Estes

ALASKA POWER AUTHORITY

SUSITNA HYDROELECTRIC PROJECT

SUMMARY INFORMATION PACKAGE ON ON-GOING HYDRAULIC AND HYDROLOGY STUDIES

APA PANEL MEETING

ANCHORAGE, AK

JUNE 3, 1981

ACRES

Acres American Incorporated
1000 Liberty Bank Building
Main at Court
Buffalo, New York 14202
Telephone (716) 853-7525

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TABLE OF CONTENTS

1 - HYDROLOGICAL AND CLIMATOLOGICAL STATIONS

1.1 - Station Location

A map showing the current hydrological and climatological stations in the Susitna River Basin is attached at the end of this document.

1.2 - Water Quality Monitoring

Copies of correspondence among APA, ADF&G, and Acres on current R&M water quality monitoring and analyses are attached along with the Minutes of the Coordination Meeting held on May 7, 1981, and a technical discussion among ADF&G, USGS, and R&M held on May 14, 1981, dealing with the resolution of the differences in USGS and R&M data collection methods and their comparability.

MINUTES OF MEETING
Coordination Meeting on Fisheries Habitat, Vegetation, Instream Flow, and Engineering Studies Programs on the Lower Susitna River. Held in Acres American Offices in Anchorage, Alaska on May 7, 1981

File No. P5700.13.30
P5700.14.03
P5700.14.07

Present were:

Name	Affiliation
James D. Gill	Acres American Inc.
G. Krishnan	Acres American Inc.
Milo Bell	TES
Woody Trihey	Acres American Inc.
Christopher Estes	ADF&G
Bob Lamke	USGS
Bob Madison	USGS
Andy Hoffman	ADF&G
Bruce R. Bedard	Alaska Power Authority
Thomas Trent	ADF&G
Dana Schmidt	TES
Leslie Griffiths	R&M
Brent T. Drage	R&M
Jeff Coffin	R&M
Larry Peterson	R&M
Russell Nemecek	TES
Robert Williams	TES
Bob Krogeng	TES

ITEM 1

ACTION BY

Jim Gill opened the meeting by introducing key project personnel in attendance. He reviewed the meeting objectives and mentioned the review studies completed so far and planned for 1980-81. He also stressed the need to set up coordination procedures for groups involved in the downstream river (Watana to Cook Inlet) studies on the Susitna River with special attention on fisheries habitat, vegetation, and instream flow studies.

ITEM 2

Woody Trihey, a special consultant to Acres, reviewed the draft FERC license requirements as outlined in the Federal Register on February 2, 1981, in terms of downstream river studies on the Susitna River. Pertinent sections of the Federal Register are included as Attachment A.

Mr. Trihey explained that FERC would be looking for a general description of the project, i.e. setting, locale, nature of the project, as well as discussion on the project's potential

ACTION BY

effect on existing uses of flow in the Susitna. Baseline data collected during the study should describe normal and seasonal variability in streamflow and water quality. With this information the long and short term effects of the proposed project on the natural variability of background streamflow conditions can be explained.

Mr. Trihey felt the baseline data collection currently being carried out on the river was adequate for the first phase of the study and initial license application in that the project effects on the normal and seasonal variability of stream flows can be described. As more specific information is obtained on instream flow uses which may conflict with the proposed hydro-development additional data collection and analysis can be incorporated into later work phases. He stressed that there is no requirement by FERC that the initial license application be based upon a detailed environmental analysis, but the application must be complete and comprehensive. Meaning that the magnitude and consequences of the proposed development needs to be considered with respect to all other existing/competing uses for streamflows in the project area. In addition the license application must describe actions which could be undertaken to mitigate any adverse impact associated with the project. The mitigation plan must be prepared in consultation with State and Federal Agencies. The FERC will review the license application, request an outside review by appropriate State and Federal Agencies, then decide on its adequacy. When FERC determines the license application is deficient they generally provide the applicant with a statement of what additional data, analysis, or inter-agency consultation is required.

It was Mr. Trihey's opinion that a license application could be submitted in the spring of 1982, but it would be returned to the applicant with the statement that considerable additional work would be required in several areas. Acres/TES

ITEM 3

Mr. G. Krishnan of Acres, Buffalo opened the next section of the meeting by outlining hydraulic and hydrologic projects completed by Acres/R&M team during the first year of the feasibility study. These included the following:

- Compilation of historical streamflow, climatological and water quality data on the Susitna River Basin.
- One year of climate and hydrological data collection in the basin during 1980.
- Freezeup and breakup observations on the river.
- Hydrographic surveys completed in the reach from Talkeetna to Deadman Creek.

ACTION BY

- Regional flood analysis showing relationship of flood peak and flood volume, and recurrence in the Susitna Basin.
- Preliminary report on Subtask 3.10 - Lower Susitna Studies addressing pre and post project flows and flood peaks based on either a one or two dam scheme.

He added that future analysis downstream will be based on the flows from a two dam scheme. — Acres/TES

Brent Drage from R&M Consultants followed with more detailed description of work items completed to date by R&M on the Susitna River. Attachment B is a summary of this description.

Bob Williams, a consultant working with Terrestrial Environmental Specialists (TES), explained TES's role in the first phase of the Susitna project. They are currently compiling an extensive literature review on fish species as applicable to the Susitna River system which should be available to project personnel by mid-summer. They have also provided input to Acres on selection of dam development plans, access route, and transmission corridors. Christopher Estes suggested they coordinate their fishery literature review with the ADF&G fish habitat preference literature review project supervised by Rich Cannon. He also requested a copy of the bibliography, listing all of the literature reviewed. — TES

Milo Bell, also working with TES, described several literature reviews he has prepared in connection with this project including one on dissolved nitrogen studies in rivers. He is currently working on an extensive literature review on the effect of silt on fisheries. Copies of this review will be made available to interested project personnel when it is completed. — Acres/TES

Christopher Estes and Tom Trent from ADF&G concluded this section of the meeting by presenting an outline of the fisheries studies to be conducted on the river primarily from Talkeetna to Devil Canyon. The field program has been designed to better define the relationship between various fish species and habitat in terms of water quality, substrate, and streamflow parameters. In addition, numerous staff gages will be installed throughout the project area in order to identify those habitat areas where problems may occur due to flow regulation.

ACTION BY

Christopher reminded Acres of their committment to supply Leitz Levels and an electronic distance finder. Bob Williams verified that John Hayden has agreed to this. Estes also referenced a November 30, 1979, letter to Eric Yould on this subject. Jim Gill said he would follow up on this. — Acres

A procedures manual is being developed describing the specific data to be collected outlining the three elements of ADF&G's Phase I program: anadromous adult study group, resident juvenile fish studies, and the aquatic habitat study group. Further discussion of this program was continued under Item 4 of the meeting agenda.

The meeting proceeded to discuss the Acres/R&M water quality program as being conducted in the light of observations made by Tom Trent in a memo to APA (Attachment C).

Krishnan briefly traced the development of the water quality program as currently being carried out by R&M citing the meetings last year with representatives of USGS, ADF&G, APA, DNR, TES, R&M, and Acres.

Bob Madison of USGS stressed the point that the methods of USGS and R&M for water quality sampling were not comparable. It was difficult, however, to say how the sampling procedure affected the anlaytical results. Christopher Estes emphasized the need for the compatability of results of the R&M and USGS observations so that R&M could compliment and extend the USGS historical records. He also stated that it would be logical to insure that the same paremeters be evaulated at each sampling site as discussed in the memo from Tom Trent to Dave Wozniak (April 15, 1981).

Dana Schmidt indicated that the WQ parameters presently measured by R&M are adequate for purposes of preparing the initial license application and Phase II study plan; hence expansion of the present WQ data collection program is not necessary at this stage. — Acres/TES/ADF&G

After some discussion it was agreed that:

(a) R&M will collect depth integrated WQ samples and three surface samples during their next field observations at Gold Creek and analyze the two samples. The results would be evaluated jointly with USGS to determine the comparability of the two sampling procedures.

ACTION BY

(b) Brent will set up a meeting with USGS personnel to determine the sampling schedule and analysis techniques which will be followed to resolve the present question concerning incompatability of WQ data. — R&M/USGS

Christopher requested that the APA consider funding the Chulitna water quality program, with the understanding that R&M and the USGS would resolve the comparability issue, adding that the Chulitna data would be of value to all study participants. Jim Gill said APA would have to make the final decision on the Chulitna water quality monitoring. — Acres/APA

ITEM 4

During this segment of the meeting, each of the agencies involved gave a short description of their 1981-82 field programs and analyses to be undertaken.

Mr. Krishnan began by outlining the proposed Acres activities for the comming year. Four key tasks were described:

(a) Water Surface Profile Modeling

Water level and discharge observations made during 1980 field program along with river cross section data in the reach from Talkeetna to above Watana dam site gathered during hydrographic surveys is presently being computerized for input into the HEC-2 water surface profile model. This model will be used to estimate water surface elevations during the open water seasons for various streamflows at different sections along the river. The model is proposed to be calibrated using 1980 observations and will be independently verified with 1981 data. The model will be used to predict water levels under pre and post project flows under open water conditions. — R&M/Acres

(b) Ice Modeling

Ice observation carried out during freezeup and breakup will be used to calibrate an ice model developed by Acres to simulate ice cover formation, stability, and thickness in the river reach. An associated backwater profile program will use the information from the ice simulation model to predict water levels for ice cover conditions under pre and post project conditions. — Acres

ACTION BY

(c) Reservoir Modeling

Both HEC-2 and ice modeling will be carried out in the reservoir pools to determine the upstream effects of various water levels in the reservoir. Ice cover formation on the reservoir, its behavior, and stability will also be evaluated with respect to various reservoir operations. — Acres

(d) Reservoir Temperature and Sediment Modeling

It is proposed to use HEC models for temperature and sediment modeling of the reservoirs. The prime objective in using the models will be to arrive at multilevel power outlets that may be required to conform to environmental requirements as to temperature and sediment concentration in the downstream flow. There is essentially scant data available on river water temperatures and sediment loads. Data from the continuous water quality monitor near Watana Camp will be used as supplement to historical and 1980 data collected for input in the models. Correlations where possible will be made between observed long-term air temperature and water temperatures to extend the data base for analysis. A reevaluation of the extent of mathematic modeling is under way in view of limited base line information available. — Acres

(e) Morphological and Sediment Yield Studies

These were discussed by Brent Drage (R&M). For morphology studies below the dam sites the river will be divided into two parts - Susitna River upstream of the Chulitna River confluence and the river downstream of the confluence up to the mouth.

Regime type relationships will be developed for the upper, more stable part of the river, above the Chulitna confluence. Once these regime relationships are developed for natural flow conditions, sediment discharge and flow parameters can be altered to identify possible changes in river characteristics such as gradient and channel width under regulated flow conditions. Significant problems of aggredation or degradation if expected to occur will be addressed.

The river downstream of the Chulitna confluence is a more complex situation and much less historical data is available. Reports such as the Subtask 3.10 Preliminary Open Water Report provide some — R&M

ACTION BY

guidelines for problem identification and further studies. The analysis carried out will be refined as more data becomes available and also extended to address needs of environmental groups for such information.

Bob Lamke of the USGS was asked about the status of a USGS bedload measurement program for the Susitna. He explained that their three year study for bedload, bed material, and suspended sediment data collection was being negotiated with the Alaska Power Authority. Bill Emmett (USGS, Denver, Co.) is being consulted on developing the program based on his previous experience in sediment transport and discharge on other Alaskan rivers. Bob Lamke did feel that it would not be possible to get geared up to begin data collection this summer. — Acres/APA

The aquatic studies program was outlined by Christopher Estes (ADF&G). Five locations are to be selected as representative of the reach between Devil Canyon and Chulitna confluence. At these selected sites substrate and water quality data will be collected at three times during the year based on seasonal discharge changes and will include pH, dissolved oxygen, specific conductance, water temperature, and turbidity measurements. Water samples will also be taken in the sloughs for more detailed analysis by the USGS. This will permit the ADF&G to compare the water quality/discharge relationships between the mainstream river and sloughs, thus adding further importance for all water quality data collected to be comparable. ADF&G need some input from R&M on selection of five typical reaches. Brent Drage will get together with Christopher Estes for finalizing the reaches. — ADF&G/R&M

Numerous staff gages will be installed at sampling sites in the side channels or sloughs of interest for habitat studies and readings collected at varying intervals (from 3 times daily at selected sites to twice weekly at others) to correlate water levels in the main stem with those in the selected sloughs and channels. Periodic discharge measurements and water velocities will be carried out at several sites to refine — ADF&G

ACTION BY

stage discharge relationships. Joint crews consisting of representatives from the adult anadromous section, resident juvenile section, and aquatic habitat section will work on the river from Cook Inlet to Watana collecting the information outlined above, as well as maintaining fishwheels, sonars, and thermographs to be set up at several locations along the river.

These fisheries studies should characterize and identify locations of typical fish habitat areas for different species, improve our present understanding of fish movement in the Susitna River system and provide some initial insight as to responsiveness of the various habitat types to changes in stream flow. From the data collected it would be possible to answer questions like how readily are the side channels or sloughs watered and dewatered, are they relatively stable or subject to rapid changes, etc. Woody Trihey stated that the final product from ADF&G Phase I field program should be an initial characterization of typical fish habitats in the project area and utilization of these habitats. Knowing this and post project stream flow conditions TES could provide initial comments pertaining to the generic type of impacts that might occur to the various habitats due to the project. — TES/Acres

The final review of the 1981-82 program was presented by Bob Williams (TES). He explained that last year TES identified 50-60 impact issues associated with different phases of the project. During the coming year, they will take information generated by other involved agencies and apply it to the various impact issues. — TES

The detail of the impact analysis will be based on the relative importance of the issue as time and budget constraints prohibit addressing all issues in great detail. A composite list of impact issues is included in the TES Procedures Manual produced last year, and a more detailed list will be available soon. Kevin Young (Acres) should follow up to obtain the details. Literature survey will be continued for species of salmon. Reviews are nearly complete for Chinook and Coho salmons; others are still being developed. — TES/Acres

	ACTION BY
Mr. Williams stressed that reports submitted to TES must be in good final form following the approved Acres' format as there is no time available for TES to do any rewriting.	Acres/ADF&G
It was agreed that TES will supply Krishnan with a detailed description of hydraulic and hydrologic information that is required for their analysis and evaluation. A similar list should be drawn up by ADF&G as well. This will enable producing timely data/information to meet needs of different agencies.	TES/ADF&G/ Acres
A plan for coordinating and channelizing information exchange among the study team members was discussed. It was concluded that Woody Trihey and Dana Schmidt should form the focal point of all field data collection and hydraulic analysis and information. Jim Gill would keep in touch with the progress. All correspondences should be copied to Kevin Young to continue coordination of all efforts in the environmental studies.	Acres/TES

Reported by G. Krishnan

GK/ljr

Attachments

MINUTES OF MEETING
Held at the Office of
Acres American, Incorporated, Anchorage
May 14, 1981

WATER QUALITY SAMPLING COORDINATION MEETING
Susitna Hydroelectric Project, Subtask 3.03

The meeting was attended by:

Andy Hoffman	ADF&G
Bob Lamke	USGS
Bob Madison	USGS
Derrill Cowing	USGS
Brent Drage	R&M
Leslie Griffiths	R&M

Basically, it was decided that total phosphorous and total nitrogen should be reported as total dissolved phosphorous and nitrogen since in our analyses we only analyze the dissolved fraction in the water and not the totals available in the water-sediment mixture. The terminology conforms to those terms as defined in the 1979 "Water Resources Data for Alaska" (USGS).

There was also some question as to what exactly was defined by the total suspended solids analysis reported in our water quality reports. Brent explained how this related to the suspended sediment analysis and settleable solids field tests. Generally, it was agreed we'd be saved a lot of confusion if this parameter was deleted from our water quality program, leaving the settleable solids measurements and actual suspended sediment analysis taken from the depth - integrated samples.

There was some discussion on the value of ICAP scan versus wet chemistry techniques for water quality analyses. It was agreed that for this phase, the ICAP scan would provide baseline data that was adequate to describe the system. As specific parameters were identified as being of greater importance, different, perhaps more accurate or refined analysis techniques could be implemented.

To resolve the immediate problem we agreed to coordinate a sampling trip with this USGS where they would do sampling following their normal procedures and we would collect both grab samples and depth integreated samples for analysis and comparison. As it stands, that trip is scheduled for the 26th and 27th of May.

R&M will meet again with the USGS to compare results for the analyses and determine what, if anything needs to be done to improve or change our program to optimize the usefulness of water quality data collected.

RECEIVED MAY 4 1981

ALASKA POWER AUTHORITY

333 WEST 4th AVENUE - SUITE 31 - ANCHORAGE, ALASKA 99501

Phone: (907) 277-7641
(907) 276-2715

May 1, 1981

Mr. John Lawrence
Acres American Incorporated
The Liberty Bank Building
Main at Court
Buffalo, New York 14202
Attn: John Hayden

Dear John:

Attached is a memo dated April 15, 1981 from Tom Trent that critiques the water quality sampling programs. His recommendations would incur a scope change of at least $29,740.00 for USGS services and an undetermined amount for R&M services.

Please analyze Mr. Trent's comments and have your staff be prepared to discuss them in the May 7, 1981 meeting you have scheduled here in Anchorage.

Sincerely,

David D. Wozniak
Project Manager

ALASKA POWER AUTHORITY
SUSITNA

FILE P5700.11

SEQUENCE NO. E. 1525

ACTION	INFORM.	DISTRIB.	INITIAL
		DCW	
	✓	JDL	
	✓	CAD	5/6
	✓	JDG	
		[illegible]	5/7
		JPS	
		IPGH	
		FNS	
		SHT	
		DWL	
		MRV	
		HRC	
		FILE	

MEMORANDUM

State of Alaska

TO: Dave Wozniak
Su Hydro Project Manager
Alaska Power Authority
333 W. 4th Avenue, Suite 31
Anchorage, Alaska 99501

DATE: April 15, 1981

FILE NO:

TELEPHONE NO:

FROM: Thomas W. Trent
Aquatic Studies Coordinator
Su Hydro Aquatic Studies
Anchorage

SUBJECT: USGS Water Quality Measurements

The present USGS and R&M Su Hydro Water Quality sampling programs for sites on the Susitna River downstream from Devil Canyon (figure 1) have been reviewed by my staff. Inconsistencies with the types and level of analysis will prevent comparison of these sites for hydrologic appraisal of the overall lower Susitna Basin. Following is a summary of the existing USGS and R&M water quality program and our recommendations for improvement.

According to the present USGS work plan, sediment samples are analyzed by particle analysis (Attachment 1) and suspended sediment at the Gold Creek Site; whereas the samples at the Sunshine site are analyzed to the sand break (Attachment 2). In addition, the water quality analysis at the Sunshine site is more comprehensive than the Gold Creek site (Attachments 3 and 4).

R&M is collecting water quality data above the proposed dam site and at Gold Creek (Attachment 4).

There are three basic differences between the R&M and USGS sampling and analysis schemes: 1) parameters; 2) methods of collection and preservation; and, 3) methods of analysis.

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Parameters

The differences in parameters being analyzed are: USGS measures suspended sediment and R&M measures settleable solids and total suspended solids. These are not comparable (Madison 1981). The specific nutrients which USGS and R&M measures are different. The USGS will measure a broader range of inorganic cations and anions than R&M.

Collection and Preservation

The differences between the methods of collection and preparation are significant and make comparison of samples questionable if at all possible at 3 stations. R&M composites 3 grab samples which are collected 1 foot under the surface across the river (right and left bank and center channel) (R&M 1980), whereas USGS takes a depth integrated composite sample at several points along a transect across the river. The USGS depth integrated method accounts for differences in concentration which will otherwise result if a sample is collected in too shallow of water or the water is stratified and not homogeneous, thus give a better representation of the river water quality. The 3 R&M surface grab samples may not be sufficient techniques for nutrients are not the same; thus, data comparison is questionable.

Analysis

The methods and level of analysis used for trace metals by R&M are different; thus data comparison is questionable.

With this wide variety of differences in sample collection and analysis, comparison of the USGS data which are collected on the Chulitna and Sunshine Stations to R&M data at their Gold Creek stations would be inadvisable. USGS concurred with us concerning the advantages of modifying their program (attachment 1) to permit comparative analysis. It was also their opinion that a coordinated uniform hydrologic appraisal of the lower Susitna Basin would be beneficial to the overall Su Hydro Feasibility Study Program. In addition, the USGS suggested that the Chulitna River station be included in this proposed revised sampling and analysis scheme because of its proportionally high contribution to the Susitna River and potentially significant influence on water quality and channel geometry (Attachment 5).

A summary of the suggested revisions to the USGS program currently funded by the APA and R&M program follow:

USGS Modifications

	WATER QUALITY*		SEDIMENT*	
	present:	change to: agree	present:	change to:
Gold Creek	USGS minimal and R&M data	USGS comprehensive	particle size	-
Sunshine	USGS comrehensive	-	sand break	particle size agree
Chulitna	none	USGS comprehensive NO	particle size	-

*examples of minimal and comprehensive water quality and particle size and sand break analysis are attached.

Estimated additional costs to the existing APA/USGS cooperative sampling program to implement these changes would be:

	4/1-6/30 1981	7/1-9/30 1981	10/1-6/30 1982
Chulitna River	$4,120	$4,120	$9,100
Susitna River at Gold Cr.	$2,340	$2,340	$7,720
Susitna R. at Sunshine			
TOTAL	$6,460	$6,460	$16,820

R&M Modifications

To enable the use of R&M data for comparison purposes with existing and historical USGS data, uniform data collection and analysis procedures which are approved by USGS should be adopted by R&M.

R&M and USGS Evaluation

The Steering Committee should review the overall USGS and R&M water quality and hydraulic sampling and analysis procedures to evaluate the validity of the existing programs and determine whether they are integrated. It is our understanding that the only Su Hydro study participants which are presently required to author procedure manuals are TES subcontractors and the ADF&G.

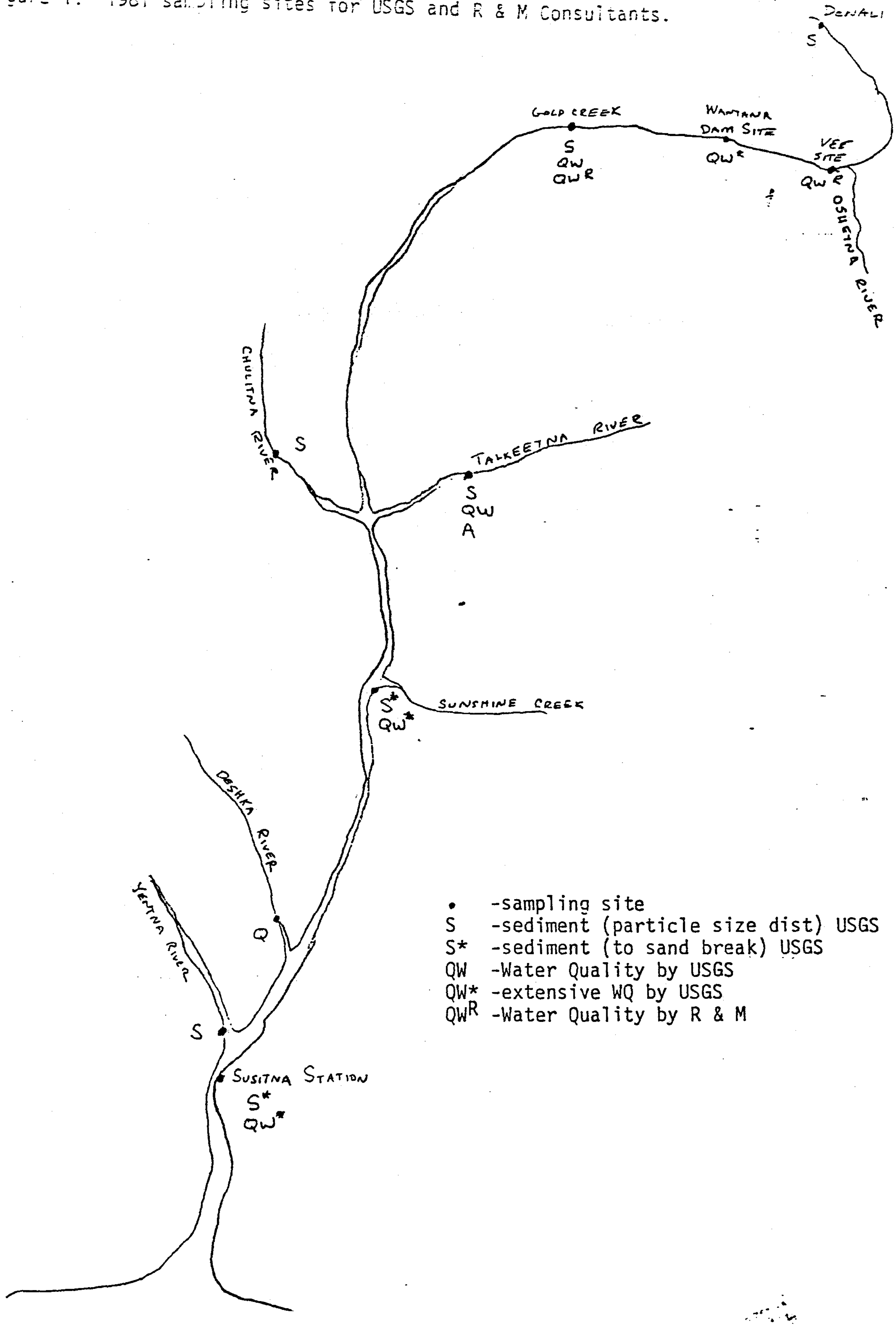
We strongly support the changes to the USGS program and believe they will benefit all study participants. With respect to the Department of Fish and Game's use of this information, it will be evaluated to assess the present relationship between discharge and water quality on the river and eventually used to determine the physical and chemical changes which will occur with changes in flow regimes if the proposed dams were constructed. Therefore we suggest and request that these minor changes to the existing USGS APA program be adopted and funded by the APA.

Madison, B. 1981. Personal communication pertaining to evaluation of R&M water quality procedure manual. April 15, 1981. USGS.

R&M. 1980 Susitna Hydroelectric Project. Procedures for water quality data collection. R&M Consultants. Anchorage. 11pp.

cc: R. George - USGS
B. Drage - R&M

Figure 1. 1981 sampling sites for USGS and R & M Consultants.



Attachment 1. Example of USGS particle site distribution analysis.

15292000 SUSITNA RIVER AT GOLD CREEK--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1949-58, 1962, 1967-68, 1974 to current year.

PERIOD OF DAILY RECORD.--
WATER TEMPERATURES: June to September 1957, July 1974 to September 1978 (seasonal and fragmentary), October 1978 to September 1979.
SUSPENDED-SEDIMENT DISCHARGE: May to September 1952, June to September 1957.

INSTRUMENTATION.--Temperature recorder since July 30, 1974.

REMARKS.--No record Dec. 1^ to May 21 and July 10-31, sensor frozen in ice and clock stopped; respectively.

EXTREMES FOR CURRENT YEAR.--
WATER TEMPERATURES: Maximum, 15.0°C July 3, 4 (may have been greater during period of no record July 10-31); minimum, 0.0°C on most days during winter period.

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

DATE	TIME	SAMPLE LOC-ATION, CROSS SECTION (FT FM L BANK)	SAMP-LING DEPTH (FT)	DEPTH AT SAMPLE LOC-ATION, TOTAL (FEET)	TEMPER-ATURE (DEG C)
JUL					
10...	1431	60	1.6	8.00	12.3
10...	1432	60	6.4	8.00	12.3
10...	1433	130	2.2	10.8	12.3
10...	1434	130	8.6	10.8	12.3
10...	1435	185	2.5	12.5	12.1
10...	1436	185	10	12.5	12.2
10...	1437	230	2.5	12.5	12.1
10...	1438	230	10	12.5	12.1
10...	1439	290	2.3	11.3	12.0
10...	1440	290	9.0	11.3	12.0
10...	1441	345	1.5	7.60	12.0
10...	1442	345	6.1	7.60	12.0
10...	1443	400	3.5	5.80	12.0

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SEDI-MENT, SUS-PENDED (MG/L)	SEDI-MENT DIS-CHARGE, SUS-PENDED (T/DAY)	SED. SUSP. FALL DIAM. % FINER THAN .002 MM	SED. SUSP. FALL DIAM. % FINER THAN .004 MM	SED. SUSP. FALL DIAM. % FINER THAN .008 MM	SED. SUSP. FALL DIAM. % FINER THAN .016 MM
MAY								
21...	1450	17400	168	7890	--	--	--	--
JUL								
10...	1430	25700	627	43500	16	21	27	34
SEP								
05...	1430	8820	67	1600	--	--	--	--

DATE	SED. SUSP. FALL DIAM. % FINER THAN .031 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .125 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .250 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .500 MM	SED. SUSP. SIEVE DIAM. % FINER THAN 1.00 MM	SED. SUSP. SIEVE DIAM. % FINER THAN 2.00 MM
MAY							
21...	--	--	--	--	--	--	--
JUL							
10...	40	47	56	72	91	98	98
SEP							
05...	--	--	--	--	--	--	--

Attachment 2. Example of USGS sediment analysis to the sand break. See outlined column.

15294350 SUSITNA RIVER AT SUSITNA STATION--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

DATE	COBALT, SUS-PENDED RECOV-ERABLE (UG/L AS CO)	COBALT, DIS-SOLVED (UG/L AS CO)	COPPER, TOTAL RECOV-ERABLE (UG/L AS CU)	COPPER, SUS-PENDED RECOV-ERABLE (UG/L AS CU)	COPPER, DIS-SOLVED (UG/L AS CU)	IRON, TOTAL RECOV-ERABLE (UG/L AS FE)	IRON, SUS-PENDED RECOV-ERABLE (UG/L AS FE)	IRON, DIS-SOLVED (UG/L AS FE)	LEAD, TOTAL RECOV-ERABLE (UG/L AS PB)	LEAD, SUS-PENDED RECOV-ERABLE (UG/L AS PB)	LEAD, DIS-SOLVED (UG/L AS PB)	MANGA-NESE, TOTAL RECOV-ERABLE (UG/L AS MN)
OCT 02...	--	--	--	--	--	--	--	--	--	--	--	--
DEC 20...	--	--	--	--	--	--	--	--	--	--	--	--
JAN 15...	8	<3	3	1	2	490	400	90	11	7	4	40
APR 05...	--	--	--	--	--	--	--	--	--	--	--	--
MAY 14...	6	0	25	21	4	14000	14000	170	60	40	0	10
JUN 19...	0	7	29	28	1	12000	12000	0	12	10	2	250
JUL 26...	--	--	--	--	--	--	--	--	--	--	--	--
AUG 29...	--	--	--	--	--	--	--	--	--	--	--	--
SEP 17...	5	<3	37	34	1	26000	--	40	16	14	2	580

DATE	MANGA-NESE, SUS-PENDED RECOV. (UG/L AS MN)	MANGA-NESE, DIS-SOLVED (UG/L AS MN)	MERCURY TOTAL RECOV-ERABLE (UG/L AS HG)	MERCURY SUS-PENDED RECOV-ERABLE (UG/L AS HG)	MERCURY DIS-SOLVED (UG/L AS HG)	SELE-NIUM, TOTAL (UG/L AS SE)	SELE-NIUM, SUS-PENDED TOTAL (UG/L AS SE)	SELE-NIUM, DIS-SOLVED (UG/L AS SE)	SILVER, TOTAL RECOV-ERABLE (UG/L AS AG)	SILVER, SUS-PENDED RECOV-ERABLE (UG/L AS AG)	SILVER, DIS-SOLVED (UG/L AS AG)	ZINC, TOTAL RECOV-ERABLE (UG/L AS ZN)
OCT 02...	--	--	--	--	--	--	--	--	--	--	--	--
DEC 20...	--	--	--	--	--	--	--	--	--	--	--	--
JAN 15...	30	10	.1	.1	.0	1	0	1	1	1	0	10
APR 05...	--	--	--	--	--	--	--	--	--	--	--	--
MAY 14...	0	10	.2	.2	.0	1	1	0	0	0	0	50
JUN 19...	240	10	.1	.1	.0	1	0	1	0	0	0	60
JUL 26...	--	--	--	--	--	--	--	--	--	--	--	--
AUG 29...	--	--	--	--	--	--	--	--	--	--	--	--
SEP 17...	580	4	.1	.1	.0	1	1	0	0	0	0	80

DATE	ZINC, SUS-PENDED RECOV-ERABLE (UG/L AS ZN)	ZINC, DIS-SOLVED (UG/L AS ZN)	CARBON, ORGANIC DIS-SOLVED (MG/L AS C)	CARBON, ORGANIC SUS-PENDED TOTAL (MG/L AS C)	LENGTH OF EXPO-SURE (DAYS)	PERI-PHYTON BIOMASS ASH WEIGHT G/SQ M	PERI-PHYTON BIOMASS TOTAL DRY WEIGHT G/SQ M	CHLOR-A PERI-PHYTON CHROMO-GRAPHIC FLUOROM (MG/M2)	CHLOR-B PERI-PHYTON CHROMO-GRAPHIC FLUOROM (MG/M2)	SEDI-MENT, SUS-PENDED (MG/L)	[illegible]	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
OCT 02...	--	--	--	--	--	--	--	--	--	--	[illegible]	--
DEC 20...	--	--	--	--	--	--	--	--	--	--	[illegible]	--
JAN 15...	7	3	9.3	.2	--	--	--	--	--	3	[illegible]	--
APR 05...	--	--	--	--	80	.000	.000	.000	.000	4	[illegible]	--
MAY 14...	40	10	6.8	1.8	--	--	--	--	--	E683	[illegible]	E36
JUN 19...	50	10	.9	2.6	36	.000	.000	.000	.000	416	[illegible]	54
JUL 26...	--	--	--	--	--	--	--	--	--	2370	[illegible]	74
AUG 29...	--	--	--	--	--	--	--	--	--	742	[illegible]	72
SEP 17...	80	<3	.6	1.1	--	--	--	--	--	901	[illegible]	55

E ESTIMATED

Attachment 3. Example of comprehensive water quality analysis that will be taken at Sunshine.

Page 1 of 7.

15294350 SUSITNA RIVER AT SUSITNA STATION--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1955, 1970, 1975 to current year.

PERIOD OF DAILY RECORD.--
WATER TEMPERATURES: May 1975 to current year (seasonal).

INSTRUMENTATION.--Temperature recorder since May 23, 1975.

REMARKS.--No record Oct. 1 to May 14, when gage was shut down for the winter. Records represent water temperature at sensor within 0.5°C. Temperature at the sensor was compared with the average for the river by temperature cross-sections Oct. 2, Jan. 15, Apr. 5, May 14, June 19, July 26, Aug. 29, and Sept. 17. A maximum variation of 2.5°C was found within the cross-sections.

EXTREMES FOR PERIOD OF DAILY RECORD.--
WATER TEMPERATURES: Maximum, 16.5°C July 9, 1976 and July 3 and 4, 1979; minimum, 0.0°C on most days during winter periods.

EXTREMES FOR CURRENT YEAR.--
WATER TEMPERATURES: Maximum, 16.5°C July 3 and 4; minimum, 0.0°C on most days during winter period.

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

DATE	TIME	SAMPLE LOC-ATION, CROSS SECTION (FT FM L BANK)	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)
OCT							
02...	1401	1.0	155	7.6	4.0	12.8	98
02...	1402	180	155	7.6	3.9	12.8	98
02...	1403	380	158	7.8	3.8	12.8	98
02...	1404	580	160	7.6	3.8	12.8	98
02...	1405	830	167	7.6	3.7	12.8	98
02...	1406	1030	168	7.4	3.6	12.8	98
02...	1407	1248	160	--	3.8	12.8	98

DATE	TIME	SAMPLE LOC-ATION, CROSS SECTION (FT FM L BANK)	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)
JAN							
15...	1231	150	196	6.7	.0	11.4	80
15...	1232	480	196	6.8	.0	11.5	81
15...	1233	942	201	7.0	.0	10.0	70

DATE	TIME	SAMPLE LOC-ATION, CROSS SECTION (FT FM L BANK)	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	TEMPER-ATURE (DEG C)	OXYGEN, DIS-SOLVED (MG/L)
APR					
05...	1331	250	199	.2	11.0
05...	1332	900	212	.2	11.4
05...	1333	1000	218	.2	10.3

DATE	TIME	SAMPLE LOC-ATION, CROSS SECTION (FT FM L BANK)	SAMP-LING DEPTH (FT)	PER-CENT OF TOTAL DEPTH	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)
MAY									
14...	1530	150	19	80	95	7.6	5.5	12.7	100
14...	1531	150	4.9	20	--	--	5.5	--	--
14...	1532	250	14	80	95	7.6	5.5	12.7	100
14...	1533	250	3.5	20	--	--	5.5	--	--
14...	1534	450	10	80	90	7.6	6.0	12.5	99
14...	1535	450	2.5	20	--	--	6.0	--	--
14...	1536	700	9.4	80	90	7.6	6.5	12.2	98
14...	1537	700	2.4	20	--	--	6.5	--	--
14...	1538	950	7.0	80	95	7.7	6.6	12.0	97
14...	1539	950	1.8	20	--	--	6.6	--	--
14...	1540	.0	--	--	95	--	5.6	12.4	98

Attachment 3. Page 2 of 7.

15294350 SUSITNA RIVER AT SUSITNA STATION--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

DATE	TIME	SAMPLE LOCATION, CROSS SECTION (FT FM L BANK)	SAMPLING DEPTH (FT)	DEPTH AT SAMPLE LOCATION, TOTAL (FEET)	STREAM VELOCITY, POINT (FPS)	PERCENT OF TOTAL DEPTH (FEET)	SPECIFIC CONDUCTANCE (MICROMHOS)	PH (UNITS)	[illegible] (MHOS)	[illegible] (UNITS)
JUN										
19...	1331	50	--	15.0	5.30	--	112	--		
19...	1332	50	3.0	15.0	5.40	20	--	--		
19...	1333	50	9.1	15.0	--	60	--	--		
19...	1334	50	12	15.0	5.20	80	--	--		
19...	1335	50	.5	15.0	--	--	110	7.9		
19...	1336	150	--	30.0	5.40	--	112	--		
19...	1337	150	5.9	30.0	6.00	20	112	--		
19...	1338	150	18	30.0	--	60	112	--		
19...	1339	150	24	30.0	4.80	80	112	--		
19...	1340	150	.5	30.0	--	--	110	8.0		
19...	1341	200	--	27.0	5.60	--	112	--		
19...	1342	200	5.5	27.0	6.70	20	--	--		
19...	1343	200	16	27.0	--	60	--	--		
19...	1344	200	22	27.0	4.60	80	--	--		
19...	1345	200	.5	27.0	--	--	110	7.9	110	[illegible]
19...	1346	250	--	23.0	5.40	--	112	--	112	--
19...	1347	250	4.6	23.0	6.30	20	--	--		
19...	1348	250	14	23.0	--	60	--	--	--	--
19...	1349	250	19	23.0	4.60	80	--	--		
19...	1350	250	.5	23.0	--	--	110	7.8	110	7.8
19...	1351	350	--	17.0	5.70	--	115	--	[illegible]	--
19...	1352	350	3.4	17.0	7.00	20	115	--		
19...	1353	350	10	17.0	--	60	113	--		
19...	1354	350	14	17.0	4.60	80	--	--	--	--
19...	1355	350	.5	17.0	--	--	110	7.8	110	7.8
19...	1356	450	--	15.0	5.70	--	115	--	115	[illegible]
19...	1357	450	3.0	15.0	6.30	20	--	--		
19...	1358	450	8.9	15.0	--	60	--	--		
19...	1359	450	12	15.0	5.20	80	--	--		
19...	1400	450	.5	15.0	--	--	115	7.7		
19...	1401	600	--	15.0	5.00	--	120	--		
19...	1402	600	3.0	15.0	6.50	20	--	--		
19...	1403	600	8.9	15.0	--	60	--	--		
19...	1404	600	12	15.0	3.80	80	--	--		
19...	1405	600	.5	15.0	--	--	115	7.7		
19...	1406	700	--	14.0	5.90	--	122	--		
19...	1407	700	2.7	14.0	6.60	20	--	--		
19...	1408	700	8.2	14.0	--	60	--	--		
19...	1409	700	11	14.0	5.40	80	--	--		
19...	1410	700	.5	14.0	--	--	115	--		
19...	1411	850	--	15.0	4.70	--	124	--		
19...	1412	850	3.1	15.0	5.90	20	126	--		
19...	1413	850	9.2	15.0	--	60	126	--		
19...	1414	850	12	15.0	3.80	80	--	--		
19...	1415	850	.5	15.0	--	--	120	--		
19...	1416	1000	--	14.0	3.90	--	127	--		
19...	1417	1000	2.9	14.0	4.90	20	--	--		
19...	1418	1000	8.6	14.0	--	60	--	--		
19...	1419	1000	11	14.0	3.10	80	--	--		
19...	1420	1000	.5	14.0	--	--	120	--		

SOUTH-CENTRAL ALASKA

15294350 SUSITNA RIVER AT SUSITNA STATION--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

DATE	TEMPERATURE (DEG C)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	BICAR-BONATE (MG/L AS HCO3)	SULFATE DIS-SOLVED (MG/L AS SO4)	IRON, TOTAL RECOV-ERABLE (UG/L AS FE)	SEDI-MENT SUS-PENDED (MG/L)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
JUN								
19...	--	--	--	46	10	11000	327	70
19...	10.9	--	--	--	--	--	--	--
19...	10.9	--	--	--	--	--	--	--
19...	10.9	--	--	--	--	--	--	--
19...	--	11.0	99	--	--	--	--	--
19...	--	--	--	45	11	11000	365	58
19...	10.9	--	--	46	10	12000	362	68
19...	10.9	--	--	--	--	--	398	60
19...	10.9	--	--	45	10	11000	469	53
19...	--	11.0	99	--	--	--	--	--
19...	--	--	--	45	10	11000	602	39
19...	10.9	--	--	--	--	--	--	--
19...	10.9	--	--	--	--	--	--	--
19...	10.9	--	--	--	--	--	--	--
19...	--	11.0	99	--	--	--	--	--
19...	--	--	--	46	10	--	486	48
19...	11.0	--	--	--	--	--	--	--
19...	11.0	--	--	--	--	--	--	--
19...	11.0	--	--	--	--	--	--	--
19...	--	1120	99	--	--	--	--	--
19...	--	--	--	47	11	13000	413	39
19...	10.9	--	--	46	11	11000	343	70
19...	10.9	--	--	46	11	12000	444	55
19...	10.9	--	--	--	--	--	--	--
19...	--	11.0	99	--	--	--	--	--
19...	--	--	--	47	12	11000	428	56
19...	10.8	--	--	--	--	--	--	--
19...	10.8	--	--	--	--	--	--	--
19...	10.8	--	--	--	--	--	--	--
19...	--	11.0	99	--	--	--	--	--
19...	--	--	--	49	14	9000	350	64
19...	10.3	--	--	--	--	--	--	--
19...	10.3	--	--	--	--	--	--	--
19...	10.3	--	--	--	--	--	--	--
19...	--	11.1	99	--	--	--	--	--
19...	--	--	--	49	15	8800	376	56
19...	10.1	--	--	--	--	--	--	--
19...	10.1	--	--	--	--	--	--	--
19...	10.1	--	--	--	--	--	--	--
19...	--	11.2	99	--	--	--	--	--
19...	--	--	--	50	15	8700	614	34
19...	9.9	--	--	51	15	8100	314	65
19...	10.0	--	--	--	--	--	411	50
19...	10.0	--	--	--	--	--	--	--
19...	--	11.2	99	--	--	--	--	--
19...	--	--	--	51	15	8600	451	45
19...	10.1	--	--	--	--	--	--	--
19...	10.1	--	--	--	--	--	--	--
19...	10.1	--	--	--	--	--	--	--
19...	--	11.2	99	--	--	--	--	--

DATE	TIME	SAMPLE LOC-ATION, CROSS SECTION (FT FM L BANK)	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	SEDI-MENT SUS-PENDED (MG/L)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
JUL									
26...	1605	147	112	7.5	11.2	11.1	100	2030	59
26...	1610	247	115	7.6	11.2	11.1	100	1880	76
26...	1615	447	112	7.7	9.8	11.5	99	2150	81
26...	1620	697	115	7.8	8.4	11.7	99	2790	75
26...	1625	1097	120	7.6	8.5	11.7	99	2980	78

15294350 SUSITNA RIVER AT SUSITNA STATION--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

DATE	TIME	SAMPLE LOC-ATION, CROSS SECTION (FT FM L BANK)	DEPTH AT SAMPLE LOC-ATION, TOTAL (FEET)	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	SEDI-MENT, SUS-PENDED (MG/L)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
AUG										
29...	1401	110	24.0	122	7.0	10.1	11.0	99	608	84
29...	1402	210	29.0	123	7.0	10.0	11.0	99	654	79
29...	1403	360	17.0	126	7.2	9.6	11.0	99	711	75
29...	1404	660	15.0	130	7.3	8.0	11.3	97	810	66
29...	1405	910	13.0	132	7.4	8.0	11.2	97	927	56

DATE	TIME	SAMPLE LOC-ATION, CROSS SECTION (FT FM L BANK)	SAMP-LING DEPTH (FT)	DEPTH AT SAMPLE LOC-ATION, TOTAL (FEET)	STREAM VELOC-ITY, POINT (FPS)	PER-CENT OF TOTAL DEPTH	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)
SEP									
17...	1601	50	--	16.0	3.20	--	133	--	--
17...	1602	50	.3	16.0	--	--	135	7.2	8.2
17...	1606	150	--	30.0	5.00	--	132	--	--
17...	1607	150	.3	30.0	--	--	135	7.2	8.3
17...	1608	150	6.0	30.0	5.40	20	133	--	--
17...	1609	150	18	30.0	--	60	133	--	--
17...	1610	150	24	30.0	4.70	80	133	--	--
17...	1611	200	--	27.0	4.60	--	132	--	--
17...	1612	200	.3	27.0	--	--	135	7.3	8.2
17...	1616	250	--	26.0	5.20	--	132	--	--
17...	1617	250	.3	26.0	--	--	131	7.4	8.1
17...	1621	350	--	17.0	5.80	--	131	--	--
17...	1622	350	.3	17.0	--	--	131	7.4	8.1
17...	1623	350	3.4	17.0	6.50	20	131	--	--
17...	1624	350	10	17.0	--	60	131	--	--
17...	1625	350	13	17.0	5.10	80	131	--	--
17...	1626	450	--	14.0	5.90	--	124	--	--
17...	1627	450	.3	14.0	--	--	124	7.6	7.0
17...	1631	550	--	14.0	6.80	--	125	--	--
17...	1632	550	.3	14.0	--	--	124	7.7	7.0
17...	1636	650	--	14.0	4.90	--	124	--	--
17...	1637	650	.3	14.0	--	--	124	7.7	7.0
17...	1641	800	--	14.0	5.10	--	127	--	--
17...	1642	800	.3	14.0	--	--	127	7.6	7.1
17...	1643	800	2.8	14.0	6.20	20	128	--	--
17...	1644	800	8.4	14.0	--	60	128	--	--
17...	1645	800	11	14.0	4.00	80	127	--	--
17...	1646	950	--	12.0	2.90	--	129	--	--
17...	1647	950	.3	12.0	--	--	129	7.6	7.2

15294350 SUSITNA RIVER AT SUSITNA STATION--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

DATE	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	BICAR-BONATE (MG/L AS HCO3)	CAR-BONATE (MG/L AS CO3)	SULFATE DIS-SOLVED (MG/L AS SO4)	IRON, TOTAL RECOV-ERABLE (UG/L AS FE)	SEDI-MENT, SUS-PENDED (MG/L)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
SEP								
17...	--	--	54	0	21	18000	543	75
17...	11.2	98	--	--	--	--	--	--
17...	--	--	53	0	21	15000	645	64
17...	11.2	99	--	--	--	--	--	--
17...	--	--	54	0	21	17000	594	68
17...	--	--	54	0	21	17000	616	66
17...	--	--	54	0	21	17000	675	61
17...	--	--	54	0	22	19000	768	55
17...	11.2	98	--	--	--	--	--	--
17...	--	--	55	0	21	18000	780	57
17...	11.2	98	--	--	--	--	--	--
17...	--	--	55	0	21	19000	737	61
17...	11.2	98	--	--	--	--	--	--
17...	--	--	55	0	20	17000	628	71
17...	--	--	55	0	20	19000	749	60
17...	--	--	55	0	21	16000	948	49
17...	--	--	56	0	21	20000	1380	42
17...	11.3	97	--	--	--	--	--	--
17...	--	--	57	0	20	21000	1030	55
17...	11.4	97	--	--	--	--	--	--
17...	--	--	56	0	20	19000	1120	53
17...	11.4	97	--	--	--	--	--	--
17...	--	--	57	0	22	19000	1190	48
17...	11.4	97	--	--	--	--	--	--
17...	--	--	58	0	21	18000	767	73
17...	--	--	57	0	21	19000	1040	52
17...	--	--	57	0	21	19000	1400	40
17...	--	--	58	0	21	18000	1030	60
17...	11.5	98	--	--	--	--	--	--

DATE	TIME	STREAM WIDTH (FT)	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH (UNITS)	TEMPER-ATURE, AIR (DEG C)	TUR-BID-ITY (NTU)	BARO-METRIC PRES-SURE (MM OF HG)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)	HARD-NESS (MG/L AS CACO3)	HARD-NESS, NONCAR-BONATE (MG/L CACO3)
OCT												
02...	1400	1250	28200	--	--	--	--	755	--	--	--	--
DEC												
20...	1545	1195	8410	183	--	-32.0	--	--	--	<1	--	--
JAN												
15...	1230	960	9890	--	--	E-1.0	2.2	740	K3	<1	79	13
APR												
05...	1330	1100	6700	--	--	--	1.5	--	K11	K1	84	13
MAY												
14...	1630	1350	86800	92	7.6	E11.0	160	765	K15	<1	37	3
JUN												
19...	1330	1300	95200	119	--	--	170	760	K7	K1	49	10
JUL												
26...	1600	1897	186400	115	7.7	--	790	760	K91	K65	60	6
AUG												
29...	1400	1210	90700	--	--	--	260	--	K9	K14	53	9
SEP												
17...	1600	1170	87700	130	--	11.5	100	731	K28	K8	59	13

E ESTIMATED
K NON-IDEAL COLONY COUNT

15294350 SUSITNA RIVER AT SUSITNA STATION--Continued

DATE	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE (MG/L AS HCO3)	CAR-BONATE (MG/L AS CO3)	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)
OCT 02...	--	--	--	--	--	--	--	--	--	--	--	--
DEC 20...	--	--	--	--	73	0	--	--	--	--	--	--
JAN 15...	25	3.9	7.0	1.5	[illegible]	0	18	11	.2	9.8	130	116
APR 05...	27	4.0	7.6	1.6	86	0	15	14	.1	11	113	123
MAY 14...	12	1.7	3.0	1.0	41	0	3.7	3.4	.1	6.3	64	52
JUN 19...	16	2.3	2.6	1.4	48	--	17	2.9	.1	5.0	68	71
JUL 26...	20	2.4	3.0	1.7	66	0	9.2	1.5	.3	4.3	70	75
AUG 29...	17	2.5	2.5	1.5	53	0	16	2.3	.1	4.2	66	72
SEP 17...	19	2.7	2.6	1.5	56	0	17	2.3	.1	4.9	79	78

DATE	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)	NITRO-GEN, AMMONIA TOTAL (MG/L AS N)	NITRO-GEN, ORGANIC TOTAL (MG/L AS N)	NITRO-GEN, AM-MONIA + ORGANIC TOTAL (MG/L AS N)	NITRO-GEN, NH4 + ORG. SUSP. TOTAL (MG/L AS N)	NITRO-GEN, AM-MONIA + ORGANIC DIS. (MG/L AS N)	NITRO-GEN, TOTAL (MG/L AS N)	NITRO-GEN, DIS-SOLVED (MG/L AS N)	PHOS-PHORUS, TOTAL (MG/L AS P)	PHOS-PHORUS, DIS-SOLVED (MG/L AS P)	ARSENIC TOTAL (UG/L AS AS)
OCT 02...	--	--	--	--	--	--	--	--	--	--	--	--
DEC 20...	[illegible]	[illegible]	--	--	--	--	--	--	--	--	--	--
JAN 15...	.21	--	.06	.16	.22	.12	.10	.43	--	.02	.05	2
APR 05...	.21	--	.04	.03	.07	.00	.11	.28	--	.01	.02	--
MAY 14...	.58	--	.01	.16	1.17	.00	.21	.67	--	.01	.01	8
JUN 19...	.13	--	.04	1.2	1.2	.88	.32	1.3	--	.25	.00	10
JUL 26...	.09	--	.02	.45	.47	.46	.01	.56	--	.77	.01	--
AUG 29...	.07	--	.03	.40	.43	.31	.12	.50	--	.46	.00	--
SEP 17...	.08	.09	.01	.41	.42	.00	.42	.50	.51	.36	.01	11

DATE	ARSENIC SUS-PENDED TOTAL (UG/L AS AS)	ARSENIC DIS-SOLVED (UG/L AS AS)	BARIUM, TOTAL RECOV-ERABLE (UG/L AS BA)	BARIUM, SUS-PENDED RECOV-ERABLE (UG/L AS BA)	BARIUM, DIS-SOLVED (UG/L AS BA)	CADMIUM TOTAL RECOV-ERABLE (UG/L AS CD)	CADMIUM SUS-PENDED RECOV-ERABLE (UG/L AS CD)	CADMIUM DIS-SOLVED (UG/L AS CD)	CHRO-MIUM, TOTAL RECOV-ERABLE (UG/L AS CR)	CHRO-MIUM, SUS-PENDED RECOV. (UG/L AS CR)	CHRO-MIUM, DIS-SOLVED (UG/L AS CR)	COBALT, TOTAL RECOV-ERABLE (UG/L AS CO)
OCT 02...	--	--	--	--	--	--	--	--	--	--	--	--
DEC 20...	--	--	--	--	--	--	--	--	--	--	--	--
JAN 15...	--	1	0	0	40	0	0	1	0	0	10	1
APR 05...	--	--	--	--	--	--	--	--	--	--	--	--
MAY 14...	--	1	200	200	0	1	1	0	20	10	10	6
JUN 19...	--	2	200	200	0	1	0	1	30	20	10	7
JUL 26...	--	--	--	--	--	--	--	--	--	--	--	--
AUG 29...	--	--	--	--	--	--	--	--	--	--	--	--
SEP 17...	9	2	100	70	30	0	0	<1	40	30	10	8

15294350 SUSITNA RIVER AT SUSITNA STATION--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

DATE	COBALT, SUS-PENDED RECOV-ERABLE (UG/L AS CO)	COBALT, DIS-SOLVED (UG/L AS CO)	COPPER, TOTAL RECOV-ERABLE (UG/L AS CU)	COPPER, SUS-PENDED RECOV-ERABLE (UG/L AS CU)	COPPER, DIS-SOLVED (UG/L AS CU)	IRON, TOTAL RECOV-ERABLE (UG/L AS FE)	IRON, SUS-PENDED RECOV-ERABLE (UG/L AS FE)	IRON, DIS-SOLVED (UG/L AS FE)	LEAD, TOTAL RECOV-ERABLE (UG/L AS PB)	LEAD, SUS-PENDED RECOV-ERABLE (UG/L AS PB)	LEAD, DIS-SOLVED (UG/L AS PB)	MANGA-NESE, TOTAL RECOV-ERABLE (UG/L AS MN)
OCT 02...	--	--	--	--	--	--	--	--	--	--	--	--
DEC 20...	--	--	--	--	--	--	--	--	--	--	--	--
JAN 15...	0	<3	[illegible]	[illegible]	2	490	400	90	[illegible]	[illegible]	[illegible]	40
APR 05...	--	--	--	--	--	--	--	--	--	--	--	--
MAY 14...	6	0	25	21	4	14000	14000	170	60	60	0	10
JUN 19...	0	7	29	28	1	12000	12000	0	12	10	2	250
JUL 26...	--	--	--	--	--	--	--	--	--	--	--	--
AUG 29...	--	--	--	--	--	--	--	--	--	--	--	--
SEP 17...	5	<3	37	36	1	26000	--	40	16	14	2	580

DATE	MANGA-NESE, SUS-PENDED RECOV. (UG/L AS MN)	MANGA-NESE, DIS-SOLVED (UG/L AS MN)	MERCURY, TOTAL RECOV-ERABLE (UG/L AS HG)	MERCURY SUS-PENDED RECOV-ERABLE (UG/L AS HG)	MERCURY DIS-SOLVED (UG/L AS HG)	SELE-NIUM, TOTAL (UG/L AS SE)	SELE-NIUM, SUS-PENDED TOTAL (UG/L AS SE)	SELE-NIUM, DIS-SOLVED (UG/L AS SE)	SILVER, TOTAL RECOV-ERABLE (UG/L AS AG)	SILVER, SUS-PENDED RECOV-ERABLE (UG/L AS AG)	SILVER, DIS-SOLVED (UG/L AS AG)	ZINC, TOTAL RECOV-ERABLE (UG/L AS ZN)
OCT 02...	--	--	--	--	--	--	--	--	--	--	--	--
DEC 20...	--	--	--	--	--	--	--	--	--	--	--	--
JAN 15...	30	10	.1	.1	.0	1	0	1	1	1	0	10
APR 05...	--	--	--	--	--	--	--	--	--	--	--	--
MAY 14...	0	10	.2	.2	.0	1	1	0	0	0	0	50
JUN 19...	240	10	.1	.1	.0	1	0	1	0	0	0	60
JUL 26...	--	--	--	--	--	--	--	--	--	--	--	--
AUG 29...	--	--	--	--	--	--	--	--	--	--	--	--
SEP 17...	580	4	.1	.1	.0	1	1	0	0	0	0	80

DATE	ZINC, SUS-PENDED RECOV-ERABLE (UG/L AS ZN)	ZINC, DIS-SOLVED (UG/L AS ZN)	CARBON, ORGANIC DIS-SOLVED (MG/L AS C)	CARBON, ORGANIC SUS-PENDED TOTAL (MG/L AS C)	SEDI-MENT, SUS-PENDED (MG/L)	SEDI-MENT DIS-CHARGE, SUS-PENDED (T/DAY)
OCT 02...	--	--	--	--	--	--
DEC 20...	--	--	--	--	--	--
JAN 15...	7	3	9.3	.2	3	80
APR 05...	--	--	--	--	4	72
MAY 14...	40	10	6.8	1.8	E683	--
JUN 19...	50	10	.9	2.6	416	107000
JUL 26...	--	--	--	--	2370	1190000
AUG 29...	--	--	--	--	742	182000
SEP 17...	80	<3	.6	1.1	901	213000

E ESTIMATED

Attachment 4. List of parameters measured by R & M and USGS at Gold Creek. This is also an example of minimal USGS Water Quality analysis.

WATER QUALITY PARAMETERS TO BE MEASURED

PARAMETER	R&M	USGS	
FIELD:			
Dissolved Oxygen	X	X	
pH	X	X	
Specific Conductance	X	X	
Temperature	X	XX	X
Carbon Dioxide	X	X	
Alkalinity	X	X	
Settleable Solids	X		
LABORATORY:			
Turbidity	X		
Total Dissolved Solids	X	X	
Total Suspended Solids	X		
Total Phosphorous	X	X	
Ortho-Phosphate	X	X	
Kjeldahl Nitrogen	X		
Total Nitrogen	X		
Nitrate Nitrogen	X		
Ammonia Nitrogen	X		
Chemical Oxygen Demand	X		
Hardness	X		
Chloride	X		
Color	X		
Sulfate	X		
ICAP Scan	X		
Uranium	X		
Radioactivity, Gross Alpha	X		
Organic Chemicals	X		
Total Organic Carbon	X		
Total Inorganic Carbon	X		
Trace Metals		X	

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
Water Resources Division
733 W. Fourth Ave., Suite 400
Anchorage, Alaska 99501

Attachment 5.

March 31, 1981

Mr. Tom Trent
Susitna River Study
Department of Fish and Game
State of Alaska
2207 Spenard Road
Anchorage, Alaska 99503

Dear Mr. Trent:

This letter is in response to your recent request for cost estimates for the collection of additional water quality parameters at the two Susitna River stations downstream from Devils Canyon presently operated under the cooperative program with Alaska Power Authority. In order to provide the kinds of information needed for a hydrologic appraisal of the Susitna basin we feel strongly that the same types of data should also be collected at the Chulitna River site. The costs for the increased data collection are shown below and are broken down into periods to reflect our different Fiscal Years.

	April 1- June 30, 1981	July 1- September 30, 1981	October 1- June 30, 1982
Chulitna R	2,340	2,340	7,720
Susitna R at Gold Creek / Susitna R at Sunshine	4,120	4,120	9,100
Total	$6,460	$6,460	$16,820

These costs would be in addition to the present operating cost for these stations.

Listed below is a breakdown of the specific parameters that would be collected at each of the stations and the frequency of collection:

I. Nutrients + Organics. 8/year

NO_2 + NO_3 dissolved, NH_4 dissolved, NH_4 + Organic-N dissolved, NO_2 + NO_3 total, NH_4 total, NH_4 + Organic N total, Phosphorus dissolved total, Phosphorus total, dissolved organic Carbon, and suspended organic Carbon.

2. Inorganic Constituents. 8/year

Silica, Calcium, Magnesium, Sodium, Potassium, Sulphate, Chloride, Flouride, Turbidity, and dissolved solids (residue at 180°C).

3. Minor Elements (dissolved and total). 4/year

Arsenic, Barium, Cadmium, Chromium, Cobalt, Copper, Iron, Lead, Manganese, Mercury, Nickel, Selemium, and Zinc.

4. Field Parameters. 8/year

Specific conductance, alkalinity, pH, temperature, dissolved oxygen, and bacteria.

5. Suspended Sediment and complete particle size analysis. 8/year

Robert J. Madison
Acting District Chief

2 - LOWER SUSITNA STUDIES - OPEN WATER CALCULATIONS

2.1 - Introduction

The Lower Susitna River is considered to be the reach downstream of Talkeetna to Cook Inlet. At the confluence with the Chulitna and Talkeetna Rivers, the Susitna River changes abruptly from a meandering single channel configuration to a predominantly braided pattern. Upstream of Talkeetna to the proposed damsites, the Susitna River is being studied quite extensively under Subtask 3.06 - "Hydraulic and Ice Studies" and Subtask 3.07 - "Sediment Yield and River Morphology Studies". Downstream of Talkeetna, a reconnaissance level study is being carried out under Subtask 3.10.

A prime objective of this interim report is to quantify, as best as is practical, the potential changes in the flow regime during floods. Vegetation and habitat study personnel indicated that estimates of change in water levels during various floods would benefit their programs.

There are currently only two stations that have existing hydrologic data; Susitna River at Sunshine and Susitna Station. At these two reaches, the river is constricted into a single channel which is not representative of the predominantly braided river pattern. With respect to potential changes in water levels during various floods under pre and post-project conditions, these two stations would probably reflect the extreme case. Therefore, a third station was added to this study which would represent the flow regime in a braided reach. A sample section was selected 8,000 feet downstream of the Willow Creek confluence at the Delta Islands. This cross-section was synthesized from a reconnaissance field trip and hydraulic regime relationships which enabled estimating hydraulic characteristics under pre and post- project conditions. With three sections in the Lower River, it is possible to interpolate the following results to intermediate locations of interest.

2.2 - Summary

Variances in flow and stage in the Lower Susitna as a result of flow regulation are reasonably bounded by this analysis for open water floods. The magnitude of change for pre and post-project floods of 2, 5, 10 and 25 year recurrence interval can be estimated from this analysis. Since the data base is scant, the procedures utilized in this study were basic and perhaps oversimplified. However, generally the assumptions made were conservative and reflect higher changes in flow and stage than may occur.

A summary comparing each station is presented on Table 2.1. At Sunshine, the stage in the river is expected to be 1.2 to 0.8 feet lower during floods with a recurrence interval of 2 to 25 years. At Susitna Station, a change in stage for the same flood intervals could vary from 1.3 feet to 1.1 feet. Comparing these two stations to the Delta Island Station shows that the potential decrease in stage for a braided section would be less at just below 2 feet. Since the rivers width increases more with an increase in stage, this is expected for a braided reach.

Based on these three points, estimates of post project stage changes could be made for intermediate river reaches. Sunshine is representative of an upstream constriction, Susitna station represents a narrow downstream section, and the Delta Island is representative of a broad braided reach. Therefore, other river reaches would have stage changes equal to or less than Sunshine or Susitna station and equal to or greater than the Delta Island section, depending on the characteristics of the river reach being considered.

Local variances in river reaches and effects of debris jamming, transitional channel changes and other natural influences could distort these results. However, for the purposes of establishing guidelines, it can generally be stated that stages after flow regulation will be 0.7 to 1.5 feet lower during floods, depending on the reach of river under consideration.

Additional field data, that is scheduled to be collected during the 1981 open water season, should provide sufficient information to carry this study through another degree of refinement. Proposed activities for 1981 consist of:

- Breakup observations by Acres, R&M, TES.
- Vertical aerial photography on 3" x5" prints at various water levels.
- Continuous stream gaging by USGS on the Susitna River at Sunshine and Susitna Station and on the Yentna River.
- Staff gage installation and monitoring by ADF&G.
- Field observations by hydrologists, aquatic biologists, terrestial biologists, etc.
- River Regime studies by R&M and Acres.

TABLE 2.1

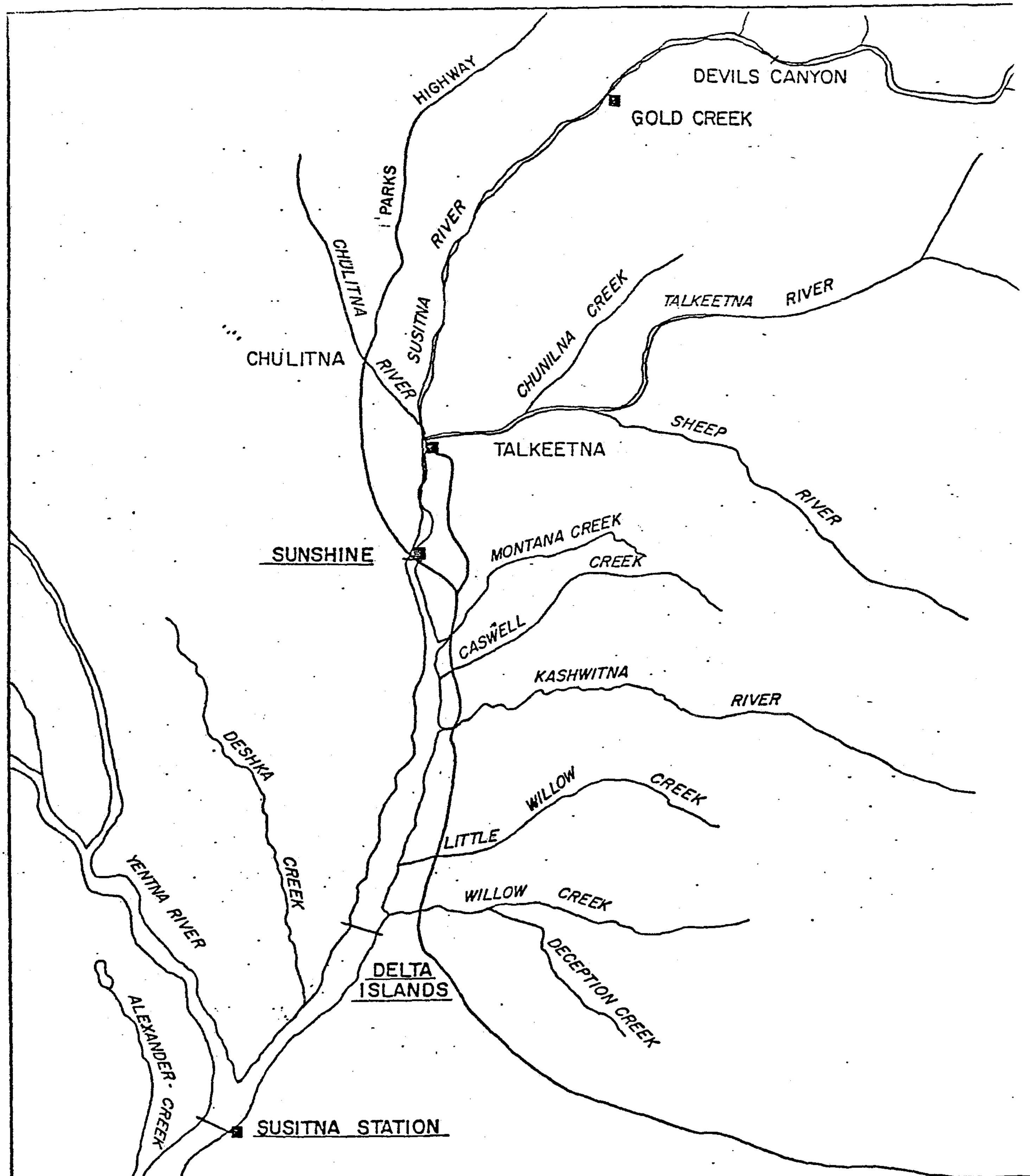
REVISED TENTATIVE ESTIMATES OF PRE AND POST PROJECT
DISCHARGE AND STAGE FREQUENCY ANALYSIS

PREPROJECT			POSTPROJECT					
			LOWER LIMIT (= TURBINE DISCHARGE)			BEST ESTIMATE		
RECURRENCE INTERVAL YRS	DISCHARGE (CFS)	STAGE (FT)	DISCHARGE (CFS)	GAGE HEIGHT (FT)	PERCENT CHANGE IN DEPTH OF FLOW	DISCHARGE (CFS)	GAGE HEIGHT (FT)	PERCENT CHANGE IN DEPTH OF FLOW
A. Susitna River Below Watana Dam Site (Installed Capacity 800 MW)								
2	42,000		16,000			20,000		
5	54,000		16,000			30,000		
10	63,000		16,000			40,000		
25	75,000		16,000			52,000		
B. Susitna River Below Devil Canyon Dam Site (Installed Capacity 600 MW)								
2	47,000		16,000			25,000		
5	61,000		16,000			37,000		
10	71,000		16,000			48,000		
25	84,000		16,000			61,000		
C. Susitna River at Gold Creek								
2	50,000	13.5	19,000	9.8	3	28,000	11.1	17
5	66,000	14.8	21,000	10.1	3	42,000	12.8	14
10	78,000	15.7	23,000	10.4	3	55,000	14.0	11
25	92,000	16.7	24,000	10.6	4	69,000	15.1	10

TABLE 2.1

REVISED TENTATIVE ESTIMATES OF PRE AND POST PROJECT DISCHARGE AND STAGE FREQUENCY ANALYSIS

	PREPROJECT		POSTPROJECT					
			LOWER LIMIT (= TURBINE DISCHARGE)			BEST ESTIMATE		
RECURRENCE INTERVAL YRS	DISCHARGE (CFS)	STAGE (FT)	DISCHARGE (CFS)	GAGE HEIGHT (FT)	PERCENT CHANGE IN DEPTH OF FLOW	DISCHARGE (CFS)	GAGE HEIGHT (FT)	PERCENT CHANGE IN DEPTH OF FLOW
D. Susitna River at Sunshine Station								
2	96,000	57.9	65,000	56.0	8	74,000	56.7	5
5	125,000	59.2	80,000	57.1	8	101,000	58.1	4
10	146,000	60.0	91,000	57.7	8	123,000	59.1	3
25	176,000	61.0	108,000	58.4	9	153,000	60.2	3
E. Susitna River at Delta Islands								
2	105,000	94.6	74,000	92.9	11	83,000	93.3	8
5	136,000	95.6	91,000	93.8	11	112,000	94.8	5
10	159,000	96.3	104,000	94.5	14	136,000	95.6	4
25	193,000	97.3	121,000	95.2	11	170,000	96.6	4
F. Susitna River at Susitna Station								
2	157,000	16.8	126,000	15.0	5	136,000	15.5	3
5	204,000	19.1	159,000	16.9	5	180,000	17.9	3
10	239,000	20.5	184,000	18.1	6	216,000	19.6	2
25	289,000	23.0	217,000	19.7	7	266,000	21.9	2



LOCATION MAP
LOWER SUSITNA RIVER

R&M
R&M CONSULTANTS, INC.
ENGINEERS · GEOLOGISTS PLANNERS SURVEYORS

ACRES

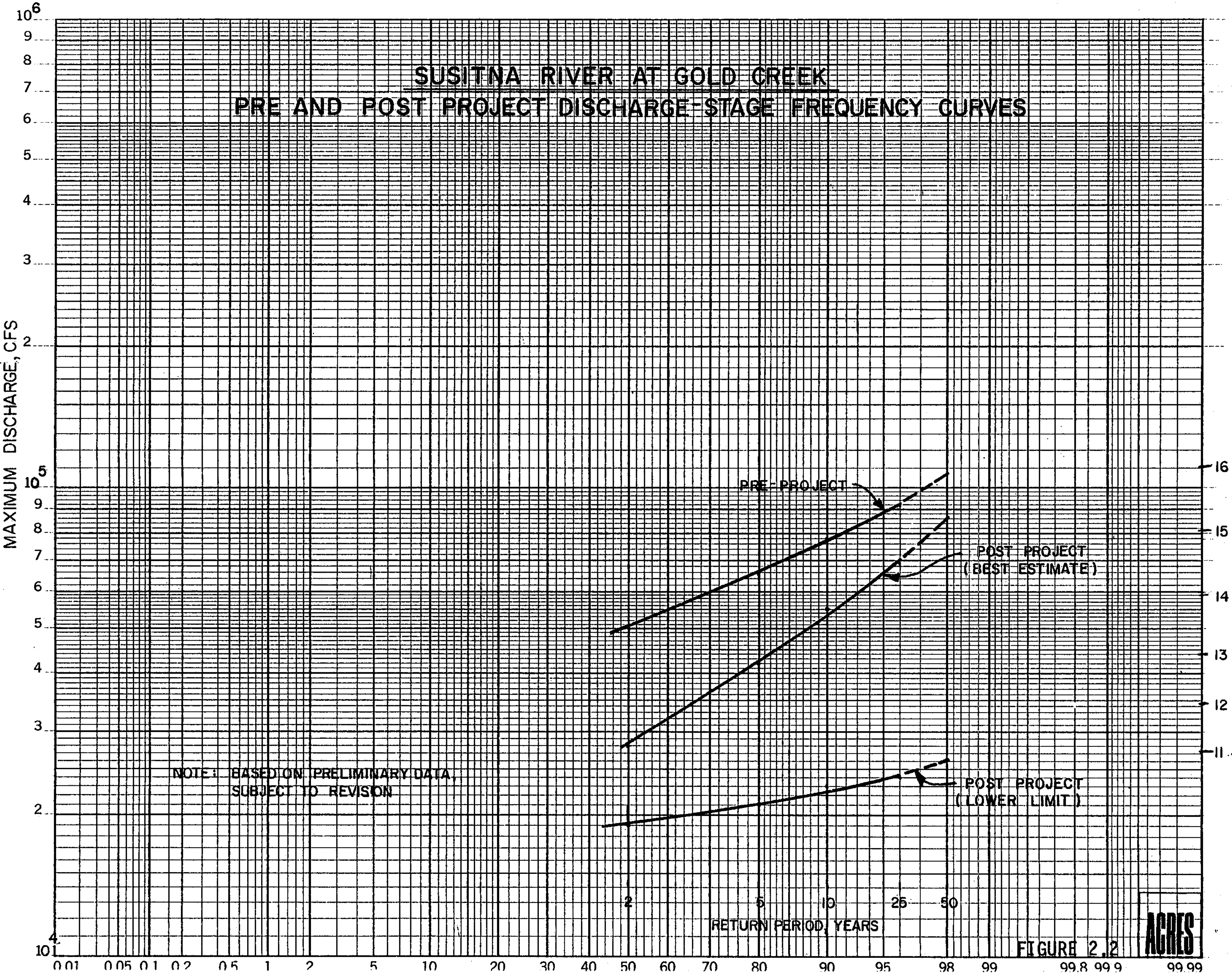
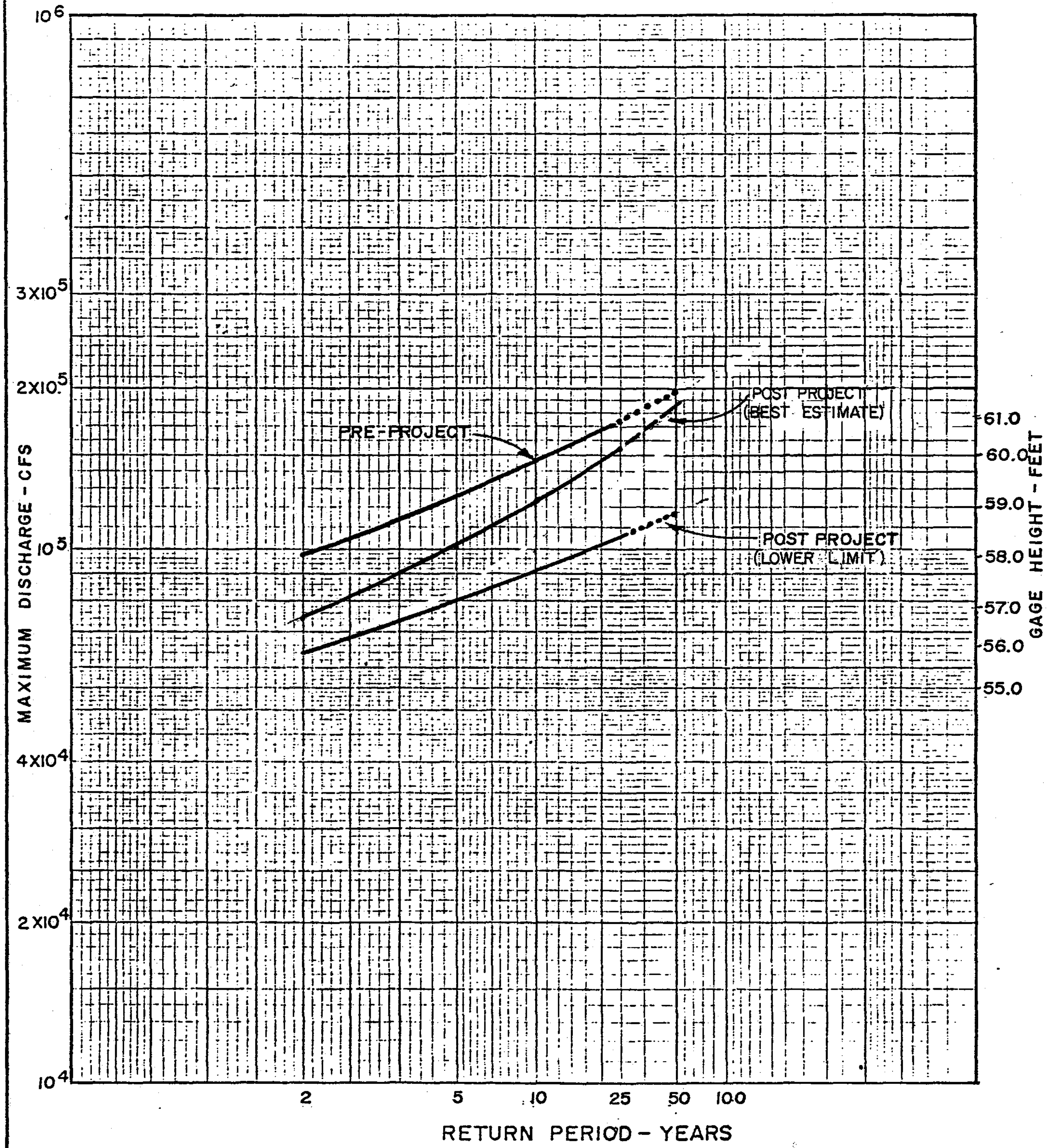


FIGURE 2.2

ACRES



NOTE: BASED ON PRELIMINARY DATA, SUBJECT TO REVISION

ACRES

ALASKA POWER AUTHORITY

SUSITNA HYDROELECTRIC PROJECT

SUSITNA RIVER AT SUNSHINE
PRE AND POST PROJECT
DISCHARGE-STAGE FREQUENCY CURVES

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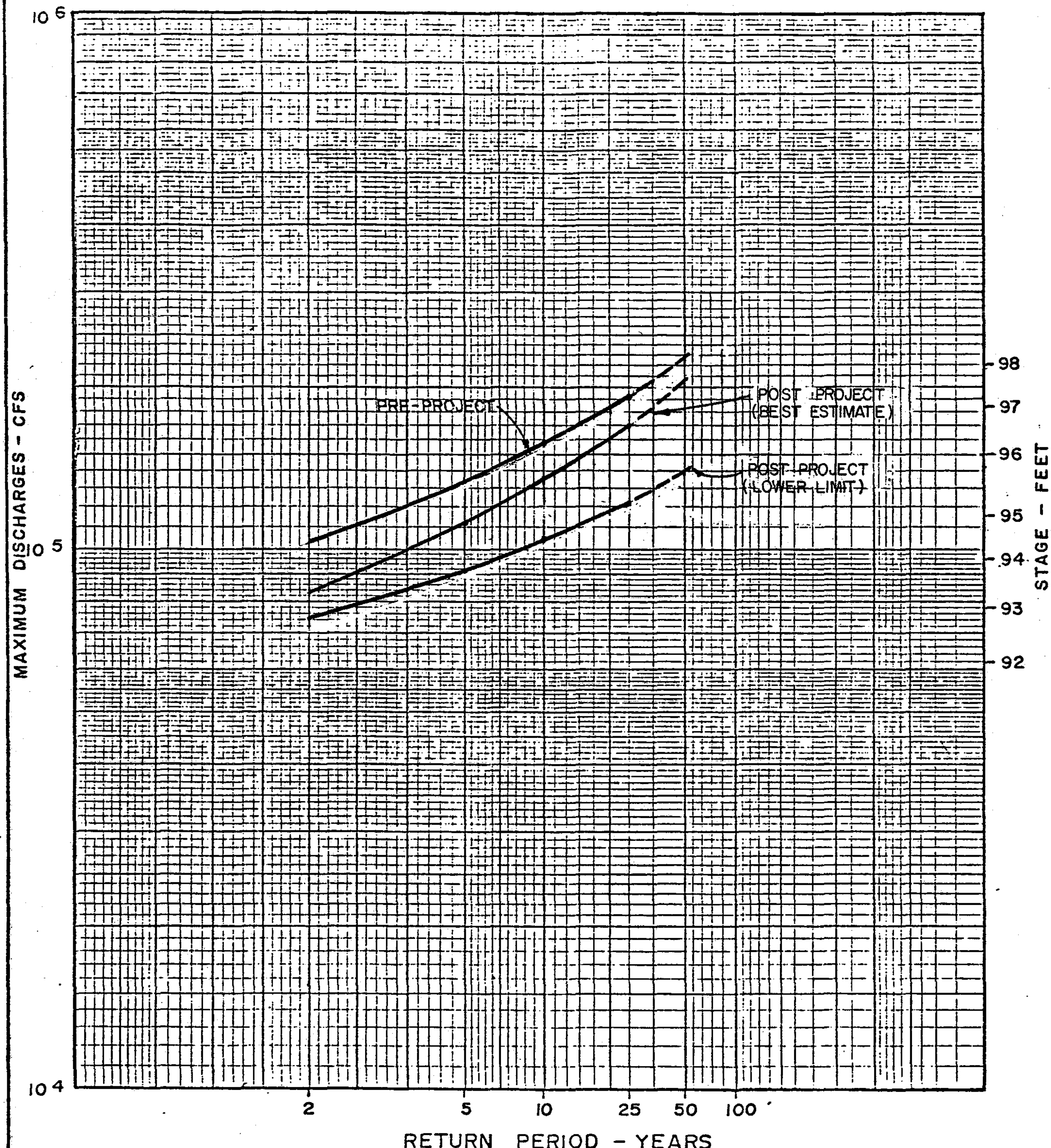
MARCH 1981

2.3



NOTE: BASED ON PRELIMINARY
DATA, SUBJECT TO REVISION

ACRES

ALASKA POWER AUTHORITY

SUSITNA HYDROELECTRIC PROJECT

SUSITNA RIVER AT DELTA ISLANDS
PRE AND POST PROJECT
DISCHARGE-STAGE FREQUENCY CURVE

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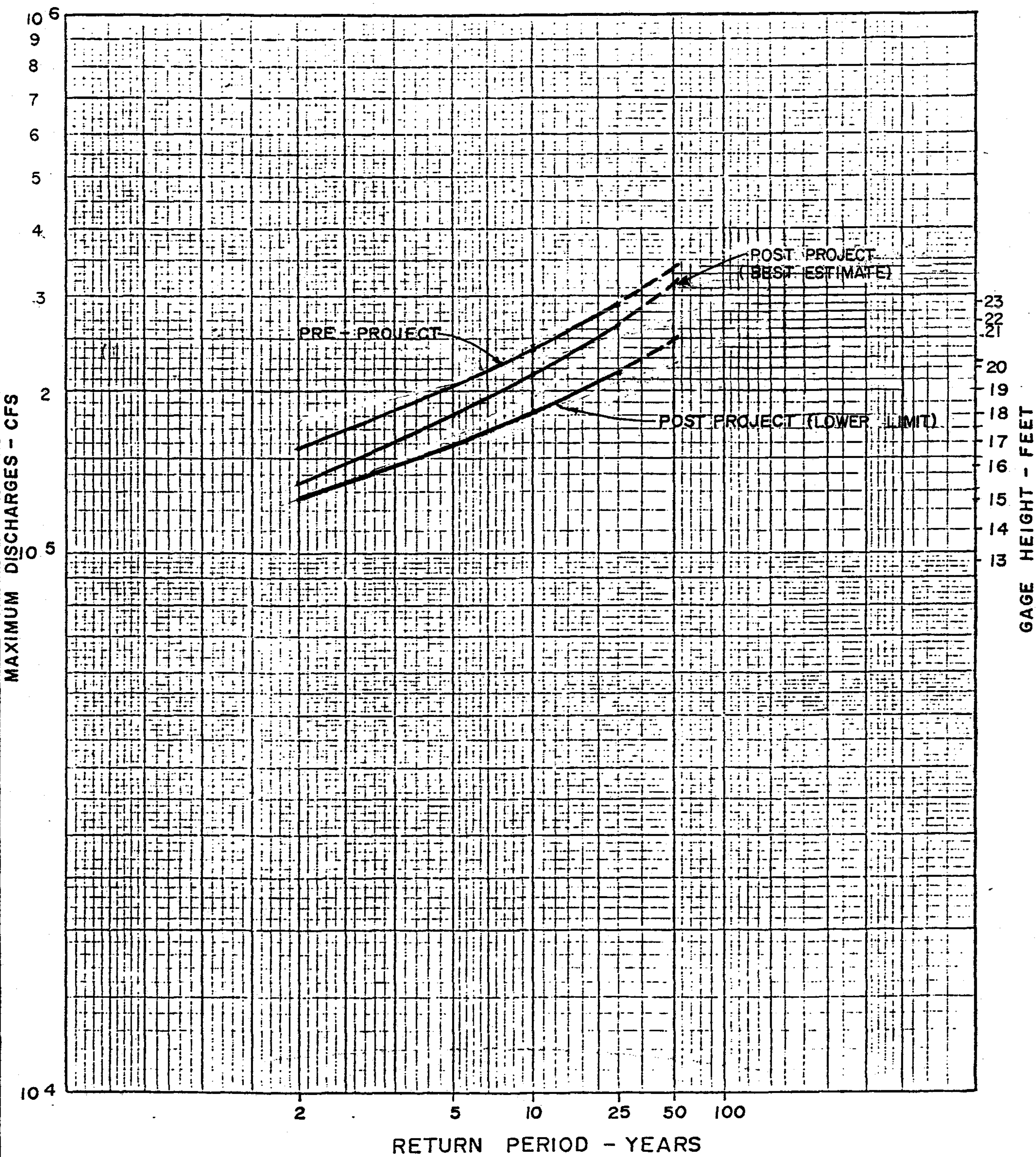
ENGINEERS GEOLOGISTS PLANNERS SURVEYORS

MARCH 1981

Z.4



NOTE: BASED ON PRELIMINARY DATA, SUBJECT TO REVISION

ACRES

ALASKA POWER AUTHORITY

SUSITNA HYDROELECTRIC PROJECT

SUSITNA RIVER AT SUSITNA STATION
PRE AND POST PROJECT
DISCHARGE - STAGE FREQUENCY CURVE

R&M CONSULTANTS, INC.
ENGINEERS GEOLOGISTS PLANNERS SURVEYORS

MARCH 1981 | 2.5

3 - RIVER MORPHOLOGY AND SEDIMENT YIELD

Details of the proposed morphology and sediment yield studies are included in the Minutes of the May 7, 1981 meeting presented in Section 2.

4 - ENERGY SIMULATION RUNS - TYPICAL COMPUTER OUTPUTS

Typical computer plots and outputs of energy and reservoir conditions for Watana (400 MW) and Watana plus Devil Canyon (800 + 600 MW) are presented in the following pages. These simulation runs were based on maximizing firm power from the development schemes and do not impose restriction on the drawdown limits for the reservoirs.

DEVELOPMENT: WATANA 400 MW[1]: MONTHLY ENERGY, GWH

OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
250.3	285.9	308.6	283.3	267.9	240.4	216.0	199.9	198.0	197.5	207.2	223.0
250.8	283.9	308.0	283.1	267.8	240.2	216.1	200.9	199.3	198.2	207.2	290.2
250.3	285.8	308.8	283.6	268.2	240.5	216.1	198.8	199.3	200.6	289.6	291.8
250.8	286.7	309.0	283.4	268.0	240.4	216.3	201.9	200.9	198.2	291.1	291.8
250.2	285.5	308.4	283.4	268.1	240.4	216.1	200.8	199.6	197.7	287.7	291.8
250.1	285.5	308.7	283.6	268.3	240.6	216.2	199.5	199.7	200.7	290.7	291.8
250.2	285.5	308.4	283.2	267.9	240.4	216.0	201.1	201.9	286.6	291.8	291.8
250.2	285.7	308.9	283.7	268.3	240.7	216.2	200.4	200.7	199.8	291.1	291.8
250.7	286.6	309.4	284.0	268.4	240.7	216.4	200.5	199.8	198.9	291.2	219.7
250.0	285.4	308.4	283.4	268.1	240.5	216.1	200.4	198.9	198.3	287.8	291.8
250.5	286.1	308.9	283.7	268.3	240.7	216.3	201.2	198.3	196.7	288.1	291.8
250.7	286.4	309.1	284.0	268.6	240.9	216.7	201.7	200.9	288.0	291.8	291.8
250.3	285.9	308.9	283.8	268.4	240.8	216.5	200.9	203.7	290.8	291.8	291.8
250.6	286.3	309.0	283.7	268.3	240.7	216.2	201.8	200.8	286.7	291.8	291.8
250.5	285.9	308.5	283.3	268.0	240.4	216.0	198.5	203.6	289.3	291.8	277.1
250.4	286.0	308.7	283.3	268.0	240.5	216.3	200.7	199.8	199.6	290.8	291.8
250.5	285.9	308.4	283.4	268.1	240.6	216.4	199.7	200.1	199.1	288.8	291.8
249.9	285.0	308.2	283.3	268.1	240.5	216.1	201.0	201.2	200.2	291.2	291.8
250.1	285.6	308.7	283.8	268.5	241.0	216.6	201.3	201.4	287.6	291.8	263.8
249.9	285.0	308.1	283.0	267.8	240.3	216.2	200.2	197.5	195.8	203.7	219.6
257.3	275.4	307.2	282.2	266.2	237.9	213.7	199.4	198.9	198.7	207.9	222.7
263.5	288.4	307.0	280.4	264.1	236.7	212.8	195.8	201.8	206.2	213.2	227.9
260.8	288.5	308.1	282.9	266.6	238.2	214.1	202.2	205.4	201.8	207.6	224.2
254.6	280.3	308.2	283.0	267.7	240.2	215.6	199.3	199.9	198.9	206.8	223.5
254.3	279.5	307.8	282.7	267.4	239.9	215.0	200.9	199.3	196.3	205.5	222.7
257.9	275.5	307.7	282.6	267.0	238.6	214.0	200.4	203.6	202.7	207.9	224.1
254.6	281.3	308.0	282.8	267.6	240.1	215.9	199.9	199.0	198.0	207.1	223.0
254.8	279.1	308.3	283.1	267.8	240.3	215.5	199.6	202.5	201.8	207.3	223.9
251.6	285.3	309.1	283.8	268.4	240.8	216.5	200.8	198.9	197.5	206.0	222.0
250.6	284.8	308.5	283.4	268.1	240.6	216.3	201.1	200.6	200.5	291.7	291.8

1 Reservoir Drawdown Unconstrained

DEVELOPMENT: WATANA 400 MW[1]: MONTHLY INFLOW, FT^3/S

OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
4719.9	2083.6	1168.9	815.1	641.7	569.1	680.1	8655.9	16432.1	19193.4	16913.6	7320.4
3299.1	1107.3	906.2	808.0	673.0	619.8	1302.2	11649.8	18517.9	19786.6	16478.0	17205.5
4592.9	2170.1	1501.0	1274.5	841.0	735.0	803.9	4216.5	25773.4	22110.9	17356.3	11571.0
6285.7	2756.8	1281.2	818.9	611.7	670.7	1382.0	15037.2	21469.8	17355.3	16681.6	11513.5
4218.9	1599.6	1183.8	1087.8	803.1	638.2	942.6	11696.8	19476.7	16983.6	20420.6	9165.5
3859.2	2051.1	1549.5	1388.3	1050.5	886.1	940.8	6718.1	24881.4	23787.9	23537.0	13447.8
4102.3	1588.1	1038.6	816.9	754.8	694.4	718.3	12953.3	27171.8	25831.3	19153.4	13194.4
4208.0	2276.6	1707.0	1373.0	1189.0	935.0	945.1	10176.2	25275.0	19948.9	17317.7	14841.1
6034.9	2935.9	2258.5	1480.6	1041.7	973.5	1265.4	9957.8	22097.8	19752.7	18843.4	5978.7
3668.0	1729.5	1115.1	1081.0	949.0	694.0	885.7	10140.6	18329.6	20493.1	23940.4	12466.9
5165.5	2213.5	1672.3	1400.4	1138.9	961.1	1069.9	13044.2	13233.4	19506.1	19323.1	16085.6
6049.3	2327.8	1973.2	1779.9	1304.8	1331.0	1965.0	13637.9	22784.1	19839.8	19480.2	10146.2
4637.6	2263.4	1760.4	1608.9	1257.4	1176.8	1457.4	11333.5	36017.1	23443.7	19887.1	12746.2
5560.1	2508.9	1708.9	1308.9	1184.7	883.6	776.6	15299.2	20663.4	28767.4	21011.4	10800.0
5187.1	1789.1	1194.7	852.0	781.6	575.2	609.2	3578.8	42841.9	20082.8	14048.2	7524.2
4759.4	2368.2	1070.3	863.0	772.7	807.3	1232.4	10966.0	21213.0	23235.9	17394.1	16225.6
5221.2	1565.3	1203.6	1060.4	984.7	984.7	1338.4	7094.1	25939.6	16153.5	17390.9	9214.1
3269.8	1202.2	1121.6	1102.2	1031.3	889.5	849.7	12555.5	24711.9	21987.3	26104.5	13672.9
4019.0	1934.3	1704.2	1617.6	1560.4	1560.4	1576.7	12826.7	25704.0	22082.8	14147.5	7163.6
3135.0	1354.9	753.9	619.2	607.5	686.0	1261.6	9313.7	13962.1	14843.5	7771.9	4260.0
2403.1	1020.9	709.3	636.2	602.1	624.1	986.4	9536.4	14399.0	18410.1	16263.8	7224.1
3768.0	2496.4	1687.4	1097.1	777.4	717.1	813.7	2857.2	27612.8	21126.4	27446.6	12188.9
4979.1	2587.0	1957.4	1670.9	1491.4	1366.0	1305.4	15973.1	27429.3	19820.3	17509.5	10955.7
4301.2	1977.9	1246.5	1031.5	1000.2	873.9	914.1	7287.0	23859.3	16351.1	18016.7	8099.7
3056.5	1354.7	931.6	786.4	689.9	627.3	871.9	12889.0	14780.6	15971.9	13523.7	9786.2
3088.8	1474.4	1276.7	1215.8	1110.3	1041.4	1211.2	11672.2	26689.2	23430.4	15126.6	13075.3
5679.1	1601.1	876.2	757.8	743.2	690.7	1059.8	8938.8	19994.0	17015.3	18393.5	5711.5
2973.5	1926.7	1687.5	1348.7	1202.9	1110.8	1203.4	8569.4	31352.8	19707.3	16807.3	10613.1
5793.9	2645.3	1979.7	1577.9	1267.7	1256.7	1408.4	11231.5	17277.2	18385.2	13412.1	7132.6
3773.9	1944.9	1312.6	1136.8	1055.4	1101.2	1317.9	12369.3	22904.8	24911.7	16670.7	9096.7

1 Reservoir Drawdown Unconstrained

DEVELOPMENT: WATANA 400 MW[1]: MONTHLY TURBINE FLOW, FT^3/S

OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
6816.0	7858.4	8624.6	8066.1	7770.9	7097.2	6484.4	6027.0	5863.7	5668.1	5762.5	6108.8
6865.4	7901.1	8730.8	8181.5	7889.2	7209.3	6590.0	6123.0	5929.7	5693.1	5767.9	7925.6
6816.0	7859.6	8626.4	8063.6	7760.6	7081.5	6466.5	6007.4	5878.4	5645.2	7925.6	7925.6
6816.0	7843.4	8584.2	8019.3	7723.0	7052.0	6441.0	5978.8	5761.2	5487.9	7925.6	7925.6
6816.0	7863.2	8640.5	8086.2	7788.1	7109.6	6494.2	6033.7	5844.2	5604.4	7925.6	7925.6
6816.0	7866.7	8643.4	8080.7	7776.1	7093.2	6474.5	6012.8	5862.9	5618.6	7925.6	7925.6
6816.0	7864.4	8643.1	8090.3	7796.3	7120.3	6504.3	6044.7	5847.0	7925.6	7925.6	7925.6
6816.0	7863.3	8633.5	8067.3	7761.3	7078.1	6458.6	5997.2	5820.1	5550.4	7925.6	7925.6
6816.0	7845.8	8587.6	8011.1	7698.9	7019.5	6404.1	5942.0	5764.9	5522.7	7925.6	5978.7
6816.0	7868.5	8650.9	8095.7	7798.3	7118.0	6500.4	6039.7	5862.9	5642.1	7925.6	7925.6
6816.0	7854.2	8613.7	8049.3	7743.3	7061.3	6442.9	5980.9	5781.0	5579.8	7925.6	7925.6
6816.0	7845.7	8593.7	8025.8	7713.3	7028.1	6407.1	5936.6	5726.3	7925.6	7925.6	7925.6
6816.0	7859.2	8624.5	8058.2	7749.4	7064.0	6442.7	5975.9	5786.3	7925.6	7925.6	7925.6
6816.0	7850.4	8602.2	8034.8	7729.5	7048.6	6431.2	5972.6	5757.8	7925.6	7925.6	7925.6
6816.0	7854.0	8617.8	8062.2	7766.3	7091.3	6477.6	6020.9	5898.7	7925.6	7925.6	7524.2
6816.0	7858.1	8620.7	8060.5	7765.8	7090.8	6475.2	6011.7	5826.1	5579.8	7925.6	7925.6
6816.0	7853.6	8619.4	8066.0	7767.9	7089.0	6470.2	6004.7	5848.8	5594.7	7925.6	7925.6
6816.0	7872.4	8665.1	8114.7	7817.1	7134.8	6513.9	6051.4	5855.6	5570.6	7925.6	7925.6
6816.0	7865.2	8641.2	8078.2	7769.8	7080.5	6452.4	5981.2	5779.1	7925.6	7925.6	7163.6
6816.0	7873.7	8666.4	8118.1	7829.0	7154.5	6538.0	6072.8	5899.3	5716.3	5862.5	6320.8
7244.5	8126.6	9256.7	8696.1	8412.2	7732.1	7138.4	6708.5	6544.6	6296.6	6361.3	6719.3
7566.0	8861.1	9639.3	9061.6	8821.4	8175.1	7583.8	7155.0	7107.8	6741.9	6565.6	6763.5
7395.2	8623.2	9378.6	8786.7	8477.3	7780.5	7171.8	6726.8	6470.5	6027.4	5997.8	6345.1
7062.0	8004.7	8957.9	8388.8	8091.7	7396.6	6762.7	6296.7	6144.5	5883.7	5939.9	6308.2
7066.9	8019.9	9000.5	8440.3	8149.6	7457.3	6825.7	6373.3	6169.2	5924.1	6058.6	6473.3
7262.9	8129.8	9258.7	8686.2	8389.0	7690.0	7078.8	6640.7	6444.4	6056.9	5998.8	6336.3
7035.8	7976.2	8896.4	8337.2	8046.6	7358.9	6730.9	6260.1	6089.9	5855.4	5939.3	6298.9
7095.8	8037.2	9034.1	8458.3	8153.4	7450.2	6809.6	6345.1	6182.4	5841.6	5813.0	6159.3
6867.4	7878.2	8662.7	8089.0	7778.2	7091.5	6467.9	5999.8	5811.0	5592.2	5686.6	6061.8
6844.2	7884.1	8683.5	8122.9	7823.1	7140.0	6516.8	6048.7	5850.8	5580.5	7925.6	7925.6

1 Reservoir Drawdown Unconstrained

DEVELOPMENT: WATANA 400 MW[1]: MONTHLY DOWNSTREAM FLOW, FT^3/S

OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
6816.0	7858.4	8624.6	8066.1	7770.9	7097.2	6484.4	6027.0	5863.7	5668.1	5762.5	6108.8
6865.4	7901.1	8730.8	8181.5	7889.2	7209.3	6590.0	6123.0	5929.7	5693.1	5767.9	12518.6
6816.0	7859.6	8626.4	8063.6	7760.6	7081.5	6466.5	6007.4	5878.4	5645.2	11170.3	11571.0
6816.0	7843.4	8584.2	8019.3	7723.0	7052.0	6441.0	5978.8	5761.2	5487.9	14644.1	11513.5
6816.0	7863.2	8640.5	8086.2	7788.1	7109.6	6494.2	6033.7	5844.2	5604.4	8771.8	9165.5
6816.0	7866.7	8643.4	8080.7	7776.1	7093.2	6474.5	6012.8	5862.9	5618.6	20405.2	13447.8
6816.0	7864.4	8643.1	8090.3	7796.3	7120.3	6504.3	6044.7	5847.0	10943.4	19153.4	13194.4
6816.0	7863.3	8633.5	8067.3	7761.3	7078.1	6458.6	5997.2	5820.1	5550.4	15305.7	14841.1
6816.0	7845.8	8587.6	8011.1	7698.9	7019.5	6404.1	5942.0	5764.9	5522.7	17029.7	5978.7
6816.0	7868.5	8650.9	8095.7	7798.3	7118.0	6500.4	6039.7	5862.9	5642.1	12633.6	12466.9
6816.0	7854.2	8613.7	8049.3	7743.3	7061.3	6442.9	5980.9	5781.0	5579.8	8806.1	16085.6
6816.0	7845.7	8593.7	8025.8	7713.3	7028.1	6407.1	5936.6	5726.3	8900.2	19480.2	10146.2
6816.0	7859.2	8624.5	8058.2	7749.4	7064.0	6442.7	5975.9	5786.3	20580.1	19887.1	12746.2
6816.0	7850.4	8602.2	8034.8	7729.5	7048.6	6431.2	5972.6	5757.8	14418.5	21011.4	10800.0
6816.0	7854.0	8617.8	8062.2	7766.3	7091.3	6477.6	6020.9	5898.7	12887.7	14048.2	7524.2
6816.0	7858.1	8620.7	8060.5	7765.8	7090.8	6475.2	6011.7	5826.1	5579.8	14577.7	16225.6
6816.0	7853.6	8619.4	8066.0	7767.9	7089.0	6470.2	6004.7	5848.8	5594.7	8806.1	9214.1
6816.0	7872.4	8665.1	8114.7	7817.1	7134.8	6513.9	6051.4	5855.6	5570.6	24414.0	13672.9
6816.0	7865.2	8641.2	8078.2	7769.8	7080.5	6452.4	5981.2	5779.1	10122.6	14147.5	7163.6
6816.0	7873.7	8666.4	8118.1	7829.0	7154.5	6538.0	6072.8	5899.3	5716.3	5862.5	6320.8
7244.5	8126.6	9256.7	8696.1	8412.2	7732.1	7138.4	6708.5	6544.6	6296.6	6361.3	6719.3
7566.0	8861.1	9639.3	9061.6	8821.4	8175.1	7583.8	7155.0	7107.8	6741.9	6565.6	6763.5
7395.2	8623.2	9378.6	8786.7	8477.3	7780.5	7171.8	6726.8	6470.5	6027.4	5997.8	6345.1
7062.0	8004.7	8957.9	8388.8	8091.7	7396.6	6762.7	6296.7	6144.5	5883.7	5939.9	6308.2
7066.9	8019.9	9000.5	8440.3	8149.6	7457.3	6825.7	6373.3	6169.2	5924.1	6058.6	6473.3
7262.9	8129.8	9258.7	8686.2	8389.0	7690.0	7078.8	6640.7	6444.4	6056.9	5998.8	6336.3
7035.8	7976.2	8896.4	8337.2	8046.6	7358.9	6730.9	6260.1	6089.9	5855.4	5939.3	6298.9
7095.8	8037.2	9034.1	8458.3	8153.4	7450.2	6809.6	6345.1	6182.4	5841.6	5813.0	6159.3
6867.4	7878.2	8662.7	8089.0	7778.2	7091.5	6467.9	5999.8	5811.0	5592.2	5686.6	6061.8
6844.2	7884.1	8683.5	8122.9	7823.1	7140.0	6516.8	6048.7	5850.8	5580.5	16309.3	9096.7

1 Reservoir Drawdown Unconstrained

DEVELOPMENT: WATANA 400 MW[1]: MONTHLY RESERVOIR ELEVATION, FT

OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
2198.	2191.	2179.	2166.	2153.	2141.	2130.	2127.	2139.	2161.	2183.	2194.
2194.	2182.	2169.	2156.	2143.	2130.	2120.	2120.	2136.	2160.	2182.	2196.
2198.	2191.	2180.	2167.	2155.	2143.	2132.	2126.	2142.	2174.	2195.	2200.
2200.	2195.	2183.	2170.	2158.	2146.	2135.	2139.	2161.	2186.	2198.	2200.
2198.	2190.	2178.	2165.	2152.	2140.	2129.	2129.	2147.	2169.	2190.	2200.
2197.	2190.	2178.	2166.	2154.	2142.	2132.	2127.	2145.	2178.	2197.	2200.
2198.	2190.	2177.	2164.	2151.	2139.	2128.	2129.	2154.	2187.	2200.	2200.
2198.	2190.	2179.	2167.	2155.	2144.	2133.	2132.	2153.	2184.	2198.	2200.
2199.	2194.	2184.	2173.	2161.	2150.	2140.	2139.	2157.	2184.	2198.	2198.
2197.	2189.	2177.	2164.	2151.	2139.	2129.	2127.	2142.	2167.	2190.	2200.
2199.	2192.	2181.	2169.	2157.	2145.	2135.	2137.	2150.	2169.	2191.	2200.
2199.	2194.	2183.	2171.	2160.	2149.	2140.	2143.	2165.	2190.	2200.	2200.
2198.	2191.	2180.	2168.	2157.	2145.	2136.	2136.	2168.	2197.	2200.	2200.
2199.	2193.	2182.	2170.	2158.	2147.	2136.	2139.	2161.	2187.	2200.	2200.
2199.	2192.	2180.	2167.	2154.	2142.	2131.	2123.	2154.	2194.	2200.	2200.
2198.	2191.	2180.	2167.	2154.	2142.	2132.	2131.	2150.	2179.	2198.	2200.
2199.	2192.	2179.	2166.	2154.	2143.	2132.	2129.	2148.	2175.	2192.	2200.
2197.	2188.	2175.	2162.	2150.	2138.	2127.	2128.	2151.	2182.	2199.	2200.
2198.	2190.	2178.	2166.	2155.	2144.	2135.	2137.	2161.	2189.	2200.	2200.
2197.	2188.	2175.	2161.	2148.	2136.	2125.	2123.	2133.	2149.	2159.	2158.
2174.	2142.	2128.	2113.	2097.	2079.	2062.	2058.	2072.	2095.	2117.	2127.
2160.	2115.	2101.	2083.	2063.	2043.	2025.	2011.	2032.	2075.	2113.	2138.
2169.	2133.	2121.	2108.	2093.	2076.	2061.	2065.	2099.	2133.	2156.	2170.
2185.	2164.	2152.	2138.	2125.	2113.	2102.	2097.	2114.	2140.	2160.	2172.
2183.	2161.	2148.	2134.	2120.	2107.	2094.	2094.	2110.	2127.	2142.	2152.
2174.	2141.	2128.	2114.	2100.	2084.	2069.	2068.	2096.	2133.	2157.	2171.
2187.	2169.	2156.	2142.	2129.	2116.	2105.	2103.	2117.	2140.	2161.	2172.
2182.	2158.	2146.	2133.	2121.	2109.	2097.	2093.	2119.	2154.	2177.	2191.
2196.	2188.	2177.	2165.	2154.	2143.	2133.	2133.	2148.	2170.	2188.	2196.
2196.	2186.	2174.	2161.	2149.	2138.	2128.	2129.	2150.	2182.	2200.	2200.

1 Reservoir Drawdown Unconstrained

DEVELOPMENT:WATANA 800 MW[1]: MONTHLY ENERGY, GWH

OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANN
259.	311.	339.	309.	292.	258.	225.	183.	174.	170.	189.	230.	2938.
269.	312.	337.	306.	288.	255.	221.	185.	181.	175.	186.	236.	2951.
266.	310.	338.	308.	292.	258.	226.	199.	141.	162.	331.	418.	3249.
256.	309.	338.	309.	292.	259.	226.	171.	150.	178.	480.	416.	3384.
261.	311.	338.	309.	291.	258.	224.	156.	149.	171.	276.	331.	3075.
260.	309.	337.	307.	290.	258.	225.	185.	157.	168.	581.	485.	3561.
267.	313.	339.	309.	290.	256.	224.	165.	147.	312.	581.	476.	3679.
259.	308.	337.	308.	290.	257.	225.	176.	159.	173.	498.	536.	3527.
253.	306.	333.	307.	292.	260.	226.	184.	172.	175.	548.	225.	3282.
264.	311.	337.	307.	289.	256.	223.	153.	157.	159.	419.	450.	3325.
262.	310.	337.	307.	291.	258.	226.	185.	183.	170.	212.	566.	3306.
258.	310.	335.	305.	290.	256.	222.	177.	143.	260.	581.	366.	3503.
263.	312.	338.	308.	291.	258.	225.	200.	137.	579.	581.	460.	3954.
264.	313.	339.	309.	291.	259.	227.	176.	155.	416.	581.	390.	3721.
263.	311.	339.	309.	291.	258.	226.	203.	132.	361.	524.	272.	3489.
260.	312.	340.	310.	292.	259.	226.	192.	162.	159.	445.	566.	3523.
255.	311.	337.	308.	290.	257.	223.	186.	138.	168.	275.	333.	3081.
267.	311.	337.	306.	289.	256.	223.	182.	159.	158.	581.	493.	3563.
267.	311.	338.	307.	290.	257.	225.	179.	150.	270.	528.	259.	3380.
269.	313.	340.	309.	291.	257.	223.	193.	188.	190.	205.	226.	3003.
260.	303.	327.	295.	277.	243.	212.	181.	154.	153.	173.	211.	2787.
247.	290.	316.	287.	269.	236.	204.	181.	140.	165.	166.	210.	2711.
257.	299.	323.	292.	274.	242.	211.	146.	134.	172.	199.	223.	2773.
267.	309.	334.	304.	285.	253.	221.	197.	163.	183.	194.	228.	2937.
264.	308.	333.	303.	284.	251.	218.	173.	170.	171.	187.	210.	2872.
261.	303.	326.	295.	276.	243.	211.	166.	145.	158.	186.	205.	2775.
251.	307.	334.	303.	285.	252.	219.	171.	159.	182.	202.	225.	2889.
261.	301.	326.	298.	280.	248.	215.	165.	138.	171.	194.	219.	2815.
256.	305.	334.	305.	288.	255.	223.	204.	187.	177.	188.	224.	2946.
261.	306.	334.	304.	287.	255.	222.	194.	186.	165.	182.	279.	2975.

1 Reservoir Drawdown Unconstrained

DEVELOPMENT:WATANA 800 MW[1]: MONTHLY NATURAL INFLOW, FT^3/S

OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
4719.9	2083.6	1168.9	815.1	641.7	569.1	680.1	8655.9	16432.1	19193.4	16913.6	7320.4
3299.1	1107.3	906.2	808.0	673.0	619.8	1302.2	11649.8	18517.9	19786.6	16478.0	17205.5
4592.9	2170.1	1501.0	1274.5	841.0	735.0	803.9	4216.5	25773.4	22110.9	17356.3	11571.0
6285.7	2756.8	1281.2	818.9	611.7	670.7	1382.0	15037.2	21469.8	17355.3	16681.6	11513.5
4218.9	1599.6	1183.8	1087.8	803.1	638.2	942.6	11696.8	19476.7	16983.6	20420.6	9165.5
3859.2	2051.1	1549.5	1388.3	1050.5	886.1	940.8	6718.1	24881.4	23787.9	23537.0	13447.8
4102.3	1588.1	1038.6	816.9	754.8	694.4	718.3	12953.3	27171.8	25831.3	19153.4	13194.4
4208.0	2276.6	1707.0	1373.0	1189.0	935.0	945.1	10176.2	25275.0	19948.9	17317.7	14841.1
6034.9	2935.9	2258.5	1480.6	1041.7	973.5	1265.4	9957.8	22097.8	19752.7	18843.4	5978.7
3668.0	1729.5	1115.1	1081.0	949.0	694.0	885.7	10140.6	18329.6	20493.1	23940.4	12466.9
5165.5	2213.5	1672.3	1400.4	1138.9	961.1	1069.9	13044.2	13233.4	19506.1	19323.1	16085.6
6049.3	2327.8	1973.2	1779.9	1304.8	1331.0	1965.0	13637.9	22784.1	19839.8	19480.2	10146.2
4637.6	2263.4	1760.4	1608.9	1257.4	1176.8	1457.4	11333.5	36017.1	23443.7	19887.1	12746.2
5560.1	2508.9	1708.9	1308.9	1184.7	883.6	776.6	15299.2	20663.4	28767.4	21011.4	10800.0
5187.1	1789.1	1194.7	852.0	781.6	575.2	609.2	3578.8	42841.9	20082.8	14048.2	7524.2
4759.4	2368.2	1070.3	863.0	772.7	807.3	1232.4	10966.0	21213.0	23235.9	17394.1	16225.6
5221.2	1565.3	1203.6	1060.4	984.7	984.7	1338.4	7094.1	25939.6	16153.5	17390.9	9214.1
3269.8	1202.2	1121.6	1102.2	1031.3	889.5	849.7	12555.5	24711.9	21987.3	26104.5	13672.9
4019.0	1934.3	1704.2	1617.6	1560.4	1560.4	1576.7	12826.7	25704.0	22082.8	14147.5	7163.6
3135.0	1354.9	753.9	619.2	607.5	686.0	1261.6	9313.7	13962.1	14843.5	7771.9	4260.0
2403.1	1020.9	709.3	636.2	602.1	624.1	986.4	9536.4	14399.0	18410.1	16263.8	7224.1
3768.0	2496.4	1687.4	1097.1	777.4	717.1	813.7	2857.2	27612.8	21126.4	27446.6	12188.9
4979.1	2587.0	1957.4	1670.9	1491.4	1366.0	1305.4	15973.1	27429.3	19820.3	17509.5	10955.7
4301.2	1977.9	1246.5	1031.5	1000.2	873.9	914.1	7287.0	23859.3	16351.1	18016.7	8099.7
3056.5	1354.7	931.6	786.4	689.9	627.3	871.9	12889.0	14780.6	15971.9	13523.7	9786.2
3088.8	1474.4	1276.7	1215.8	1110.3	1041.4	1211.2	11672.2	26689.2	23430.4	15126.6	13075.3
5679.1	1601.1	876.2	757.8	743.2	690.7	1059.8	8938.8	19994.0	17015.3	18393.5	5711.5
2973.5	1926.7	1687.5	1348.7	1202.9	1110.8	1203.4	8569.4	31352.8	19707.3	16807.3	10613.1
5793.9	2645.3	1979.7	1577.9	1267.7	1256.7	1408.4	11231.5	17277.2	18385.2	13412.1	7132.6
3773.9	1944.9	1312.6	1136.8	1055.4	1101.2	1317.9	12369.3	22904.8	24911.7	16670.7	9096.7

1 Reservoir Drawdown Unconstrained

DEVELOPMENT: WATANA 800 MW[1]: MONTHLY TURBINE FLOW, FT^3/S

OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANN
6966.	8726.	9365.	8691.	9263.	7564.	6956.	5495.	5278.	4826.	5214.	6464.	7067.
7329.	8902.	9493.	8812.	9393.	7687.	7018.	5687.	5584.	5032.	5176.	6627.	7228.
7148.	8707.	9328.	8654.	9250.	7556.	6966.	6001.	4272.	4527.	8968.	11571.	7746.
6874.	8635.	9292.	8642.	9212.	7534.	6908.	5032.	4404.	4889.	12928.	11514.	7989.
7034.	8735.	9364.	8702.	9256.	7576.	6929.	4670.	4473.	4793.	7520.	9165.	7351.
6999.	8676.	9308.	8637.	9198.	7538.	6922.	5567.	4725.	4657.	15671.	13448.	8446.
7186.	8791.	9385.	8723.	9262.	7555.	6958.	4936.	4343.	8531.	15582.	13194.	8704.
6973.	8652.	9318.	8651.	9200.	7512.	6913.	5255.	4716.	4753.	13409.	14841.	8349.
6802.	8557.	9117.	8567.	9170.	7496.	6867.	5410.	5071.	4819.	14766.	6249.	7741.
7109.	8767.	9350.	8666.	9219.	7541.	6914.	4599.	4722.	4481.	11388.	12467.	7935.
7028.	8681.	9281.	8608.	9189.	7510.	6910.	5485.	5479.	4778.	5779.	15673.	7867.
6924.	8660.	9210.	8523.	9125.	7411.	6741.	5161.	4155.	7083.	15582.	10146.	8227.
7062.	8745.	9341.	8657.	9213.	7516.	6905.	5930.	4003.	15641.	15582.	12746.	9278.
7091.	8775.	9342.	8647.	9183.	7541.	6961.	5182.	4555.	11385.	15582.	10800.	8754.
7064.	8734.	9355.	8695.	9249.	7567.	6969.	6157.	3920.	9783.	14048.	7524.	8255.
6990.	8744.	9399.	8723.	9277.	7579.	6966.	5725.	4842.	4421.	12017.	15673.	8363.
6860.	8713.	9318.	8651.	9205.	7505.	6863.	5574.	4123.	4678.	7447.	9214.	7346.
7178.	8778.	9365.	8666.	9225.	7540.	6934.	5472.	4751.	4348.	15643.	13673.	8464.
7178.	8759.	9351.	8649.	9197.	7489.	6882.	5302.	4413.	7366.	14147.	7164.	7991.
7237.	8814.	9441.	8760.	9319.	7614.	6973.	5856.	5793.	5508.	5858.	6694.	7322.
7514.	9216.	9870.	9172.	9824.	8066.	7479.	6216.	5309.	4884.	5300.	6564.	7451.
7465.	9214.	9961.	9354.	10042.	8275.	7661.	6808.	5166.	5386.	5079.	6366.	7565.
7512.	9143.	9749.	9036.	9662.	7917.	7311.	4834.	4293.	5046.	5637.	6413.	7213.
7406.	8955.	9561.	8888.	9462.	7753.	7149.	6230.	5162.	5343.	5497.	6560.	7331.
7397.	9040.	9667.	8990.	9586.	7846.	7239.	5550.	5452.	5150.	5468.	6240.	7302.
7528.	9188.	9790.	9102.	9704.	7943.	7318.	5558.	4758.	4688.	5318.	5924.	7235.
6972.	8925.	9572.	8885.	9477.	7744.	7106.	5389.	5032.	5354.	5761.	6528.	7229.
7372.	8922.	9531.	8905.	9512.	7772.	7136.	5318.	4383.	4932.	5403.	6197.	7115.
6983.	8686.	9333.	8675.	9242.	7547.	6953.	6147.	5687.	5050.	5227.	6359.	7158.
7201.	8827.	9476.	8812.	9398.	7713.	7089.	5982.	5719.	4654.	4948.	7729.	7296.

1 Reservoir Drawdown Unconstrained

DEVELOPMENT:WATANA 800 MW[1]: MONTHLY DOWNSTREAM FLOW, FT^3/S

OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
6966.	8726.	9365.	8691.	9263.	7564.	6956.	5495.	5278.	4826.	5214.	6464.
7329.	8902.	9493.	8812.	9393.	7687.	7018.	5687.	5584.	5032.	5176.	6627.
7148.	8707.	9328.	8654.	9250.	7556.	6966.	6001.	4272.	4527.	8968.	11571.
6874.	8635.	9292.	8642.	9212.	7534.	6908.	5032.	4404.	4889.	12928.	11514.
7034.	8735.	9364.	8702.	9256.	7576.	6929.	4670.	4473.	4793.	7520.	9165.
6999.	8676.	9308.	8637.	9198.	7538.	6922.	5567.	4725.	4657.	20789.	13448.
7186.	8791.	9385.	8723.	9262.	7555.	6958.	4936.	4343.	8531.	22348.	13194.
6973.	8652.	9318.	8651.	9200.	7512.	6913.	5255.	4716.	4753.	13409.	14841.
6802.	8557.	9117.	8567.	9170.	7496.	6867.	5410.	5071.	4819.	14766.	6249.
7109.	8767.	9350.	8666.	9219.	7541.	6914.	4599.	4722.	4481.	11388.	12467.
7028.	8681.	9281.	8608.	9189.	7510.	6910.	5485.	5479.	4778.	5779.	16212.
6924.	8660.	9210.	8523.	9125.	7411.	6741.	5161.	4155.	7083.	23001.	10146.
7062.	8745.	9341.	8657.	9213.	7516.	6905.	5930.	4003.	19101.	23815.	12746.
7091.	8775.	9342.	8647.	9183.	7541.	6961.	5182.	4555.	11385.	26064.	10800.
7064.	8734.	9355.	8695.	9249.	7567.	6969.	6157.	3920.	9783.	14048.	7524.
6990.	8744.	9399.	8723.	9277.	7579.	6966.	5725.	4842.	4421.	12017.	16492.
6860.	8713.	9318.	8651.	9205.	7505.	6863.	5574.	4123.	4678.	7447.	9214.
7178.	8778.	9365.	8666.	9225.	7540.	6934.	5472.	4751.	4348.	29117.	13673.
7178.	8759.	9351.	8649.	9197.	7489.	6882.	5302.	4413.	7366.	14147.	7164.
7237.	8814.	9441.	8760.	9319.	7614.	6973.	5856.	5793.	5508.	5858.	6694.
7514.	9216.	9870.	9172.	9824.	8066.	7479.	6216.	5309.	4884.	5300.	6564.
7465.	9214.	9961.	9354.	10042.	8275.	7661.	6808.	5166.	5386.	5079.	6366.
7512.	9143.	9749.	9036.	9662.	7917.	7311.	4834.	4293.	5046.	5637.	6413.
7406.	8955.	9561.	8888.	9462.	7753.	7149.	6230.	5162.	5343.	5497.	6560.
7397.	9040.	9667.	8990.	9586.	7846.	7239.	5550.	5452.	5150.	5468.	6240.
7528.	9188.	9790.	9102.	9704.	7943.	7318.	5558.	4758.	4688.	5318.	5924.
6972.	8925.	9572.	8885.	9477.	7744.	7106.	5389.	5032.	5354.	5761.	6528.
7372.	8922.	9531.	8905.	9512.	7772.	7136.	5318.	4383.	4932.	5403.	6197.
6983.	8686.	9333.	8675.	9242.	7547.	6953.	6147.	5687.	5050.	5227.	6359.
7201.	8827.	9476.	8812.	9398.	7713.	7089.	5982.	5719.	4654.	4948.	7729.

1 Reservoir Drawdown Unconstrained

DEVELOPMENT:WATANA 800 MW[1]: MONTHLY RESERVOIR ELEVATION, FT

OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
2196.	2184.	2169.	2155.	2140.	2127.	2116.	2122.	2142.	2167.	2188.	2190.
2183.	2169.	2153.	2139.	2123.	2111.	2101.	2111.	2134.	2161.	2181.	2200.
2195.	2184.	2170.	2156.	2141.	2129.	2118.	2115.	2153.	2185.	2200.	2200.
2199.	2188.	2174.	2160.	2145.	2132.	2122.	2140.	2171.	2193.	2200.	2200.
2195.	2182.	2168.	2154.	2139.	2126.	2116.	2128.	2155.	2177.	2200.	2200.
2194.	2183.	2169.	2156.	2141.	2129.	2118.	2120.	2157.	2191.	2200.	2200.
2194.	2182.	2167.	2152.	2137.	2125.	2114.	2128.	2169.	2200.	2200.	2200.
2195.	2184.	2170.	2157.	2143.	2131.	2120.	2129.	2166.	2193.	2200.	2200.
2199.	2189.	2176.	2164.	2149.	2137.	2127.	2135.	2166.	2193.	2200.	2200.
2193.	2181.	2166.	2152.	2138.	2125.	2114.	2124.	2149.	2178.	2200.	2200.
2197.	2185.	2171.	2159.	2144.	2132.	2122.	2135.	2149.	2176.	2200.	2200.
2198.	2187.	2174.	2162.	2148.	2137.	2129.	2144.	2177.	2200.	2200.	2200.
2196.	2184.	2170.	2158.	2144.	2132.	2122.	2132.	2189.	2200.	2200.	2200.
2197.	2186.	2172.	2159.	2145.	2133.	2122.	2140.	2169.	2200.	2200.	2200.
2197.	2184.	2170.	2156.	2140.	2128.	2116.	2112.	2182.	2200.	2200.	2200.
2196.	2185.	2170.	2156.	2140.	2128.	2118.	2127.	2157.	2190.	2200.	2200.
2197.	2184.	2170.	2156.	2141.	2130.	2120.	2123.	2162.	2182.	2200.	2200.
2193.	2179.	2165.	2151.	2136.	2125.	2114.	2126.	2162.	2194.	2200.	2200.
2194.	2182.	2168.	2156.	2142.	2132.	2122.	2135.	2174.	2200.	2200.	2200.
2193.	2179.	2164.	2149.	2134.	2121.	2111.	2117.	2132.	2148.	2152.	2148.
2138.	2124.	2107.	2089.	2066.	2047.	2031.	2039.	2062.	2096.	2117.	2118.
2111.	2099.	2078.	2057.	2034.	2015.	1997.	1983.	2044.	2084.	2128.	2139.
2134.	2123.	2109.	2094.	2073.	2057.	2042.	2070.	2120.	2146.	2168.	2176.
2170.	2158.	2143.	2129.	2113.	2101.	2086.	2089.	2125.	2145.	2168.	2170.
2162.	2149.	2133.	2118.	2102.	2085.	2069.	2088.	2108.	2127.	2142.	2148.
2140.	2126.	2111.	2096.	2074.	2057.	2041.	2057.	2108.	2142.	2160.	2172.
2170.	2157.	2141.	2127.	2111.	2098.	2083.	2092.	2121.	2142.	2164.	2163.
2155.	2143.	2129.	2115.	2100.	2083.	2069.	2077.	2132.	2158.	2179.	2187.
2184.	2174.	2160.	2148.	2133.	2122.	2112.	2121.	2142.	2166.	2181.	2182.
2176.	2164.	2149.	2135.	2120.	2108.	2097.	2109.	2140.	2177.	2198.	2200.

1 Reservoir Drawdown Unconstrained

DEVELOPMENT: DEVIL CANYON 600 MW[1]: MONTHLY ENERGY, GWH

OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANN
232.	253.	276.	255.	244.	222.	198.	212.	205.	203.	206.	199.	2704.
222.	253.	278.	258.	248.	225.	202.	210.	197.	197.	209.	258.	2756.
225.	254.	277.	256.	244.	221.	197.	196.	238.	210.	326.	376.	3022.
235.	255.	277.	255.	244.	221.	198.	224.	229.	194.	446.	390.	3167.
229.	253.	277.	256.	245.	222.	199.	239.	229.	201.	323.	324.	2998.
231.	256.	278.	257.	246.	222.	198.	209.	222.	205.	446.	392.	3162.
224.	252.	276.	255.	246.	223.	199.	230.	233.	345.	446.	432.	3360.
232.	256.	278.	256.	246.	222.	198.	218.	220.	200.	446.	432.	3204.
237.	258.	282.	257.	244.	220.	197.	211.	207.	198.	446.	203.	2960.
227.	253.	278.	257.	247.	223.	200.	242.	222.	213.	446.	429.	3238.
229.	254.	278.	257.	245.	222.	198.	209.	195.	203.	246.	432.	2969.
233.	254.	280.	259.	246.	223.	201.	218.	236.	293.	446.	342.	3232.
228.	253.	276.	256.	245.	222.	198.	195.	243.	446.	446.	413.	3420.
227.	251.	276.	255.	245.	220.	196.	219.	224.	434.	446.	330.	3323.
228.	253.	276.	255.	245.	221.	197.	192.	249.	336.	446.	247.	3146.
231.	252.	274.	254.	244.	221.	197.	203.	217.	213.	417.	432.	3156.
235.	253.	277.	256.	246.	223.	200.	209.	241.	204.	298.	304.	2947.
224.	253.	278.	258.	247.	224.	200.	213.	219.	215.	446.	432.	3209.
224.	253.	277.	257.	246.	223.	199.	216.	229.	294.	446.	230.	3093.
222.	252.	275.	255.	245.	223.	200.	202.	190.	183.	190.	202.	2639.
231.	261.	288.	269.	259.	236.	211.	214.	225.	220.	222.	218.	2855.
244.	274.	299.	277.	267.	244.	219.	214.	240.	208.	230.	219.	2934.
233.	265.	292.	272.	261.	237.	212.	250.	246.	201.	196.	206.	2872.
224.	256.	281.	260.	251.	227.	202.	198.	215.	190.	201.	201.	2705.
227.	256.	281.	262.	252.	229.	205.	222.	208.	202.	208.	219.	2770.
230.	261.	289.	269.	260.	236.	212.	229.	234.	215.	209.	224.	2868.
240.	257.	281.	261.	251.	228.	205.	224.	220.	191.	193.	204.	2753.
230.	263.	289.	266.	255.	232.	208.	230.	241.	201.	201.	210.	2829.
235.	259.	281.	259.	248.	225.	200.	191.	191.	195.	207.	205.	2696.
229.	258.	281.	260.	249.	225.	201.	201.	192.	208.	214.	246.	2764.

1 Reservoir Drawdown Unconstrained, Watana Development Upstream

DEVELOPMENT: DEVIL CANYON 600 MW[1]: MONTHLY REGULATED INFLOW, FT^3/S

OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
9048.	9366.	9712.	8963.	9451.	7766.	7200.	9167.	9347.	9206.	9028.	7726.
8035.	9150.	9743.	9007.	9583.	7840.	7423.	8822.	8505.	8610.	9280.	11815.
8409.	9445.	9841.	9072.	9453.	7742.	7115.	7550.	12749.	10029.	13550.	15311.
9344.	9586.	9830.	9003.	9480.	7726.	7208.	10472.	11926.	8546.	17997.	16343.
8819.	9377.	9770.	8973.	9510.	7758.	7306.	11846.	11896.	9135.	14822.	13993.
8947.	9587.	9945.	9158.	9648.	7812.	7256.	8916.	11121.	9507.	25673.	14530.
8281.	9192.	9721.	8932.	9539.	7870.	7255.	10986.	12273.	15293.	33241.	20858.
9033.	9646.	9876.	9071.	9600.	7852.	7241.	9849.	10994.	9074.	17598.	23811.
9607.	9866.	10411.	9186.	9510.	7719.	7212.	9192.	9701.	8840.	21225.	8273.
8579.	9305.	9863.	9138.	9680.	7908.	7383.	12118.	11136.	10275.	21304.	18193.
8822.	9499.	9959.	9179.	9591.	7813.	7206.	9001.	8432.	9245.	11265.	25269.
9173.	9523.	10137.	9387.	9702.	8026.	7622.	9943.	12726.	13165.	28578.	14291.
8710.	9305.	9777.	9031.	9525.	7803.	7217.	7544.	13328.	24372.	31404.	16788.
8590.	9147.	9716.	9021.	9589.	7690.	7029.	9977.	11417.	18627.	31715.	12754.
8691.	9325.	9739.	8946.	9487.	7744.	7143.	7095.	13866.	13469.	17275.	10156.
8965.	9295.	9580.	8847.	9389.	7698.	7130.	8327.	10635.	10341.	16807.	23042.
9416.	9396.	9868.	9087.	9611.	7910.	7425.	8857.	13131.	9444.	13154.	12474.
8329.	9289.	9852.	9177.	9700.	7939.	7342.	9229.	10920.	10536.	42271.	18076.
8313.	9297.	9803.	9116.	9633.	7925.	7310.	9612.	11930.	12942.	18689.	9288.
8123.	9167.	9604.	8894.	9468.	7781.	7293.	8088.	7769.	7123.	7284.	7767.
8442.	9464.	10072.	9414.	10039.	8260.	7599.	8589.	10744.	10348.	10078.	9008.
9423.	10384.	10737.	9795.	10375.	8573.	8006.	7957.	11988.	9016.	10817.	9261.
8631.	9794.	10461.	9766.	10354.	8501.	7831.	12437.	13295.	8839.	7926.	8272.
8082.	9309.	9843.	9104.	9719.	7914.	7295.	7449.	10225.	7785.	8419.	7815.
8268.	9255.	9799.	9102.	9699.	7970.	7393.	9780.	9424.	8786.	8934.	9412.
8364.	9478.	10212.	9487.	10171.	8403.	7809.	10281.	11984.	10204.	9128.	10083.
9627.	9425.	9835.	9163.	9743.	8013.	7509.	10126.	10665.	7828.	7569.	8035.
8531.	9853.	10453.	9521.	10046.	8272.	7748.	10607.	12882.	8998.	8531.	8805.
9272.	9817.	10116.	9254.	9758.	7994.	7330.	7069.	7966.	8438.	9055.	8258.
8658.	9585.	9949.	9145.	9694.	7839.	7259.	7910.	8015.	9756.	9620.	9881.

1 Reservoir Drawdown Unconstrained, Watana Development Upstream

DEVELOPMENT: DEVIL CANYON 600 MW[1]: MONTHLY TURBINE FLOW, FT^3/S

OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANN
8010.	9045.	9538.	8827.	9357.	7665.	7078.	7332.	7310.	7016.	7121.	7096.	7950.
7682.	9026.	9618.	8909.	9488.	7763.	7221.	7253.	7044.	6821.	7228.	9221.	8106.
7780.	9076.	9584.	8863.	9351.	7649.	7040.	6777.	8508.	7278.	11259.	13441.	8884.
8112.	9110.	9561.	8822.	9346.	7630.	7058.	7751.	8165.	6717.	15434.	13928.	9303.
7929.	9055.	9567.	8837.	9383.	7667.	7118.	8257.	8185.	6964.	11171.	11579.	8809.
7976.	9131.	9626.	8897.	9423.	7674.	7089.	7244.	7920.	7082.	15434.	13989.	9291.
7735.	8991.	9553.	8827.	9401.	7712.	7106.	7960.	8308.	11912.	15434.	15434.	9865.
8006.	9149.	9596.	8861.	9400.	7682.	7077.	7552.	7854.	6913.	15434.	15434.	9413.
8207.	9211.	9765.	8875.	9339.	7607.	7040.	7301.	7385.	6830.	15434.	7263.	8688.
7844.	9035.	9607.	8902.	9450.	7724.	7149.	8358.	7928.	7378.	15434.	15330.	9512.
7927.	9090.	9620.	8893.	9390.	7661.	7058.	7242.	6956.	7012.	8522.	15434.	8734.
8051.	9091.	9674.	8955.	9413.	7718.	7182.	7550.	8441.	10124.	15434.	12219.	9488.
7888.	9024.	9559.	8844.	9369.	7659.	7061.	6736.	8665.	15434.	15434.	14767.	10037.
7842.	8960.	9529.	8834.	9386.	7615.	6995.	7579.	7986.	15006.	15434.	11777.	9745.
7880.	9029.	9547.	8820.	9368.	7655.	7056.	6627.	8891.	11626.	15434.	8840.	9231.
7980.	9018.	9489.	8785.	9333.	7638.	7048.	7026.	7738.	7381.	14412.	15434.	9274.
8141.	9053.	9593.	8869.	9408.	7707.	7144.	7217.	8624.	7061.	10300.	10844.	8663.
7755.	9033.	9609.	8921.	9463.	7739.	7138.	7349.	7835.	7442.	15434.	15434.	9429.
7747.	9028.	9577.	8882.	9415.	7707.	7096.	7456.	8172.	10154.	15434.	8226.	9074.
7681.	8990.	9522.	8827.	9394.	7697.	7133.	6972.	6780.	6315.	6572.	7231.	7760.
7979.	9339.	9971.	9293.	9932.	8162.	7539.	7404.	8024.	7616.	7689.	7789.	8395.
8446.	9799.	10350.	9573.	10209.	8423.	7833.	7386.	8570.	7201.	7948.	7814.	8629.
8073.	9469.	10106.	9401.	10009.	8207.	7571.	8633.	8794.	6943.	6781.	7343.	8444.
7745.	9132.	9702.	8996.	9591.	7833.	7222.	6840.	7692.	6564.	6958.	7189.	7955.
7833.	9147.	9733.	9046.	9643.	7908.	7316.	7664.	7438.	6968.	7201.	7828.	8144.
7946.	9333.	10002.	9294.	9939.	8172.	7563.	7917.	8371.	7446.	7223.	8004.	8434.
8303.	9173.	9703.	9024.	9610.	7878.	7308.	7759.	7845.	6591.	6665.	7283.	8095.
7952.	9388.	9993.	9212.	9779.	8022.	7442.	7964.	8628.	6965.	6967.	7502.	8318.
8130.	9251.	9724.	8964.	9501.	7770.	7141.	6607.	6826.	6744.	7141.	7310.	7926.
7930.	9206.	9712.	8978.	9546.	7775.	7174.	6945.	6867.	7205.	7384.	8805.	8127.

1 Reservoir Drawdown Unconstrained, Watana Development Upstream

DEVELOPMENT: DEVIL CANYON 600 MW[1]: TOTAL MONTHLY DOWNSTREAM FLOW, FT^3/S

OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
8010.	9045.	9538.	8827.	9357.	7665.	7078.	7332.	7310.	7016.	7121.	7096.
7382.	9026.	9618.	8909.	9488.	7763.	7221.	7253.	7044.	6821.	7228.	9221.
7780.	9076.	9584.	8863.	9351.	7649.	7040.	6777.	8508.	7278.	11259.	13441.
8112.	9110.	9561.	8822.	9346.	7630.	7058.	7751.	8165.	6717.	15472.	13928.
7929.	9055.	9567.	8837.	9383.	7667.	7118.	8257.	8185.	6964.	11171.	11579.
7976.	9131.	9626.	8897.	9423.	7674.	7089.	7244.	7920.	7082.	24250.	13989.
7735.	8991.	9553.	8827.	9401.	7712.	7106.	7960.	8308.	11912.	29785.	17557.
8006.	9149.	9596.	8861.	9400.	7682.	7077.	7552.	7854.	6913.	15526.	20623.
8207.	9211.	9765.	8875.	9339.	7607.	7040.	7301.	7385.	6830.	18849.	7263.
7844.	9035.	9607.	8902.	9450.	7724.	7149.	8358.	7928.	7378.	16650.	15330.
7927.	9090.	9620.	8893.	9390.	7661.	7058.	7242.	6956.	7012.	8522.	22425.
8051.	9091.	9674.	8955.	9413.	7718.	7182.	7550.	8441.	10124.	26894.	12219.
7888.	9024.	9559.	8844.	9369.	7659.	7061.	6736.	8665.	22825.	29049.	14767.
7842.	8960.	9529.	8834.	9386.	7615.	6995.	7579.	7986.	15006.	30006.	11777.
7880.	9029.	9547.	8820.	9368.	7655.	7056.	6627.	8891.	11626.	15737.	8840.
7980.	9018.	9489.	8785.	9333.	7638.	7048.	7026.	7738.	7381.	14412.	21033.
8141.	9053.	9593.	8869.	9408.	7707.	7144.	7217.	8624.	7061.	10300.	10844.
7755.	9033.	9609.	8921.	9463.	7739.	7138.	7349.	7835.	7442.	38082.	16021.
7747.	9028.	9577.	8882.	9415.	7707.	7096.	7456.	8172.	10154.	16746.	8226.
7681.	8990.	9522.	8827.	9394.	7697.	7133.	6972.	6780.	6315.	6572.	7231.
7979.	9339.	9971.	9293.	9932.	8162.	7539.	7404.	8024.	7616.	7689.	7789.
8446.	9799.	10350.	9573.	10209.	8423.	7833.	7386.	8570.	7201.	7948.	7814.
8073.	9469.	10106.	9401.	10009.	8207.	7571.	8633.	8794.	6943.	6781.	7343.
7745.	9132.	9702.	8996.	9591.	7833.	7222.	6840.	7692.	6564.	6958.	7189.
7833.	9147.	9733.	9046.	9643.	7908.	7316.	7664.	7438.	6968.	7201.	7828.
7946.	9333.	10002.	9294.	9939.	8172.	7563.	7917.	8371.	7446.	7223.	8004.
8303.	9173.	9703.	9024.	9610.	7878.	7308.	7759.	7845.	6591.	6665.	7283.
7952.	9388.	9993.	9212.	9779.	8022.	7442.	7964.	8628.	6965.	6967.	7502.
8130.	9251.	9724.	8964.	9501.	7770.	7141.	6607.	6826.	6744.	7141.	7310.
7930.	9206.	9712.	8978.	9546.	7775.	7174.	6945.	6867.	7205.	7384.	8805.

1 Reservoir Drawdown Unconstrained, Watana Development Upstream

DEVELOPMENT: DEVIL CANYON 600 MW[1]: MONTHLY RESERVOIR ELEVATION, FT

OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.
1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.
1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.
1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.
1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.
1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.
1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.
1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.
1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.
1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.
1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.
1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.
1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.
1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.
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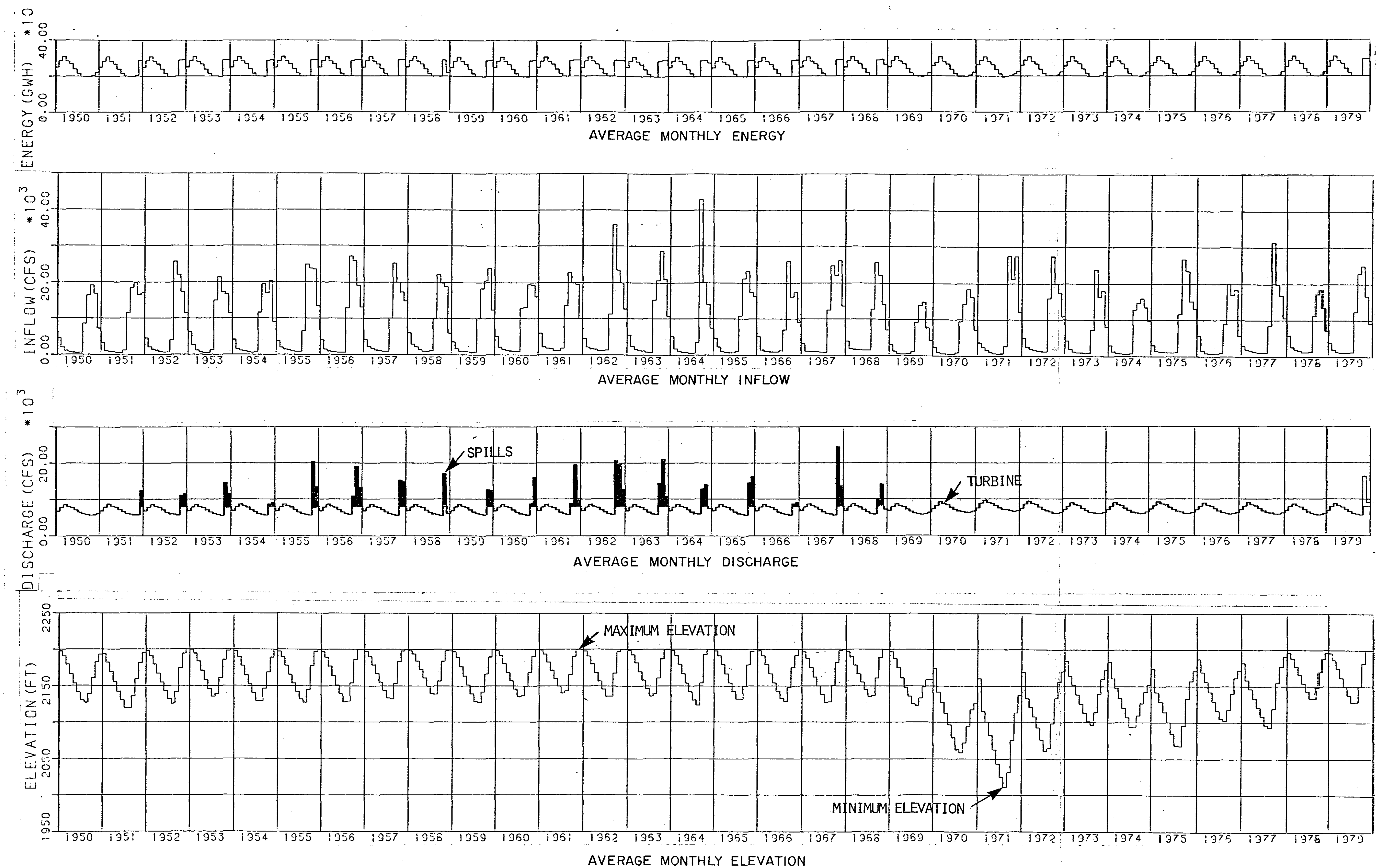
1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.
1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.
1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.
1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.
1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.
1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.
1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.
1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.
1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.
1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.
1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.
1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.
1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.
1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.	1450.

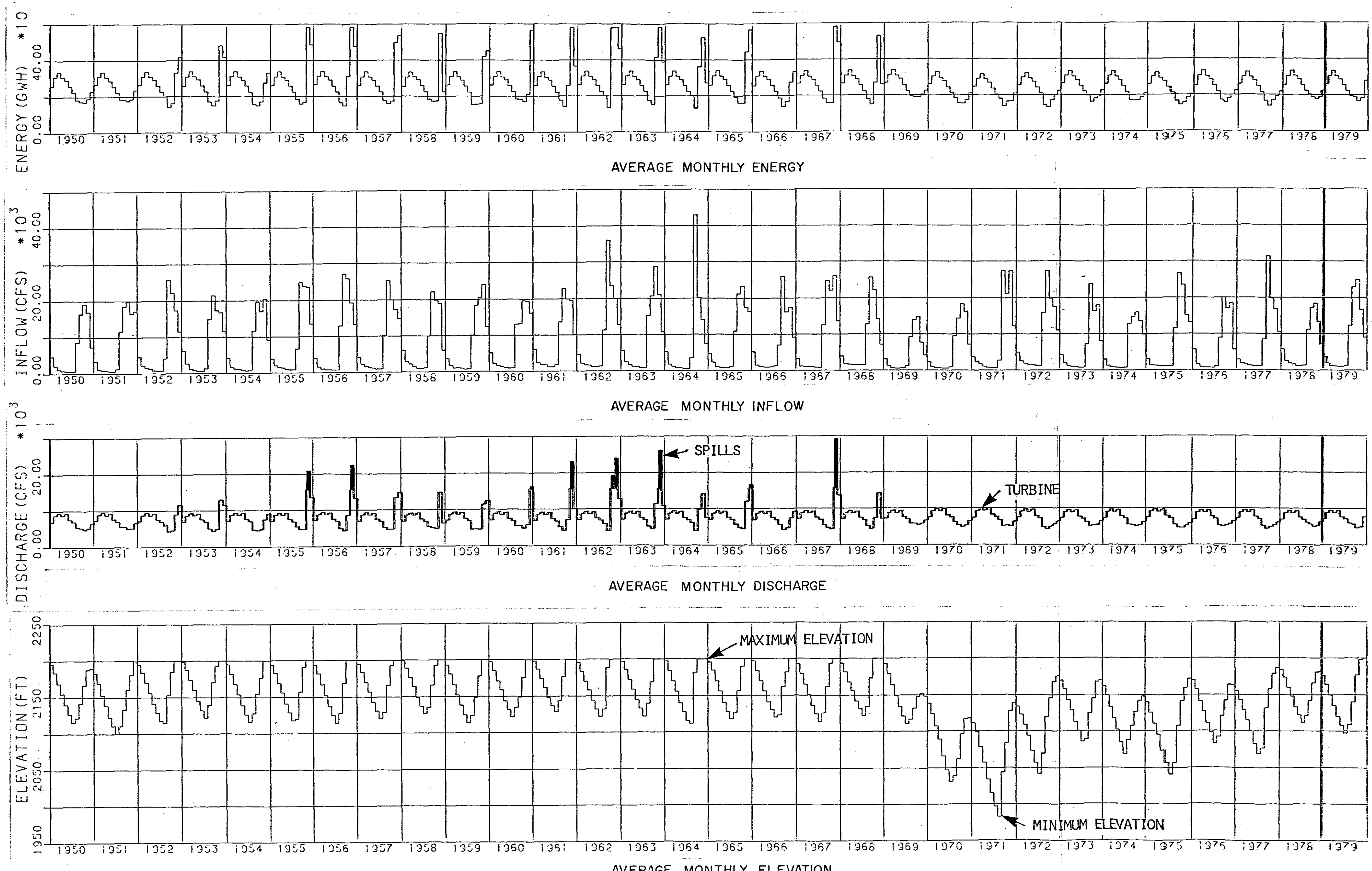
1 Reservoir Drawdown Unconstrained, Watana Development Upstream



WATER YEAR: OCT-SEP

WATANA RESERVOIR (400MW)

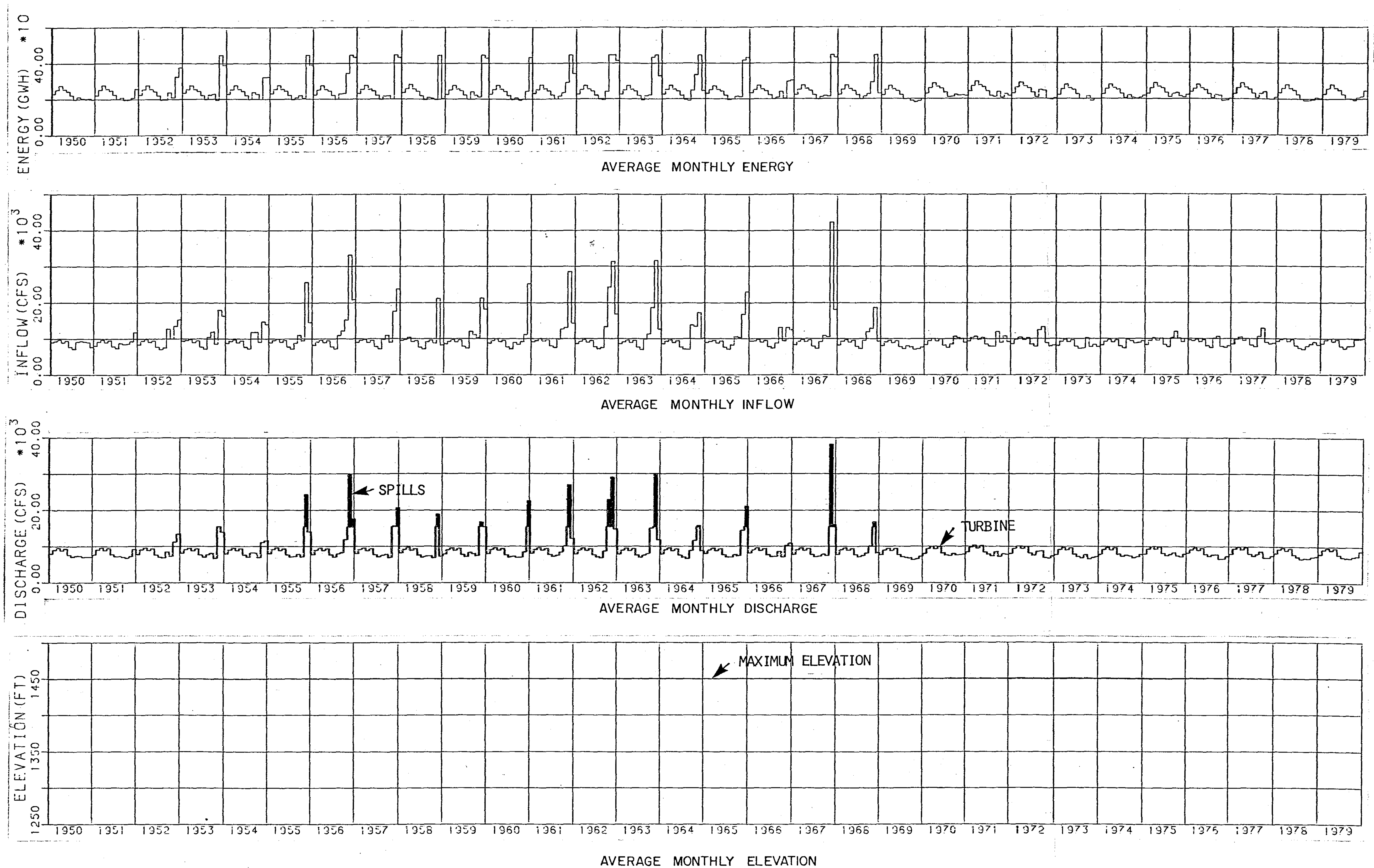
WATANA/DEVIL CANYON DEVELOPMENT



NOTE:
WATER YEAR: OCT.- SEP.

WATANA RESERVOIR (800 MW)

WATANA/DEVIL CANYON DEVELOPMENT



NOTE:
WATER YEAR: OCT. - SEP.

DEVIL CANYON RESERVOIR (600 MW)

WATANA/DEVIL CANYON DEVELOPMENT