

J. D. Lawrence

FEASIBILITY REPORT

PROJECT MANUAL

DECEMBER 21, 1981



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FEASIBILITY REPORT

PROJECT MANUAL

SECTION

- 1 INTRODUCTION
- 2 COMPONENTS OF FEASIBILITY REPORT
- 3 SCHEDULE
- 4 RESPONSIBILITIES
- 5 DISTRIBUTION
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PROJECT MANUAL - SUBTASK 6.31 - FEASIBILITY REPORT

SECTION 1 - INTRODUCTION

The purpose of this Project Manual is to set forth standard procedures for preparation of text, plates and drawings, editing, proofreading, checking and production of the feasibility report. The Manual also includes a schedule for preparation of the report and an outline of the contents. A first draft of Volume 1 is scheduled for issue to APA on February 1, 1982. The report is required to be delivered to APA on March 15, 1982 in final draft form. A final issue of the report will be made on April 30, 1982. Subsequent to issue of this report, it is expected that APA will proceed with submission of an FERC license application. This submission of FERC licensing documents to APA for their review is scheduled for May 1, 1982.

SECTION 2 - COMPONENTS OF FEASIBILITY REPORT

The feasibility report will comprise the following main components:

- 1) Volume 1 - Engineering and Economic Aspects
- 2) Volume 2 - Environmental Aspects
- 3) Volumes 3 through n - Appendices
- 4) Project Overview

A number of reports, which have been already issued to APA, will be referenced but not included in Volumes 1 and 2 of the report and appendices. A list of these reports is presented in this section.

A table of contents for the Report is given in this section. The name of the Susitna project team members responsible for the various section is also listed. Volume 2 will essentially be prepared by TES, except for certain section as noted. A list of the various appendices is also given at the end of this section.

A summary outline of the contents of Volumes 1 and 2 is presented in Attachment A.

SUSITNA HYDROELECTRIC PROJECT

Page 1 of 4

Revised December 10, 1981

FEASIBILITY REPORT

PRELIMINARY OUTLINE

VOLUME 1 - ENGINEERING AND ECONOMIC ASPECTS

RESPONSIBILITY

1 - INTRODUCTION

- | | | |
|---|---|-------------|
| 1.1 - The Study Area |) | Lawrence |
| 1.2 - Project Description |) | Hayden |
| 1.3 - Objectives and Scope of Current Studies |) | Vanderburgh |
| 1.4 - Plan Formulation and Selection Process |) | McBee |
| 1.5 - Organization of Report |) | |

2 - SUMMARY

- | | | |
|---|---|-------|
| 2.1 - Scope of Work |) | McBee |
| → 2.2 - Previous Studies |) | |
| → 2.3 - Railbelt Load Forecasts |) | |
| → 2.4 - Railbelt System and Future Power Generating Options |) | |
| 2.5 - Susitna Basin |) | |
| → 2.6 - Susitna Basin Development Selection |) | |
| 2.7 - Susitna Hydroelectric Development |) | |
| 2.8 - Watana Development |) | |
| 2.9 - Devil Canyon Development |) | |
| 2.10 - Transmission Facilities |) | |
| 2.11 - Estimates of Cost |) | |
| 2.12 - Development Schedule |) | |
| 2.13 - Environmental Impacts and Mitigation Measures |) | |
| → 2.14 - Project Operation |) | |
| → 2.15 - Economic and Financial Evaluation |) | |
| → 2.16 - Conclusions and Recommendations |) | |

3 - SCOPE OF WORK

- | | | |
|--|---|-------------|
| 3.1 - Evolution of Plan of Study |) | Lawrence/ |
| 3.2 - Power Studies |) | Vanderburgh |
| 3.3 - Surveys and Site Facilities |) | McBee |
| 3.4 - Hydrology |) | |
| 3.5 - Seismic Studies |) | |
| 3.6 - Geotechnical Explorations |) | |
| 3.7 - Design Development |) | |
| 3.8 - Environmental Studies |) | |
| 3.9 - Transmission |) | |
| 3.10 - Construction Cost Estimates and Schedules |) | |
| 3.11 - Licensing |) | |
| 3.12 - Marketing and Financing |) | |
| 3.13 - Public Participation Program |) | |

4 - PREVIOUS STUDIES

- | | | |
|---|---|-------|
| 4.1 - Early Studies of Hydroelectric Potential |) | McBee |
| 4.2 - U.S. Bureau of Reclamation - 1953 Study |) | |
| 4.3 - U.S. Bureau of Reclamation - 1961 Study |) | |
| 4.4 - Alaska Power Administration - 1974 |) | |
| 4.5 - Kaiser Proposal for Development |) | |
| 4.6 - U.S. Army Corps of Engineer - 1975 and 1979 Studies |) | |

	<u>RESPONSIBILITY</u>
5 - RAILBELT LOAD FORECASTS	
5.1 - Introduction	) Hoover
5.2 - Past Projections of Railbelt Electricity)
5.3 - ISER Forecasts)
5.4 - Electricity Demand Profiles)
5.5 - Demand Forecasts)
5.6 - Potential for Load Management and Energy Conservation)
5.7 - Battelle Forecasts)
5.8 - Load Forecasts Used for Generation Planning Studies)
6 - RAILBELT SYSTEM AND FUTURE POWER GENERATION OPTIONS	
6.1 - Introduction	) McBee
6.2 - Existing System Characteristics)
6.3 - Fairbanks - Anchorage Intertie)
6.4 - Hydroelectric Options)
6.5 - Thermal Options)
6.6 - Without Susitna Plan	) Hoover
7 - SUSITNA BASIN	
7.1 - Introduction	Grubb (Lead)
7.2 - Climatology	Krishnan
7.3 - Hydrology	Krishnan
7.4 - Regional Geology	Singh/Thompson
7.5 - Seismology	Singh
7.6 - Water Use & Quality	Grubb
7.7 - Fisheries Resources	) Grubb
7.8 - Wildlife Resources)
7.9 - Botanical Resources)
7.10 - Historical and Archaeological Resources)
7.11 - Socio-Economics)
7.12 - Recreational Resources)
7.13 - Aesthetic Resources)
7.14 - Land Use)
8 - SUSITNA BASIN DEVELOPMENT SELECTION	
8.1 - Introduction	) McBee
8.2 - Plan Formulation and Selection Methodology)
8.3 - Selection of Candidate Damsites)
8.4 - Site Screening)
8.5 - Engineering Layouts)
8.6 - Capital Cost Estimates)
8.7 - Formulation of Susitna Basin Development Plans)
8.8 - Evaluation of Basin Development Plans)
8.9 - On-line Schedule	) Meilhede

	<u>RESPONSIBILITY</u>
9 - SUSITNA HYDROELECTRIC DEVELOPMENT	
9.1 - Site Topography	) Dumont
9.2 - Site Geology	) Singh
9.3 - Geotechnical Considerations	) Singh
9.4 - Site Seismicity	) Singh
9.5 - Selections of Reservoir Levels	) Krishnan
9.6 - Selection of Installed Capacity	Krishnan (Lead)
9.7 - Selection of Spillway Capacity	Krishnan (Lead)
9.8 - Selection of Watana General Arrangement	) Ibbotson/
9.9 - Selection of Devil Canyon General Arrangement	) Dumont
9.10 - Selection of Main Access Plan	Gwozdek/Grubb
10 - WATANA DEVELOPMENT	
10.1 - General Arrangement	Ibbotson
10.2 - Site Access	Gwozdek
10.3 - Site Facilities	Gwozdek
10.4 - Diversion	Gwozdek
10.5 - Low Level Outlet Facilities	Ibbotson
10.6 - Main Dam	Lamb
10.7 - Saddle Dam	Lamb
10.8 - Primary Outlet Facilities	Ibbotson
10.9 - Main Spillway	Ibbotson
10.10- Emergency Spillway	Ibbotson
10.11- Intake	Dumont
10.12- Penstocks	Rodrigue
10.13- Powerhouse	Ibbotson
10.14- Reservoir	Krishnan
10.15- Tailrace	Ibbotson
10.16- Turbines and Generators	Rodrigue/Pereira
10.17- Miscellaneous Mechanical Equipment	Rodrigue
10.18- Accessory Electrical Equipment	Pereira
10.19- Switchyard Structures and Equipment	Shadeed
10.20- Project Lands	Smith
11 - DEVIL CANYON DEVELOPMENT	
11.1 - General Arrangement	Ibbotson
11.2 - Site Access	Ibbotson
11.3 - Site Facilities	Gwozdek
11.4 - Diversion	Gwozdek
11.5 - Arch Dam	Ibbotson
11.6 - Saddle Dam	Lamb
11.7 - Primary Outlet Facilities	Ibbotson
11.8 - Main Spillway	Ibbotson
11.9 - Emergency Spillway	Ibbotson
11.10- Intake	Dumont
11.11- Penstocks	Rodrigue
11.12- Powerhouse	Ibbotson
11.13- Reservoir	Krishnan
11.14- Tailrace	Ibbotson
11.15- Turbines and Generators	Rodrigue/Pereira
11.16- Miscellaneous Mechanical Equipment	Rodrigue
11.17- Accessory Electrical Equipment	Pereira
11.18- Switchyard Structures and Equipment	Shadeed
11.19- Project Lands	Smith

	<u>RESPONSIBILITY</u>
12 - TRANSMISSION FACILITIES	
12.1 - Electric Systems Studies)
12.2 - Corridor Selection Studies	) Shadeed
12.3 - Detailed Route Selection)
12.4 - Towers, Hardware and Conductors)
12.5 - Substations)
12.6 - Dispatch Center and Communications)
13 - PROJECT OPERATION	
13.1 - Project Operation	Pereira/Krishnan
13.2 - Operation and Maintenance	Pereira (lead)
13.3 - Dependable Capacity and Average Annual Energy	Krishnan
13.4 - Performance Monitoring	Ibbotson/Lamb
14 - ESTIMATES OF COST	
14.1 - Construction Costs	) Plummer
14.2 - Mitigation Costs)
14.3 - Operation, Maintenance and Replacement Costs)
14.4 - Engineering and Administration Costs)
14.5 - Allowance for Funds Used During Construction)
14.6 - Differential Escalation on Construction Costs)
14.7 - Cash Flow Requirements)
15 - DEVELOPMENT SCHEDULE	) Meilhede
15.1 - Watana Development)
15.2 - Devil Canyon Development)
15.3 - System Development Schedule)
16 - ECONOMIC AND FINANCIAL EVALUATION	
16.1 - Economic Evaluation	Diener
16.2 - Financial Evaluation	Warnock
16.3 - Power Marketing	Warnock
17 - CONCLUSIONS AND RECOMMENDATIONS	Lawrence (lead)

LIST OF APPENDICES

<u>VOLUME</u>	<u>APPENDIX</u>	<u>DESCRIPTION</u>
3	A	ELECTRICAL SUPPLY AND DEMAND STUDIES
	A1	OGP Data
4	B	HYDROLOGICAL STUDIES
	B1	Hydrological and Meteorological Data
	B2	Water Resources Studies
	B3	Flood Studies
	B4	Hydraulic and Ice Studies
	B5	Sediment Yield and River Morphology Studies
	B6	Climatic Studies for Transmission Line
	B7	Lower Susitna River Studies
5	C	PROJECT LAND STUDIES
	C1	Land Status Background Information
	C2	Inventory of Private & Public Lands Required for Project
	C3	Marketability and Disposal Study for Reservoir Area
6	D	DESIGN DEVELOPMENT STUDIES
	D1	Access Route Selection Studies
	D2	Dam Selection Studies
	D3	Project Layout Studies
	D4	Power Facilities Selection Studies
7	E	TRANSMISSION LINE STUDIES
	E1	Electric Systems Studies
8	F	COST ESTIMATES
	F1	Watana Hydroelectric Development - Estimate of Cost
	F2	Devil Canyon Hydroelectric Development - Estimate of Cost
	F3	Transmission Facilities - Estimate of Cost
9	G	AGENCY CONSULTATION
10	H	COORDINATION AND PUBLIC PARTICIPATION
11	I	COMMENTS AND RESPONSES

September 30, 1981

REFERENCED REPORTS

The following is a list of reports which will be referenced but not included in Volume 1 of the feasibility report and appendices. Referenced reports for Volume 2 are not included.

Subtask		Date of Issue
1.02	Forecasting Peak Electrical Demand for Alaska's Railbelt (WCC)	December 1, 1980
2.10	Access Route Selection Report (Draft)	October 31, 1981
Task 4	Final Report on Seismic Studies (WCC)	January 31, 1982
Task 5	Geotechnical Exploration Report on 1980 Studies	August, 1981
Task 5	Geotechnical Exploration Report on 1981 Studies	February 1982
6.05	Development Selection Report	September 1981
8.03	Final Transmission Line Route Selection Report	February, 1982

SECTION 3 - SCHEDULE

3.1 - Key Dates

The schedule for preparation and production of Volumes 1 and 2 together with the appendices is presented on the following schedule sheets.

Key dates for the Report and related deliverables are as follows:

First Draft of Report and Appendices to Client for Review	February 1, 1982
Final Seismic Report Issued by Woodward-Clyde	February 1, 1982
Environmental Component of Feasibility Report (Volume 2) issued by TES for review by Client	March 1, 1982
Comments and Revisions to First Draft of Report and Appendices Completed.....	March 1, 1982
Final Draft of Report and Appendices Delivered to Client.....	March 15, 1982
First Draft of Project Overview Report.....	March 15, 1982
Final Draft of Project Overview Report.....	April/82
Final Feasibility Report Issued to Client.....	April 30, 1982*

*Subject to receipt of comments and responses

First draft issue of the Report will be limited to less than 25 copies. Final draft and final issues will be as indicated in Section 5.

3.2 - First Draft Issue

The first draft issue of the report (February 1, 1982) will be limited to less than 25 copies. The purpose of this issue is to give the Client an opportunity to comment on the report. In this regard, the text should be reasonably complete and readable, however, final and comprehensive proofreading will not likely be possible at this time. Similarly, drawings (plates or figures) accompanying this first draft, should be complete enough to illustrate their specific purpose, but not necessarily with drafting check or all the finishing touches for final reproduction completed. Some drawings may possibly have to follow the February 1 issue date.

It is not anticipated that the Client's comments will result in serious changes to drawings. We should, however, be prepared to modify the text significantly as a result of this first draft review.

3.3 - Final Draft Issue

This is the key issue (March 15, 1982) for the Report. It is expected that 2 weeks will be required to assemble, reduce, print, collate, bind and ship the Report, so that all text, figures and plates must be complete by March 1, 1982.

3.4 - Other Material

The schedule and details of the final issue of the Feasibility Report and of the Project Overview Report will be provided later.

SECTION 4 - RESPONSIBILITIES

4.1 - Overall Coordination

Overall management of the preparation and production of the Feasibility Report is the responsibility of M.R. Vanderburgh. J.E. McBee will serve as Technical Editor for all sections of the report and will direct actual reproduction and distribution of the first draft and the final draft report and appendices.

Specifically, the responsibilities of the Technical Editor are as follows:

- 1) Ensure that the overall schedule for preparation and production of the report is maintained.
- 2) Develop standards for final preparation of text, tables, covers and other non-graphical material.
- 3) Edit draft material to ensure a uniformly high quality report presentation.
- 4) Establish methods of reproduction for various draft and final versions of the report (including graphic material) and select vendor(s), in consultation with Graphics Department.
- 5) Ensure final versions are proofread and check submitted graphical material for reproducibility.
- 6) Supervise and coordinate reproduction of various draft and final versions of the report.
- 7) Supervise and coordinate distribution of reports.
- 8) Receive comments (internal and external) through various section coordinators and incorporate same in final versions.

4.2 - Technical Input

The persons named in the right hand column of the report outline have primary responsibility for the preparation and technical content of the sections and sub-sections indicated including all graphic and tabular material.

These responsibilities include:

- 1) Preparation of a list and production schedule of all plates and drawings required for the report and submission to the Project Squad Leader and Technical Editor.
- 2) Preparation of draft text and submission to Technical Editor.
- 3) Direction and technical input for figures, plates and drawings and submission to Project Squad Leader for preparation.
- 4) Review of draft text for technical content after editing and word processing.
- 5) Review of figures, plates and drawings at appropriate stages of preparation.
- 6) Ensuring that the particular section and sub-section is consistent and up-to-date with other relevant portions of the feasibility report and with the Client and project requirements.

The preparation of all plates and drawings shall be coordinated by Jack Mazurkiewicz, as Project Squad Leader.

His responsibilities include the following:

- 1) Supervision and coordination of preparation and checking of all figures, plates and drawings, including ensuring sufficient manpower is available to meet the schedule, quality control of drafting and adherence to Company and project standards.

- 2) Circulation of check prints for approval and comment by other departments.
Expediting of same.
- 3) Submission of completed originals to Technical Editor for reproduction.
Technical Editor will be responsible for reduction and other photographic operations, with assistance and cooperation of Graphics Department.
- 4) Control of drafting budget.

SECTION 5 - DISTRIBUTION

A preliminary distribution list for the final draft and final reports is presented in Table 1. A preliminary distribution list for the first draft (February 1, 1982) is given in Table 2.

A list of agencies receiving the final draft report as part of the formal agency coordination process is included herein for reference.

SUSITNA HYDROELECTRIC PROJECT
REPORTS CIRCULATED FOR FORMAL AGENCY COORDINATION

<u>NAME</u>	<u>NUMBER KEY</u>
Plan of Study	1
1980 Environmental Summary Report	2
1980 Fish Ecology Annual Report	3
1980 Plant Ecology Annual Report	4
1980 Big Game Annual Report	5
1980 Furbearer Annual Report	6
1980 Birds and Non-Game Mammal Annual Report	7
1980 Land Use Annual Report	8
1980 Socioeconomic Annual Report	9
1980 Cultural Resources Annual Report	10
Transmission Line Corridor Screening Report	11
Development Selection Report	12
1981 Final Subtask Report	13
Draft Feasibility Report	14

	<u>Reports sent/to be sent</u>
Regional Administrator Region X U.S. Environmental Protection Agency 1200 South Avenue Seattle, WA 98101	1, 2, 11, 12, 13, 14
Col. Lee Nunn District Engineer U.S. Army Corps of Engineers Anchorage District P.O. Box 7002 Anchorage, Alaska 99510	1, 2, 11, 12, 13, 14
Mr. Keith Schreiner Regional Director, Region 7 U.S. Fish and Wildlife Service 1011 E. Tudor Road Anchorage, Alaska 99503	1, 2, 3, 4, 5, 6, 7, 11, 12, 13, 14
Mr. Robert McVey Director, Alaska Region National Marine Fisheries Service NOAA P.O. Box 1668 Juneau, Alaska 99802	1, 2, 3, 4, 5, 6, 7, 11, 12, 13, 14
Mr. John E. Cook Regional Director Alaska Office National Park Service 540 West Fifth Avenue Anchorage, Alaska 99501	1, 2, 9, 10, 11, 12, 13, 14
Mr. John Rego Bureau of Land Management 701-C Street Anchorage, Alaska 99501	1, 2, 8, 11, 12, 13, 14
Mr. Larry Wright National Park Service 1011 E. Tudor Road, Suite 297 Anchorage, Alaska 99503	1, 2, 11, 12, 13, 14
Ms. Judy Schwarz U.S. Environmental Protection Agency Mail Stop 443 Region X EPA 1200 South 6th Avenue Seattle, Washington 98101	1, 2, 11, 12, 13, 14
Mr. Ron Morris Director, Anchorage Field Office National Marine Fisheries Service 701 C Street Box 43 Anchorage, Alaska 99513	1, 2, 11, 12, 13, 14

	Reports sent/to be sent
Mr. Ronald O. Skoog Commissioner State of Alaska Department of Fish and Game Juneau, Alaska 99801	1, 2, 3, 4, 5, 6, 7, 11, 12, 13, 14
Mr. Ernest W. Mueller Commissioner Alaska Department of Environmental Conservation Juneau, Alaska 99801	1, 2, 3, 4, 5, 6, 7, 11, 12, 13, 14
Mr. Lee Wyatt Planning Director Matanuska-Susitna Barough Box B Palmer, Alaska 99811	1, 2, 11, 12, 13, 14
Mr. Tom Barnes Office of Coastal Management Division of Policy Development & Planning Pouch AP Juneau, Alaska 99811	1, 2, 11, 12, 13, 14
Mr. Roy Huhndorf Cook Inlet Region Corporation P.O. Drawer 4N Anchorage, Alaska 99509	1, 2, 8, 11, 12, 13, 14
Mr. Thomas Trent State of Alaska Department of Fish & Game 333 Raspberry Road Anchorage, Alaska 99502	1, 2, 11, 12, 13, 14
Mr. Bob Martin Alaska Department of Environmental Conservation 437 E. Street, 2nd Floor Anchorage, Alaska 99501	1, 2, 11, 12, 13, 14
Mr. Alan Carson Alaska Department of Natural Resources 323 East 4th Avenue Anchorage, Alaska 99501	1, 2, 11, 12, 13, 14
Ms. Lee McAnerney Commissioner Department of Community & Regional Affairs Pouch B Juneau, Alaska 99811	1, 2, 9, 11, 12, 13, 14
Mr. Robert Shaw State Historic Preservation Officer Alaska Department of Natural Resources Division of Parks 619 Warehouse Avenue, 210 Anchorage, Alaska 99501	1, 2, 9, 10, 11, 12, 13, 14
Mr. John Katz Alaska Department of Natural Resources Pouch M Juneau, Alaska 99811	1, 2, 8, 11, 12, 13, 14

TABLE 1

SUSITNA FEASIBILITY REPORT
PRELIMINARY DISTRIBUTION LIST

Final Draft

Copy	Recipient	Vol.	Vol.	Appendices								
		1	2	A	B	C	D	E	F	G	H	I
1	File	X	X	X	X	X	X	X	X	X	X	
2	File	X	X	X	X	X	X	X	X	X	X	
3	File	X	X	X	X	X	X	X	X	X	X	
4	D.C. Willett	X	X									
5	J.D. Lawrence	X	X	X	X	X	X	X	X	X	X	
6	J.W. Hayden	X	X	X	X	X	X	X	X	X	X	
7	M.R. Vanderburgh	X	X									
8	R.B. Peck	X	X	X	X	X	X	X	X	X	X	
9	A.J. Hendron	X	X	X	X	X	X	X	X	X	X	
10	L.S. Sykes	X	X	X	X	X	X	X	X	X	X	
11	M.D. Copen	X	X	X	X	X	X	X	X	X	X	
12	S. Tibshirani	X	X	X	X	X	X	X	X	X	X	
13	J.G. Warnock	X	X	X	X	X	X	X	X	X	X	
14	D.H. MacDonald	X	X	X	X	X	X	X	X	X	X	
15	J.G.S. Thomson	X	X	X								
16	L. Wolofsky	X	X	X								
17	J.G. MacPherson	X	X	X	X	X	X	X	X	X		
18	H. Eichenbaum	X	X	X								
19	I. McCaig	X	X	X								
20	R.K. Ibbotson	X	X	X	X	X	X	X	X	X		
21	S.N. Thompson	X	X				X	X	X	X		
22	V. Singh	X	X				X	X	X	X		
23	D.W. Lamb	X	X				X	X	X	X		
24	G. Krishnan	X	X	X	X		X		X	X		
25	K.R. Young	X	X		X	X	X	X	X	X		
26	E.N. Shadeed	X	X	X		X	X	X	X	X		
27	Spare	X	X				X					
28	Spare	X	X				X					
29	Spare	X	X				X					
30	Spare	X	X				X					
Totals		30	30	20	16	16	24	19	20	29	12	

TABLE 2

SUSITNA FEASIBILITY REPORT
PRELIMINARY DISTRIBUTION REPORT

First Draft

<u>Copy</u>	<u>Recipient</u>	<u>Volumes 1 & 2</u>	<u>Appendices</u>							
			<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>	<u>G</u>	<u>H</u>
1	APA	X	X	X	X	X	X	X	X	X
2	APA	X	X	X	X	X	X	X	X	X
3	APA	X	X	X	X	X	X	X	X	X
4	APA	X	X	X	X	X	X	X	X	X
5	APA	X	X	X	X	X	X	X	X	X
6	File - Buffalo	X	X	X	X	X	X	X	X	X
7	File - Buffalo	X	X	X	X	X	X	X	X	X
8	File - Columbia	X	X	X	X	X	X	X	X	X
9	File - Anchorage	X	X	X	X	X	X	X	X	X
10	File - Anchorage	X	X	X	X	X	X	X	X	X
11	TES	X		X	X	X	X		X	X
12	R&M	X		X	X	X	X	X	X	X
13	Woodwardy-Clyde	X			X	X	X	X	X	X
14	Circi/H&N	X			X	X	X	X	X	X
15	Moolin Associates	X				X	X	X	X	X
16	Spare	X								
17	J.G. Warnock	X	X			X	X	X	X	X
18	Working copies	X	X	X		X	X	X	X	X
19	Working copies	X	X	X		X	X	X	X	X
20	Working copies	X				X				
21	Working copies	X				X				
22	Working copies	X				X				
Totals		22	13	14	14	21	18	17	18	18

TABLE 3

DISTRIBUTION OF REPORT

	<i>Final</i> Agency Coordination		Acres American						Sub- Contractors		Alaska Power Authority		Misc.		Total	
			Buffalo		Anchorage		Columbia									
	D	F	D	F	D	F	D	F	D	F	D	F	D	F	D	F
VOLUME 1 - Engineering & Economic Aspects	20	-	25	50	3	3	7	7	10	10	191	122	2	2	251	193
VOLUME 2 - Environmental Aspects	20	-	25	50	3	3	7	7	10	10	191	122	2	2	251	193
VOLUME 3 -																
Appendix A - Electrical Supply & Demand Studies	20	-	15	25	3	3	7	4	10	10	100	70	2	2	150	114
Appendix B - Hydrological Studies	20	-	15	25	3	3	7	4	10	10	100	70	2	2	150	114
Appendix C - Project Lands Studies	20	-	15	25	3	3	7	4	10	10	100	70	2	2	150	114
Appendix D - Design Development Studies	20	-	15	25	3	3	7	4	10	10	100	70	2	2	150	114
Appendix E - Transmission Line Studies	20	-	15	25	3	3	7	4	10	10	100	70	2	2	150	114
Appendix F - Cost Estimates	20	-	15	25	3	3	7	4	10	10	100	70	2	2	150	114
Appendix G - Risk & Sensitivity Analysis	20	-	15	25	3	3	7	4	10	10	100	70	2	2	150	114
Appendix H - Coordination & Public Participation	20	-	15	25	3	3	7	4	10	10	100	70	2	2	150	114
Appendix I - Comments & Responses	--	-	--	25	-	3	-	4	--	10	---	70	-	2	---	114

SECTION 6-

6.1 - General

Graphical presentations will be either in the form of figures or plates. Preparation of figures and plates shall be in accordance with Attachment B - Susitan Hydroelectric Project - Feasibility and Geotechnical Reports - Drafting Procedures, and Acres Drafting Standards for Hydroelectric & Heavy Civil Projects, dated February 20, 1980 or subsequent revisions.

6.2 - Figures

For the purpose of the Report, figures fall into one or more of the following categories:

- a chart, graph, simple drawing or map which is meant to be read in conjunction with a specific section of the text;
- a chart, etc. published by others which is required to illustrate or complement the report.

The figure will be inserted at the back of each section. Wherever a choice is possible, figures should be 8-1/2 " x 11" (final size) although 11" x 17" will be accepted grudgingly. (The 11" x 17" size causes complications during binding since it must be folded and inserted in the text.) A typical figure arrangement is presented in Attachment B.

In order to improve clarity, where appropriate, figures which contain a great deal of line work should be drawn oversize for reduction. This will not be practical in all cases, of course, and caution and judgement should be used with material from other sources, since reduction often reduces clarity in these cases.

6.3 - Plates

Plates will fall into one or more of the following categories:

- a drawing prepared for other project purposes (i.e., preliminary design, etc.);
- a drawing referred to in more than one section of the Report; or
- a drawing which will be used for the FERC license application.

Plates will be limited to 11 inches by 17 inches in their final reduced version in the Report. Color may be used where appropriate, although color presentations should be coordinated with the Technical Editor to ensure reasonable uniformity of presentation and to avoid excessive cost.

Drawings shall be prepared suitable for reduction. In general, it is preferable to prepare drawings to a larger scale and to reduce them, since clarity is improved by this means. Accordingly, preparation of drawings to final 11" x 17" size should be avoided, particularly where line work is congested or complicated.

SECTION 7 - TEXT

7.1 - Format

All draft sections should be typed and submitted to the Technical Editor for initial review. Sections should be broken down as follows:

Two digits	1.1
Letters	(a)
Roman Numerals	(i)
Dash	-
Dot	.

After initial review, the draft will be put on the Lanier to facilitate future revisions.

7.2 - Contents

Included in Attachment A are brief descriptions of each section and a schedule for submittal of drafts. The person responsible for each section of the Report is listed in the right margin of the table of contents. It is his responsibility, along with the task coordinators, to make sure these sections are delivered to the Technical Editor on schedule.

SECTION 8 - APPENDICES

- To Follow

SECTION 9 - REPRODUCTION

- To follow

ATTACHMENT A

SUMMARY OUTLINES OF VOLUME 1 & 2

SUSITNA HYDROELECTRIC PROJECT
FEASIBILITY REPORT

1 - INTRODUCTION

Preamble similar to DSR.

1.1 - The Study Area

Similar to DSR.

1.2 - Project Description

Updated from DSR.

1.3 - Objectives and Scope of Current Studies

Similar to DSR.

1.4 - Plan Formulation and Selection Process

Preamble similar to DSR.

(a) Planning Methodology

Edited version from DSR

(b) Economic Analyses

Version from DSR revised and updated as appropriate

1.5 - Organization of Report

Brief description of objective of report

VOLUME 1 - Technical and Economic Aspects

Brief (one or two sentence) description of each section.

VOLUME 2 - Environmental Aspects

Brief (one or two sentence) description of each section.

VOLUME 3 to 8 - Appendices - Technical and Economic Aspects

Brief description of contents of each volume.

2 - SUMMARY

✓ 2.1 - Scope of Work

Preamble similar in format to corresponding section of DSR, modified and updated to suit.

✓ 2.2 - Previous Studies

Similar to DSR.

✓ 2.3 - Railbelt Load Forecasts

Similar to DSR with results and implications of Battelle studies incorporated.

✓ 2.4 - Railbelt System & Future Power Generating Options

Similar to DSR with results and implications of Battelle studies incorporated.

✓ 2.5 - Susitna Basin

Similar to DSR, updated as appropriate.

✓ 2.6 - Susitna Basin Development Selection

Similar to DSR, updated as appropriate.

✓ 2.7 - Susitna Hydroelectric Development

Edited and updated version of corresponding section of DSR.

✓ 2.8 - Watana Development

Summary description of site characteristics and project components.

✓ 2.9 - Devil Canyon Development

Summary description of site characteristics and project components.

✓ 2.10 - Transmission Facilities

Summary description of electric system studies, corridor selection studies, detailed route selection, and facilities.

✓ 2.11 - Estimates of Cost

Summary of components of project cost (construction, engineering, etc.) and tabulated costs. Brief description of basis for AFDC, escalation and cash flow.

✓ 2.12 - Development Schedule

Brief summary of schedule milestones for Watana and Devil Canyon. Simplified bar chart schedule to accompany.

5 1/2

11

8

12

8

4

2

2

✓ 2.13 - Environmental Impacts and Mitigation Measures

Brief summary of the principal environmental impacts of the project and the measures recommended and/or incorporated in the project to mitigate these impacts. 7 6

✓ 2.14 - Project Operation

Discussion of how reservoirs will be operated (i.e., relative to maximum energy vs. environmental restraints). Discussion of operating and maintenance options, staff requirements, (permanent and temporary). 2

2.15 - Economic and Financial Evaluation

Summary and discussion of economic evaluation, financial evaluation and power marketing. 4

2.16 - Conclusions and Recommendations

A 2 or 3 page summary of basic conclusions and recommendations of the study. 2

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3 - SCOPE OF WORK

Preamble generally describing scope of feasibility study, i.e., development selection and more detailed engineering studies to establish conceptual designs. Mention input from power studies, site surveys, hydrological and geotechnical field programs, seismic studies, environmental studies and transmission studies.

Include a brief discussion of the evolution of the plan of study.

3.1 - Evolution of Plan of Study

Brief statement of objectives and scope.

4 - PREVIOUS STUDIES

From corresponding section in LTR.

5 - RAILBELT LOAD FORECASTS

5.1 - Introduction

Brief outline of purpose of section.

5.2 - Past Projections of Railbelt Electricity Demand

Outline of past projections, based on Section 5.4 of DSR: revised as appropriate.

5.3 - ISER Forecasts

Outline of methodology, assumptions, address forecasting uncertainty, summarize results of forecasts.

5.4 - Electricity Demand Profiles

Review of historical growth of electricity consumption in Railbelt; see similar section (5.2) in DSR.

5.5 - Demand Forecasts

Discuss approach, load pattern, sales allocation, peak loads, etc.; see similar section (5.5) in DSR.

5.6 - Potential for Load Management and Energy Conservation

See similar section (5.6) in DSR.

5.7 - Battelle Forecasts

Summarize forecasts presented in Battelle report.

5.8 - Load Forecasts used for Generation Planning Studies

Discuss forecasts used in relation to all of the above.

6 - RAILBELT SYSTEM & FUTURE POWER GENERATION OPTIONS

6.1 - Introduction

See Section 6.1 of DSR.

6.2 - Existing System Characteristics

See Section 6.2 of DSR.

6.3 - Fairbanks-Anchorage Intertie

Update of Section 6.3 of DSR.

6.4 - Hydroelectric Options

See Section 6.4 of DSR; update as required.

6.5 - Thermal Options

See Section 6.5 of DSR; update as required.

6.6 - Without Susitna Plan

Describe "options" if Susitna not constructed.

7 - SUSITNA BASIN

7.1 - General

State purpose of section to describe climatological, physical and environmental characteristics of Susitna River Basin. Information from previous data sources augmented by field programs and office studies undertaken in 1980 and 1981.

7.2 - Climatology

General description of climate in upper and lower basin.

(a) Climatic Data Records

Describe sources of previous NOAA data (Summary table of data). Describe automatic stations. Figure (Station locations).

(b) Precipitation

Describe precipitation patterns in Basin based on existing records.
Figure (regional isohyter map if data sufficient)
Describe SCS snow course station network.

(c) Temperature

Tabulation of historical temperature records.

7.3 - Hydrology

(a) Streamflow Records

Describe sources of previous USGS data. Figure (station locations)
Describe multisite correlation technique to extend available data.
Describe gaging station established at Watana
2 or 3 summary tables
Figures - Flow Distribution in Basin
(4 or 5) - Stream Flow Distribution (by correlation technique)
- Watana Rating Curve

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Refer to appendix for detailed information.

(b) River Ice

Describe previously observed ice conditions (see DSR)

Describe current program, including computer model simulations, refer to appendix for detailed data, etc.

(c) Floods

Discussion of flood peak origin, and regional flood frequency analyses similar to comparable section in DSR.

Present and discuss results of latest reassessment of spillway design floods for both projects.

Present and discuss results of review of COE PMF estimates. Refer to appendices for detailed data.

Tables - 3 or 4 summarizing basic data

Figures - 3 or 4 flood hydrographs, etc. as required to illustrate results.

(d) Sediment Yield and River Morphology

Discuss level of existing sediment sampling data and previous studies

Discuss proposed reassessment of reservoir sediment accumulation after several years of data has been collected.

Discuss results of river morphology studies

Table - summary data

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7.4 - Regional Geology

(a) Geologic Setting

General description of geological setting of basin - Talkeetna Mountains

Figure - regional map

(b) Stratigraphy

Description of three main bedrock groups, origin, etc.

Figures - Geologic time scale

- Generalized geological column

- Generalized geological plan

(c) Structural

Description of periods and mechanisms of rock deformation:

- Jurassic period (metamorphism, plutonism & uplift

- middle to late Cretaceous (alpine-type orogeny)

- Tertiary period (faulting & minor folding)

Figures - main structural features

(d) Surface Geology

Description of surface geology, including influences of climatic conditions (weathering), glacial advance and retreat, permafrost

Describe soil types

Figure - surface geology map

7.5 - Seismology

Brief introductory section noting relative lack of available data previous to study. Mention comprehensive field and office study program undertaken as part of work program. Refer to WCC final report on seismic studies.

(a) Seismic Geology

Discuss regional geology in relation to seismology of region.

(b) Field Investigation

Summarize field investigations undertaken in 1980 and 1981. Briefly describe screening process (i.e., 216 lineaments screened to identify 48 significant features as candidates for further study, reduced to 13 features significant to project design. Significant features relative to each site will be discussed in more detail in Sections 10 and 11.

(c) Seismic Monitoring

Discuss results of 1980 microseismic monitoring program. Describe program for future seismologic network monitoring.

(d) Reservoir Induced Seismicity

Describe mechanism of RIS, briefly discuss recorded experience with other large reservoirs. Discuss implications of RIS with respect to Susitna. Specific discussion of RIS if appropriate will be in Sections 10 and 11.

(e) Ground Motion Evaluations

Identify sources of potential earthquakes. Discuss 13 significant features in relation to earthquake potential.

Present maximum credible earthquake magnitudes (and peak particle accelerations) for potential earthquake sources.

Discuss design of dams to withstand ground motions. Specific considerations relative to dam design to be discussed in Sections 10 and 11.

7.6 - Water Use and Quality

Describe existing surface water quality in the Susitna river and major tributaries.

7.7 - Fishery Resources

Describe species and distribution of anadromous and resident fishes. Focus on area critical to reproduction. Use figures to show these areas.

7.8 - Wildlife Resources

(a) Big Game

- Moose

Describe population levels, distribution, movement and habitat uses, both upstream and downstream of the dam sites. Utilize figures from TES.

- Caribou

Describe population levels, distribution and migration routes, particularly as they related to access road. Utilize figures from TES.

- Wolf

Describe number and territory of packs and relationships to and dependence on moose populations. Use figures from TES.

- Wolverine

Describe population estimates, movement patterns and habitat use.

- Bear

Describe distribution, number, movement patterns, habitats, use of salmon, den location.

- Dall Sheep

Describe number and location of herds and location of licks.

- Furbearers

Describe number and distribution of aquatic furbearers (beaver, muskrat, mink, other) together; then same for other furbearers. Focus on habitat relationships.

(b) Birds and Non-game Mammals

Describe number of avian species and important habitats. Focus on raptors.
Describe number of non-game mammal species and important habitats.

7.9 - Botanical Resources

Describe existing plant communities in the area to be affected, acreages of each and significance. Include downstream flood plain area, transmission and access routes. Use figures and tables from TES.

7.10 - Historic and Archaeological Resources

Describe number of sites discovered in areas affected by construction and operation of the dams, impoundments, transmission line and access roads. Describe which are known to be significant or eligible for the National Register and those to which impacts cannot be avoided. Use map to show significant sites and table to show number.

7.11 - Socioeconomics

Describe the local, regional and state impact area and, using tables, the socioeconomic parameters of each.

7.12 - Recreational Resources

Describe existing recreational use of the project area. Use figures to show important recreation areas.

7.13 - Aesthetic Resources

Describe aesthetic resources of the area. Photo?

7.14 - Land Use

Describe existing land use in the project area.

8 - Susitna Basin Development Selection

Describe purpose of section to select a preferred development plan and compare selected plan with alternative methods of generating Railbelt energy needs. Comparison based on technical, economic, environmental and social aspects.

Refer to DSR for more detailed evaluation.

8.2 - Plan Formulation & Selection Methodology

Outline basic steps in plan formulation and selection process:

- define objectives;
- select candidate dam sites;
- screen candidates dam sites;
- formulate development plans;
- detailed evaluation of plans;

8.3 - Selection of Candidate Dam Sites

(a) Candidate Dam Sites

List sites and show locations:

- Gold Creek;
- Susitna II (Olson);
- Devil Canyon;
- High Devil Canyon (Susitna II);
- Devil Creek;
- Watana;
- Susitna III;
- Vee;
- Maclaren;
- Denali;
- Bette Creek;
- Tyone

Summarize relevant data re: dam type, reservoir levels, etc.
Describe level of study detail.

(b) Power and Energy Estimates

Describe basis and tabulate.

(c) Capital Cost Estimates

Describe briefly and tabulate.

8.4 - Site Screening

Briefly state objective. Identify criteria.

(a) Screening Criteria

Describe criteria and discuss under following headings:

- environmental
- alternative sites
- energy contribution

(b) Screening Process

Describe results of screening process:

- site eliminated
- sites retained

8.5 - Engineering Layouts

Describe process of development of engineering layouts and re-evaluating costs for 7 remaining sites. Discuss staged development.

(a) Devil Canyon

Brief description (General Arrangement Drawing) of layout

(b) Watana

AS ABOVE

(c) High Devil Canyon

AS ABOVE

(d) Susitna III

AS ABOVE

(e) Vee

AS ABOVE

(f) Maclaren

AS ABOVE

(g) Denali

AS ABOVE

8.6 - Capital Cost Estimates

Brief discussion of sources of data, methods of developing costs, treatment of contingencies, indirect costs, etc.

Summarize data (tables).

8.7 - Formulation of Susitna Basin Development Plans

Describe process to select preferred development plan.

(a) Application of Screening Model

Summary description of model, input data, model runs and results/

(b) Tunnel Scheme

Discuss rationale for replacing Devil Canyon with long tunnel in combination with Watana. Discuss four sub-alternative schemes:

- re-regulation downstream of Watana (peaking)
- tunnel intake in Watana reservoir (peaking)
- base load operation with re-regulating dam
- base load operation with intakes in Watana reservoir

(c) Additional Basin Development Plan

Watana & Devil Canyon together. Briefly describe.

(d) Selected Basin Development Plans

Identify plans selected for more detailed evaluation

- Watana/Devil Canyon
- High Devil Canyon/Vee
- Watana/Tunnel
- Watana/High Devil Canyon

Discuss subplans considering staged construction.

8.8 - Evaluation of Basin Development Plan

Briefly discuss objectives.

(a) Preliminary Evaluations

Summarize basic data relative to cost, construction schedule, energy production for selected plans. Reference to multireservoir model simulation. Discussion of project restraints.

(b) Plan Modifications

Discuss modifications to plans for re-regulation dams to mitigate problems associated with daily peaking.

(c) Evaluation Criteria and Methodology

Discuss approach

- least cost only for optimum staging concept
- economic, environmental, social, and energy considerations for most appropriate plan.

Discuss use of OGP5 model, input, results of simulation studies.

(d) Initial Economic Analysis

Discuss tabulated results, economic life on-dine date assumptions, etc.

(e) Economic Sensitivity Analysis

Discuss impact of low and high low growth scenarios on results.

(f) Evaluation Criteria

List and briefly discuss various criteria:

- economic
- environmental
- social
- energy contribution

(g) Results of Evaluation Process

Discuss each alternative under various criteria listed above:

- Devil Canyon vs tunnel
- Watana/Devil Canyon vs High Devil Canyon/Vee

Identify preferred Susitna Basin development plan.

8.9 - On-Line Schedule

Brief discussion of on-line schedule for various alternatives.

9 - SUSITNA HYDROELECTRIC DEVELOPMENT

Outline purpose of this section to describe site topography, geology, seismicity for both Watana and Devil Creek (selected development plan for Section 8), describe process by which final layouts, reservoir levels, and installed capacity, selected for each development.

Section will also describe process of selecting access route to Devil Canyon and Watana.

9.1 - Site Topography

(a) Watana

Description of site topography and discussion of implications on project arrangement.

(b) Devil Canyon

AS (a) ABOVE.

9.2 - Site Geology

(a) Watana

Brief description of geological setting and structural geology (previously described in Section 7).

Describe engineering geology under following headings:

- soils
- rock types and properties
- groundwater
- faults, shear zones, altered zones and other similar features.

(b) Devil Canyon

AS (a) ABOVE

9.3 - Geotechnical Considerations

(a) Watana

Discuss implications of geological conditions under following headings:

- foundation permeability
- stability of underground structures
- stability of soil and rock slopes
- relict channel
- permafrost
- suitability of excavated materials for use in permanent construction
- potential borrow areas for embankment materials and concrete aggregates

(b) Devil Canyon

Discuss implications of geological conditions under following headings:

- foundation permeability
- suitability of dam abutments as arch dam foundations
- stability of underground structures
- stability of soil and rock slopes
- permafrost
- suitability of excavated materials for use in permanent construction
- potential borrow areas for embankment materials and concrete aggregates

9.4 - Site Seismicity

(a) Watana

Discuss implications of site seismicity on design of structures at Watana and reservoir.

(b) Devil Canyon

AS (a) ABOVE.

9.5 - Selection of Reservoir Levels

Describe methodology for preliminary selection of reservoir levels at Watana and Devil Canyon.

Discussion of economic, physical and environmental restraints on the selected levels.

Presentation and discussion of results.

9.6 - Selection of Installed Capacity

Describe methodology for preliminary selection of installed capacity at Watana and Devil Canyon.

Discuss economic, physical and environmental restraints on reservoir fluctuations, minimum discharges, etc.

Presentation and discussion of results.

9.7 - Selection of Spillway Capacity

Refer to Section 7.3. Describe flood routing analysis for Watana, performed for various spillway capacities. Discuss results of analysis and implications on alternative methods of handling intermediate to PMF flood events.

Discuss dependency of Devil Canyon spillway capacity requirements on selected capacity at Watana.

9.8 - Selection of Watana General Arrangement

Discuss briefly main components of general arrangement as introduction to following sections.

(a) Main Dam

Discuss selection of dam type (embankment or concrete arch). Briefly describe selected dam section. Describe alternative dam axis locations evaluated.

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(b) Diversion

Briefly describe diversion scheme, including advantages and disadvantages of right and left bank location.

(c) Spillway Facilities

Discuss design concept adopted for purposes of establishing general arrangement. Refer to Section 9.7 above.

Describe various spillway facilities

- tunnel spillway with fixed cone type outlet valve
- chute spillway (with flip bucket or stilling basin)
- cascade type spillway
- emergency spillway (fuse plug or gated)

(d) Low Level Outlet Facilities

Discuss concept and describe facilities.

(e) Saddle Dam

Discuss need for saddle dam, foundation conditions, etc.

(f) Relict Channel

Discuss influence of possible buried channel on project arrangement.
Discuss alternatives for avoidance or treatment of affected area.

(g) Power Facilities

Discuss design and construction considerations relative to surface or underground powerhouse.

Describe facilities briefly.

(h) General Arrangement

Describe various project general arrangements evaluated.

Discuss economic, technical, environmental considerations involved with each alternative, and elimination process followed to select "best" layout.

Describe selected layout briefly (project facilities will be described in more detail in Section 10).

9.9 - Selection of Devil Canyon General Arrangement

Discuss briefly main components of general arrangement as introduction to following sections.

(a) Main Dam

As described in Section 9.9 for Watana.

(b) Diversion

As described in Section 9.9 for Watana

(c) Spillway Facilities

As described in Section 9.9 for Watana.

(d) Low Level Outlet Facilities

As described in Section 9.9 for Watana.

(e) Power Facilities

As described in Section 9.9 for Watana.

(f) Saddle Dam

Describe need for saddle dam, briefly describe dam type, foundation, contact at thrust block, etc.

(g) Power Facilities

As described in Section 9.9 for Watana.

(h) General Arrangement

As described in Section 9.9 for Watana.

9.10 - Selection of Main Access Plan

Outline purpose of section to describe selection process for access to Watana and Devil Canyon, describe alternating routes evaluated, describe selected route.

(a) Access Plan Selection Methodology

Describe methodology for access plan selection, economic, technical, socio-economic, environmental, and scheduling considerations involved in selection process.

(b) Alternative Access Plans

Describe 8 ⁺ access plans considered. Present economic, technical, socio-economic, environmental and scheduling advantages and disadvantages of each.

(c) Evaluation of Alternative Access Plans

Compare various plans and

(d) Results of Evaluation Process

Identify selected plan, discuss reasons for selection, and describe plan in more detail.

10 - WATANA DEVELOPMENT

Briefly outline purpose of this section to describe the various structures, permanent equipment and systems which comprise the project arrangement selected as described in Section 9. Note that descriptions of proposed project operation, estimates of dependable capacity and energy, operation and maintenance considerations and performance monitoring are presented in Section 15.

10.1 - General Arrangement

Outline description of each component of Watana Development, including:

- dam type and principal dimensions
- spillway types, capacities, salient features
- diversion arrangement and structures
- low level outlets
- power facilities
- major equipment
- permanent housing and miscellaneous structures

10.2 - Site Access

Describe site roads and bridges, access tunnels, air strip, etc. required for construction and for permanent operation.

- Plates - Location Plan
- Typical Arrangements

10.3 - Site Facilities

Describe facilities required for construction, i.e., camps, contractors areas, communications site power, services, hospitals, etc.

Describe permanent facilities, i.e., garages, machine shop, accomodation for permanent staff, etc.

10.4 - Diversion

Describe diversion scheme including sequence of diversion. Describe components of scheme under following headings:

- upstream cofferdam
- downstream cofferdam
- foundation treatment
- tunnel portals
- gate structure
- tunnels
- tunnel plugs

Plates - Cofferdams - Plans and Sections

- Gate Structure - Plans and Sections
- Tunnels - Arrangement and Typical Sections

10.5 - Low Level Outlet Facilities

Describe facilities and proposed method of operation.

Plates - Profile and Typical Sections and Details

10.6 - Main Dam

Description of dam (including construction methods) under following headings:

- sources of construction materials;
- precedent structures;
- excavation and foundation preparation;
- grouting and pressure relief;
- impervious core;
- filter and transition zones;
- upstream and downstream supporting zones;
- slope protection;
- construction schedule

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Description and discussion of specific design features under following headings:

- crest width;
- freeboard and crest superelevation;
- instrumentation;
- resistance to earthquake action;
- stability analysis;

Plates - Longitudinal Section

- Typical Cross Sections and Details

10.7 - Saddle Dam

Description of dam (including construction methods) under following headings:

- sources of construction materials;
- excavation and foundation treatment;
- special problems (permafrost);
- impervious core;
- filters and transitions;
- supportive zones;
- slope protection;

10.8 - Primary Outlet Facilities

Description of primary outlet works under following headings:

- intakes;
- tunnel(s);
- gates and valves;
- typical operation;

Plates - Longitudinal Section

- Typical Sections
- Gates and Valves Arrangement

10.9 - Main Spillway

Description of main spillway under following headings:

- excavation and rock support;
- gate structure;
- chute and flip bucket (or stilling basin);
- gates and hoists;
- special drainage provisions;
- typical operation;

Plates - Centerline Profile

- Typical Sections
- Gates Arrangement

10.10 - Emergency Spillway

Description of emergency spillway under the following headings:

- excavation and slope treatment;
- fuse plug or gate structure;
- operation;

Plates - Plan

- Centerline Profile
- Typical Section

10.11 - Intake

Description of power intake under following headings:

- intake channel excavation and slope treatment;
- intake structure foundation treatment;
- intake structure;
- intake gates and hoists;
- trashracks and stoplogs;

Plates - Plan

- Typical Sections
- Arrangement of gates and trashracks

10.12 - Penstocks

Description of penstocks under following headings:

- concrete lined tunnels;
- steel lined tunnels;
- manifold sections;
- grouting and drainage;

Plates - Plan

- Typical Sections

10.13 - Powerhouse

Description of powerhouse complex under following headings:

- access tunnel;
- powerhouse cavern;
- grouting and pressure relief;
- rock support;
- powerhouse substructure;
- powerhouse superstructure;
- erection bay;
- transformer gallery;
- draft tube tunnels;
- draft tube manifold;
- cable shaft;

Plates - Plan

- Isometric
- Typical Vertical and Horizontal Sections
- Typical Details

10.14 - Reservoir

Description of reservoir under following headings:

- extent of clearing;
- reservoir slope stability;
- sedimentation mitigation measures;

Plates - Plans

- Typical Sections

10.15 - Tailrace

Description of tailrace under following headings:

- tailrace tunnels;
- downstream portals;
- rock support & concrete lining;
- tailrace fluctuations;
- tailrace channel;

Plates - Plan

- Typical Sections

10.16 - Turbines & Generators

Description of turbine and generator equipment under following headings:

- turbines and governors;
- generators and exciters;
- penstock valves;
- equipment selection;
- potential vendors;
- turbine operating characteristics;
- installation considerations;

Plates - Single Line Diagram

- Typical Turbine Performance Curves
- Penstock Valves Typical Arrangement

10.17 - Miscellaneous Mechanical Equipment

Description of miscellaneous mechanical equipment under following headings:

- powerhouse crane(s);
- elevator(s);
- powerhouse dewatering systems;
- compressed air system;
- oil handling systems;
- heating and ventilating systems;
- domestic water and sewage system;
- draft tube gates & handling equipment;
- machine shop and electrical test equipment;
- fire protection system;

Plates - Equipment Layouts

- Typical Details
- Typical Flow Charts

10.18 - Accessory Electrical Equipment

Description of accessory electrical equipment under the following headings:

- generator step-up transformer;
- generator bus;
- circuit breaker cubicles;
- control metering and relaying panels;
- control room equipment;
- station service equipment;
- communications, telemetry and supervisory equipment;
- DC and field flashing systems;
- fire detection and alarm systems;
- 345 kv cable or bus;

Plates - Equipment Arrangement

- One-line Diagrams

10.19 - Switchyard Structures and Equipment

Description of switchyard structures and equipment under following headings:

- selection of switchyard type (SF₆ or conventional);
- switchyard location;
- voltage levels;
- equipment and structures;

Plates - Plan

- Equipment Arrangement
- One-line Diagrams

10.20 - Project Lands

Description of project lands under following headings:

- general description of ownership of lands in project area;
- land requirements for access;
- land requirements for construction areas;
- land requirements for permanent facilities;
- land requirements for borrow areas;
- land requirements for reservoir;
- reservoir buffer zone and recreation considerations;

Plates - Maps

11 - DEVIL CANYON DEVELOPMENT

Brief outline of purpose of section (similar to Section 10 for Watana).

11.1 - General Arrangement

Outline description of each component of Devil Canyon Development, including:

- dam type and principal dimensions;
- spillway types, capacities and salient features;
- diversion arrangement and structures;
- low level outlets;
- power facilities;
- major equipment;
- permanent housing and miscellaneous structures;

11.2 - Site Access

Describe site roads and bridges, access tunnels, etc. required for construction and for permanent operation. Relate to access which will be in place for Watana (if existing scheme maintained).

Plates - Location Plan
- Typical Arrangements

11.3 - Site Facilities

Similar as outlined in Section 10 for Watana.

11.4 - Diversion

Describe diversion scheme including sequence of diversion. Describe components of scheme under following headings:

- upstream cofferdam;
- downstream cofferdam;
- foundation treatment;
- tunnel portals;
- gate structure;
- tunnel;
- tunnel plug;

Plates - Cofferdams - Plans & Sections

- Gate Structure - Plans & Sections
- Tunnels - Arrangement & Typical Sections

11.5 - Arch Dam

Description of arch dam under the following headings:

- precedent structures;
- excavation and treatment of abutments;
- excavation and treatment of river bed foundations;
- concrete plug;
- arch structure;
- thrust block;
- crest details;
- construction schedule;
- construction methods;

Description and discussion of specific design features under following headings:

- freeboard;
- instrumentation;
- resistance to earthquake action;
- stability analysis;
- plunge pool treatment;

Plates - Plan
- Typical Sections

11.6 - Saddle Dam

Similar as outlined in Section 10 for Watana.

11.7 - Primary Outlet Facilities

Similar as outlined in Section 10 for Watana except note operation during initial filling for emergency drawdown.

11.8 - Main Spillway

Similar as outlined in Section 10 for Watana.

11.9 - Emergency Spillway

AS ABOVE

11.10 - Intake

AS ABOVE

11.11 - Penstocks

AS ABOVE

11.12 - Powerhouse

AS ABOVE

11.13 - Reservoir

AS ABOVE

11.14 - Tailrace

AS ABOVE

11.15 - Turbines and Generators

AS ABOVE

11.16 - Miscellaneous Mechanical Equipment

AS ABOVE

11.17 - Accessory Electrical Equipment

AS ABOVE

11.18 - Switchyard Structures and Equipment

AS ABOVE

11.19 - Project Lands

AS ABOVE

12 - TRANSMISSION FACILITIES

(Introductory statement)

12.1 - Electric System Studies

- briefly describe transmission planning criteria
- describe existing utilities system data
- power transfer requirements
- selection of transmission system configuration and characteristics
- performance of selected transmission system

(Figure - Transmission System Single Line)

(Possibly 2 or 3 tables)

12.2 - Corridor Selection

- briefly describe the corridor selection methodology
- a short discussion of previous studies
- describe selection criteria for feasible corridors and results
- describe screening criteria of alternate corridors and results
- summarize conclusions

12.3 - Detailed Route Selection

- briefly describe selection criteria
- describe selected 1/2 mi route
- show the 1/2 mi corridor on a map and include probable locations of substations

12.4 - Towers, Hardware and Conductors

- review different types of tower structures
- discuss foundation requirements in various geographical areas
- short discussion of conductor requirements
- discuss hardware and insulators

(2 or 3 figures)

12.5 - Substations

- briefly discuss single line diagrams
- review alternate substation arrangements
- discuss location of substations

(2 or 3 drawings)

12.6 - Dispatch Center and Communications

- briefly review existing utilities dispatch facilities
- discuss alternatives to achieve effective control of the Fairbanks/Susitna/Anchorage power pool
- propose a conceptual design
- discuss location of the dispatch center

(2 or 3 figures)

13 - PROJECT OPERATION

13.1 - Project Operation

Discussion of factors influencing operation of Watana and Devil Canyon. These would include:

- daily demand curves
- seasonal demand curves
- available flow
- restrictions on reservoir drawdown
- minimum flow requirements
- system stability
- synchronous condenser operation

Describe proposed operation of Watana and Devil Canyon within framework of above considerations and restraints.

13.2 - Dependable Capacity and Average Annual Energy

Outline of dependable capacity and annual energy production for both Watana and Devil Canyon. Emphasis will be on graphical and tabular data.

13.3 - Operation and Maintenance

Discussion of factors influencing type of station operation (i.e., remote, semi-remote, manual) and approach to routine inspection, normal repair and maintenance, emergency repair, etc. Discuss need (or otherwise) for permanent community, permanent and temporary staff levels, support facilities such as machine shop, vehicular service facilities, etc.

13.4 - Performance Monitoring

Description of various instruments, observational systems and reference points to monitor performance of the various project structures, particularly Watana and Devil Canyon dams, spillways, saddle dams, etc.

14 - ESTIMATES OF COST

14.1 - Construction Costs

Presentation of construction cost estimates for both Watana and Devil Canyon. The tabulated estimate will be accompanied by discussion covering the following:

- assumed cost levels (i.e. January 1982);
- sources of cost information (i.e., quantity takeoffs, information from suppliers);
- labor/materials breakdown (to be confirmed);
- contingencies for site construction;
- contingencies for equipment;
- treatment of taxes;

14.2 - Mitigation Costs

Discussion of cost for items incorporated into the projects to mitigate environmental impacts.

14.3 - Operation, Maintenance and Replacement Costs

Discussion of O&M costs and iterim replacement, etc.

14.4 - Engineering and Administration Costs

Presentation of engineering, management and administration costs for both Watana and Devil Canyon.

14.5 - Allowance for Funds Used During Construction

Discussion of AFDC assumptions made for projects.

14.6 - Differential Escalation on Construction Costs

Discussion of treatment of escalation in presentation of costs, both during construction and beyond.

14.7 - Cash Flow Requirements

Presentation of cash flow for construction of both Watana and Devil Canyon.

15 - DEVELOPMENT SCHEDULE

Preamble outlining main elements of total project (Watana and Devil Canyon schedule).

15.1 - Watana Development

Presentation of comprehensive project schedule for Watana. Discussion of principal features of schedule under following headings:

- site access;
- temporary construction facilities;
- diversion;
- main dam construction;
- construction of spillways;
- construction of powerhouse complex;
- permanent townsite facilities;
- transmission;
- critical items;

15.2 - Devil Canyon Development

Presentation of comprehensive project schedule for Watana. Discussion of principal features of schedule as outlined above for Devil Canyon.

15.3 - System Development Schedule

Present and discuss overall system development schedule.

16 - ECONOMIC AND FINANCIAL EVALUATION

16.1 - Economic Evaluation

Discussion of approach to economic evaluation. Assumptions relative to:

- construction cost escalation
- fuel cost escalation
- cost of money
- investment costs
- annual costs
- replacement costs
- economic life.

Tabulation of benefit-cost ratios throughout economic life of project. Discussion of results, effects of stage construction, deferring or accelerating Devil Canyon, sensitivity of analysis to assumptions made.

16.2 - Financial Evaluation

Discussion of approach to financial evaluation. Discussion of effect of recent State legislation on project financing.

Development of financial analysis assuming part State-part institutional financing (subject to discussions with APA).

Balance of this section are subject to further discussion with APA.

16.3 - Power Marketing

The contents of this section are subject to further discussion with APA.

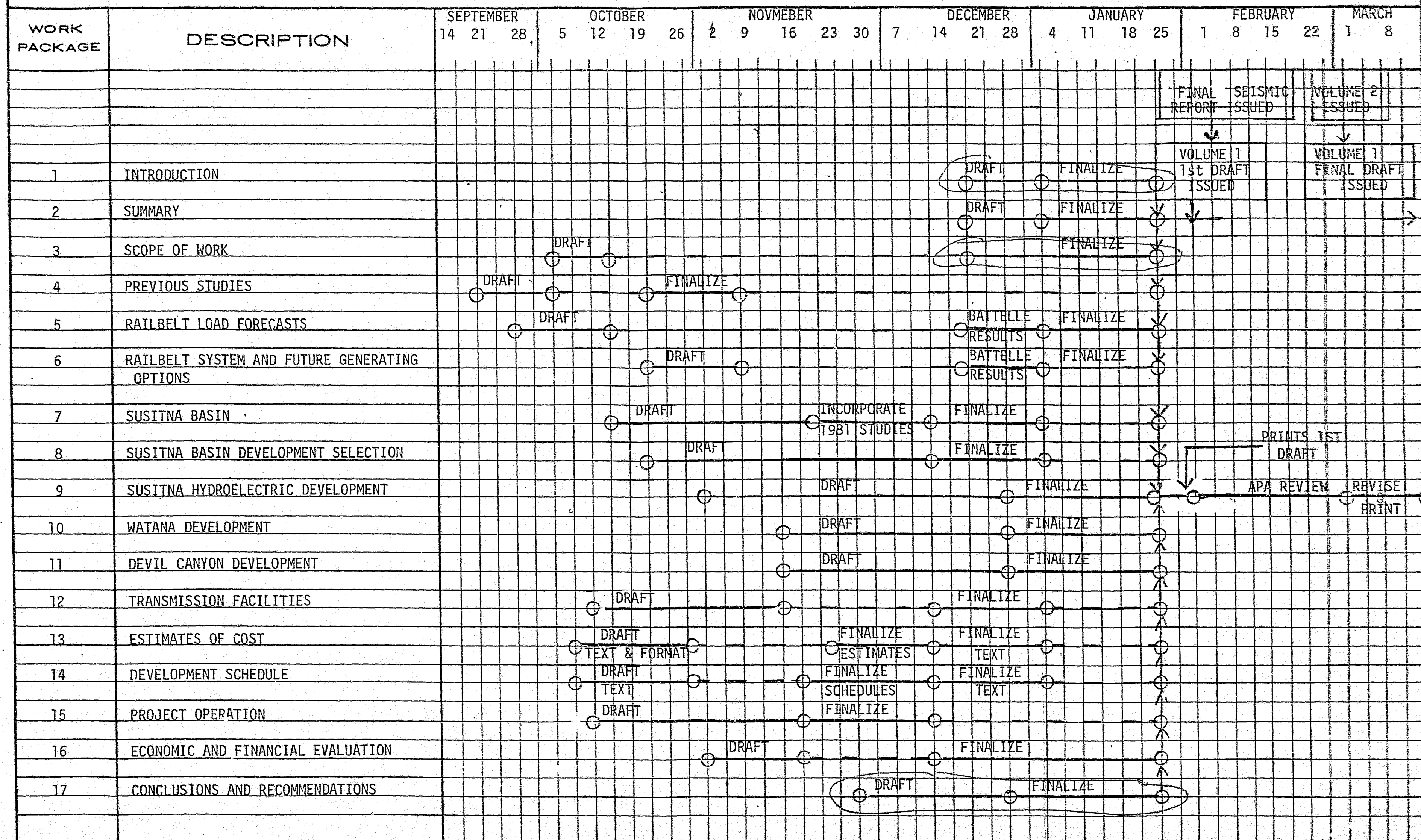


SCHEDULE SHEET

CHARGE NO. P5700.06
CLIENT ALASKA POWER AUTHORITY
PROJECT FEASIBILITY REPORT - VOLUME 1

SHEET OF

PREPARED BY MRV DATE October 13, 1981
PROJECT APPROVAL



SUSITNA HYDROELECTRIC PROJECT
ENVIRONMENTAL PROGRAM

OUTLINE FOR FEASIBILITY REPORT AND
LICENSE APPLICATION EXHIBIT E
(ENVIRONMENTAL REPORT)

TITLE PAGE

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LIST OF FIGURES

1 - INTRODUCTION

1.1 - General Description of the Locale

Location, physiography and topography, climate, vegetation, land use.

1.2 - General Project Description

2 - REPORT ON WATER USE AND QUALITY

3 - REPORT ON FISH, WILDLIFE AND BOTANICAL RESOURCES

3.1 - Description of Botanical Resources

- (a) Regional Botanical Setting
- (b) Floristics
- (c) Vegetation/Habitat Type Maps
- (d) Vegetation/Habitat Type Descriptions
- (e) Wetlands

3.2 - Description of Wildlife Resources

- (a) Big Game
- (b) Furbearers
- (c) Birds
- (d) Non-Game Mammals

3.3 - Description of Fish Resources

- (a) Anadromous Fish
- (b) Resident Fish
- (c) Aquatic Habitat

3.4 - Threatened or Endangered Species

- (a) Plants
- (b) Wildlife
- (c) Fish

3.5 - Anticipated Impacts on Botanical Resources

- (a) Watana Dam and Impoundment
- (b) Devil Canyon Dam and Impoundment
- (c) Borrow Areas
- (d) Downstream Floodplain
- (e) Access Road
- (f) Transmission Line

3.6 - Anticipated Impacts on Wildlife Resources

- (a) Watana Dam and Impoundment
- (b) Devil Canyon Dam and Impoundment
- (c) Access Road
- (d) Transmission Line

3.7 - Anticipated Impacts on Fisheries

- (a) Watana Dam and Impoundment
- (b) Devil Canyon Dam and Impoundment
- (c) Access Road
- (d) Transmission Line

3.8 - Anticipated Impacts on Threatened or Endangered Species

- (a) Plants
- (b) Wildlife
- (c) Fish

3.9 - Mitigation of Impacts on Fish, Wildlife and Botanical Resources

- (a) Agency Recommendations
- (b) Mitigation Plans of the Applicant

4 - REPORT ON HISTORIC AND ARCHAEOLOGICAL RESOURCES

4.1 - Agency Consultation

- (a) Consultation Methods
- (b) Summary of Comments

4.2 - Study Methods

- (a) Objectives - 5-step program
- (b) Methods

4.3 - Historic and Archaeological Sites in the Project Area

(includes location map, references 7.06 and 7.07 Final Reports for details)

- (a) Watana Dam and Impoundment
- (b) Devil Canyon Dam and Impoundment
- (c) Borrow Area, Associated Facilities, and Areas Disturbed by Geotechnical Testing
- (d) Access Road
- (e) Transmission Line

4.4 - Impacts on Historical and Archaeological Sites

- (a) Watana Dam and Impoundment
- (b) Devil Canyon Dam and Impoundment
- (c) Borrow Areas, Associated Facilities, and Areas Disturbed by Geotechnical Testing
- (d) Access Road
- (e) Transmission Line

4.5 - Mitigation of Impacts on Historic and Archaeological Sites

- (a) Mitigation Policy and Approach
- (b) Mitigation Plan

4.6 - Support Documents

Reference to complete 7.06 Phase 1 Report.

5 - REPORT ON SOCIOECONOMIC IMPACTS

5.1 - Identification of the Socioeconomic Impact Area

5.2 - Description of Employment, Population and Personal Income Trends in the Impact Area

5.3 - Effects of In-Migration of Governmental Facilities and Services of Impact Area

5.4 - On-Site Manpower Requirements and Payroll

(During and subsequent to project construction, including a projection of total on-site employment and construction payroll by month.)

5.5 - Numbers and Residence of Construction Personnel

- (a) Estimate of Existing Local Work Force
- (b) Estimate of Community Patterns
- (c) Estimate of Temporary Relocations

5.6 - Adequacy of Available Housing

- (a) Local
- (b) Regional

5.7 - Displacement of Residences and Businesses

- (a) Watana Dam and Impoundment
- (b) Devil Canyon Dam and Impoundment
- (c) Access Road
- (d) Transmission Line

5.8 - Fiscal Impacts on Local Government

- (a) Local Study Area
- (b) Regional Study Area

6 - REPORT ON GEOLOGICAL AND SOIL RESOURCES

6.1 - Geological Features

6.2 - Soils

6.3 - Geologic Hazards

6.4 - Soils Impacts

6.5 - Mitigation Measures

7 - REPORT ON RECREATIONAL RESOURCES

7.1 - Statements on Designation as National Wild and Scenic Rivers Systems
National System, and Wilderness Area Under the Wilderness Act

7.2 - Existing and Proposed Recreation Facilities

- (a) Project Area
- (b) Regional: Adjacent Areas

7.3 - Plan for Public Access

- (a) Description of Shoreline Buffer Zone
- (b) Access Road Plan and Policy (include cross-reference to Section 9.2)
- (c) Relationship of Access to Recreation Plan

7.4 - Estimates of Existing and Future Recreational Use

- (a) Results of Participation Survey
- (b) Estimates of Regional Use
- (c) Estimates of Recreational Use Due to Increased Access

7.5 - Schedule and Cost of Recreation Planning

- (a) Short-Term
- (b) Long-Term

7.6 - Agency Consultation Concerning Recreation Planning

(Includes Public Safety)

- (a) Federal Agencies
- (b) State Agencies
- (c) Local Agencies

7.7 - Recreation Plan Drawings

8 - REPORT ON AESTHETIC RESOURCES

8.1 - Aesthetic Character of Lands and Water to be Affected

8.2 - Impacts on Aesthetic Resources

- (a) Watana Dam and Impoundment
- (b) Devil Canyon Dam and Impoundment
- (c) Access Road
- (d) Transmission Line

8.3 - Proposed Mitigative Measures

- (a) Measures Recommended by Agencies
- (b) Mitigation Policy and Approach
- (c) Specific Mitigative Measures

8.4 - Illustrations

(additional maps, drawings, and photography)

9 - REPORT ON LAND USE

9.1 - Existing Land Use in the Project Area

(include reference to Section 3.1 (e) Wetlands)

9.2 - Land Uses with the Project

Description of Project Facilities, including Access Road Plan and Transmission Corridor. Also, included changes in Land Use.

9.3 - Illustrations

(aerial photos, maps, drawings)

10 - ALTERNATIVES

11 - LIST OF LITERATURE

11.1- General Description of the Locale

11.2 - Water Use and Quality

11.3 - Fish, Wildlife, and Botanical Resources

- (a) Botanical Resources
- (b) Wildlife Resources
- (c) Fish Resources

11.4 - Historic and Archaeological Resources

11.5 - Socioeconomics

11.6 - Geological and Soil Resources

11.7 - Recreational Resources

11.8 - Aesthetic Resources

11.9 - Land Use

11.10 - Alternatives

APPENDIX - DOCUMENTATION OF AGENCY CONSULTATION

APPENDIX A - Authorities Contacted

APPENDIX B - Copies of Letters Received from Agencies

ATTACHMENT B

FEASIBILITY AND GEOTECHNICAL REPORT
DRAFTING PROCEDURES

INFORMATION TO SUPPLEMENT ACRES DRAFTING STANDARDS

FOR THE

SUSITNA HYDROELECTRIC PROJECT

FEASIBILITY & GEOTECHNICAL REPORTS

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	4.1 - Drawing Sheets	4-1
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DRAFTING STANDARDS1 - INTRODUCTION

This Drafting Instruction is issued to supplement Acres Standards and to further clarify certain details which are pertinent to this project. If any conflict exists between the two, this Instruction shall be used.

Acres Standards and this Instruction are issued to maintain uniformity in drawing presentation and as a guide to good drafting practice. ALL DRAFTING PERSONNEL MUST BECOME THOROUGHLY FAMILIAR WITH BOTH OF THESE STANDARDS. It is understood that not all specific examples can be illustrated in the Standards. Drafting Personnel are expected to use initiative and creative abilities in the preparation of drawings within the constraints of the Standards.

2 - BUDGETS, SCHEDULES, AND RECORDS

2.1 - Responsibility

The squad leader and departmental coordinator shall be jointly responsible for budgets and schedules covering the preparation of drawings by their respective departments.

2.2 - Schedules

The squad leader shall prepare schedules for each drawing taking into consideration the time allotted (Budget), date the drawing is to be started, availability of information, and completion date (Schedule).

2.3 - Work Assignment (Form AAl-001)

This is to be completed by the squad leader for each drawing or series of drawings, if more than one sheet is required.

2.4 - Drawing Record (Form AAl-002)

The squad leader shall complete the top portion to convey to the draftsman the hours budgeted for each section of work to be completed. The draftsman shall keep the Drawing Record up-to-date by making daily entries of the time charged.

2.5 - Drawing Mock-ups

When a complex drawing is to be prepared, a mock-up or blockout shall be prepared by the squad leader (Form AAl-003). Its purpose is to pre-plan the arrangement of views in order to produce a well-balanced drawing. The information may be drawn or sketched freehand but must be in the same proportion as the form is to the drawing.

3 - BASIC DRAFTING PRINCIPLES

3.1 - General

The squad leader will coordinate the preparation of all drawings done under his direction; comments and information for drafting shall be directed through the squad leader. The squad leader will be responsible for the quality of the work consistent with the requirements of the Standards. The project engineer, department head, departmental chief of drafting, and department coordinator will resolve differing interpretations of the Standards whenever required.

Sketches and final drawings shall be complete and clear to avoid any possibility of more than one interpretation. Except for special details, work shall be done in Third Angle Projection. Unnecessary repetition of information and use of extraneous dimensions which are not required for construction or location must be avoided.

PLAN views shall be drawn in the upper left-hand corner of the sheet with not less than one inch clear space from the top or side border lines.

PLAN views shall commence from lowest elevation, with other elevations, sections, and details following in that order.

Where several DETAILS are shown on one drawing, those relating to each other shall be grouped together; when details require only part of a sheet, do not center them on the sheet or use space unnecessarily (additional space is often required later for other details).

PLANS shall refer to the elevation at which they are drawn; SECTIONS and ELEVATIONS shall be identified with letters in order of sequence drawn (with the letters I and O omitted; when sections beyond the letter Z are required use double letters beginning with AA, BB, CC, etc.); and DETAILS identified by numbers in order of sequence drawn.

4 - PREPARATION OF DRAWINGS

4.1 - Drawing Sheets

All drawings shall be produced on standard size sheets. Sheets are pre-printed on .003 translar, matte two sides. Sizes are 8-1/2" x 11", and 27" x 38-1/2" (see Exhibits 4 and 5).

4.2 - Reduction

Drawings may be reduced for binding into books. Bar scales shall be shown on all drawings (See 4.5).

4.3 - Title Block

Titles will be in one of three formats: Figures, Plates, and Drawings for the FERC license application.

For Figures - See Exhibit 4

For Plates - See Exhibit 5

For License - Later

4.4 - Numbering of Drawings

4.5 - Scales

The principal scales are shown in Acres Standards, Sheets 301-01-11 and 301-01-12.

Bar scales are to be either 2 inches or 3 inches long depending on the scale being represented. The location of bar scales on each sheet is shown on Exhibit 5.

When more than one bar scale is used on a drawing they shall be labeled Scale A, Scale B, Scale C, etc., with Scale A at the bottom so that the scale may be identified below the main title of the various views.

4.6 - Lettering & Line Work

The drawings shall be in pencil, with the exception of contours which shall be in ink. Lettering on the body of the drawing shall be in ink, using Leroy template No. 140. Letters of views shall be in ink, using Leroy template No. 200. Drawing titles in the main block shall be in ink, using Leroy template No. 200. The proper pen size for each of these is shown on the template.

4.7 - North Arrow

When it is necessary to show the direction of north on a drawing, the arrow shall be placed in the top left-hand corner using Acres standard north arrow stickers. Unless other criteria dictates, the arrow shall point to the top of the sheet.

4.8 - Orientation of Drawings

The orientation of drawings shall be such that the direction of river stream flow will be from left to right or from the top of the drawing. Section marks will be directed to give this orientation. This rule takes precedence over the direction of the North Arrow.

Refer also to Acres Standard 301-01-09. Any deviation from this rule must have the prior approval of the Squad Leader.

4.9 - Dimensioning (See Acres Standard 301-01-12)

Exceptions to the foot and inch rule are:

- (a) Use engineering scales for site plans, surveys, roads, geotechnical, and excavation drawings. In these cases, all dimensions shall be in feet and decimals of a foot. The number of places to the right of the decimal point is determined by the degree of accuracy needed and should never be greater than required.

- (b) Elevations on all drawings shall be expressed in feet and decimals of a foot to two places of a decimal.

When decimals are used, the decimal point shall be clearly shown.

4.10 - General Notes

Printed general notes, including reference notes and legends, should be placed at the right side of the drawing above the title block and below the key plan (if any). Preferably, general notes shall be placed printed on the first sheet (or alternatively, the second sheet) of a drawing series. Reference shall be made on all other sheets in the series to the sheet where general notes are located (i.e., see Sheet ____ of ____ for General Notes).

Where more than one drawing or drawing set is required to detail part of a structure, reference shall be made to the other drawing(s) using the pre-printed label, "THIS DRAWING SHALL BE USED IN CONJUNCTION WITH DRAWING ____."



Work Assignment

Work Package

PROJECT NUMBER						WORK CODE				DEPT. CODE					

Date _____ File _____

Project _____	Department _____	
Assigned By _____	Assigned To _____	
Date Assigned _____	Date Required _____	Date Completed _____

Scope of Assignment _____

Product Required	Reference Material Attached
Sketch _____ <input type="checkbox"/>	_____
Drawing(s) _____ <input type="checkbox"/>	_____
Design Transmittal _____ <input type="checkbox"/>	_____
Memorandum _____ <input type="checkbox"/>	_____
Other (state) _____	_____

Man Hours	Allocated	Actual	Remarks
Engineering	_____	_____	_____
Drafting Incl. Checking	_____	_____	_____
Total	_____	_____	_____

Assignment Complete

— Reviewed By _____ Date _____
COORDINATOR OR SQUAD LEADER

— Accepted By _____ Date _____
PROJECT ENGINEER

Remarks _____



Drawing Record

Work Package

[illegible]

PROJECT NUMBER

WORK CODE

DEPT.
CODE

Date _____ File _____

Project _____ Drawing No. _____

Drawing Title _____

Coordinator _____ Squad Leader _____

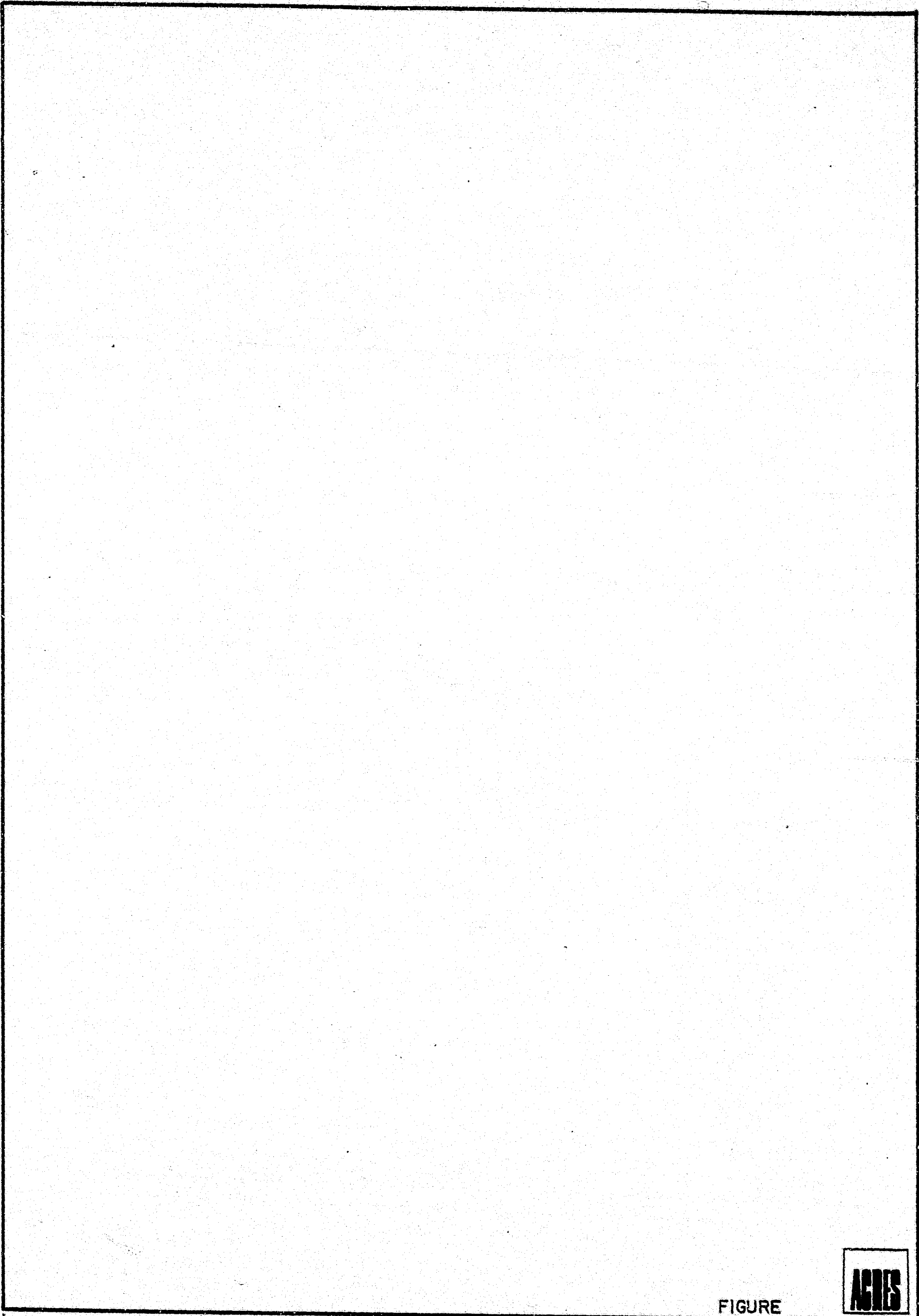
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Record of Drawing Revisions

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DRAWING MOCK-UP																																										
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PROJECT PRIME DEPT.		APPROVALS	PREPARED	COORDINATOR REVIEW	PROJ. ENG. REVIEW	DRAWING TITLE	
		BY					
COORDINATOR		DATE				PROJECT NO.	DWG. NO.
SQUAD LEADER							



FIGURE



EXHIBIT 4