,000	100	6,400	460	50	3.9	3/ Inventory plan is premised on development of Rampart.
30	Nowitna River	Nowitna R.	Ruby B-2	2,570	450	180	1,900	100	280	58	55	16.1	
31	Vachon Island	Tanana R.	Kantishna R. D-3	44,500	350	96	26,000	96	2,050	426	55	29.0	Alternative site to Junction Island.
32 (12)	Junction Island	Tanana R.	Kantishna R. D-1	42,490	400	114	25,000	100	2,330	532	50	15.1	
33	Kantishna River	Kantishna R.	Kantishna R. B-1	5,440	500	95	5,200	99	394	82	55	22.2	
34	McKinley River	McKinley R.	Mt. McKinley B-3	710	1,775	297	910	90	201	42	55	42.3	
35	Chatanika River	Chatanika R.	Livengood A-4	770	500	91	420	99	32	7	55	63.0	
36	Teklanika River	Teklanika R.	Healy D-6	520	1,800	457	728	100	272	57	55	24.2	
37	Browne	Nenana R.	Fairbanks A-5	2,450	1,000	207	3,400	66	365	80	55	58.0	
38	Walker Creek	Nenana R.	Fairbanks A-5	2,330	1,200	166	3,300	35	166	35	55	87.5	
39	Yanert No. 2	Nenana R.	Healy C-4	1,190	2,200	232	1,670	93	298	62	55	37.2)	(Alternative for upper Nenana River System. It would inundate Carlo and Bruskansna sites.
40 (15)	Healy	Nenana R.	Healy D-4	1,900	1,700	291	2,675)			130)			
41 (14)	Carlo	Nenana R.	Healy C-4	1,190	1,900	166	1,670)	83	840	30)	50	10.7	Assumes operation as a system.
42 (13)	Bruskansna	Nenana R.	Healy B-4	650	2,330	212	826)			40)			
43	Totatlanika River	Totatlanika R.	Fairbanks A-4	250	1,600	420	320	100	114	24	55	33.1	
44	Chena River	Chena R.	Big Delta D-5	950	900	107	523	99	46	10	55	128.0	
45	Salcha River	Salcha R.	Big Delta C-5	1,990	975	136	1,170	95	123	25	55	69.4	
46	Tanana River (Little Delta)	Tanana R.	Big Delta B-6	18,080	900	107	14,500	25	315	65	55	43.1	
47 (16)	Big Delta	Tanana R.	Big Delta A-4	15,300	1,100	99	12,500	98	987	226	50	16.8	
48 (17)	Gerstle	Tanana R.	Mt. Hayes D-2	10,700	1,290	59	9,500	---	438	100	50	17.0	
49 (18)	Johnson	Tanana R.	Mt. Hayes C-2	10,450	1,470	149	7,830	97	920	210	50	16.1	
50 (19)	Cathedral Bluffs	Tanana R.	Tanacross B-6	8,550	1,650	146	5,800	100	693	158	50	15.3	
51	Nabesna	Nebesna R.	Nebesna D-3	2,145	2,025	191	2,300	88	320	66	55	33.9	
52	Chisana River	Chisana R.	Nebesna A-3	732	3,250	883	1,100	100	797	170	55	21.8	
53	Rock Lake	Ptarmigan Creek	McCarthy D-1	93	3,600	514	140	98	58	12	55	56.5	
54 (20)	Rampart	Yukon	Tanana B-3	200,000	665	445	81,000	100	34,200	5,040	75	2.0	
55	East Fork Chandalar River, Afterbay	E.F. Chandalar R.	Chandalar	5,500	900	99	1,500	100	122	25	55	21.1	
56	East Fork Chandalar River, Zimmerman Creek	E.F. Chandalar R.	Chandalar	5,500	1,100	169	1,500	100	210	44	55	29.3	
57	East Fork Chandalar River, Little Rock	E.F. Chandalar R.	Christian	4,200	1,600	132	1,150	95	119	25	55	70.3	
58	East F[illegible] Chandalar River	E.F. Chandalar R.	Arctic	2,500	2,025	162	680	100	90	19	55	56.0	
59	P[illegible]e	Porcupine R.	Coleen B-1	23,400	975	313	9,100	100	2,320	530	50	5.0	
60 (22)	W[illegible]pe[illegible]	Yukon	Charley R. B-5	122,000	1,020	300	57,600	100	14,200	2,160	75	4.5	
61 (23)	F[illegible]mile	Fortymile	Eagle B-1	6,060	1,550	324	3,230	84	723	166	50	8.9	
62	[illegible] Fort[illegible]tymile	N.F. Fortymile	E[illegible]e B-2	2,065	1,800	249	1,400	85	245	51	55	17.2	
63	[illegible] Fork Forty[illegible]	S.F. Fortymile	Eagle A-2	2,800	1,775	228	1,500	88	245	51	55	24.9	
	[illegible]n-Taiya	Yukon	Skagway C-1	25,700	2,200	1,913	13,500	100	21,000	3,200	75	3.3	Yukon-Taiya would reduce downstream potential.

No.	Power Site	Stream	USGS Map sheet	Drainage Area (sq. mi.)	Maximum Regulated Water Surface (ft.)	Average Head (ft.)	Average Annual Runoff (1000 AF)	Per Cent Regulation	Firm Energy (million Kwh)	Installed Capacity (1000 KW)	1/ (plant factor %)	Index Cost 2/	
SOUTHWEST REGION													
65 (25)	Crooked Creek	Kuskokwim R.	Sleetmute D-6	31,100	500	352	32,400	100	9,400	2,140	50	5.0	
66	So. Fork Kuskokwim River	S.F. Koskokwim R.	McGrath A-1	870	2,000	174	840	60	72	15	55	112.0	
67	Lake Kulik	Wind R.	Dillingham	236	123	30	3,800	100	95	20	55	40.6	
68 (26)	Nuyakuk Lake	Nuyakuk R.	Dillingham D-6	1,530	342	176	4,300	90	555	127	50	15.9	
69	Chikuminuk	Allen R.	Taylor Mtns.	286	630	262	800	90	154	32	55	22.8	Would be reduced 11 million Kwh by development of Nuyakuk.
70	Upnuk Lake	Tikchik R.	Taylor Mtns.	100	830	170	280	100	39	8	55	46.6	
71 (27)	Iliamna Lake	Kuichak R.	Dillingham A-2	6,440	150	114	14,600	100	1,370	313	50	11.1	
72	Kakhonak Lake	Kakhonak R.	Iliamna B-4	145	300	200	275	100	45	9	55	53.8	
73	Newhalen River	Newhalen R.	Iliamna D-6	3,319	325	74	6,675	100	411	85	55	11.9	New mapping indicates Newhalen could be included on list of lower priced hydro.
74 (28)	Tazimina	Tazimina R.	Iliamna D-5	346	725	393	724	96	224	51	50	15.0	
75	Kontrashibuna	Tanalian R.	Lake Clark A-4	200	510	226	461	99	83	17	55	17.6	
76 (29)	Ingersol	Kijik R.	Lake Clark B-3	300	1,460	1,120	695	99	630	144	50	14.2	
77	Alagnak River	Alagnak R.	Iliamna A-8	530	775	170	960	35	47	10	55	53.5	
78	Nonvianuk Lake	Nonvianuk R.	Iliamna A-7	370	631	115	670	100	63	13	55	22.6	
79 (30)	Kukaklek Lake	Alagnek R.	Iliamna A-7	480	825	326	870	100	232	53	50	10.9	
80 (31)	Naknek	Naknek R.	Naknek C-2	2,720	150	124	4,600	100	473	108	50	13.2	
81	American Creek	American Creek	Mt. Katmai D-4	100	1,625	861	180	95	120	25	55	22.7	
82	Ukak River	Ukak R.	Mt. Katmai B-4	194	375	145	330	75	30	6	55	164.0	
83	Contact Creek	Contact Creek	Mt. Katnai A-6	54	1,050	274	92	65	13	3	55	354.0	
84	Becharof	Eggegik R.	Naknek A-3	1,280	70	58	1,600	100	76	16	55	21.3	
85	Ugashik Lakes	Ugashik R.	Ugashik C-3	830	50	33	1,100	100	30	6	55	50.2	
SOUTHCENTRAL REGION													
86	Olga Bay	Olga Narrows	Karluk A-1	335	70	64	710	100	37	8	55	68.6	Alternative to Fraser Lake.
87	Fraser Lake	Dog Salmon Creek	Karluk A-1	72	353	302	130	100	32	7	55	33.0	
88	Ayakulik	Ayukulik	Karluk A-2	181	200	181	330	100	49	10	55	42.6	
89	Karluk Lake	Karluk	Karluk C-1	165	400	344	300	100	85	18	55	24.9	
90	Terror Lake	Unnamed	Kodiak C-4	15	1,325	1,057	72	94	85	12	55	24.9	
91	McNeil River	McNeil River	Iliamna A-4	102	150	112	180	50	8	2	55	145.0	
92	Paint River	Paint R.	Iliamna A-4	205	150	115	370	80	28	6	55	115.0	
93 (32)	Crescent Lake	Crescent R.	Kenai B-8	200	599	517	454	98	179	41	50	9.9	
94 (33)	Chakachamna	Chakachatna R.	Tyonek A-7	1,120	1,127	793	2,460	100	1,600	366	50	6.5	
95	Chuitna	Chuitna R.	Tyonek A-4	66	800	552	140	70	45	9	55	83.4	
96	Lower Beluga	Beluga R.	Tyonek A-3	950	100	49	1,790	100	72	15	55	19.1	
97 (34)	Coffee	Beluga R.	Tyonik A-4	860	210	109	1,800	100	160	37	50	11.5	
98 (35)	Upper Beluga	Beluga R.	Tyonek B-4	840	375	142	1,800	100	210	48	50	11.1	
99	Strandline Lake	Beluga R.	Tyonek B-6	54	1,300	852	115	100	81	17	55	30.8	Development of Upper Beluga would reduce energy 12 million Kwh.
100	Lake Creek (Lower)	Lake Creek	Talkeetna A-2	335	800	305	710	60	105	22	55	32.6	
101	Upper Lake Creek	Lake Creek	Talkeetna B-3	85	1,400	560	180	90	74	15	55	20.3	
102	Talachulitna River	Talachulitna R.	Tyonek C-4	360	700	231	720	100	137	28	55	41.6	
103	Hayes, Skwentna R.	Skwnetna R.	Tyonek D-5	1,730	575	187	3,500	80	429	89	55	72.8	
104	Emerald	Skwentna R.	Tyonek D-8	370	1,900	366	790	74	177	37	55	69.7	
105 (36)	Yentna	Yentna R.	Tyonek C-2	6,400	150	82	12,750)			145)			
106 (37)	Talachulitna	Skwetna R.	Tyonek D-4	2,250	350	124	4,500)	79	1,390	75)	50	10.1	Assumes operation as a system.
107 (38)	Skwentna	Skwetna R.	Tyonek D-6	950	1,000	291	1,900)			98)			
108	Chulina Creek	Chulina Creek	Talkeetna B-1	240	800	198	380	40	25	5	55	50.9	
109 (39)	Lower Chulitna	Chulitna R.	Talkeetna B-1	2,600	500	89	6,350	84	394	90	50	8.1	
110 (40)	Tokichitna	Chulitna R.	Talkeetna C-1	2,560	725	186	6,200	85	806	184	50	8.8	
111	Talkeetna River (sheep)	Talkeetna R.	Talkeetna Mt. B-6	1,790	605	91	4,400	50	149	31	55	40.4	
112 (41)	Keetna	Talkeetna R.	Talkeetna Mt. B-6	1,260	950	286	1,690	82	324	74	50	11.3	
113	Iron Creek	Iron Creek	Talkeetna Mt. B-5	210	1,750	750	400	60	147	31	55	63.9	
114	Granite Gorge	Talkeetna R.	Talkeetna Mt. B-5	865	1,500	416	1,160	87	345	72	55	43.8	
115	Greenstone	Talkeetna R.	Talkeetna Mt. C-5	790	1,575	304	1,150	65	246	51	55	38.6	Alternative to Granite Gorge.
116	Trapper	Talkeetna R.	Talkeetna Mt. C-5	760	1,700	245	1,140	94	216	45	55	68.6	
117	Lucy	Chulitna R.	Talkeetna Mt. D-5	1,080	1,100	166	2,600	20	71	15	55	19.3	
118	Coal	Chulitna R.	Talkeetna Mt. D-6	985	1,450	241	2,400	40	193	40	55	36.3	Would be inundated by development of Ohio site.
119	Ohio	Chulitna R.	Talkeetna Mt. D-6	916	1,500	224	2,220	35	14[illegible]	30	55	21.0	
120	Chulitna-Hurricane	Chulitna R.	Healy A-6	795	1,600	207	1,900	50	166	34	55	26.7	Would be inundated by development of Ohio site.
121	West Fork Chulitna	W.F. Chulitna R.	Healy A-6	355	1,900	287	640	45	68	14	55	33.4	
122	East Fork Chulitna	E.F. Chulitna R.	Healy A-5	135	2,500	380	240	80	59	12	55	31.3	
123 (42)	Whiskers	Susitna R.	Talkeetna B-1	6,320	490	59	7,500	100	368	84	50	11.5	
124 (43)	Lane	Susitna R.	Talkeetna C-1	6,280	660	169	7,500	100	1,052	240	50	8.9	
125 (44)	Gold	Susitna R.	Talkeetna Mt. C-6	6,160	850	189	7,327	100	1,139	260	50	13.1	
126	Deadman Creek	Deadman Dr.	Talkeetna Mt. D-3	160	3,000	962	350	60	165	34	55	22.7	
127 (45)	Devil Canyon	Susitna R.	Talkeetna Mt. D-5	5,810	1,450	575	6,840)			738)			
128 (46)	Watana	Susitna R.	Talkeetna Mt. D-4	5,180	1,905	425	6,040)	100	7,000	478)	50	6.3	Assumes operation as a system.
129 (47)	Vee	Susitna R.	Talkeetna Mt. C-2	4,140	2,355	430	4,730)			386)			
130 (48)	Denali	Susitna R.	Talkeetna Mt. D-1	1,260	2,552	---	2,310)			---)			
131	McLaren River	McLaren R.	Gulkana D-6	485	2,875	263	1,410	85	263	55	55	45.2	
132	Boulder Creek	Boulder Cr.	Healy B-1	42	3,575	917	67	70	35	7	55	55.6	
133	Palmer	Matanuska R.	Anchorage C-6	2,070	400	166	2,918	20	79	16	55	195.5	
134	Moose Creek	Matanuska R.	Anchorage C-6	2,070	500	166	2,918	25	100	21	55	124.2	Alternative to Palmer site.
135	King Mountain	Matanuska R.	Anchorage D-5	1,635	1,050	276	2,300	40	210	44	55	37.6	

No.	Power Site	Stream	USGS Map sheet	Drainage Area (sq. mi.)	Maximum Regulated Water Surface (ft.)	Average Head (ft.)	Average Annual Runoff (1000 AF)	Per Cent Regulation	Firm Energy (million Kwh)	Installed Capacity (1000 KW)	1/ (plant factor %)	Index Cost 2/	
136	Coal Creek	Matanuska R.	Anchorage D-4	1,128	1,300	291	1,600	80	307	64	55	78.5	Alternative to King Mtn. site.
137	Boulder Creek	Boulder Cr.	Anchorage D-4	90	2,600	1,317	82	80	69	14	55	57.0	
138	Rush Lake	Boulder Cr.	Anchorage D-4	89	1,950	892	78	79	45	9	55	92.7	
139	Purinton Creek	Matanuska R.	Anchorage D-4	1,082	1,450	291	1,500	90	324	67	55	108.1	Alternative to Hick site.
140	Hicks Site	Matanuska R.	Anchorage D-3	950	1,675	281	1,300	90	286	59	55	37.2	
141	Caribou Creek	Caribou Cr.	Anchorage D-2	260	2,450	527	220	93	90	19	55	21.7	
142	Eagle River	Eagle R.	Anchorage B-7	194	450	167	397	82	45	9	55	38.8	
143	Sunrise	Sixmile Cr.	Seward D-7	238	450	327	350	55	52	11	55	122.2	
144	Lower Kenai	Kenai R.	Kenai B-3	1,650	160	84	4,300	88	263	55	55	18.2	
145	Moose Horn	Kenai R.	Kenai C-2	1,540	275	95	4,000	93	290	60	55	18.8	
146	Killey River	Killey R.	Kenai B-2	160	725	358	380	90	100	21	55	38.1	
147	Stelters Ranch	Kenai R.	Kenai B-1	849	500	199	2,600	97	403	84	55	17.9	
148	Kenai Lake	Kenai R.	Seward B-8	660	650	341	2,030	97	552	115	55	22.3	Alternative to Stelters Ranch site.
149	Crescent Lake	Crescent L.	Seward B-7	23	1,454	934	38	100	29	6	55	31.4	
150 (49)	Snow	Snow R.	Seward B-7	85	1,250	653	535	97	278	63	50	11.2	
151	Kasilof River	Kasilof R.	Kenai B-4	738	200	136	1,729	100	193	40	55	15.8	
152	Tustumena	Tustumena Glacier	Kenai A-2	57	1,496	1,100	133	85	102	21	55	17.1	
153	Sheep Creek	Sheep Cr.	Seldovia D-2	101	725	382	460	54	94	20	55	23.8	
154 (50)	Bradley Lake	Bradley Cr.	Seldovia D-3	88	1,195	1,155	445	93	410	94	50	8.0	Authorized Project.
155	Resurrection River	Resurrection R.	Seward A-7	141	425	233	600	75	86	18	55	58.5	
156	Nellie Juan River	Nellie Juan R.	Seward B-5	130	400	240	708	34	47	10	55	32.0	
157	Upper Nellie Juan	Nellie Juan R.	Seward B-6	35	1,189	421	190	90	57	12	55	17.6	
158 (51)	Lowe	Lowe R.	Valdez A-6	190	800	334	1,400	66	254	55	50	11.2	
159	Allison Creek	Allison Cr.	Valdez A-7	6	1,380	1,191	32	55	18	4	55	19.5	
160	Solomon Gulch	Unnamed	Valdez A-7	18	660	608	100	20	11	2	55	27.0	
161	Silver Lake	Duck R.	Cordova D-7	25	390	346	180	95	48	10	55	15.6	
162	Power Creek	Power Cr.	Cordova C-5	21	560	490	182	90	66	14	55	20.9	
163 (52)	Million Dollar	Copper R.	Cordova C-2	24,200	200	85	38,000	71	1,927	440	50	14.8	
164	Van Cleve	Unnamed	Cordova C-1	17	1,450	475	95	25	10	2	55	234.0	
165	Little Bremner River	Little Bremner R.	Valdez A-2	182	600	272	503	62	70	15	55	67.8	
166	Bremner R., Salmon Site	Bremner R.	Valdez A-1	660	525	166	2,100	30	86	18	55	46.7	
167	So. Fork Bremner River	S.F. Bremner R.	Cordova D-1	148	1,150	537	470	75	156	32	55	32.5	
168	Three Mile Canyon	Bremner R.	Cordova D-1	526	725	228	1,660	41	127	26	55	51.5	Alternative to Salmon site.
169	No. Fork Bremner River	N.F. Bremner R.	Bering Glacier	150	1,625	490	470	87	166	35	55	56.0	
170 (53)	Cleave	Copper R.	Valdez A-3	21,500	420	165	28,000	96	3,600	820	55	13.3	
171	Tsina	Tsina	Valdez A-5	104	1,750	360	220	90	58	12	55	64.2	
172	Tiekel River	Tiekel R.	Valdez A-3	421	950	400	900	35	105	22	55	37.8	
173 (54)	Wood Canyon	Copper R.	Valdez B-2	20,600	1,400	950	26,700	100	21,900	3,600	69.4	3.2	
174	Hanagita Lake	Hanagita R.	McCarthy A-8	100	2,575	1,010	228	85	160	33	55	27.0	
175	Tebay Lakes	Tebay R.	Valdez A-1	105	1,875	1,007	240	95	193	40	55	23.6	
176	Kuskulana River	Kuskulana R.	McCarthy C-8	260	2,050	508	550	50	114	24	55	66.9	
177	Young Creek	Young Cr.	McCarthy A-4	40	3,475	2,017	110	45	82	17	55	60.3	High Wood Canyon plan would reduce potential by about 5%.
178	Canyon Creek	Canyon Cr.	McCarthy A-4	100	3,100	1,308	270	45	131	27	55	46.1	
179	Kiagna River	Kiagna R.	McCarthy A-4	185	2,500	970	490	50	193	40	55	77.9	High Wood Canyon pian would reduce potential by about 10%.
180	Kotsina River	Kotsina R.	Valdez C-1	209	2,075	524	440	70	133	28	55	47.9	
181	Klutina	Klutina R.	Valdez D-5	670	1,800	335	950	100	263	54	55	17.6	
182	Tolsona Creek	Tolsona Cr.	Gulkana A-4	174	2,025	460	200	70	53	11	55	52.5	
183	Tazlina	Tazline R.	Gulkana A-5	1,970	1,875	273	2,300	100	503	104	55	15.6	
184	Nelchina River	Nelchina R.	Gulkana A-6	820	2,250	285	940	99	219	45	55	53.3	
185	Lower Gulkana River	Gulkana R	Gulkana B-3	1,850	1,700	232	2,000	11	42	9	55	84.8	
186	Upper Gulkana River	Gulkana R.	Gulkana B-3	1,770	1,850	124	1,900	23	45	9	55	86.8	
187	Gulkana River	Gulkana R.	Gulkana C-4	575	2,475	405	620	80	164	34	55	27.5	
188	West Fork Gulkana River	W.F. Gulkana R.	Gulkana C-5	398	2,375	192	440	100	69	14	55	58.7	
189	Summit Lake	Gulkana R.	Mt. Hayes A-4	83	3,210	500	88	100	36	8	55	19.9	
190	Gakona Site	Copper R.	Gulkana B-3	3,965	1,750	266	4,400	75	727	150	55	35.2	Alternative to Sanford site.
191	Sanford	Copper R.	Gukana B-3	3,365	1,825	178	3,700	70	385	80	55	29.3	
192	White River	White R.	Bering Glacier A-4	29	375	282	210	80	39	8	55	51.3	
SOUTHEAST REGION													
193	Alsek River	Alsek R.	Yakutat B-1	11,000	450	166	12,000	90	1,490	310	55	17.9	Major portion of reservoir area is in Canada.
194	Endicott River	Endicott R.	Juneau D-5	56	800	483	270	97	105	21	55	25.9	
195	Chilkoot	Chilkoot R.	Skagway B-2	130	175	136	780	90	78	16	55	35.8	
196 (55)	Chilkat	Chilkat R.	Skagway C-3	190	600	320	870	80	180	41	50	10.6	
197	West Creek	West Creek	Skagway C-2	40	800	625	268	75	105	21	55	25.9	
198	Goat Lake	Pitchfork Falls	Skagway C-1	4	2,915	2,017	30	95	46	10	55	16.5	
199	Lace River	Lace R.	Juneau D-3	363	200	166	2,300	97	298	62	55	51.8	
200	Unnamed Lake near Lace R.	Unnamed	Juneau D-3	3	3,160	3,003	20	100	48	10	55	19.4	
201	Antler River	Antler R.	Juneau D-3	5	1,950	1,813	29	100	43	9	55	17.8	
202	Nugget Creek	Nugget Cr.	Juneau B-2	16	725	607	151	40	30	6	55	52.9	
203	Carlson Creek	Carlson Cr.	Juneau B-1	24	450	344	246	66	46	10	55	27.5	
204	Boundary Lake	Boundary Cr.	Taku R. C-6	23	925	795	170	85	95	20	55	22.2	
205	Yehring Creek	Yehring Cr.	Taku R. B-6	16	1,100	1,077	112	26	26	5	55	29.0	
206 (56)	Lake Dorothy	Dorothy Cr.	Taku R. A-6	11	2,422	2,248	81	100	150	34	50	7.3	
207 (57)	Speel Division Snettisham Project	Speel R.	Taku R. A-5	194	325	273			275	63	50	8.1	

No.	Power Site	Stream	USGS Map sheet	Drainage Area (sq. mi.)	Maximum Regulated Water Surface (ft.)	Average Head (ft.)	Average Annual Runoff (1000 AF)	Per Cent Regulation	Firm Energy (million Kwh)	Installed Capacity (1000 KW)	1/ (plant factor %)	Index Cost 2/	
208 (58)	Tease Creek	Tease Cr.	Taku R. A-5	11	1,100	1,034	110	75	70	16	50	14.9	
209 (59)	Sweetheart Falls	Sweetheart Falls Cr.	Sumdum D-5	35	684	612	250	100	125	29	50	9.6	
210 (60)	Houghton	Unnamed	Sumdum D-3	39	550	457	370	98	136	31	50	11.0	
211	Farragut	Farragut R.	Sumdum A-3	64	525	493	480	56	163	37	50	13.8	Recent calculations indicate Farragut could be included on list of lower priced hydros.
212 (61)	Scenery Creek	Scenery Cr.	Sumdum A-3	21	957	620	147	90	67	15	50	10.8	
213 (62)	Thomas Bay	Cascade Cr.	Sumdum A-3	19	1,514	1,442	160	88	166	38	50	8.1	
214	Ruth Lake	Delta Cr.	Petersburg D-3	8	1,550	1,449	59	90	63	13	55	18.1	
215 (63)	Stikine River	Stikine R.	Petersburg C-1	20,000	350	291	45,000	90	9,900	2,260	50	9.0	
216 (64)	Goat	Goat Cr.	Bradfield Canal C-6	14	1,298	1,056	112	90	87	20	50	13.9	
217	Katate River	Katate R.	Bradfield Canal C-6	73	650	249	594	82	99	21	55	18.3	
218	Aaron	Aaron Cr.	Bradfield Canal C-6	61	300	183	652	56	58	12	55	86.0	
219	Harding River	Harding R.	Bradfield Canal C-5	68	250	207	548	92	85	18	55	49.2	
220	No. Bradfield River	N. Bradfield R.	Bradfield Canal B-5	150	250	157	1,200	61	131	27	55	71.0	
221 (65)	Tyee Creek	Tyee Cr.	Bradfield Canal A-5	15	1,387	1,275	123	93	120	27	50	8.9	
222	Anan Creek	Anan Cr.	Bradfield Canal A-6	27	325	230	200	89	33	7	55	34.4	
223 (66)	Spur	Unnamed	Bradfield Canal A-4	10	1,889	1,776	83	87	105	24	50	10.7	
224	Saks Cove	Saks Cr.	Ketchikan D-4	22	675	621	150	93	72	15	55	18.7	
225 (67)	Leduc	Leduc R.	Ketchikan	7	1,384	1,241	61	100	62	14	50	14.5	
226	Chickamin River	Chickamin R.	Bradfield Canal A-2	562	325	228	4,800	82	727	150	55	26.1	
227	Granite Creek	Granite Cr.	Ketchikan C-3	9	945	863	82	67	39	8	55	17.2	
228 (69)	Punchbowl Creek	Punchbowl Cr.	Ketchikan C-3	14	650	622	126	99	64	15	55	10.6	
229 (68)	Rudyerd	Unnamed	Ketchikan C-2	8	1,775	1,600	63	100	83	19	50	10.6	
230	Wilson River	Wilson R.	Ketchikan B-2	70	400	166	560	93	71	15	55	30.7	
231 (70)	Red	Red R.	Ketchikan A-2	44	400	347	410	89	104	24	50	12.2	
232	Davis River	Davis R.	Ketchikan D-1	78	450	367	667	67	131	28	55	17.4	
233	Kelp	Unnamed	Sitka B-4	21	675	612	161	82	66	16	50	15.1	
234 (75)	Takatz Creek	Takatz Cr.	Sitka A-3	11	1,040	991	129	87	97	20	50	12.5	
235	Baranof Lake	Baranof R.	Sitka A-3	32	145	108	316	42	11	2	55	19.1	
236	Carbon Lake	Unnamed	Sitka A-3	27	300	260	350	65	49	10	55	24.8	
237	Milk Lake	Unnamed	Port Alexander D-3	11	700	666	167	36	33	7	55	19.0	
238	Brentwood Creek	Brentwood Cr.	Port Alexander C-3	7	950	655	98	71	38	8	55	27.7	
239 (74)	Deer	Unnamed	Port Alexander C-3	7	374	339	114	96	31	7	50	14.8	
240 (73)	Maksoutof River	Maksoutof R.	Port Alexander C-3	24	600	570	272	93	117	24	50	12.6	
241	Plotnikof Lake	Unnamed	Port Alexander D-3	20	350	315	24	76	44	9	55	17.7	
242 (76)	Green Lake	Vodopad R.	Port Alexander D-4	29	400	353	212	84	52	11	50	12.4	
243	Hasselborg Creek	Hasselborg Cr.	Sitka C-1	83	331	306	343	90	77	16	55	22.3	
244	Thayer Creek	Thayer Cr.	Sitka C-2	61	407	377	252	100	78	16	55	22.1	
245	Kathleen Creek	Kathleen Cr.	Sitka D-3	29	525	502	126	94	48	10	55	33.7	
246	Towers Creek	Towers Cr.	Petersburg D-5	81	275	259	300	100	64	13	55	108.7	
247	Orchard Creek	Orchard Cr.	Ketchikan D-5	60	200	170	420	75	44	9	55	17.8	
248 (71)	Lake Grace	Grace Cr.	Ketchikan C-3	29	500	456	281	90	99	20	50	10.1	
249	Manzanita Lake		Ketchikan C-4	63	300	269	620	91	124	26	55	17.5	
250 (72)	Swan Lake	Falls Cr.	Ketchikan C-4	36	326	275	336	91	69	15	50	12.8	
251	Thorne	Thorne R	Craig C-2	166	125	103	1,100	85	80	17	55	17.6	
252	Reynolds Creek	Reynolds Cr.	Craig A-2	7	---	---	54	99	54	11	55	19.7	Three power plants and lakes involved.

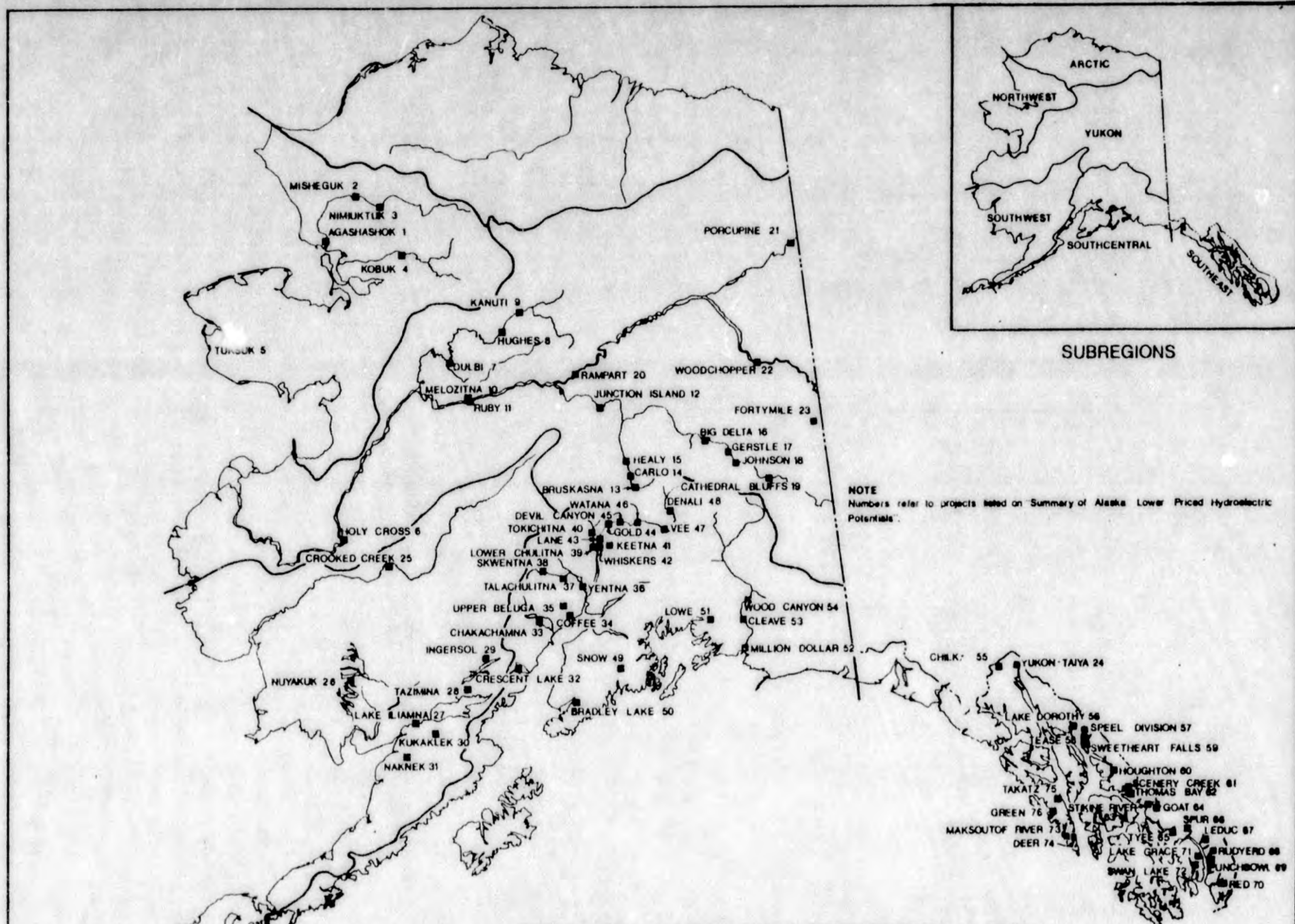
Power site numbers refer to map locations.

Numbers in parentheses refer to the published list and map of lower priced hydroelectric potentials 2500 kw continuous power and larger.

1/ The size and cost of the power plants for the inventory study was based on 55% plant factor. The list of the 76 lower priced sites assumes 50% plant factor with no significant change in cost. There are exceptions for the larger sites which were considered base load plants. Specific plant factors are noted.

2/ The index cost is a relative comparison cost of energy at the power plant bus bar. Substation and transmission costs are not included.

3/ An alternative development of the Ruby site to elevation 325 would inundate the Rampart dam site. Power production at Ruby would increase to 14.2 billion kwh annually and 3,250,000 kw.



UNDEVELOPED HYDROELECTRIC RESOURCES OF ALASKA

APPENDIX C
Description of Small Capacity Sites Within Geographic Areas

Following are tabulations of parameters of sites within each of the geographic areas examined, and descriptions of some of the particular factors of each area. The site number refers to the list of 252 sites while the number in parentheses refers to the list of (best) 76 sites. The comparison is to a 1966 Susitna Project energy cost index of 6.3 mills/kWh and generation capability of 6,100 GWh/year (range from 2,670 to 10,260 GWh/year).

1. Matanuska River Basin

No.	Site	Stream	Firm Energy GWH/year	Capacity MW	Cost Mills/kWh
133	Palmer	Matanuska R.	79	16	195.5
134	Moose Creek	Matanuska R.	100	21	124.2
	(Alternative to Palmer)				
135	King Mountain	Matanuska R.	210	44	37.6
136	Coal Creek	Matanuska R.	207	64	78.5
	(Alternative to King Mountain)				
137	Boulder Creek	Boulder Cr.	69	14	57.0
138	Rush Lake	Boulder Cr.	45	9	92.7
139	Purinton Creek	Matanuska R.	324	67	108.1
	(Alternative to Hicks)				
140	Hicks Site	Matanuska R.	286	59	27.2
141	Caribou Creek	Caribou Cr.	90	19	21.7
	Total (excluding Palmer, King Mountain, and Hicks)		935	194	

The small Caribou Creek site, which has the lowest index cost, was determined to be unfeasible because it is located in a broad glaciated valley with poor foundation, and probable severe reservoir sedimentation.

2. Tanana River Basin

No.		Site	Stream	Firm Energy GWH/year	Capacity MW	Cost Mills/kWh
31		Vachon Island	Tanana R.	2,050	426	29.0
		(Alternative to Junction Island)				
32	(12)	Junction Island	Tanana R.	2,330	532	15.1
45		Salchia River	Salchia R.	123	25	69.4
46		Tanana River (Little Delta)	Tanana R.	315	65	43.1
47	(16)	Big Delta	Tanana R.	987	226	16.8
48	(17)	Gerstle	Tanana R.	438	100	17.0
49	(18)	Johnson	Tanana R.	920	210	16.1
50	(19)	Cathedral Bluffs	Tanana R.	693	158	15.3
		Total (excluding Vachon Island)		5,806	1,316	

Three of the sites--Vachon Island, Salcha River, and Tanana River (Little Delta)--are significantly more costly than the others. All sites except Salcha River involve regulation of the main stem of the Tanana River.

Additional geologic investigation after development of cost estimates revealed that Cathedral Bluffs would require extensive foundation treatment, which is not reflected in the cost estimate.

3. Cook Inlet - Western Drainage

There are several sites west of Cook Inlet, all but one of which are smaller than 50 MW.

No.		Site	Stream	Firm Energy GWH/year	Capacity MW	Cost Mills/kWh
90	(32)	Cresent Lake	Cresent R.	179	41	9.9
94	(33)	Chakachamna	Chakachatna R.	1,600	366	6.5
95		Chuitna	Chuitna R.	45	9	83.4
96		Lower Beluga	Beluga R.	72	15	19.1
97	(34)	Coffee	Beluga R.	160	37	11.5
98	(35)	Upper Beluga	Beluga R.	210	48	11.1
99		Strandline Lake	Beluga R.	81	17	30.8
		(Upper Beluga would reduce Strandline Lake energy 12 GWH/year)				
		Total		2,347	533	

Two of the sites, Chuitna and Strandline Lake, are very costly. Chakachamna has an index cost comparable to Susitna (6.5 versus 6.3). Chakachamna could supply 60 percent of the low estimate 1990-2000 power requirement, 30 percent of the medium estimate, and 15 percent of the high estimate. Part of Lake Chakachamna is included in the recently designated Lake Clark National Monument, and it may not be available for development. Cresent Lake is also in the Lake Clark National Monument.

4. Yentna-Skwentna River Basin

No.		Site	Stream	Firm Energy GWH/year	Capacity MW	Cost Mills/kWh
100		Lake Creek (Lower)	Lake Creek	105	22	32.6
101		Upper Lake Creek	Lake Creek	74	15	20.3
102		Talachulitna River	Talachulitna R.	137	28	41.6
103		Hayes, Skwentna R.	Skwentna R.	429	89	72.8
104		Emerald	Skwentna R.	177	37	69.7
105	(36)	Yentna	Yentna R.		145)	
106	(37)	Talachulitna	Skwentna R.	1,390	75)	10.1
107	(38)	Skwentna	Skwentna R.		98)	
		(Yentna, Talachulitna, and Skwentna operated as a system)				
	Total			2,312	509	

The cost of the Yentna-Skwentna system includes 70 miles of access road. This system is the lowest cost potential hydro development other than authorized projects and those that would be precluded by land use designations. The capacity of the system would be 318 MW.

5. Talkeetna River Basin

No.		Site	Stream	Firm Energy GWH/year	Capacity MW	Cost Mills/kWh
108		Chunilna Creek	Chunilna Cr.	25	5	50.9
111		Talkeetna R. (Sheep)	Talkeetna R.	149	31	40.4
112	(41)	Keetna	Talkeetna R.	324	74	11.3
114		Iron Creek	Iron Creek	147	31	63.9
115		Greenstone (Alternative to Granite Gorge)	Talkeetna R.	246	51	38.6
116		Trapper	Talkeetna R.	216	45	68.6
	Total (excluding Granite Gorge)			1,107	237	

Most of the sites in this basin require large dams (from 300 to 565 feet high and more than 3,000 feet long).

6. Chulitna River Basin

No.		Site	Stream	Firm Energy GWH/year	Capacity MW	Cost Mills/kWh
109	(39)	Lower Chulitna	Chulitna R.	394	90	8.1
110	(40)	Tokichitna	Chulitna R.	806	184	8.8
117		Lucy	Chulitna R.	71	15	19.3
118		Coal	Chulitna R.	193	40	36.6
119		Ohio	Chulitna R.	144	30	21.0
		(Would inundate Coal and Chulitna-Hurricane)				
120		Chulitna-Hurricane	Chulitna R.	166	34	26.7
121		W. Fork Chulitna	W.F. Chulitna R.	68	14	33.4
122		E. Fork Chulitna	E.F. Chulitna R.	59	12	31.3
	Total (excluding Coal and Chulitna-Hurricane)			1,542	345	

Two sites (Coal and Chulitna-Hurricane) are eliminated by a more economical third site (Ohio) which would involve the same reach of river. Only the Lower Chulitna and Tokichitna sites are near the economic range of Susitna. Part of the Tokichitna reservoir would be included in the new Denali National Monument.

7. Kenai Peninsula

The Kenai Peninsula has several sites, most of which are small and at best marginally economical.

No.		Site	Stream	Firm Energy GWH/year	Capacity MW	Cost Mills/kWh
143		Sunrise	Sixmile Cr.	52	11	122.2
144		Lower Kenai	Kenai R.	263	55	18.2
145		Moose Horn	Kenai R.	290	60	18.8
146		Killey River	Killey R.	100	21	38.1
147		Stelters Ranch	Kenai R.	403	84	17.9
148		Kenai Lake	Kenai R.	522	115	22.3
		(Alternative to Stelters Ranch site)				
149		Cresent Lake	Cresent L.	29	56	31.4
150	(49)	Snow	Snow R.	278	63	11.2
152		Tustumena	Tustumena Gla.	102	21	17.1
153		Sheep Creek	Sheep Cr.	94	20	23.8
154	(50)	Bradley Lake	Bradley Cr.	410	94	8.0
		(Authorized Project)				
155		Resurrection R.	Resurrection R.	86	18	58.5
156		Nellie Juan River	Nellie Juan R.	47	10	32.0
157		Upper Nellie Juan	Nellie Juan R.	57	12	17.6
	Total (excluding Kenai Lake)			2,211	475	

For comparison purposes Bradley Lake energy cost on a January 1977 price basis is 36 mills per kWh compared to the index cost of 8.0. This factor of 4.5 includes several plan modifications and refinements to reduce costs. Bradley Lake is an authorized Corps of Engineers project with final planning, design, and construction funding pending. It is a supplement to the Susitna Project and not a significant alternative.

An average of two to five of these sites would have to be developed each year to meet the Anchorage-Kenai area projected power growth of 200 MW annually during the 1990's. Environmental impacts for development of the Kenai River sites would be significant, primarily due to extensive fishery.

8. Scattered Sites Tributary to Railbelt

Scattered sites and small basins tributary to the Railbelt area include:

No.	Site	Stream	Firm Energy GWH/year	Capacity MW	Cost Mills/kWh
33	Kantishna River	Kantishna R.	394	82	22.2
34	McKinley River	McKinley R.	201	42	42.3
35	Chatanika River	Chatanika R.	32	7	63.0
36	Teklanika River	Teklanika R.	272	57	24.2
43	Totatlanika River	Totatlanika R.	114	24	33.1
44	Chena River	Chena R.	46	10	128.0
51	Nabesna	Nabesna R.	320	66	33.9
126	Deadman Creek	Deadman Cr.	165	34	22.7
131	McLaren River	McLaren R.	263	55	45.2
132	Boulder Creek	Boulder Cr.	35	7	55.6
142	Eagle River	Eagle R.	45	9	38.8
158	(51) Lowe	Lowe R.	254	55	11.2
159	Allison Creek	Allison Cr.	18	4	19.5
161	Silver Lake	Duck R.	48	10	15.6
	Total		2,207	462	

Most of these sites are small--less than 100 MW. Their scattered locations are not conductive to intertieing energy supplies of a large area such as the Railbelt. Several sites are in designated national monuments or in proposed national park areas. The Lowe site is in a canyon occupied by the Trans-Alaska Oil Pipeline and the only highway access to Valdez, and the route of a planned Valdez-Glennallen transmission line.

The Silver Lake site, with an index cost of 2.5 times the Susitna index, has a possibility of serving a part of the local power needs of the Valdez area, but would not be a significant alternative or contributor to meeting the larger Railbelt area needs.

APPENDIX D

FBCF

OPTIONAL FORM NO. 10
MAY 1962 EDITION
GSA FPMR (41 CFR) 101-11.6

UNITED STATES GOVERNMENT

Memorandum

RECEIVED SEP 5 1969

TO : T. R. Cantine, Chief, Project Development, Alaska Power Administration, Juneau, Alaska

DATE: September 4, 1969

FROM : Regional Fish & Wildlife Administrator, BCF, Juneau, Alaska

SUBJECT: Initial evaluation of project effects on fish and wildlife

CODE	INIT	DATE
100	N	9/9/69
700	[illegible]	9/5
720	[illegible]	9/5
[illegible]	[illegible]	[illegible]
900		

The attached table presenting our appraisal of the effects of project development on fish and wildlife resources was prepared in response to Gary Long's request this week. The projects are those listed in the F. P. C. Alaska Power Survey, July 1966.

We judged effects to be significant where we would anticipate recommending major mitigation facilities or where losses, even though infeasible to mitigate, would be large. Minor effects are those which possibly would not justify additional mitigation features beyond those which could be accommodated in design and operation of the project at little or no additional cost. For example, we judged the minimum flows required for movement of fish below the mainstem Susitna River dams to fall in this category, which may or may not be correct. Negligible effects are those which would not justify project modification. We reported "effects unknown" in these cases where we did not have sufficient knowledge of the project area to even speculate on possible project effect.

Thus, because of the lack of project data and our lack of information on fish and wildlife resources in the project area in many cases, this evaluation of project effects should be considered very preliminary.

M. A. Monson

Melvin A. Monson

Attachment

Buy U.S. Savings Bonds Regularly on the Payroll Savings Plan

Initial Evaluating Effects of Project Development on Fish and Wildlife

Project	Significant effects		Minor effects		Negligible effects		Effects Unknown	
	fish	wildlife	fish	wildlife	fish	wildlife	fish	wildlife
1. Agashashok	x	x						
2. Misheguk							x	x
3. Nimiuktuk							x	x
4. Kobuk River	x	x						
5. Tuksuk	x	x						
6. Holy Cross	x	x						
7. Dulbi							x	x
8. Hughes							x	x
9. Kanuti	x	x						
10. Melozitna	x	x						
11. Ruby	x	x						
12. Junction Island							x	x
13. Healy					x			x
14. Carlo					x			x
15. Bruskasna					x			x
16. Big Delta							x	x
17. Gerstle							x	x
18. Johnson							x	x
19. Cathedral Bluffs							x	x
20. Rampart	x	x						
21. Porcupine	x	x						
22. Woodchopper	x	x						
23. Fortymile							x	x
24. Yukon-Taiya	x					x		
25. Crooked Creek	x	x						
26. Nuyakuk	x			x				
27. Lake Iliamna	x							x
28. Tazimina							x	x
29. Ingersol	x			x				
30. Kukaklek	x							x
31. Naknek	x							x
32. Crescent Lake	x					x		
33. Chakachamna	x					x		
34. Coffee	x			x				
35. Upper Beluga	x			x				
36. Yentna	x	x						
37. Talachulitna	x	x						
38. Skwentna	x	x						
39. Lower Chulitna	x							x
40. Tokichitna							x	x
41. Keetna	x							x
42. Whiskers	x							x

Initial Evaluating Effects of Project Development on Fish and Wildlife

Project	Significant effects		Minor effects		Negligible effects		Effects Unknown	
	fish	wildlife	fish	wildlife	fish	wildlife	fish	wildlife
43. Lane	x							x
44. Gold			x					x
45. Devil Canyon			x			x		
46. Watana			x			x		
47. Vee			x	x				
48. Denali			x	x				
49. Snow			x	x				
50. Bradley Lake					x	x		
51. Lowe			x	x				
52. Million Dollar	x							x
53. Cleave							x	x
54. Wood Canyon	x							
55. Chilkat			x					x
56. Lake Dorothy					x	x		
57. SpeelDiv.Snettisham			x			x		
58. Tease					x	x		
59. SweetheartFalls Cr			x			x		
60. Houghton							x	x
61. Scenery Creek					x	x		
62. Thomas Bay			x	x				
63. Stikine River	x	x						
64. Goat							x	x
65. Tyee Creek					x	x		
66. Spur					x	x		
67. Leduc							x	x
68. Rudyerd					x	x		
69. Punchbowl Creek					x	x		
70. Red							x	x
71. Lake Grace	x					x		
72. Swan Lake					x	x		
73. Maksoutof River							x	x
74. Deer							x	x
75. Takatz Creek					x	x		
76. Green Lake							x	x

We have reported on mitigation possibilities and costs.

APPENDIX E

Sample of Inventory-grade Hydroelectric Site Study

This appendix is included to provide a typical example of the data developed for a potential site included on the list of 76.

The appendix includes discussions on topography, geology, hydrology, estimates of power, descriptions of engineering features, and cost estimates.

Project Snow

Location

The dam would be on the Snow River, river mile 8, latitude 60° 18'N, longitude 149° 16'W. The powerplant would be on the northeast shore of a small unnamed lake at latitude 60° 17'N, longitude 149° 19'W.

Topography

Damsite topography is available to the scale of 1:2,400 with 10-foot contours from the USGS river sheet "Snow River, Alaska." Reservoir topography is shown on the above sheets to the scale 1:24,000 with 20-foot contours.

Geology

A U.S. Bureau of Reclamation geologist conducted a surface geology reconnaissance of this site in June 1965.

The Snow River, at the damsite, flows in a deep, narrow gorge incised in bedrock on the floor of a steep-walled, U-shaped, glacial valley. Graywacke and slate are well exposed in the near-vertical abutments although thin overburden mantles portions of the upper left abutment. The beds strike nearly due north, normal to the canyon, and dip steeply upstream. Insofar as could be determined from the very brief aerial reconnaissance, geologic conditions are favorable for construction of a concrete dam at this site. However, a thorough ground examination is necessary to adequately appraise the foundation. A tunnel along the right valley wall would penetrate rock similar to that exposed at the damsite.

Construction materials could be obtained from the alluvial and glacial deposits along the lower reaches of the river near its confluence with South Fork Snow River 2 to 3 miles downstream of the site.

Hydrology and Power Estimates

Drainage Area. The damsite has a tributary drainage area of 85 square miles. The mountainous basin lies north of Seward in the Kenai Mountains. The lower elevations support the growth of timber and other vegetation while the upper elevations contain numerous glaciers and the vegetal cover is sparse to non-existent.

Water Supply. Streamflows of the Snow River have been measured at a point upstream from the proposed damsite. The records from this gage "Snow River near Divide" are available from December 1960 to July 1965. These records were extended by a correlator with the records from the gage "Trail River near Lawing." The Trail River records are available from May 1947 to the present time.

The average annual streamflow at the damsite was estimated at 535,000 acre-feet, based upon the extensive Snow River gage records.

Power Estimates. The reservoir, with normal maximum water surface at elevation 1,200, would contain a total of 152,000 acre-feet of storage. The active storage capacity of 151,000 acre-feet would be sufficient to provide 75 percent regulation of the flows of the Snow River for power production. Average tail water elevation was assumed at elevation 500, yielding a new average head of 620 feet. The proposed development with an overall efficiency of 80 percent would be capable of producing 23,300 kilowatts of continuous power. The installed capacity would be 42,400 kilowatts with an assumed load factor of 55 percent.

Plan

Three alternates were estimated with normal maximum water surface elevations of 1,150, 1,200, and 1,250 feet. Elevation 1,200 was determined to be the optimum water surface elevation.

A concrete arch dam would be built with the crest at elevation 1,210 and the base at elevation 900, for a maximum structural height of 310 feet, and a height above the river of 250 feet. The crest length would be about 820 feet.

The powerplant would be connected to the reservoir by 10,000 feet of 11-foot-diameter tunnel and 2,000 feet of 8-foot-diameter surface penstock.

The powerplant would house two generators of 21,200 kW each for a total installed capacity of 42,400. The generators would be driven by Francis-type turbines operating at 400 r.p.m. under an average head of 620 feet. Average tail water would be at about elevation 500.

The estimated construction cost of the major features of the selected plan based upon January 1967 prices are as follows:

Dam	$23,500,000
Powerplant	6,800,000
Tunnel	6,500,000
Penstock	3,300,000
Roads	1,300,000
Log Boom	600,000
General Property	1,600,000
Miscellaneous	4,400,000
TOTAL	$48,000,000

Cost per installed kW = $1,130

Remarks

The U.S. Geological Survey discussed this project in a report, Preliminary Report on the Waterpower Resources of Snow River, Nellie Juan Lake, and Lost Lake, Kenai Peninsula, Alaska, dated February 1961. This report discusses the geography, climate, water supply, and possible plan of development for this project. A cost analysis was not included.

7-1654
(11-58)
Bureau of Reclamation

GPO 857747

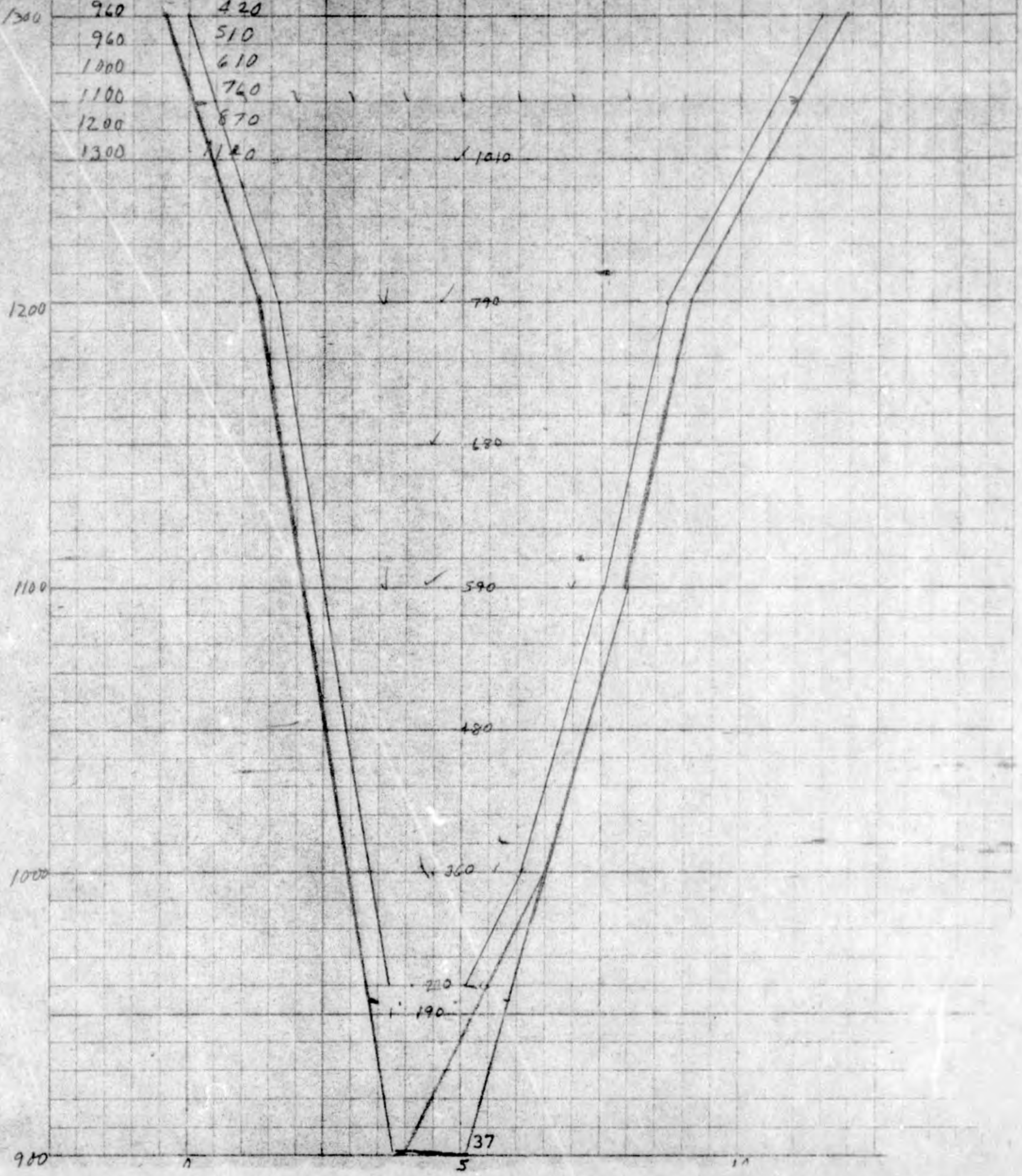
COMPUTATION SHEET

BY *Stt* DATE *12/24/64* PROJECT *Snow Basin* [uncertain] SHEET No ____ OF ____

CHKD BY ____ DATE ____ FEATURE *Dam x-section* JOB No ____

OFFICE ____ DETAIL ____ FILE No ____

Elev.	Sta.
1300	0
1200	170
1100	250
1000	330
960	420
960	510
1000	610
1100	760
1200	870
1300	1120



7-1654
(11-58)
Bureau of Reclamation

COMPUTATION SHEET

GPO 857747

BY CW DATE ______ PROJECT Snow SHEET No. ____ OF ____

CHKD BY ____ DATE ______ FEATURE ______ JOB No. ______

OFFICE ______ DETAIL Dam Estimate FILE No. ______

W.S. El.	Crest El.	L_1	H	El. of L_2	L_2
1150	1160	700	260	939	220
1200	1210	820	310	947	240
1250	1260	1050	360	954	250

W.S. El. 1150, Crest El. 1160, $L_1 = 700$; $H = 260$, $L_2 = 220$

$$V_1 = 2\times10^{-6}(260)^2 220\left[\frac{(260+0.8\times700)^2}{700-220}\right] = 29.75(1400) = 41{,}600 \text{ cu yds}$$

$$V_2 = 4\times10^{-4}(260)700(260+1.1\times700) = 72.8(1030) = 75{,}000 \text{ cu yds}$$

116,600

Using Takatz Prices

$$F.C. = \frac{116{,}600}{29{,}000}\times 4{,}430{,}000 \times \frac{34}{50} \cong \$12{,}100{,}000$$

W.S. El. 1200, Crest El. 1210, $L_1 = 820$, $H = 310$, $L_2 = 240$

$$V_1 = 2\times10^{-6}(310)^2 240\left[\frac{(310+0.8\times820)^2}{820-240}\right] = 46.1(1610) = 74{,}100 \text{ cu yds}$$

$$V_2 = 4\times10^{-4}(310)820(310+1.1\times820) = 101.6(1212) = 123{,}200 \text{ cu yds}$$

197,300 cu yds

Using Takatz Prices

$$F.C. = \frac{197{,}300}{29{,}000}\times 4{,}430{,}000 \times \frac{32.50}{50} = \$19{,}580{,}000$$

W.S. El. 1250 Crest El. 1260 $L_1 = 1050$, $H = 360$, $L_2 = 250$

$$V_1 = 2\times10^{-6}(360)^2 250\left[\frac{(360+0.8\times1050)^2}{1050-250}\right] = 64.8(1800) = 11[illegible]500 \text{ cu yds}$$

$$V_2 = 4\times10^{-4}(360)1050(360+1.1\times1050) = 151(1515) = 2[illegible]$$

345,000

Using Takatz Prices

$$F.C. = \frac{345{,}000}{29{,}000}\times 4\,430\,000 \times \frac{31.25}{50} = \$33{,}000{,}000$$

7-1654
(11-58)
Bureau of Reclamation

COMPUTATION SHEET

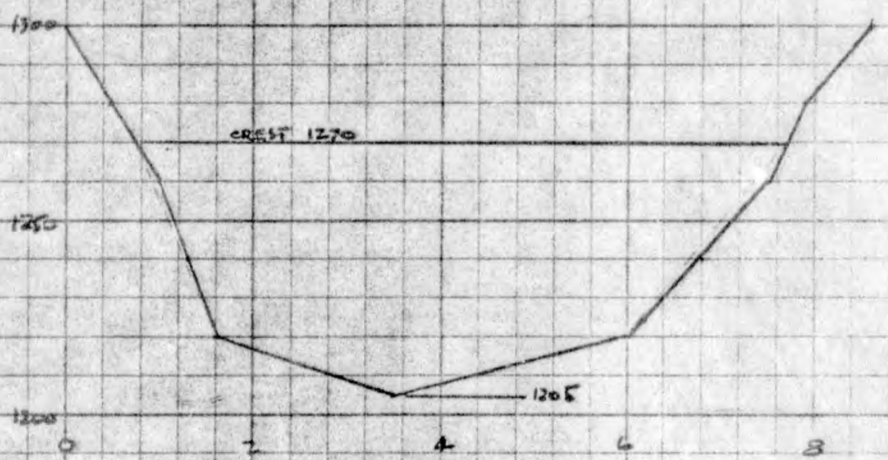
BY CCC DATE 4-5-66 PROJECT Snow SHEET No. ____ OF ____

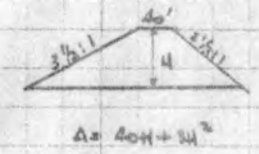
CHKD BY ____ DATE ____ FEATURE Inventory JOB No. ____

OFFICE Juneau DETAIL Dike Cost FILE No. ____

DIKE REQUIRED IN SADDLE SE OF DAM. SADDLE ELEV. 1205 (SEE RIVER SHEET).

ELEV.	STA.
1300	0
1280	0+50
1260	1
1240	1+30
1220	1+60
1205	3+50
1220	6+00
1240	6+80
1260	7+50
1280	7+90
1300	8+60





STA.	H	40H	3H²	AREA	AVE AREA	DISTANCE	VOLUME
0+70	0	0	0	0			
					4750	90	427,000
1+60	50	2000	7500	9500			
					12,588	190	2,390,000
3+50	65	2600	12,675	15,275			
					12,588	250	3,140,000
6+00	50	2000	7500	9500			
					4750	170	810,000
7+70	0	0	0	0		Total (ft³)	6,767,000
						Total (c.y.)	250,000

FIELD COST = $5.20 × 250,000 = $1,300,000

7-1654
(10-58)
Bureau of Reclamation

COMPUTATION SHEET

GPO 837747

BY SH DATE 1/14/64 PROJECT Snow River SHEET No. ____ OF ____
CHKD BY ____ DATE ____ FEATURE Tunnel Cost JOB No. ____
OFFICE Riv GWL DETAIL Q = 670 FILE No. Fact L = 2,000

Length = 10,000'

1. Try 12' h_f = 10 × 1.7 × .59 = 10.0'

Ann. Value Energy lost = 7.0 × 670/11 × .746 × 8,760 × .012 = $33,400/yr. 7.0' extra

7.0 K ∴ K = 4,770

2. Try 11' h_f = 17 × 1.0 = 17.0'

Energy lost = 11.9 × 4,770 = $56,800 11.9' extra

3. Try 10' h_f = 17.0 × 1.7 = 28.9'

Annual Tunnel Costs

1. 12' Cost = 10,000 × 1.25 × 619 × 1.20 × 1.05 × .04 = $390,000/yr

= 614 K ∴ K = 630

39,000/yr.

2. 11' Cost = 630 × 557 = 351,000/yr.

33,000/yr.

3. 10' Cost = 630 × 504 = 318,000/yr.

∴ Use 11'

Field Cost = 10,000 × 1.25 × ~~557~~ 428 = $5,400,000 (~~7,000,000~~)

7-1654
(11-58)
Bureau of Reclamation

COMPUTATION SHEET

GPO 857747

BY Sll DATE 1/18/65 PROJECT ~~Snow River~~ SHEET No. ___ OF ___
CHKD BY ___ DATE ___ FEATURE Penstock Cost c JOB No. ___
OFFICE Rev Est DETAIL Summary of Field Costs for 53,000 KW Plant FILE No. ___

A. Penstock (2 - 8') $h_f = 2{,}000 \times 1.7 \times 4.8$ = 16.3'

Field Cost = 2,000 × 1.20 × 1.25 × 700 × ~~0.8~~ 1.30 = 2,740,000 ~~1,900,000~~ ok

B. Dam = ~~29,900,000~~

C. Tunnel = ~~7,000,000~~

D. Powerplant = ~~7,000,000~~

E. Gen Prop 53,000 × 20 × 1.25 = 1,300,000 ok

F. Roads 3 mi @ 300,000 × 1.25 = 1,100,000 ok

G. Clearing 1,000 × 500 × 1.25 = 600,000 ok

Subtotal = 50,800,000
10% Misc = 5,100,000
55,900,000

Const Cost = 67,100,000

Invest Cost = 70,500,000

Annual Energy Output = 25[illegible],000,000 KWh.

50yr Value = 29,770

Annual OM&R = 53,000 × 2.25 × 2.40 = 286,000

50yr Costs
Capital = 70.5 × 4.66 = 329
OM&R = .286 × 117.1 = 34
363

Mill Rate = 363 / 29,770 = 12.2

All superseded except
Penstock c roads & dam & tunnel!

BY SH DATE 8/31/65 PROJECT Snow SHEET No ___ OF ___
CHKD BY ___ DATE ___ FEATURE Powerplant Costs JOB No ___
OFFICE Rev GWL DETAIL ___ FILE No ___

1\. 1150

$$n = \frac{24.2 \times 535}{\sqrt{\frac{9350}{24.2}} = 19.6} = 661 \quad \text{use } 600$$

2 units of 9,350 = 18,700

$\frac{KVA}{RPM} = 35$

~~Field Cost = 20 × 1,750,000 = \$3,500,000~~

Using Grace Costs

$$FC = \frac{1750}{2040} \times 3,220,000 = \$2,760,000$$

2\. 1200

$$n = \frac{24.9 \times 535}{\sqrt{\frac{21,150}{24.9}} = 29.2} = 456 \quad \text{use } 450$$

2 units of 21,150 = 42,300

$\frac{KVA}{RPM} = 105$

~~Field Cost = 2.0 × 3,600,000 = \$7,200,000~~

Using Grace Costs

$$F.C. = \frac{3600}{2040} \times 3,220,000 = \$5,680,000$$

3\. 1250

$$n = \frac{25.6 \times 535}{\sqrt{\frac{28,800}{25.6}} = 33.6} = 408 \quad \text{use } 400$$

2 units of 28,800 = 57,600

$\frac{KVA}{RPM} = 160$

~~Field Cost = 2.0 × 4,750,000 = \$9,500,000~~

Using Grace Costs

$$F.C. = \frac{475}{204} \times 3,220,000 = \$7,490,000$$

7-1654
(11-58)
Bureau of Reclamation

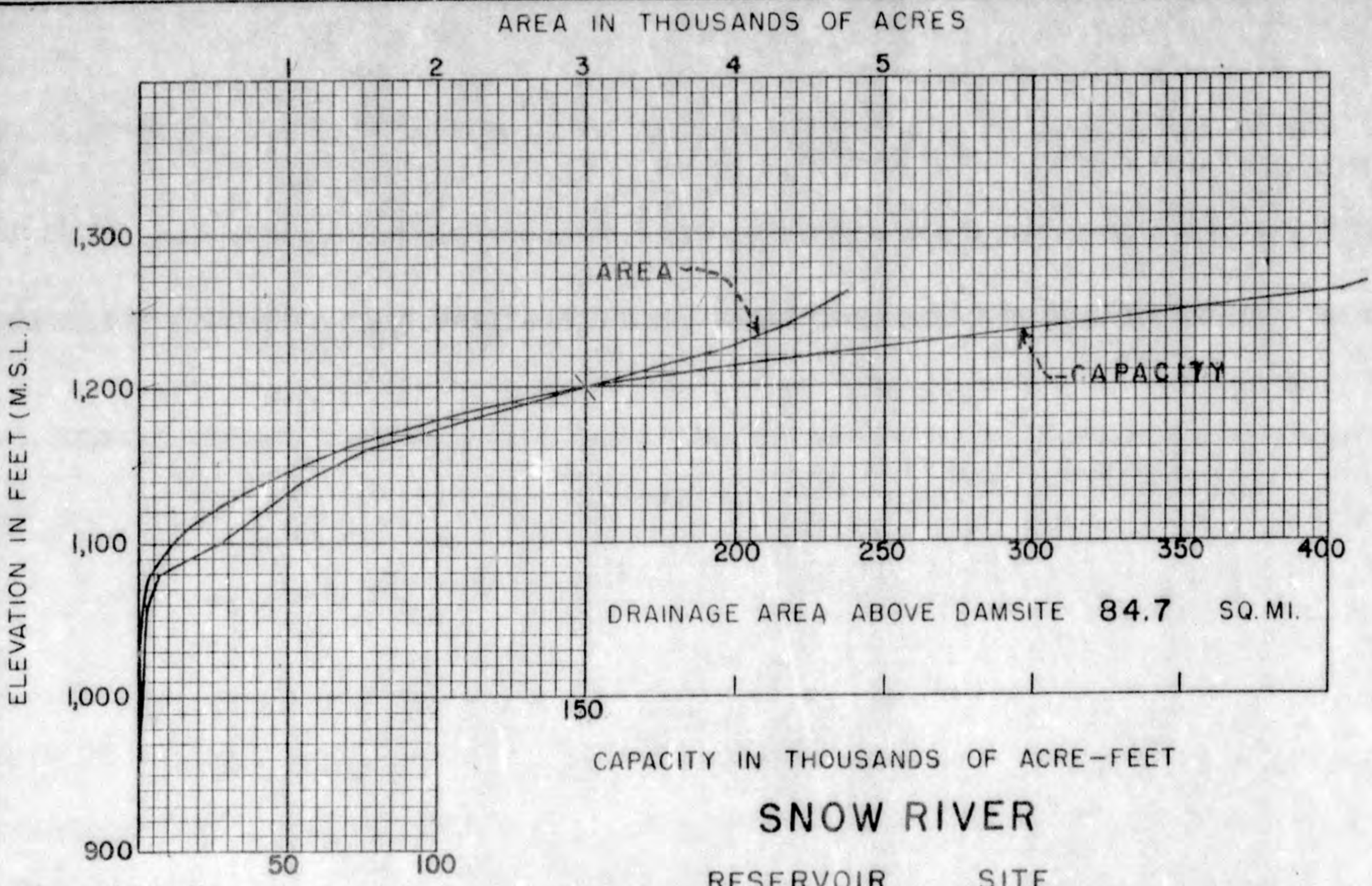
COMPUTATION SHEET

BY Cal DATE ______ PROJECT Snow SHEET No. ____ OF ____
CHKD. BY ____ DATE ______ FEATURE ______ JOB No. ______
OFFICE ______ DETAIL Summary FILE No. ______

W.S. El.	1150	1200	1250
Installed	18 700	42 300	57,600
Prime	10,300	23,300	31,700
Costs (1000)		use	
Dam (Conrad)	12,100	19,580	33,000
Dike (CGC est)	—	—	1,300
Tunnel (RwSSL est)	5,400	5,400	5,400
Penstock (RwSSL est)	2,740	2,740	2,740
Powerplant (RwSSL est)	2,760	5,680	7,490
Roads (SSL est)	1,100	1,100	1,100
Clearing (SSL est.)	400	500	600
Genprop (SSL est)	1,300	1,300	1,400
Sub total	25,800	36,300	53,030
10% Misc.	2580	3630	5303
F.C.	28,380	39,930	58,333
C.C.	34,000	47,900	70,000
CC/inst. kw	1820	1133	1215

I.C. 50,300
50 yr. 234,000
OM&R 2.25 × 42,300 × 2.90 × 117.1 = 32 400
(kw) (hr/yr)
266,400 = 11.15
Energy = 23,300 × 8760 × 117.1 23,900,000

3½% interest.



SNOW RIVER

RESERVOIR SITE

ALASKA RECONNAISSANCE

AREA & CAPACITY CURVES

ZERO AREA EL. 960

Seward (B-7)

1964

FROM U.S.G.S. TOPOGRAPHY

SCALE 1: 24,000

7-1654
(11-58)
Bureau of Reclamation

COMPUTATION SHEET

GPO 857747

BY ______ DATE ______ PROJECT Snow River ______ SHEET No. ______ OF ______

CHKD BY ______ DATE ______ FEATURE ______ JOB No. ______

OFFICE ______ DETAIL ______ FILE No. ______

Sediment load by Flow-duration method is 1.2 AF/mi²/yr.

84.7 × 1.2 × 50 = 5,100 AF/50 years -- glaciers
Colder 300 ppm -- sediment is negligible

Water Supply ②

	② Trail R. 181 mi²	① Snow R. 99.3 mi²	①/②
1948	602.2		
9	523.2		
1950	605.5		
1	522.7		
2	449.1		
3	811.0		
4	544.1		
5	563.6		
6	469.1		
7	578.1		
8	622.0		
9	509.4		
1960	597.3		
1	676.3	531.0	78.5
2	478.2	463.4	96.8
3	532.6	428.6	80.5
4	591.4	596.5	101.1
61-64 Tot	2278.5	2019.5	88.63
Ave		505,000	
48-64 Tot	9675.8		
17-yr Ave	569.2	504.5	88.63

drainage areas × 100 Ratio

Assume area at gage is 80 mi²

Runoff at dam = $\frac{84.7}{80} \times 504{,}500 =$ 535,000 AF/yr.

Using Records in 62 & 63, Cooper estimated 490,000 AF/yr.

Could increase this to 535,000 based upon above.

Corresponding increase in power production would be about 5%, and change is not warranted.

RC 8/26/65

7-1654
(11-58)
Bureau of Reclamation

COMPUTATION SHEET

GPO 857747

BY ______ DATE ______ PROJECT Snow SHEET No. ______ OF ______
CHKD. BY ______ DATE ______ FEATURE ______ JOB No. ______
OFFICE ______ DETAIL ______ FILE No. ______

Ave R.O is 535,000 AF/yr or 738 cfs.

Alternate W.S.	1150	1200	1250
Active capacity	59,000	151,000	354,000
% regulation	12.1	33.8	79.3
% release	35	75	97
regulated release AF	187,000	401,000	519,000
cfs	258	554	716
Ave head (Coopers 12 hrs/24 comp)	587	620	653
Firm KW = 0.0678 QH	10,300	23,300	31,700
Installed KW @ 55%	18,700	42,300	57,600

Ave of Kenai R & Bradley R. storage release diagram

FORM 7-223A
(JULY 3)
BURE OF RECLAMATION

Long. 149° 14' 19"

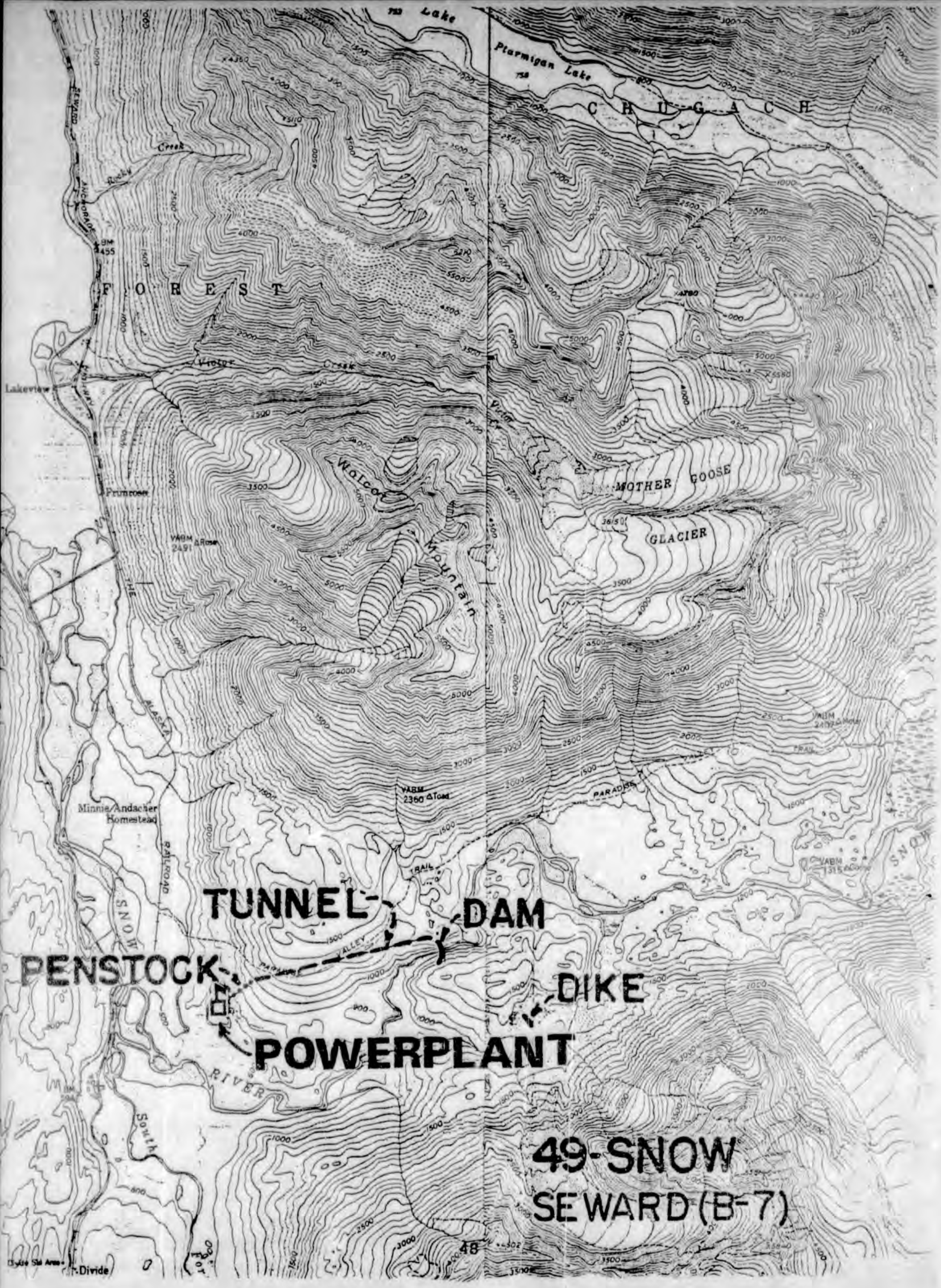
HYDROGRAPHIC SCHARGE DATA

Run-off of Snow River near Divide (30-2435) Unit 1000 Ac-ft. Drainage Area 99.8 Sq.Miles

YEAR	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	TOTAL	PERCENT MEAN
1961	34.1	8.8	6.8	7.8	5.5	3.7	3.8	43.8	76.0	124.0	111.0	105.7	531.0	
1962	61.3	9.0	4.0	2.2	1.3	1.2	3.4	21.7	76.0	139.1	100.2	44.0	463.4	
1963	10.1	11.9	3.8	2.7	3.1	2.2	2.0	23.4	46.4	125.4	102.9	94.7	428.6	
1964	30.8	5.6	5.4	3.1	1.9	1.3	2.0	9.7	92.9	117.7	121.4	204.7	596.5	
Total (3)	102.2	26.5												
Ave	34.1	8.8												
TOTAL														
MEAN														
PERCENT														

47

GPO 845247


TUNNEL
DAM
PENSTOCK
DIKE
POWERPLANT
49-SNOW
SEWARD (B-7)
Ptarmigan Lake
CHUGACH
FOREST
Victor Creek
Rocky Creek
Lakeview
Primrose
Walcott Mountain
MOTHER GOOSE
GLACIER
Minnie/Andacher Homestead
ALASKA RAILROAD
SNOW RIVER
PARADISE
TRAIL
South
Divide

APPENDIX F

References

Alaska's Fisheries Atlas, Volumes I and II, State of Alaska, 1978.

Alaska's Wildlife and Habitat, Volumes I and II, State of Alaska, 1973 and 1978.

Resources of Alaska, A Regional Summary, Joint Federal State Land Use Planning Commission for Alaska, July 1974.

Alaska Regional Profiles, Southcentral Region, State of Alaska, July 1974.

Upper Susitna River Project Power Market Analyses, Alaska Power Administration, March 1979.

Alaska Natural Resources and the Rampart Project, U.S. Department of the Interior, June 1967.

Alaska Power Survey, Federal Power Commission, 1969.

Alaska Power Survey, Federal Power Commission, 1976.

Alaska Regional Energy Resources Planning Project - Phase 1, Volume II, Alaska Division of Energy and Power Development, Department of Commerce and Economic Development, State of Alaska, October 1977 (Similar report Phase 2, dated 1979).

Electric Power in Alaska: 1976-1995, Institute of Social and Economic Research, University of Alaska.

Southcentral Alaska Water Resources Study - Level B, Alaska Water Study Committee, (Draft 1979).

Analysis of Impact of H.R. 39 on Hydroelectric Potential of Alaska, Alaska Power Administration, April 1977.

Analysis of Impact on Hydroelectric Potential of the Administration's Recommendations for Alaska D-2 Lands, Alaska Power Administration, February 1978.

Hydroelectric Powerplant Siting in Glacial Areas, Donald L. Shira. Published American Society of Civil Engineers Cold Regions Specialty Conference, May 1978.

Southcentral Railbelt Area, Alaska, Upper Susitna River Basin, Interim Feasibility Report, Hydroelectric Power and Related Purposes, Alaska District, Corps of Engineers, December 1975 and as revised June 1976.

Marketability Analyses, Upper Susitna River Hydroelectric Studies. Report on Markets for Project Power, Alaska Power Administration, December 1975.

M E M O R A N D U M

SUBJECT: Susitna Alternatives Study

DATE: September 13, 1979

TO: Brian Rogers

FROM: Glenda Straube

I've been investigating the possibility of a small scall hydroelectric project in connection with the Chena River Flood Control Project. This idea was introduced to the Federation for Community Self-Reliance by Jim Weedener. It seems that Mr. Weedener's interest stems from a desire to stop subdivisions in the area.

According to Dr. Robert Carlson of the Institute of Water Resources, Larry Katkin (local geologist who has worked on Chena Project), Robert Huffman of GVEA and David Ulbrich (engineer for the Corps)-----the possibility of this project is slim.

There a number of reasons why this may be impossible: due to the high porosity of the ear... making empondment difficult, necessity of building a birm between the Chena and Tanana Rivers and subsequent environmental impact and acquisition of more land, the flooding of such a large area including Eielson, inadequate head, and not economically feasible.

If the Corps had taken small hydroelectric power seriously at the time of the original studies, it might have been possible to build the Control Project in such a way as to allow for hydroelectric, power. Huffman thought the Corps did little about this because it wouldn't be a large enough project for them.

Unless Mr. Weedener or the Federation comes up with additional information to the contrary, I would shelve this idea. It would be interesting, though, to get a copy of the original feasibility studies on the Flood Control Project and see why and if the Corps goofed on this. I'll give Mark Wittow the name of the person in Anchorage who was responsible for the original Corps work, if Mark wants to follow up on this.

cc: Mark Wittow

Man's name is Tom Murray at Elmendorf
752-3925

9-17

Never considered - no water impoundment in present plan

HYDROELECTRIC POWER DEVELOPMENT -- WATANA AND DEVIL CANYON
A Potential Power Project of the Army Corps of Engineers

By direction of Congress, the Corps' Alaska District is studying the feasibility of developing the hydroelectric potential of the Upper Susitna River as a means of supplying energy for the rapidly expanding power demand of the Southcentral Railbelt Area of Alaska.

The District prepared a feasibility report in 1975 which included a recommendation for construction of dams at Devil Canyon and Watana. The report was forwarded to Washington, D.C. for review and public comment. Subsequently Congress authorized $25 million to be spent for Phase I Advanced Engineering and Design of the project, but funds for this have not been provided. The authorizing legislation also provided the option of a State-Federal joint venture whereby the State would provide project funding, and the Corps of Engineers would do the work. After project completion, the dams would be owned and operated by the State.

On September 28, 1977 the Corps delivered to the State a study outline that detailed the cost and established schedules for the several years of additional planning required prior to any final determination regarding project construction.

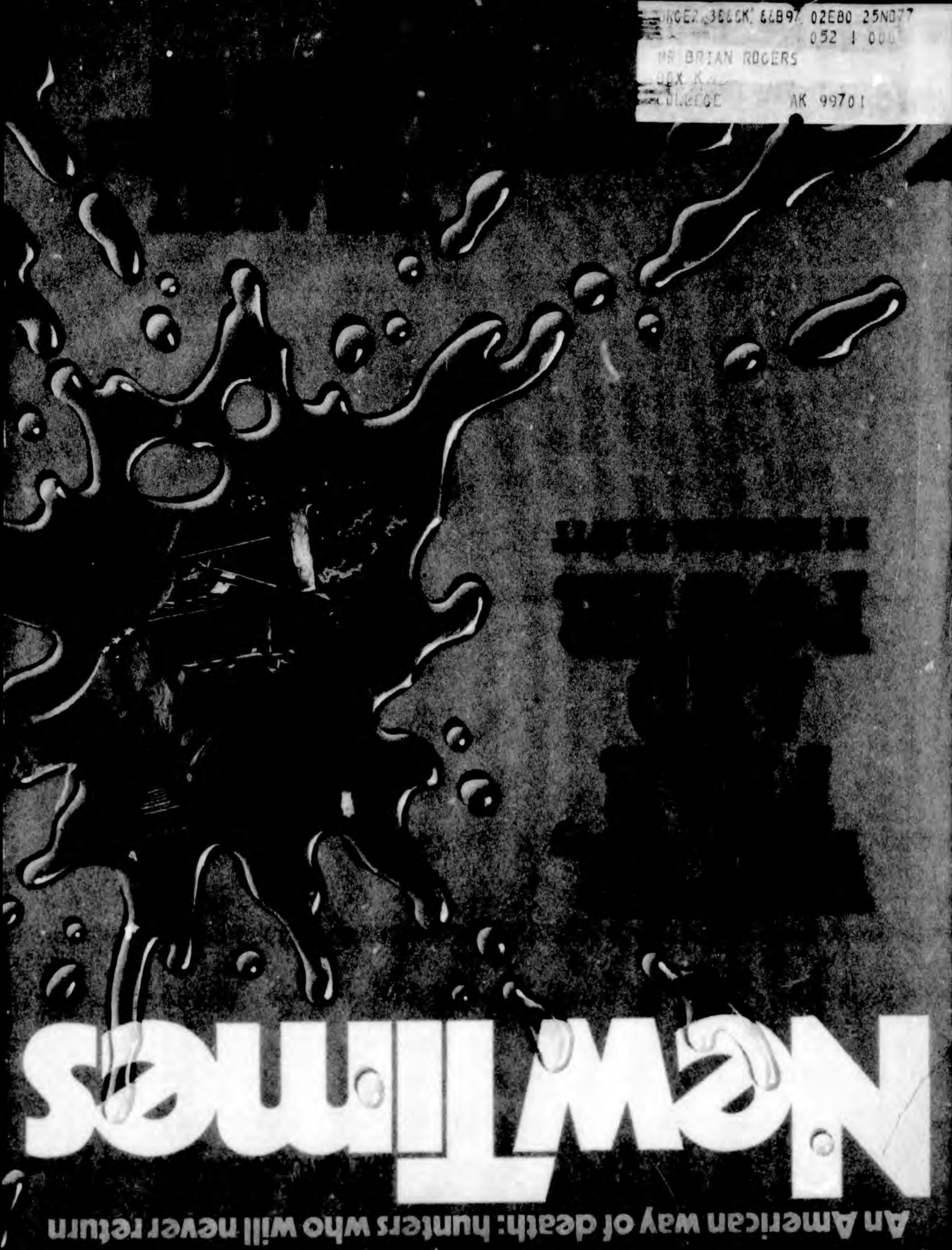
At the direction of the Office of Management and Budget the Corps has now begun intensive effort to obtain more information to verify the benefit/cost feasibility indicated in the 1975 report. This information is needed before OMB can recommend proceeding with Advanced Engineering and Design. Geological exploration is under way at Watana now. Drilling equipment and related materials have been moved by cat train over snow and frozen ground to the Watana area. Two tracked cargo vehicles and drums of fuel have been air-dropped to that area, and helicopters are used to relocate equipment at the work site to minimize any adverse effect on the terrain. Drill crews lodge at Talkeetna and commute to and from river by helicopter. Exploratory holes are being drilled to determine the nature of the underlying structure at the damsite. The data being collected will update the construction cost estimate. That estimate combined with a revised economic analysis will be used to compute a new benefit/cost ratio. The District will complete the supplement report by January 1979 and submit the document for referral to OMB.

The plan, as presently conceived, is a two-dam system which would inundate some 50,500 acres including an 82-mile reach of the Susitna River upstream from Devil Canyon Dam. The canyon reservoir would have a water surface of about 7,550 acres at normal full-pool elevation. It would extend upstream about 28 miles, confined within the canyon. Reservoir width would vary from about 1/4 to 3/4 mile. Watana Dam, about 2 miles above the Devil Canyon reservoir, would inundate about 43,000 acres at normal elevation. It would extend some 54 miles upstream from the dam and would average 1-1/4 miles in width.

Power distribution would require transmission lines from Watana to Anchorage and Fairbanks. The transmission corridor would be about 365 miles long and average 200 feet in width. The total right-of-way would cover about 8,100 acres.

This system would provide at least 6.1 billion KWH of energy annually, equivalent to consumption of some 10.7 million barrels of oil per year.

MARCH 1978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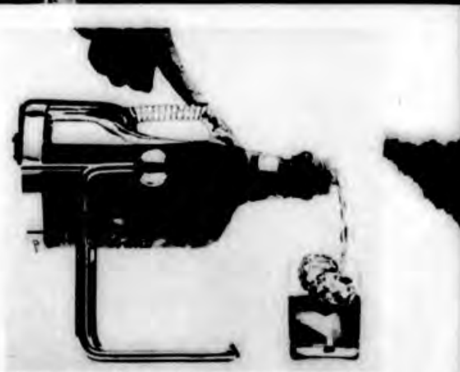

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THE ARMY CORPS OF ENGINEERS: FLOODING AMERICA IN ORDER TO SAVE IT

The ever-expanding Corps thinks of itself as the Big Levee, standing between us and the waters of retribution. But it more closely resembles a giant bulldozer out of control, burying villages, disfiguring the landscape and possibly bringing closer the very floods it is meant to prevent

By Michael Parfit

Water. The blood of nourishment, the knife that builds and destroys; the magic element that binds the classic four—earth, water, air and fire, the subject of more range wars and poems than should be remembered. But in this nation, where distrust of military control is as traditional as independence, the agency with the most power over how and where we use our water is a branch of the armed forces that former Supreme Court Justice William O. Douglas once called public enemy number one, the U.S. Army Corps of Engineers.

Like a sandbar growing under a muddy river, the Corps of Engineers has built grain upon grain of authority into an empire of power on which we all, sooner or later, may run aground. Like the sandbar, the Corps is not a flamboyant presence; it works with the quiet serenity of confidence. Few people even know what it is, but it touches every life. Consider its reach.

Across the dry-grass country of eastern Washington, a barrel-bellied fish truck runs a 270-mile route along what used to be the Columbia River, hauling the last young chinook salmon to the sea. Here is the remnant of what was once the grandest drama of nature, the annual return of 40-pound sea monsters to the mountain creeks where they were born. Their ancestors, seen in Idaho's Lemhi River, 800 miles from the coast, once encouraged a pair of weary travelers, Meriwether Lewis and William Clark, to continue west. But a century and a half later the linear efficiency of Lewis and Clark's own branch, the Corps of Engineers, has so changed the basic nature of the Columbia and Snake rivers that young salmon, longing for salt water and finding nitrogen poisoning instead, have to be bused downstream.

On the coast of Alabama, in the thriving port of Mobile, a 96-foot diesel patrol boat mutters slowly down a grey-water channel. On one shore a crew of cranes picks over dead warships, and on the other the huge green skeleton of a stacker-reclaimer towers above a mound of Alabama coal. Among the docks welders hiss and sparkle, and the air is full of the sound of horns and hammering. Tugs push tows of barges, six at a time, each full of coal, gravel, grain or oyster shells; a ship loaded with bananas creeps up the channel. On the boat a young representative of the Alabama State Docks smiles at all the activity. "We're the biggest, most influential industry in the state," he boasts. "And we're basing all our expansion on the construction of the Tennessee-Tombigbee waterway." Which is being built by the Corps of Engineers.

In a green field in Missouri, a young woman of 24, wearing a bikini, deepens a tan while baling hay on her 500-acre farm. In this Ozark valley she is a rare sign of youth and hope; all around her other farms deteriorate, paint on clapboard houses wrinkles with age and flakes away, because this valley has been under the shadow of a proposed dam for 30 years, and when you know your land is destined to be flooded, the spirit you draw from it dies. Like everyone else, the young woman knows about the dam, but she fights its demoralizing effect with activity. Two years ago she even replaced her outhouse with indoor plumbing. Her neighbors are less sanguine. "What's the use?" they say; the dam is being built by the Corps of Engineers, and the Corps seldom loses.

On Nantucket Island, Massachusetts, a man gazes out across his shorefront property, past the harbor waters at the narrow neck of sand he and his fellow conservationists have saved from developers, and wonders when—and if—permission will ever come through to install a folding aluminum dock he bought for an inboard motorboat. Both dock and boat have been in storage for over a year, waiting on Corps officers hundreds of miles away in Boston to determine the dock's impact on navigation. "I feel a little like Kafka wrestling a paper octopus," the conservationist muses. "How did the Army come to have the last word in matters *this* small?"

In a 100-year-old home in the garden district of New Orleans, in a high-ceilinged living room whose shuttered windows let in cool layers of light from a hot day, a bearded, balding English professor worries about a swamp with the melodious name of Atchafalaya. This great breeding-nesting-multiplying patch of muck at the bottom of the Mississippi basin, boiling with life, is scheduled to be turned into a channel in the name of flood control. What strikes the professor on his wry bone is that the channel may, by dra ing parts of the swamp, allow peop to build pretty, low, ranch-style homes in an area designated as a floodway, into which the excess waters of the Mississippi will one day be diverted, sure as fate. "Either there's something wrong with my logic or there is something wrong with their logic," he says rhetorically, confident of himself. "They," of course, are the Corps' engineers.

In a large lecture hall at Idaho State University in Pocatello, Idaho, a dozen ranchers and farmers listen as a man in a green suit with silver eagles on his lapels explains a new program. What it means is this, he tells them: we will now have the authority over all kinds of development in the nation which involve moving earth in and around water. This means we will control the construction of bridges, channels, canals, culverts, dams, dikes, docks, landfills; almost everything to do with the relationship of water and earth except irrigation itself. You will have to come to us for permission. Is that clear? The man in the green suit—a colonel in the U.S. Army Corps of Engineers—leans forward as if to stress his sincerity, and speaks the favored word of the Corps, invested by now with an ominous ring: "But," he says, "we will be *reasonable*."

What, exactly, is this reasonable agency with all this quiet power? In common usage, "The Corps" means the Civil Works Branch of the Army Corps of Engineers, which includes a military construction and combat arm. The Civil Works Branch is an organization of about 30,000 civilian technicians directed by about 300 Army officers. Since the officers float back and forth between the military and civil sides of the Corps, most of those now in charge of Corps activities served in command positions in Vietnam. The Corps does not actually build its facilities—the jobs are contracted out—but it designs them and supervises their construction and, most importantly, it is also responsible for evaluating the projects it proposes. It is this self-supporting capacity, plus the mutually satisfying relationship between the Corps and Congress, that has permitted the Corps to grow almost at will from a small agency with $75,000 to spend in 1824 to today's mammoth. In fiscal 1977 the Corps will spend almost $2.5 billion, much of it on projects that are destructive, wasteful and, possibly, dangerous.

The Corps' most visible responsibilities are its public works projects—dams, barge canals and flood channels—but it is also involved in flood plain analysis and management, emergency flood relief and cleanup, hydrological research, harbor maintenance, recreation and regulation. Although Corps statistics are impressive—it has built over 400 reservoirs, 25,000 miles of inland and intracoastal waterways, 750 large and small harbors, and 16,000 miles of flood control levees, flood walls and channels—the story they tell is too sterile to show the Corps' full impact. The Corps is, more simply, the nation's largest engineering agency, the nation's largest recreation agency, the nation's largest dam-building agency, and the agency most responsible for what the face of America, reflected in her waters, will look like in 50 years. Yet even this kind of description does not properly describe the influence of the Corps: the only way to begin to understand is to see it at work.

In fiscal 1977, the Corps will spend almost $2.5 billion, much of it on projects that are destructive, wasteful and, possibly, dangerous

The basic Corps of Engineers unit is the district, of which there are 38, covering the nation. This is the gut level, the place where everything happens. One of the Corps' greatest assets—or liabilities, depending on whom you talk to—is the autonomy of the individual districts.

"We have an awful lot of independent authority in the field," Brigadier General Drake Wilson, the Corps' deputy director for civil works and a former district engineer himself, told me in Washington. "So the district engineer can set the whole tone of the organization. You just kind of feel free like you can do what you want to do. It's a wonderful job."

"What the hell that really means," said a Corps critic, Oliver Houck, general counsel for the National Wildlife Federation, "is that they're running an organization they don't control."

One of the districts is headquartered in St. Louis, Missouri. There, on a stifling summer day, I found myself in an elegant room while two Corps PR men, Kenneth Long and Mel Doernhoefer, pummeled me with information on one of their projects, Meramec Park Lake, a reservoir just being started about 65 miles southwest of St. Louis. It was a strange experience, a disturbing introduction to the reasonableness of the Corps of Engineers.

In the twilight of the big room, the two men showed me slides of trash on the Meramec River, insinuated that it was caused by canoeing recreation, and promised their dam would eliminate such littering. They told me that Meramec River floods cost an average of $3 million a year and then gave me a report that claimed the dam, which offers only partial flood protection, would provide annual flood control benefits of $4,245,000. They boasted that the lake would draw 3.8 million visitors a year and introduced me to a recreation specialist who, when asked where all those people will come from, answered, "these are latent people who, right now, barbecue in their back yards or swim in the county pool." The figures, he admitted, were based on studies made in 1961.

The statistics went on without relief. Then Long and Doernhoefer started to talk about caves, and I remembered with pleasure a visit of the day before to the silent depths of Onandaga Cave, which would be flooded by the dam.

Onandaga Cave is among the most magnificent caves in the United States, and you wander through it entranced. In vast, cool spaces arms of stone reach up and down for each other as if in patient yearning, and drops of water tap you on the shoulder like children whom you can never find. A small stream, the Lost River, flows through the cave, its waterfalls amplified by canopies of onyx and its reflections, in the semi-dark, giving an impression of endless depth. But today, high above your head in many of the rooms, are small red lines, lines that mark the eventual surface of Meramec Park Lake.

My reverie about Onandaga was interrupted by the penetrating voice of Kenneth Long. The beauty of the cave, he was saying, would be enhanced by putting most of it under the reservoir's fluctuating pool. "Some of the rooms already have water in them," he said. "It's better that way." As he spoke, Long tore small pieces off a Styrofoam cup, which squeaked in his short fingers like a mouse in pain.

Two days earlier I had talked to a big, red-bearded man of 34 named Don Rimback who has self-educated himself in the dynamics of Missouri's caves with the passion of a fanatic. He had explained the significance of Onandaga Cave: it is a symbol of the geology of the Meramec Dam region, which is as holey as an old tin bucket.

"There are nine miles of surveyed cave passages within three miles of the dam site," Rimback had said. "These things are *railroad* tunnels." The Corps, Rimback had said, had failed to fully explore known caves in the dam abutments, and is asking for, at least, cost overruns which would give its benefit-cost ratios the significance of confetti. Speaking with the anger and frustration of a man forced to watch his daughter raped, Rimback had compared Meramec to Teton Dam, a Bureau of Reclamation project whose failure may be partly blamed on abutment fissures far smaller than the ones he sees at Meramec.

And now, as I listened to Doernhoefer rebut: "We have found no formations which could not be handled by engineering techniques," I felt a prickle of apprehension. It was the power of the net these men were weaving, not with lies, but with distortions; the power to mislead and to confuse.

Kenneth Long, smiling as warm as an Ozark Cave salamander, explained that the first thing the Corps did with money appropriated for the dam was to build a $1.5-million visitor center. This center (which cost as much taxpayer money as a good rural school and whose only purpose was to promote the controversial dam) came complete, he added, preening environmentalist feathers, with a tertiary sewage treatment system. And look, he said, showing a slide of a shake-roofed building standing in a grove above the 12,600 acres of forest and meadows the dam would flood, "When we built it we saved the trees."

On Kenneth Long's desk stood a small statue of a fist, its middle finger raised to the public in an unmistakable salute.

A few days later, I floated part of the Meramec River, and began to understand a bit of the motivation which leads to such relentless pursuit of projects like Meramec Park Lake. There's the money, of course, the maintenance of Corps' and contractors' jobs, but there's something more, which involves the old antagonistic relationship between humanity and nature, and the desire for power.

The Meramec is a gentle stream, shallow enough in most places to walk across, yellowish green and murky, not with silt but with phytoplankton. For a languid half day I floated and paddled down 10 miles, in and out of sun and shade and cool water, past pale limestone cliffs and the hidden mouths of caves, and always with an eerie sense of trespassing on condemned ground, of dancing with a ghost. I became disoriented: this natural world no longer symbolized the long, steady throw of time, the continuity of the earth's pace that has always soothed with its perspective. It was reversed: I would outlive the river. But there was another reaction in me, more disturbing than this snuffling of destiny: I found myself strangely fascinated with wondering what the scene would look like when it was the bottom of a lake, peeled of sycamore and alder and drowned in cold, green darkness. I once saw the remains of a village revealed by low water in another Corps lake, the stone buildings grey with algae, silt piled in the yards and bedrooms like volcanic ash or fallout, and now, floating the Meramec in thick green forest, with smallmouth bass darting away from the canoe's shadow, I began to drown in that image of power.

How would it be, I wondered, to be able to draw a small line in pencil on the tablecloth of the earth; let's see, right about *here*, and create, from a river, a 12,600-acre lake? Magnificent! What an art: rich with function, heavy with dimension and importance, monumental in duration. You cannot belittle the men of the Corps of Engineers, even with their own figures; this is water they manipulate. Like no one else, they have their fingers on the pulse of geologic time, the ability to apply the tourniquet or the leech.

And as I drifted on the river, that power backed up against my mind, the pressure building. In spite of all the consequences, if I were here, and had the chance—the stones and soil to draw across the flood—would I even hesitate to move to change the world? Bring on the cats, the scrapers, the chains to tear the woods apart! Let me watch what I can do, watch as the spadefuls gather, as the water stalls and sighs and bubbles, and as the logs collect in the corners like straw, like sawdust in the river's eye.

Meramec Park Lake, which will be the subject of a referendum early next year, is a glimpse of the Corps which, however enlightening, remains just a small piece of a large puzzle. In its entirety the Corps is an intimidating subject; its roots show up in too many pipes and sewer lines. This spring the Corps reported to Congress that 63 Corps projects were involved in various kinds of court action. It follows that most Corps conflicts, like the Meramec Park Lake controversy, are intensely local, and that few individuals are watching, opposing, or supporting the entire national scope of the Civil Works Branch. This works to the Corps' advantage: in 1971, for instance, while environmentalists were praising Richard Nixon for stopping the Cross-Florida Barge Canal, Nixon was

PHOTOGRAPH COURTESY OF THE ARMY CORPS OF ENGINEERS

Corpsmen at work: by studying this detailed model of the Mississippi River at Vicksburg, Miss., engineers hope to learn the way of water to tame it forever.

approving the construction of the Tennessee-Tombigbee Waterway, a similar Corps project in Mississippi and Alabama.

So it is important to look at the Corps not only on its most intimate levels, down in the districts, but also in its broadest implications. The Corps' significance may be most sharply appreciated out on the cutting edge of its projects, but its power, influence and durability are based on its organic functions and alliances, not on the success or failure of one or two dams.

One of the Corps' most significant functions is its responsibility for flood control. The devastating Mississippi and Ohio river basin floods of the late 1920s and early '30s resulted in a series of laws which made the Corps our flood control agency, setting up much of the power it holds today. Almost every Corps project, other than harbor dredging, contains some provisions, and some claimed benefits, for flood control. The Corps is making us all an implied promise of protection; it has become the big levee, stout and concrete hearted, standing between us and the waters of retribution.

The irony is that the levee leaks, and the promise may be false.

In 1973 the Mississippi, in whose basin the Corps has been dredging, leveeing, damming and channelizing longer than anywhere else, reached flood stages higher than those ever recorded, while the actual flow rate was 35 percent less than the previous record, set in 1844. In an August 1975 article in *Science* magazine, C.B. Belt Jr., an associate professor at St. Louis University, charged that "The 1973 flood's record was man-made." Belt blamed the record flood on levees and navigation works, and wrote that "Additional channel constriction and levee building will cause further problems."

The Corps' own brochure, *Flood Plain—Handle With Care*, points out that although "The Federal government has invested over $9 billion in flood control projects since 1936 . . . it is estimated that flood damages have been increasing each year since 1936 and that flood losses now come to almost $2 billion annually." The Corps blames this increase on careless community planning, but others put at least part of the blame back on the shoulders of the Corps' own promise.

"No dam is designed or able to hold all floods," professors Roger W. Findley and Bruce M. Hannon wrote in a paper reprinted in June in the Congressional Record, "but the impression of permanent protection encourages development of downstream areas. When the uncontrollable storm hits, it must be passed through the dam and the built-up flood plain is inundated with resulting high damages."

Dams, magnificent monuments that they are, may permanently change the face of the earth, but in terms of flood protection they are relatively short-term ventures, mainly because they are constantly filling with silt. The rate at which they become useless varies with the silt load of the river they plug, but some reservoirs, claims Raphael G. Kazmann, a noted hydrological engineer at Louisiana State University, are losing as much as one-eighth of their capacity every 50 years. What this means is not that we'll suddenly be looking at a silt plain where once there was a lake, but just that the reservoir's capacity to handle extreme floods is steadily diminished, leading with certainty to the day when the storm of the century comes boiling over the dam. Surprise!

"Under any circumstances," Kazmann writes, "there would seem to be an element of entrapment by the federal construction of projects that purport to reduce or eliminate floods permanently. . . . A . . . parallel might be drug addiction—which gives the addict the temporary illusion of power and well-being, requires ever-increasing doses to maintain the feeling, and finally destroys him physically."

How would it be, I wondered, to be able to draw a small line in pencil on the tablecloth of the earth; let's see, right about *here*, and create a 12,600-acre lake? Magnificent!

But the Corps remains addicted for two reasons. First, it has been promising flood protection for so long that the public believes it; certainly much of the nation's economic development would have proceeded differently and perhaps not as fast if the Corps had not been saying, in the words of Oliver Houck, "You can build in the wetlands, guys, because we're here." Look at New Orleans, dozing in the sun below the lip of the Mississippi, waiting for the 200-year flood that could come tomorrow. Second, since the Corps has not been blamed for the inevitable floods that disregard its structures or are partially caused by them, it has been able to say, again in Houck's words, "Well, My God, think what it would have been if we weren't here." Because of this win-either-way approach, which Houck calls " a wonderful doublespeak in 1984 terms," whenever a new flood catastrophy occurs, the public comes clamoring to the Corps.

So, as of last spring's report to Congress, the Corps was building 69 flood control reservoirs and 76 local protection projects, at a total estimated cost of $7.4 billion.

None of these flood control projects involves the production of electricity from falling water, which is another major Corps function. In addition to the projects mentioned above, the Corps is building 28 hydroelectric dams, at a total estimated cost of $5.7 billion.

Such dams are usually considered multi-purpose structures, providing, for instance, flood control and recreation as well as power, and relying on all purposes to come up with a favorable benefit-cost ratio. Although the same hydrological problems associated with flood control dams exist on power dams, you can legitimately argue that from a pure pollution standpoint falling water beats coal or plutonium as a source of power. The problem is that we have already used up most of our best hydropower sites, so the trend in hydropower construction is to build pump-storage reservoirs that actually offer a net loss of power for the convenience of meeting peak power demands. The economics of hydropower dams also require that you justify them with other purposes or you come up with something grossly uneconomical. Often, purposes that mesh on paper conflict in practice.

For proper flood control, for instance, you want to maintain a lake at relatively low levels, which lowers the power production, but for recreation you want to have a lake neither as high as the power potential demands or as low as optimum flood control demands. In addition, a recreation lake should have a nice, consistent shoreline, but meeting peak power demands requires a fluctuating water level that creates muck banks and discourages spawning fish. Adjusting just these three purposes requires the coordinated hand and timing of a juggler, but the Corps frequently throws an anvil into the act: navigation.

Navigation is the oldest civil works activity, going directly back to the Corps logjam work on the Mississippi. The Corps' current role here is divided between maintaining harbors and sea channels, and building and maintaining a remarkable network of inland waterways which has made seaports out of cities like Lewiston, Idaho, and Tulsa, Oklahoma. The Corps' harbor-dredging operation is seldom criticized, but its inland waterways are another matter.

Attempting to maintain a constant running channel in a sediment-bearing stream like the lower Mississippi cannot only increase flood problems, but is, as Raphael Kazmann writes, "a systematic attempt to replace the potentially steady state conditions of water and sediment movement by a condition of hydrologic nonequilibrium." Like trying to balance a seal on a ball.

Comparing us to King Canute, who got wet when he commanded the tide to stay out, Kazmann says that no matter how vigorously we legislate the construction and maintenance of river channels, "Political decisions not in accord with the laws of hydrology and geomorphology are sooner or later subject to final reversal by highest authority and appropriate penalties will be paid."

The best example of an ongoing navigation project is the Tennessee-Tombigbee Waterway, which will be a 253-mile long, nine-foot deep barge shortcut from Tennessee to the Gulf of Mexico. The Tenn-Tom, as it is nicknamed, belongs to the Corps' Mobile, Alabama, District, which began construction in 1972 and estimates that it will cost at least $1.3 billion. This estimate includes a $545 million overrun last year—incredible if it were not so consistent with Corps history. The Tenn-Tom, which involves more earth moving than did the Panama Canal, is the biggest Corps project now underway.

Down in the small, college town of Starkville, Mississippi, I found Dr. Glenn Clemmer in a room full of dead fish. Clemmer is an ichthyologist, a fish zoologist, and the fish were all specimens in glass jars, stacked to the ceiling of his storeroom on shelves. They gleamed pale gold through isopropyl alcohol and watched us with a million little eyes.

Clemmer, 36, is one of the few down-home opponents of the Tenn-Tom project, but he has begun to acquire allies. He and other members of his organization, CLEAN (Committee for Leaving the Environment of America Natural), have at least managed to persuade farmers of the 12-county area in which the Corps is planning to buy full title or easements on 104,800 acres of land that patriotism doesn't require them to sell out cheap. Since Corps negotiators tend to soften up landowners with handsome verbal offers that can be adjusted at contract time, Clemmer said, CLEAN has persuaded the farmers to carry tape recorders instead of shotguns for protection.

Clemmer would like to see the project killed. As he likes to say, "We can waste $100 million or we can waste $2 billion." But what would you do with the unfinished waterway? He laughed. "Oh, we could get people with shovels and we could do a fantastic hiring job of filling it back in."

Tenn-Tom is as modern a project as you'll find, and the Corps is happy to tell you that it reflects all the latest attitudes. "We were doing most of the design on Tenn-Tom after 1972," said Gen. Wilson, who was Mobile district engineer before his recent rotation to Washington, "so the National Environmental Policy Act was in effect, and new environmental awareness was upon us, so we were trying to do everything as well as we could. I believe we worked hard at it. For instance, we designed buffer zones to hide the disposal areas so the trafficway of the waterway would remain aesthetically pleasing."

The Tenn-Tom is supposed to cost $1.3 billion, but the cost overrun last year was $545 million—incredible if it were not so consistent with Corps history

Among the other items of similar environmental significance, Clemmer pointed out with a kind of sorrowful glee, is that in those earth disposal areas, where the Corps will fill and level off 43 small valleys, the Corps has provided for the seeding of new growth by designing a series of "perch wires." Perch wires are, in Corps words: "Artificial perching sites constructed of posts placed approximately 20 to 50 feet apart with wire strung between. Desirable plants will be propagated under the perch wires as a result of seed that is disseminated within bird excrement."

Meanwhile, Tenn-Tom is going to cause some genuine problems along the lines of Kazmann's analysis. In addition to the obvious ecological devastation wrought by changing a river into a series of slack-water lakes and by dumping a mountain's worth of dirt, the canal is likely to have a profound effect on ground water. An article in the Corps' own magazine, *Water Spectrum*, says that in some areas the water table may be lowered as much as 100 feet, and in others raised so much that "the . . . levels may claim some land now being farmed."

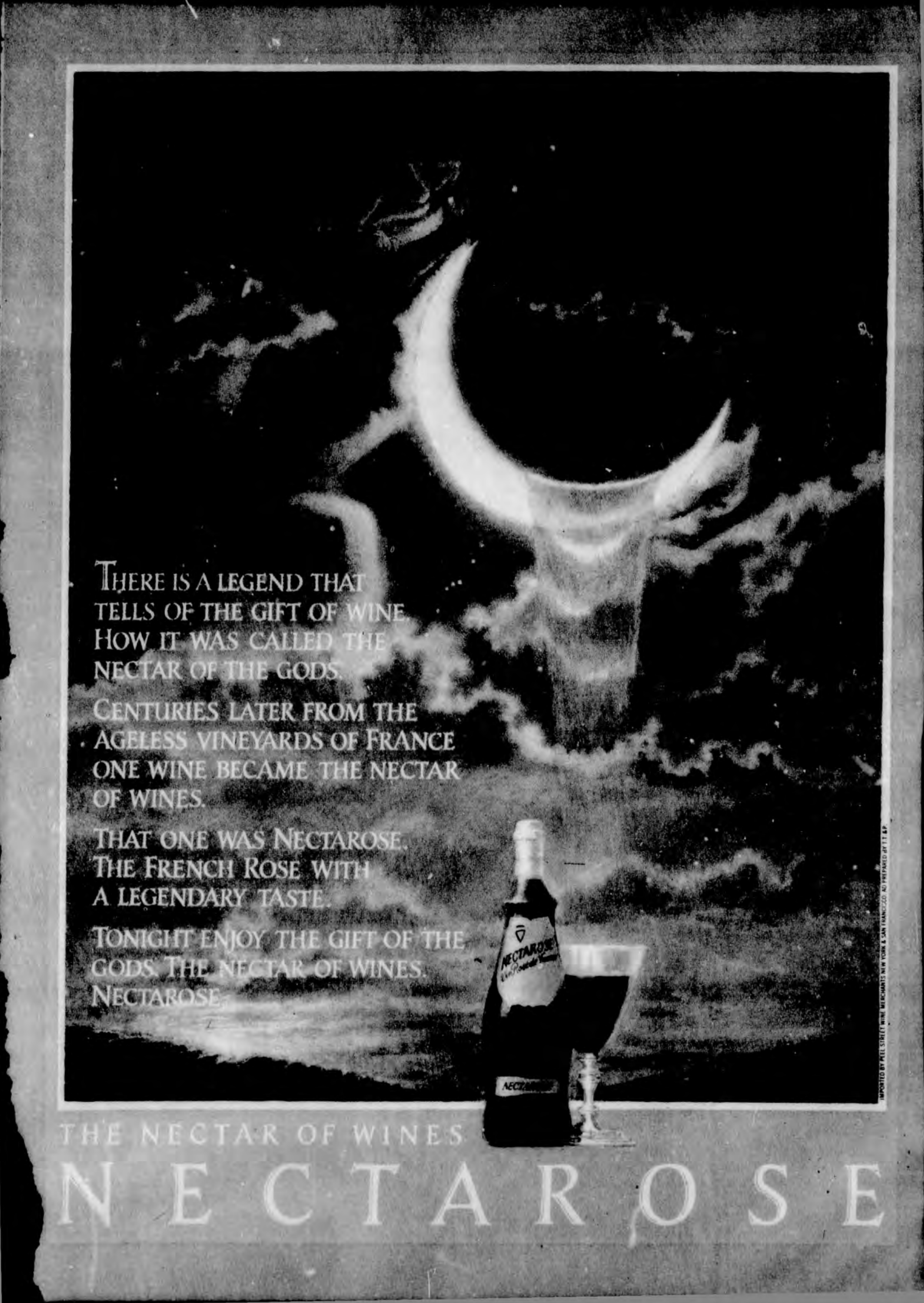
But Tenn-Tom is particularly fascinating for its economics. Congress requires that the Corps prepare a benefit-to-cost analysis of each of its projects, and a project that costs more than it is worth seldom gets funded. But the way the Corps comes up with its figures has been subject to both amused ridicule and attack, and Tenn-Tom is no exception.

Tenn-Tom is not a flood control structure. Nor will it provide hydroelectric power. Instead, by using some Tennessee River water, it will actually reduce power generated by that river downstream. It is purely a navigation channel; other benefits such as recreation are incidental. The primary commodity which will float down the Tenn-Tom to the Gulf will be high-sulfur, strip-mined coal. Here's the kicker: much of that coal will be shipped to Japan.

Since Tenn-Tom does not provide a new, vital service, its benefits are computed on its value as a barge shortcut from Knoxville or Chattanooga to the Gulf. The estimated annual benefits of $66 million are figured mostly on the time barge operators will save over the traditional route down the Mississippi. And though it will cost at least $1.3 billion to build the canal, and about $6 million a year to maintain it, the barge operators will pay no user fees. So Tenn-Tom, like all other Corps waterways, is basically a massive subsidy of the barge industry. "Using the money this way," Clemmer said, "is like helping the Rockefellers get more servants."

Ignore, however, the question of whether it is of national benefit to subsidize barge traffic to a far greater extent than we subsidize railroads or even truck operations, and look farther into the benefit calculation, which yields a meager 1.1 to 1 margin. At its heart is a discount rate—the interest charged to the cost of money—of 3¼ percent. Although use of this rate is legal (it was the one in effect at the time Tenn-Tom was authorized in 1946), it is entirely unrealistic. It's a bit like justifying a horse on a dog-food budget. And Tenn-Tom is not an oddity. Since projects are often authorized years before they are funded, the Corps always seems to be working with antiquated interest formulas. In this case, as in many, the 3¼ percent rate is vital to the project; at a more modern rate of 6½ percent, say, the ratio might drop below the balance.

It is possible that the favorable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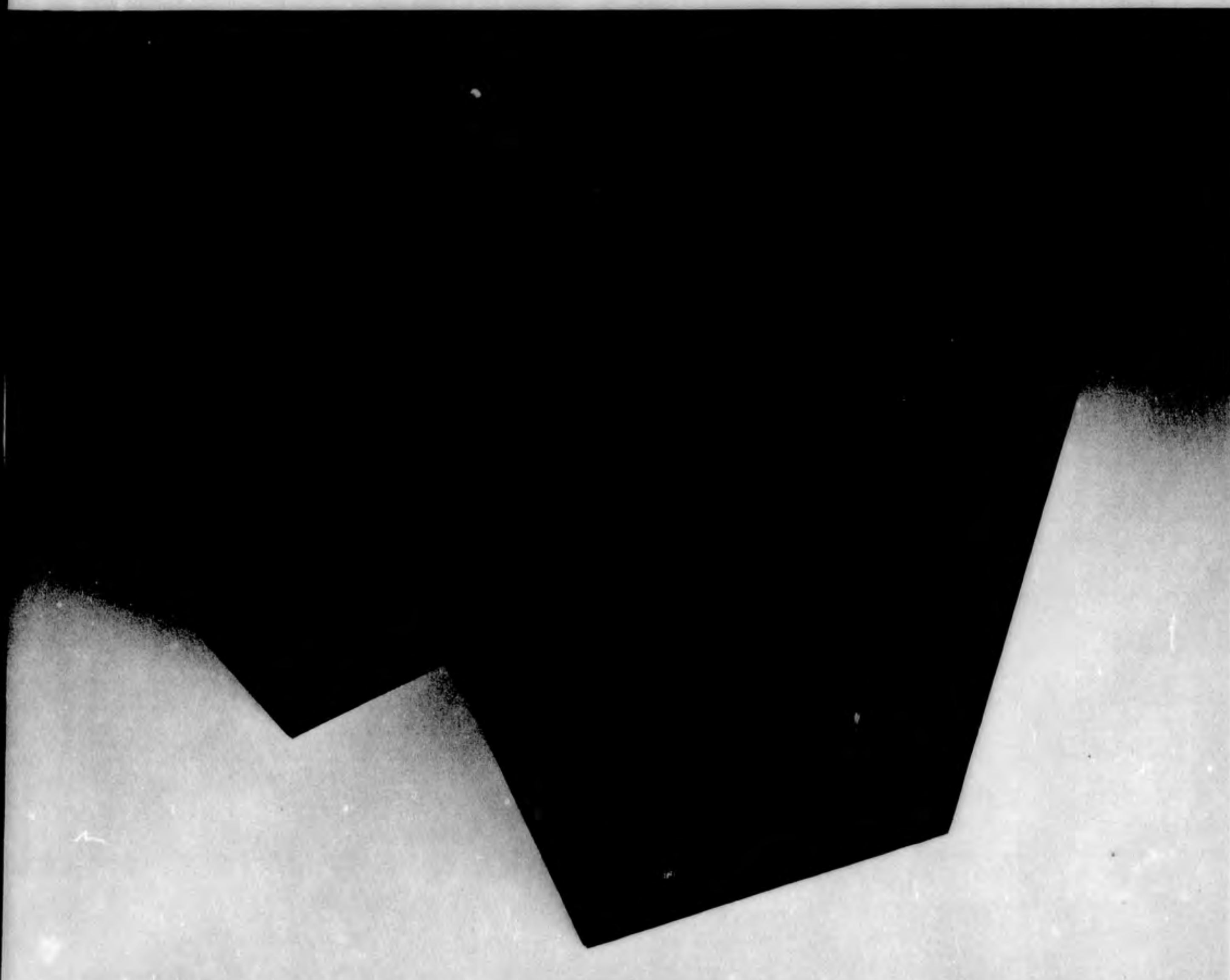

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ratio of 1.1 to 1 may collapse of its own accord if the project experiences another horrendous overrun like this year's $545 million adjustment. But the Corps is prepared. Last spring, aware that it had an economically marginal project under construction, the Corps produced, like a magician under duress, a new, more glamorous rabbit.

Today all discussion of Tenn-Tom includes an additional project, the enlarging and streamlining of the old canal between the end of Tenn-Tom and Mobile. This yields a slightly more substantial benefit-cost ratio of 1.3 to 1, and this is the ratio now used by waterway promoters. However, the additional project, which the Corps calls Plan C, has never been authorized by Congress, has never been funded, and its feasibility has never even been officially studied. It's a kind of floating wild card whose figures, a Corps spokesman hedged, "are subject to some change."

But there is an additional subtlety here. Although the Corps says it just thought of the new expansion this year, it doesn't look quite that innocent. It looks more like the Corps *designed* Tenn-Tom to create a bottleneck and force extra construction. The Tenn-Tom locks are being built to allow eight barges through at a time; the old locks downstream can only handle six at a time, forcing barge operators to change the size of their tows halfway to the Gulf. You can bet they'll lobby for expansion.

This leapfrogging design technique is not unique to Tenn-Tom either. In another controversy, involving the St. Louis District, conservationists are accusing the Corps of doing exactly the same thing: designing a lock and dam replacement on the Mississippi at Alton, 30 percent deeper than others in its series with a long-term purpose of forcing the similar expansion of the whole system.

"You can see," Clemmer said, "this is the same old group."

But what *if* Tenn-Tom, like other Corps projects, is destructive? What if it, like others, is based on faulty economics? What if Tenn-Tom is, as *Forbes* magazine called it, a "boondoggle" of enormous proportions? Does that really matter? Don't public works projects have a primary purpose beside which all this niggling is irrelevant: to provide jobs?

Bruce M. Hannon and Roger H. Bezdek, another University of Illinois professor, have an answer. In a paper printed in *Engineering Issues*, a publication of the American Society of Civil Engineers, Hannon and Bezdek say, yes, Corps projects do provide jobs, but less per dollar spent than many other possi-

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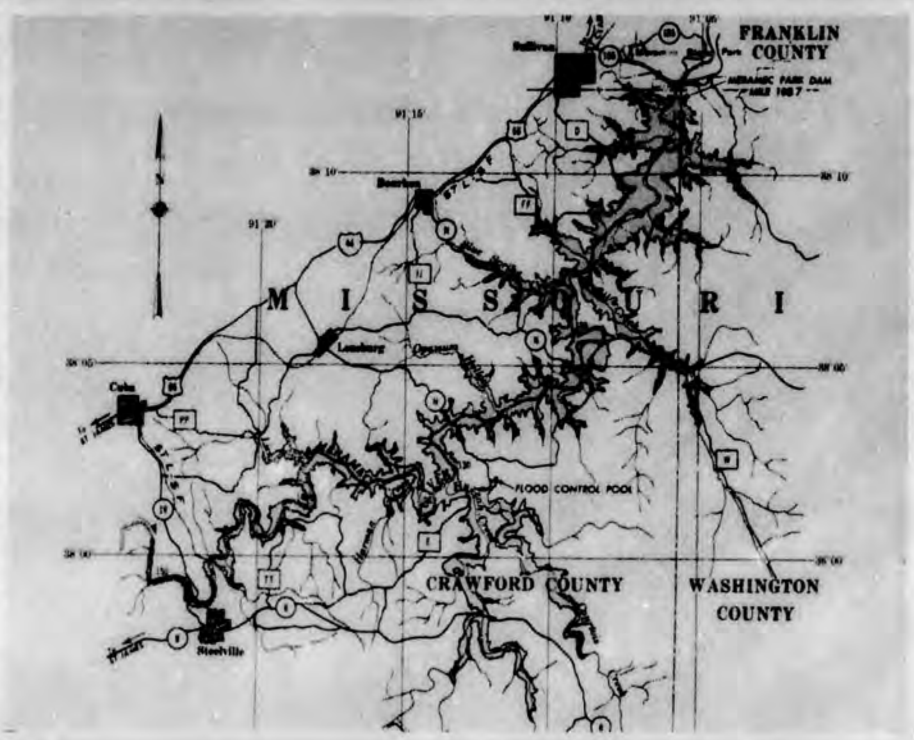

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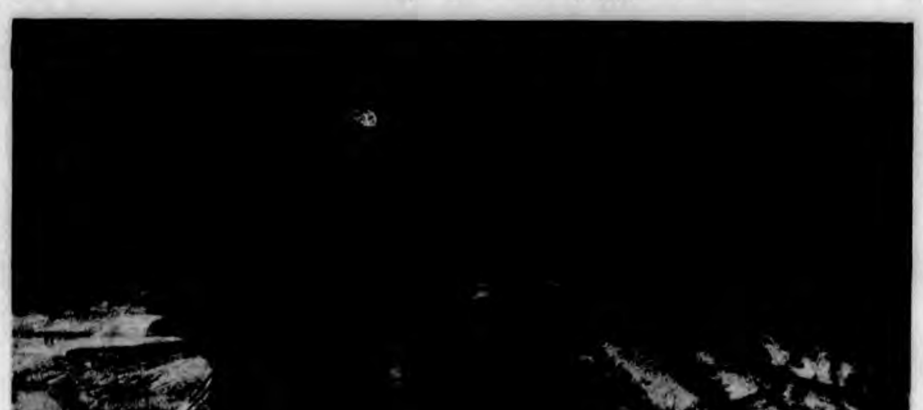

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The Meramec Park Lake project: above, the Meramec River as it looks today and, bottom, the construction under way along its banks; middle, the projected park itself—the area to be flooded is blue, with the original river barely visible as thin lines. Some 12,000 acres of sycamore and alder and 35 miles of Meramec riverbed, not to mention one of the country's most unique cave formations, will be drowned in cold, green darkness forever.

ble investments.

Hannon and Bezdek compared Corps projects with five alternatives—tax relief, National Health Insurance, Social Security benefits, railroad and mass transit construction, and waste treatment construction—and found that each alternative would offer more jobs, although a shifting in types of jobs was inevitable.

Tenn-Tom is also a good example of Corps employment impact. In the 12-county area directly affected by the waterway, 40 percent of the population is black. In the same area, blacks make up a disproportionate percentage of all poor people. However, a June 1, 1976 work force profile of employment on the Tenn-Tom lists only 144 blacks out of a total of 591 project workers—24.4 percent. Wendell Paris, chairman of the Minority Peoples Council on the Tennessee-Tombigbee Waterway, calls these statistics examples of "blatantly racist employment policies." Even if they are merely the reflection of the makeup of the people trained in skills the construction of canals demands, those percentages indicate that if the primary purpose of Tenn-Tom is to provide jobs for people who need them, it is failing.

Finally, Tenn-Tom offers a lesson in Corps dynamics. Consider: it is the largest public works project underway in the United States. It will also affect the home districts of, among others, Senator John Stennis (D-Miss.), chairman of the Senate appropriations subcommittee on public works; Representative Joe Evins (D-Tenn.), chairman of the House appropriations subcommittee on public works; and Representative Robert Jones (D-Ala.), chairman of the House public works and transportation committee. The relationship is no coincidence.

"Any attempt to focus on the Corps without realizing the indispensable part played by special interest groups and the Congress is not going to get the full story," said Brent Blackwelder, a founding staff member of the Washington-based Environmental Policy Center. "You can view them as a triangle; they all need each other."

The special interest groups are the barge operators, the big realtors, the contractors and the dredgers, who use their influence with the Congress and the Corps to promote projects, often forming organizations like the Meramec Basin Association or the Tennessee-Tombigbee Water Development Authority to promote and lobby. These groups can think up new projects or resurrect projects that the Corps has tabled. Such as Tenn-Tom.

"In 1946, Tenn-Tom was authorized but on a very shaky basis," General Wilson said. "Then the proponents kept trying to get it restudied, and in 1966 it was restudied and the new report showed a better benefit-cost ratio." With a little help from our friends.

The relationship with Congress is just as comfortable. Public works projects have been accepted as pork barrel nourishment for incumbents so long that it embarrasses no one. Victor V. Veysey, Assistant Secretary of the Army for Civil Works, as well as former congressman from California, had the best explanation. "There has been a very close association between congressmen and public works projects for the simple reason that they are very tangible projects," Veysey said. "They may be disliked by some but on every project there is a large group who are strong, strong supporters. They're tunnel vision and if the congressman gets their project moving, he's their man. It's a great political base."

The congressman gets the political base, the Corps gets its money. Because of this relationship, the Corps, even in years of fiscal restraint, gets more money than it asks for

Everything in this arrangement is mutually satisfying. The congressman gets the political base, and the Corps gets its money. In fact, because of this relationship, the Corps, even in years of fiscal restraint, usually gets more money than it asks for. This year it requested about $2.2 billion; it got almost $2.5 billion. The Mobile District asked for $84 million for Tenn-Tom; it got $104 million. The Corps made no requests for new construction starts; Congress gave it funds for 25.

The Corps protests that Congress pushes farther than it wants to go, but, in effect, it guides the hand that feeds it. Appropriations hearing records are thick with generals pointing out to congressmen that because of administration budget restraints the funds requested for a particular project are less than what the project could most effectively use, and hinting that every year we dawdle below capacity we lose more to inflation.

A telling example of Corps-Congress relationships appears at the end of Vol. I of those hearings. Evins and Jamie Whitten (D-Miss.) had been interviewing Major General Francis P. Koisch, division engineer for the lower Mississippi Valley, a division Oliver Houck calls "a little kingdom," and they wound up the session with this:

Mr. Evins: [To Koisch] We wish you good luck. You have a very important division and a tremendous workload. This committee is backing you and supporting you. We wish you good luck.

Mr. Whitten: Mr. Chairman, you left out the word, push. We are pushing you.

Mr. Evins: We will add that.

In the Corps headquarters in Washington's Forrestal Building, the corridors are dimly lit by a select few of the available overhead lights, a tribute to the sudden obsolescence of a wasteful design. Here the military presence of the Corps dominates. Officers stride up and down the halls, and the brims of hats gleam with golden braid, symbolizing the ranks of major and above.

But the olive drab patina of the Corps is hard to interpret. The Corps answers more directly to Congress than to anyone in the Pentagon save Veysey, and, after all, there are only 300 uniformed men in the entire Civil Works Branch. So the importance of the military presence is uncertain.

The late Arthur E. Morgan, first chairman of the Tennessee Valley Authority and lifetime Corps critic, blamed a lack of "ethical character and . . . engineering competence" in the Corps on the "fundamental character and structure of the U.S. Military Academy," which, he said, trains people to obey orders and to act quickly, but does not allow the "high degree of independent, critical and creative thought" demanded by good civil engineering. But others, including Brock Evans, head of the Sierra Club's Washington office and a member of a Corps advisory committee, have said that the organization's civilians run the show and use the military people, who seldom spend more than three years in any particular district and who rotate between the military and civil works branches, as point men.

Brent Blackwelder of the Environmental Policy Center uses stronger language. "The entrenched civilians run the ball game in a kind of faceless way," he said, "using the military dressing to terrorize people."

Nevertheless, the officers do set the policy, and when you talk to environmentalists in the field the standard comment on whether or not the Corps is responsive to their requests is "It all depends on who is the district engineer."

The Corps is effective, according to Oliver Houck, "to the extent that the military guy in charge is young, bright and responsive to new breezes."

Whether the military or civilian people run the Corps, however, it is apparent that they don't differ much in philosophy. Both want to do a job. General Wilson explained:

"When we go out on a district assignment we're mission-oriented; production-oriented," he said. "I guess that's one aspect of the military training that you can take in either a negative or positive fashion. We get our greatest satisfaction from doing something, and so if we get directed to study something, we try to find a way to do what the proponents want."

Several environmentalists expressed a curious attitude toward the military structure of the Corps. One lawyer who had just finished telling me how useless the public hearing process is because it gives the uninformed masses the same right to testify as his organization, which has so much more substance to offer, said he felt the military structure was valuable because it permitted swift change. You give an order and—Ten-hut!—it's done. It's a bit like praising totalitarianism for its efficiency.

One thing that was almost as much in evidence in the Forrestal Building as military trappings was talk of a New Corps. The Corps is becoming more responsive to environmental needs, people said, and the project they pointed out as an example of this New Corps was the Charles River Natural Valley Storage Area, near Boston.

The Charles River project is special because it is a nonstructural approach to floods. "Nonstructural," which is used as a kind of floating noun, is state-of-the-art flood control: instead of building a partially-effective dam, you restrict flood plain construction to allow flooding without damage, and you take advantage of natural storage areas such as swamps to absorb excess water. Environmentalists have been advocating this approach for years, and now the Corps appears to be embracing it. "Only after we have thoroughly exhausted all other alternatives, in particular those labeled nonstructural solutions, will the public accept structural solutions," General Morris wrote in 1975. "As a result, I see the Corps role in flood control changing significantly."

But Oliver Houck demands evidence on the bottom line. "Just how much bullshit is their nonstructural approach?" he asked. "How many people and how much money does the Corps have in nonstructural? That one question is the most important inquiry about the Corps." And the bottom line is not so promising. On a national scale, the Corps commitment to nonstructural solutions is still insignificant. The total estimated cost for the Corps' three such projects—in Wisconsin, Arizona and Massachusetts—is $41 million, less than 2 percent of this year's budget. And the 1977 Corps budget request asked for no new money for the Charles River project, indicating at least a low priority. (Congress later gave the project $1 million, so it continues.) It is more likely that the nonstructural approach, at least so far, is more useful for public relations than as a genuine alternative to traditional dams, levees and channels.

But by far the most controversial evidence of change in the Corps is its new authority to regulate dredging and filling in all the nation's waters. This responsibility rambled through Congress throughout the summer striking sparks,

"The entrenched civilians run the ball game in a kind of faceless way, using the military dressing to terrorize people"

but causing no action. It has been praised as a sign of a Corps environmental renaissance and attacked as an infringement of states' rights. But one thing is certain: the new role will give the Corps more power.

The brief history of the regulatory law is one of shifting and tangled alliances. When Congress was working on amendments to the Water Pollution Control Act in 1972, environmentalists lobbied for the Environmental Protection Agency (EPA) to have control over everything being put into water, including earth. But industrial interests argued that the Corps should regulate dredging and filling operations, since it had expertise in those areas. (And since it was already their friend.) So Congress gave the authority to the Corps in a section now notorious as "404."

Yet the Corps, strangely reluctant to extend the authority to its legal limits, applied the law only to its traditional area of control: navigable waters. Then, stranger still, the Natural Resources Defense Council and the National Wildlife Federation went to court and, in March 1975, won a judgment requiring the Corps to expand its authority to all the waters of the United States, which includes all but the smallest lakes and streams. By next July, if Congress does not intervene, the Corps will regulate dredging and filling in all lakes larger than 5 acres and all streams flowing faster than 5 cubic feet per second. This covers almost all water-related construction up to the point of irrigation.

So why have the environmental organizations supported this growth of court power with such vigor? Because they feel that some control of water-oriented development is better than none. Groups like the National Wildlife Federation have been worried for a long time about the fate of the nation's wetlands, those incredibly rich places which nurture much of our wildlife and which support most of the seas' bounty. At least 51 million of the nation's 127 million acres of wetlands have already been destroyed by dredging and filling according to estimates by the NWF, and the current rate of consumption by a land-hungry nation is over 800 acres a day. Although the Corps' new role covers more than just swamps, it would have its largest effect on wetlands, and environmental organizations figure that some control is better than none. "We may have to police it ourselves," one environmental leader said, "but at least they can't ignore us." And though the Corps record in regulatory operations has been poor—it has not yet denied one single ocean dumping permit in the three years it has had that responsibility—environmentalists were heartened this spring when the Corps denied a developer's application to fill 3,000 acres of mangrove swamps on an island off Florida's gulf coast.

So if there is any uncomfortable feeling among environmentalists that perhaps we are giving the Corps—and the military side of the bureaucracy—too much power over a vital domestic resource, nobody shows it. In fact, with the regulatory program still in its embryonic stage, relations between the two sides of what used to be a war are practically cordial. The feeling among environmentalists seems to be fatalistic. There's no way to stop the Corps, so let's bend its purpose. "It gives them a chance to change around," said Ron Outen, until recently a lobbyist for the NRDC's environmental lobby. "It's good for the Corps to do this kind of thing, otherwise they're going to build dams."

So the Corps of Engineers keeps growing; this time with the help of the organizations which have fought it so bitterly in the past. If the regulatory program just enacted functions as its proponents envision, the Corps will have reached a dramatic new level in its scope of authority over the nation's waters.

And the Corps seems destined to grow bigger still. Among the proposals being advanced for changes in the present responsibilities of the Corps, few seek to diminish its role. One of the most significant of these is a proposal to get the Corps into the railroad-building business. Hannon and Findley argue that the Corps could subsidize railroads in the same way it subsidizes barge operators, by building and maintaining their roadbeds.

After the waterways, the railways. And beyond, General Wilson himself speaks from time to time of the Corps building the nation's sewage-treatment facilities and rehabilitating strip-mined lands. It is hard to imagine that he conceives of such options as substitutes for traditional dam and waterway construction, but rather as a broadening of power.

There are ways, however, of significantly changing the color and power of the Corps without entirely deflating it or damaging those programs—such as flood relief—which the Corps does well. One, of course, would be to eliminate the specter of a military organization controlling our water by giving the Corps a general discharge from the Army and turning it totally civilian, as Hannon and Findley suggest. The other would be equally important: to separate the justification of Corps projects from their execution. It is the Corps' control over all phases of a project, from evaluation through construction, that keeps bad projects like Meramec Park Lake alive on transfusions of in-house justification.

"The planning and evaluation functions which [the Corps] currently performs . . . should be reassigned," Hannon and Findley write, "to avoid the bootstrap or solution-in-search-of-a-problem approach so common with mission-oriented planning and construction agencies."

One of the most vocal critics of the Corps in recent months has been none other than Jimmy Carter, who successfully fought off a Corps dam plan in Georgia when he was governor. A year ago, Carter said, "The Army Corps of Engineers ought to get out of the dam building business. At a time when the whole country is concerned about inflation and high taxes, we don't need to spend tens of millions of dollars for the purpose of perpetuating the Army Corps of Engineers."

But the Corps of Engineers is tenacious, largely because it does not present a solid target; the Corps is many little soldiers in a field of tall grass. And what is worse, they wear your own uniform, they smile, and they say, "Let's be reasonable, let's be *reasonable*," until all hostility is gone. "The trouble with the Corps," one opponent said in frustration, "is you can't get a grip on it. There's nobody to hate."

High above Independence Avenue, in the Forrestal Building, is the most reasonable man of all, Lieutenant General James W. Morris, Chief of Engineers. Morris is the epitome of the Corps officer: West Point educated, Vietnam hardened, gifted with silver hair, blue eyes and the ability to communicate, empathize, compromise and get what he wants. An aide remembers with pride the time General Morris earned a standing ovation from a group of people whose land he was about to condemn. Now General Morris knows it is time for the Corps to concede in rhetoric what it cannot give up in real change. The Corps, he said, is like a heavy truck which came to an unmarked turn in the middle of the night of 1970, the turn of environmental consciousness and law, "rocked around on one wheel and then the other, and finally got straightened out."

"I just have an enthusiasm that we're on the right track," he said. "We're going to build waterways, but they're going to be the best waterways in the world. It's the same challenge, but we'll do it in a way that it becomes a plus in our natural treasury of resources. Many of our projects now instead of having adverse environmental impacts will have favorable environmental impacts. I would like in a hundred years from now for people to look back at the critical period between 1970 and 1980 and say, of all the agencies, thank God for the Corps of Engineers, because they got it *right*."

It all sounded so hopeful up there in the quiet office, far from the Meramec Park Lake and the Tennessee-Tombigbee Waterway, far from Don Rimback's fury and Glenn Clemmer's wry regret. It seemed so full of promise. But there is the ultimate threat; most dangerous because it is clothed in smiles. With sincerity and good will, men like General Morris slowly gather power over our land and our precious waters, and with them, one by one, the grains of our freedom. And we let them do it with scarcely a murmur of protest. Because we trust them. We trust because General Morris is a reasonable man. We trust because they are all, all reasonable men.●

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TIME

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A CLOSE-UP ON THE CORPS

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By John Baskin

Memorandum

From: Maj. Gen. R.H. Groves, division engineer, North Atlantic Division, Army Corps of Engineers

Subject: Improper Terminology

1. I am observing a growing trend in the use of the verb "to feel." Please avoid its use in any paper that you may prepare for my signature. Any action that I take is supposed to be objective, emotionally sterile and totally devoid of all feeling. In my official capacity, I am capable of believing or sensing, but never feeling.

2. Please see that your work for me is purged of this offensive word.

Within months after her house in the village was taken by the Corps of Engineers, Merle McIntire was dead. Those closest to her, who knew of her resolve to die before she had to move, were not surprised. Although she was very old, her health was good. She just did not wish to live anymore. She was lying on her back when they found her, in the snow. Her hands were folded primly across her chest. She was on her way to the graveyard. She said so in a note she left.

Mrs. McClure was dead, too. She and her granddaughter had lived in the lower end of New Burlington, in a house so filled with plants it seemed it might explode. Just before she had to move, she showed a plant to a visitor. "Do you think," she asked, "that the Resurrection lily will live transplanted?"

In her new home in nearby Xenia, Mrs. McClure slept in a chair beside a window. When she awakened, she found she had been crying. "I don't know where I am," she said. "I have no idea. I don't see anything I know."

Abby Currie had an auction before she moved. Then she called the veterinarian to put her cat to sleep. The rest home prohibited cats.

Lawrence Mitchner was last. In his eighties, he lived alone in what had once been the village undertaker's parlor. A Quaker pacifist, he refused induction into World War I and spent part of the war in Leavenworth. Lawrence refused to talk to the Corps. When the engineers wrote, he tore the letters up without reading them. He told his neighbors he would never move.

The engineers moved around him. They bought the entire village and soon there were only a few houses left, foundations, steps and sidewalks which led to nowhere. Then the vandals came. They stole lumber, bricks, doorknobs, stripped the fruit trees, and took the ivy off Mrs. Louie Wills' chimney. Lawrence shuttered himself in his house and stopped answering the door.

Farmers asked the engineers about Lawrence. We'll leave him alone as long as we can and if we have to, they said, we'll move him out. *But we hope he'll die first.*

Don Haines, who had moved, but commuted 25 miles every day to farm his old land under a Corps deadline, remembered combining oats one night. "I looked across the creek to where the village was and there was nothing. No landmarks, no houses, nothing but Lawrence's light in all that dark space . . . ."

And then Lawrence Mitchner was dead, too.

The Caesar Creek Lake project was not the U.S. Army Corps of Engineers' largest project, nor its most spectacular. The Caesar Creek Gorge itself was not of the same impressive natural pageantry as, say, the Red River Gorge in Kentucky. And New Burlington's comfortable but modest houses were not on the National Register of Historic Places.

It was a small, obscure village in the Ohio countryside that lived a bit too much in the past and was forced too quickly into a future it could barely envision. Yet it would be difficult to find anywhere a Corps project which contained more of the elements of abusive power and overwhelming arrogance, nor one which seemed so flawed from concept to finish.

The Caesar Creek project was a project that demonstrated perfectly that any national insanity might be perpetrated so long as the proper channels of bureaucratic legerdemain were followed. The Corps, masters at that too, merely transferred an inside engineering skill to the paperwork: it was, after all, an expert at channelization. And over the years, this latter skill had far surpassed the former. The Corps was much more adept now at bulldozing through appropriations committees, the fine areas of environmental law and the opposition.

The Army Corps of Engineers first came to New Burlington more than forty years ago. Its ostensible purpose was to build a dam for flood control. Not for New Burlington, however, which had its own sporadic problems with flooding. The dam would be, the engineers said, flood control for the little river towns on the forty-odd-mile stretch of the Little Miami River into Cincinnati, and for the Ohio River itself.

But it was a spurious project. When costs rose, water quality and recreation benefits were tacked on. The flood-control "reservoir" had become a "lake" and the engineers were promising all things to all men, even though there were strong indications of serious problems in all its varied parts, which never added up to any concise whole. The project seemed more and more to resemble an old hooker wearing a lot of paint, standing for good effect under a dim streetlight.

Still unfinished by late-1976, construction costs had nearly tripled the engineers' original estimate. Conservationists contended that the Little Miami River, one of Ohio's few remaining scenic rivers, would be seriously damaged by the dam on its important upriver tributary. They contended, as did various government agencies, that the lake's benefits were highly overstated, and that the life of the project was only half as long as the Corps said it was. The Ohio Environmental Protection Agency indicated the quality of water would likely deteriorate, and that the lake would be polluted. And in the final Environmental Impact Statement done by the Corps, the engineers revised their earlier floodwater reductions in downstream Cincinnati: what had been labeled "a substantial amount" was now down to a maximum of three inches and, possibly, none at all.

As for New Burlington, the tiny farming village of less than 400 people and no particular note, it would be sacrificed for the greater good: New Burlington would be flooded forever.

Plans were made for Caesar Creek as early as 1928. The lake was authorized in 1938, a year after the Ohio River flood which left 100,000 people homeless. The project was on, then off. After severe flooding along the Little Miami River in 1959, it was on, and this time it was obvious it would stay on, although funding wasn't available until 1962.

"When the Corps first sets foot on your land, they should inform you of your rights, just like a criminal," says one angered landowner

And before that time, most of the villagers had never seen any of the engineers. The printer's wife saw two men surveying the stream behind her house but soon she had forgotten that initial moment of panic. For dinner was ready, and work was waiting. So the village accepted the rumors, assimilated them and lived on, vaguely worried, the demanding moment absorbed by time and duty. Now that time was over.

The Army engineers would soon begin a rural pacification program in the unincorporated village of New Burlington (a village not so hugely unlike how some might imagine a Vietnam hamlet for, after all, rural people in the world have more affinity with each other than city people). In perhaps a decade or more, which is to say, *today*, the villages could look backward and see that they and their neighboring countrymen had been merely coordinates on a map that featured New Burlington as a military objective.

Corps appraisers went to work in 1967. Stated policy was to pay "fair market value," which meant, according to the Corps, "the price the property would bring in a sale between a willing seller and a willing buyer." But what the Corps did was set a buying pattern which manipulated the market. In fact, the Corps helped create a small pocket of low-priced property which was surrounded by one of the hottest real estate areas in the nation.

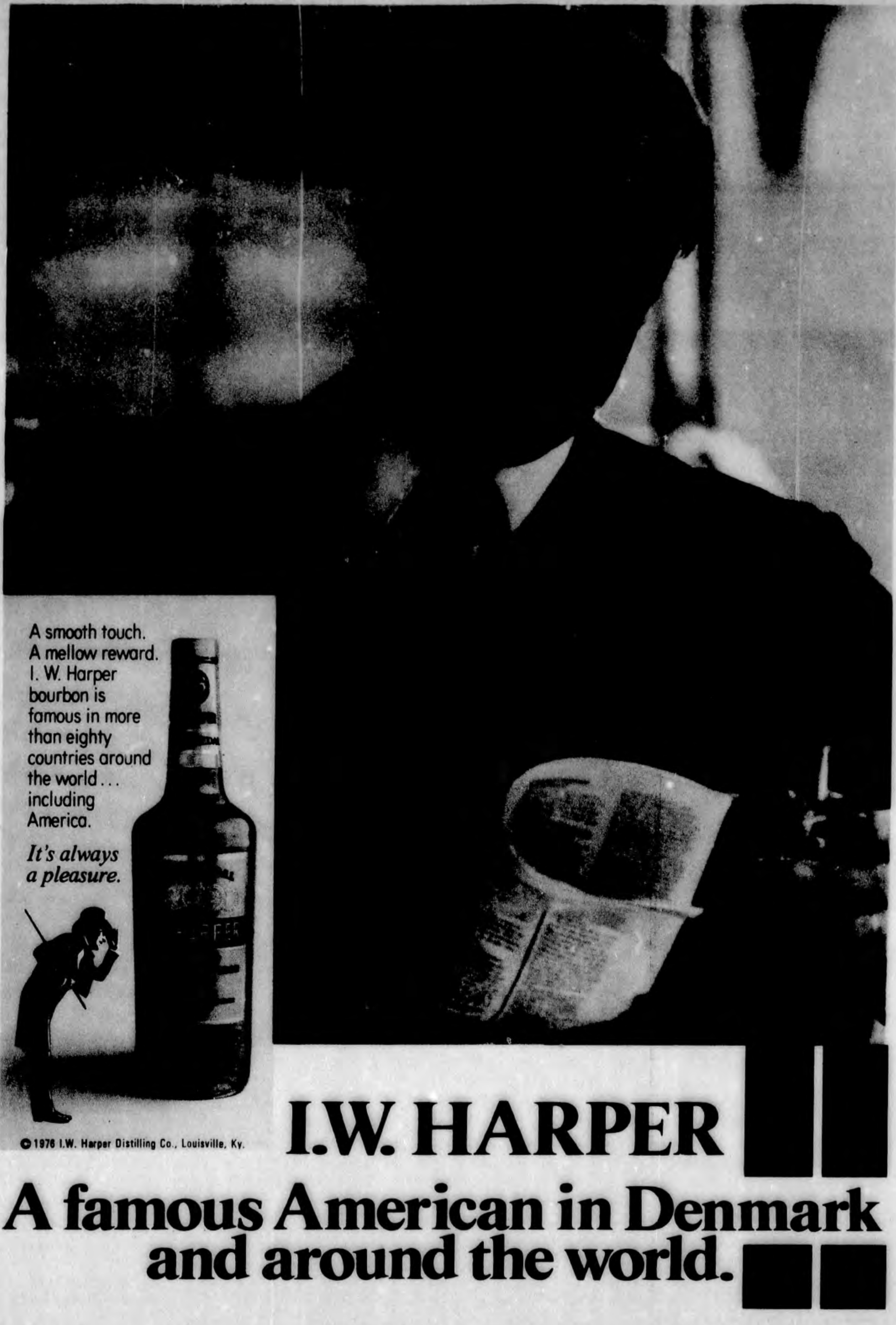
One professional appraiser, Don Sigg, who worked for both the Corps and later did private appraisals for landowners, said he knew the Corps had urged New Burlington people, over a period of years, not to improve or maintain their homes—then it bought the 80 homes of the village as a "depressed area." Frank Lundy, a bottomland farmer, said that in the late 1930's he was advised not to improve his farm. Said project manager Earl Murphy: "I've heard that it is a depressed area." The Corps, too, had its own version of "blockbusting." It made sure villagers would not act in concert by working quickly with those residents who were most vulnerable—the short-time residents who had few deep attachments or family ties, and the widows.

One of the first negotiations was with the village's oldest widow, Mrs. Louie Wills, 94. Murphy's buyers offered her $5,300 for her modest house. But she and her husband had paid $7,500 for it 13 years before. There were two more offers, reaching $6,000, and a letter from Murphy containing an ultimatum: ". . . if we do not receive the enclosed offer forms, duly signed, within the next 15 days . . . prompt action will be taken to complete acquisition by filing a declaration of taking in a condemnation proceeding . . . ."

Farther along in the letter, Murphy told Mrs. Wills that his comments were presented only as explanation and were "in no way intended as a threat." Mrs. Wills, however, saw it differently. "I've never been to court even to pay a traffic ticket," she said. "I expect when you go into court with the government, you get into it . . . ." She sold, and moved in with her daughter.

Don Collett, owner of the village hardware store, was surprised to learn the Corps did not pay anything for an established business. "Run a farmer out," said Collett, "he'll harvest his crop and go. Come next spring, he'll put in corn somewhere. A businessman starts out on another corner, he don't know whether

John Baskin's book New Burlington: The Life and Death of an American Village *was published earlier this year by W.W. Norton & Company.*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A town sentenced without trial: (counterclockwise) the detritus of New Burlington; a scavenger with wrecking bar; Merle McIntire and great-granddaughter outside her abandoned house; Merle's grandson salvaging the lumber inside.

his corn's going to come up or not . . . ."

Collett, who had recently built a new brick ranch house in the upper part of the village, also didn't like the way negotiations went when the appraisers looked at his home. "They told me," he said, "that I was *overdeveloped*. They said if I was going to live in New Burlington I couldn't have things my neighbors didn't. They said the house wasn't worth as much here as it would be in the suburbs of Dayton . . . ."

George Marburger had a stranger complaint: "I made arrangements to buy another place and while waiting for the money from the Corps, I decided to go ahead and make the down payment. So I borrowed $10,000 for a down payment thinking I could pay it back as soon as the Corps deposited my money. But they lost my file and I couldn't get *any* money. So the man sued me because I couldn't buy. I ended up losing the down payment . . . ."

Early in 1976, Marburger was preparing, at last, to move. In transactions with the Corps, he claimed he lost 70 acres of land, doubled his indebtedness, suffered a nervous breakdown and subsequently lost his job, and had been separated from his wife and children (who were now back with him). His wife said his health, job and the separation were because of the stress of negotiating with the Corps.

"I have been," said Marburger, "treated worse than any dog."

A final outrage to the villagers was that before they could close sales with the Corps, they had to pay a deposit for streetlights, an assessment for the remaining time on the township's contract with the power company. It meant that villagers were paying for a service they would never receive.

And while Corps negotiators and appraisers were often guilty of evasion and deceit, most of what they did was construed as legal. Whether it *should* have been was another matter. On at least two points, however, the Corps violated explicit rules set up by itself. One such violation was that they refused to allow landowners to introduce into the negotiations their own privately-obtained appraisals.

A second violation was that buyers had been known to offer less for property than the Corps' appraised value. Said Murphy: "Nobody knows, anyway, whether we start lower [than the appraisal] or higher because nobody knows what the appraisal is." Then he added, "We hardly ever buy anything below the appraised value."

If so, it was not because the buyers didn't try. But initial offers to landowners were never in writing so it was one man's word against the government. Until the passage of the "Muskie Bill" in 1971, landowners could not find out the appraisal figure without going to court. Even court was no solution for Roger and Alma Plummer, one of the few landowners in the project area to request a jury trial. The Plummers lived on the lower end of the project area in a 130-year-old brick house of Federal architecture which placed it on the historic register. They owned 150 acres of bottomlands along Caesar Creek, about a mile and a half above the dam site.

Corps appraisers came in 1968. Three years later, their final offer was $56,000. The Plummers refused it and asked for a jury trial. Early in 1971, Congress passed the Uniform Relocation Assistance and Real Property Acquisition Policies Act—the "Muskie Bill." Its provisions set up fair guidelines for the Corps to follow in buying property and helping people relocate. Merely its passage stated that previous practices had not been fair. Plummer read about the new bill in a farm journal, and asked his negotiator. The negotiator said he didn't know anything about it.

Most of New Burlington was bought before the bill's passage and only a few villagers qualified for help in relocating. "The Corps told us," said Plummer, "and it was printed in their pamphlets, that they would start buying at the dam site and work upstream. But then they went 15 miles to the top of the project and bought as much of New Burlington as they could. I think they did this because of the Muskie Bill. They knew it was going to pass and they said, 'Let's grab this town before we have to pay relocation expenses . . . .'"

In 1971, the Corps condemned the Plummer farm. Final figure: $61,400—$409 an acre. Published surveys of Corps' prices paid for farmland during the four previous years showed an average of $548 an acre. And surveys of open market sales within a ten-mile radius of the project during the first eight months of 1971 showed average per-acre price was over $900.

Plummer had three independent appraisals made. They averaged above $100,000. He went into county records and checked seven comparable farm sales within five miles of his own farm. They averaged $950 an acre. He and his wife began looking for another farm. They looked at 25 farms before they found one under $1,000 an acre.

Meanwhile, the Corps made a pre-trial offer of just over $74,000. Plummer refused it and hired Bowling Green, Ohio, condemnation experts, Hanna & Hanna. "The Corps told me," said Plummer, "that I could get a hearing before a three-man commission [a second method of contesting the Corps' appraisal] *right away*. But a jury trial would take awhile. You have to wait until they take you to court, so they used this as a wedge against me, trying to pressure me into signing. They let me wait about two years." In 1975, the Plummers were finally allowed into court.

During the trial, the Corps' chief witness said, as an expert, that Plummer was giving inflated comparable prices. Before Plummer could check his figures—which proved himself correct—the Corps' attorney used this in his closing argument to, as attorney Harold Hanna put it, "impugn the credibility of Mr. Plummer." Said Plummer: "To the jury, listening to this 'expert' witness, it just looked like everything I had said was a lie . . . ."

Consequently, the jury awarded the Plummers $65,000—almost matching the Corps' 1971 appraisal figure. The Corps' lawyer said the error of the witness was "inadvertent" and his testimony given "in complete good faith."

Said Plummer, angered, frustrated, and by now, cynical: "When the Corps first sets foot on your land they should inform you of your rights, just like a criminal . . . ."

And throughout the evisceration of their community, the people in and

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around New Burlington remained unorganized, incredulous. Conservative Republicans for the most part, they could not believe what an agency of their own government was doing to them. They responded as might a man with his artificial leg caught in a steel trap: the dismay came late.

"I just lost hope," said Alma Plummer, "and my innocence. All the power was on one side. We had nothing. I never thought I'd protest any government policy. Then I found I *was* a protestor. I have since said the Pledge of Allegiance but I stopped at the last four words. I could not say 'with justice for all.' The people of Caesar Creek did not receive justice . . . ."

There was finally some organization in 1972, when the Caesar Creek Preservation Association was formed. But it was like bringing in a specialist in time for the autopsy. Much of the 10,000 acres in the project area had been acquired, the dam was under construction—and less than six people were left in the village of New Burlington.

The following summer, Ohio's attorney general, William Brown—with the CCPA and other conservation groups as intervenors—filed suit to halt construction. Brown charged that the Environmental Impact Statement (EIS) filed by the Corps was inadequate, that the Corps had disregarded environmental laws, and that cost-benefit ratios justifying the project were highly overstated.

Construction was halted for a month, then U.S. District Judge Carl Rubin (who had incensed conservationists by saying that he liked to scuba-dive and "I can't very well do that in Caesar Creek") granted exceptions to the injunction and most of the work continued as usual. The Corps did, however, prepare an updated EIS. It was as thick as the Cincinnati phone directory and its table of contents alone was longer than the October 1970 draft.

Massiveness, however, did not mean accuracy. Indeed, there was a question, entertained by some who might also be called expert, asking whether an accurate EIS could *ever* be properly done. One of those who suggested such was Dr. Sture F. Anliot, professor of biology at Wilmington College, who read the updated EIS to find that 70 pages of it had been picked up from his book on the flora of Glen Helen—a nature preserve over 30 miles north of Caesar Creek.

"People have been led to think," said Anliot, "that we can come up with an accurate EIS. It is possible to do a *very good* one but no one is willing to pay the price. And predicting environmental consequences is very tentative. There is a lot we don't know. What will occur is often speculative. The Corps here put together something and called it an impact statement. But it wasn't. A good one here would have showed the project shouldn't have been built . . . ."

The EIS defied any order. It was an unruly basket of comment on history, land use, effect on taxes and the environment. There was no logical sequence to its facts, and all facts that should have been present were not. As presented by the Corps, the EIS was a weapon of bureaucratic verbiage, a language so thick and heavy as to tunk the brain pan in passing and render insensible all but the most tenacious.

But with the updated EIS, which was amended into a *final* updated EIS, some things emerged, among them that:

- The Ohio Environmental Protection Agency said flood control, recreation, and water quality benefits were overstated, and the National EPA called it "a bad project."

"I just lost hope," explained one woman. "I still say the Pledge of Allegiance, but not 'with justice for all.' Caesar Creek did not receive justice. . . ."

- Between all the demands for the lake's water, there were discrepancies which meant that one or more of the demands could not be met.
- The Federal Water Pollution Control Agency said lake benefits would last only 50 years, not 100 as the Corps contended.
- There would be serious pollution problems in the lake itself.

In the spring of 1975, Brown, who had promised conservationists he would not abandon court action against the Corps, made a deal with the engineers and dismissed his case. He agreed to drop the case if the Corps made changes in how water was released from the dam, in an attempt to lessen pollution.

Since the state was principal litigant, the intervening conservation groups were unable to proceed on their own. Mike Fremont, president of Rivers Unlimited, alleged that the promised changes were inconsequential. He contended the state had misled the conservationists and said they had been "sold out."

Said Fremont: "It was an incredible breach of faith. We were sick. We never knew what happened for sure. Political unwisdom, a payoff somewhere, an attempt to get the conservation vote. But there was no question in our minds that we had a good case . . . ."

It is now the fall of 1976. New Burlington is gone, and so are most of the people along Caesar Creek. The dam is almost finished and private timber companies are clear-cutting in the pool area. Many of the farmers who were forced to sell have moved into small brick ranch houses on lots where they can be seen in warm weather wearing old field clothes, puttering incongruously about their small, tidy yards. In many of the houses are sentimental oil paintings of the farmhouses, barns and fields they once owned.

Inflated development prices threaten the remaining farmers and some of them believe it is the beginning of the end of farming in the counties of the lake project. Antique dealers, a pro-dam lobby, consider prosperity in the nearby town of Waynesville where there are 21 of them in a four-block area. For the most part, the artifacts of a previous life in the Caesar Creek area can be found in a saccharine enterprise called "Pioneer Village." It is suggestive of a time to be when all but the current, designed moment will be viewed through glass.

Vernon Stiles, nearing 80, who received $8,000 for his two-story, nine-room house on a three-quarter acre plot in New Burlington (the Corps settled with the Stiles on their 41st wedding anniversary) is now making house payments. The widows—those who survived—are scattered, to rest homes, trailer parks and homes of sons and daughters.

There has been illness, suicide, death, isolation and the disintegration of families. The distribution of blame in such acid human events is an inexact science. Yet there is no doubt the Corps serves as a catalyst. It is a mercenary force on the American landscape ("except for the Soviet Union," said former Senator Eugene McCarthy, about the Corps, "they are the toughest foreign power we have to deal with"), operating at small profit and awesome damage.

And the old people of New Burlington continue to worry about their graveyard which is on a hill above the demolished village. The engineers say it will not be touched. The villagers themselves are not certain. They think that even in death they might not be safe from the Corps of Engineers.●

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