ALASKA POWER AUTHORITY

SUSITNA HYDROELECTRIC PROJECT

DESIGN TRANSMITTAL
SUBTASK 6.05 - DEVELOPMENT SELECTION REPORT

MARCH, 1981

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1 - INTRODUCTION

1 - INTRODUCTION

This transmittal contains the summary tables outlining the results and conclusions of the Susitna Basin Development studies. These tables will appear in the subtask 6.05 Development Selection Report.

The appendix contains the results of the system generation plan OGP5 analyses incorporating the recently developed "upper limit" 1981 Susitna Basin Cost Estimates.

Please note that all the material presented here is preliminary and is still undergoing internal review.

2- SYSTEM GENERATION PLANS - SUMMARY TABLES

TABLE 1

SALIENT FEATURES OF GENERATION PLANNING PROGRAMS

Program/ Developer	Load Modeling	Generation Modeling	Optimization Available	Reliability Criterion	Production Simulation	Availability and Cost/Run
GENOP/ Westinghouse	Done by two external programs	Done by one external program	yes	LOLP or % reserve	Deterministic or Modified Booth - Baleriaux	$500 to validate Learning Curve Costs $300 - $800/run
PROMOD/EMA	Done by one external program	Done by one external program	no	LOLP or % reserve	Modified Booth - Baleriaux	$2,500 to validate on TYMSHARE Learning Curve Costs $300 - $500/run
OGP/GE	Done by one external program	Done by one external program	yes	LOLP or % reserve	Deterministic or Stochastic	AAI validated Columbia & Buffalo Experienced Personnel $50 - $800/run

TABLE 2

LOAD AND ENERGY FORECASTS* ALASKA RAILBELT AREA

YEAR	Low Forecast MW	Low Forecast GWh	Mid Forecast MW	Mid Forecast GWh	High Forecast MW	High Forecast GWh
1980 BASE	514	2,789	514	2,789	514	2,789
1985	578	3,158	650	3,565	695	3,859
1990	641	3,503	735	4,032	920	5,085
1995	797	4,351	944	5,171	1,294	7,119
2000	952	5,198	1,173	6,413	1,669	9,153
2005	1,047	5,707	1,379	7,526	2,287	12,543
2010	1,141	6,215	1,635	8,938	2,209	15,933

* Derived from the Woodward-Clyde Consultants submittal of September 23, 1980, adjusted to eliminate industrial self-supplied and two-thirds of the military sector.

TABLE 3

ANNUAL FIXED CARRYING CHARGES
USED IN GENERATION PLANNING MODEL

	Project Life/Type			
	30-Year Thermal (%)	35-Year Thermal (%)	50-Year Hydro (%)	20-Year Thermal (%)
ECONOMIC PARAMETERS (0%-3%)				
Cost of Money	3.00	3.00	3.00	3.00
Amortization	2.10	1.65	0.89	3.72
Insurance	0.25	0.25	0.10	0.25
TOTALS	5.35	4.90	3.99	6.97
FINANCIAL PARAMETERS (7%-10%)				
Non-exempt				
Cost of Money	10.00	10.00	10.00	10.00
Amortization	0.61	0.37	0.09	1.75
Insurance	0.25	0.25	0.10	0.25
TOTALS	10.86	10.62	10.19	12.00
Tax-exempt				
Cost of Money	8.00	8.00	8.00	8.00
Amortization	0.88	0.58	0.17	2.19
Insurance	0.25	0.25	0.10	0.25
TOTALS	9.13	8.83	8.27	10.44

TABLE 4

FUEL PRICES AND ESCALATION RATES

	Natural Gas	Coal	Distillate
Base Period (January 1980) Prices ($/million Btu)			
Market Prices	$1.05	$1.15	$4.00
Shadow (Opportunity) Values	2.00	1.15	4.00
Real Escalation Rates (Percentage Change Compounded Annually)			
1980 - 1985	1.79%	9.56%	3.38%
1986 - 1990	6.20	2.39	3.09
1991 - 1995	3.99	-2.87	4.27
Composite (average) 1980 - 1995	3.98	2.93	3.58
1996 - 2005	3.98	2.93	3.58
2006 - 2010	0	0	0

TABLE 5

SUMMARY OF ECONOMIC AND FINANCIAL PARAMETERS FOR GENERATION PLANNING

	Generation Planning Analysis	
	Economic*	Financial*
1 - Base Period (January 1980) Energy Prices ($/million Btu)		
1.1 - Natural Gas	2.00	2.00
1.2 - Coal	1.15	1.15
1.3 - Distillate	4.00	4.00
2 - General Price Inflation Per Year (%)	not applicable	7
3 - Discount & Interest Rates Per Year (%)		
3.1 - Real Discount Rate	3	not applicable
3.2 - Nominal Interest Rate (Non-exempt Case)	not applicable	10
3.3 - Nominal Interest Rate (Tax-exempt Case)	not applicable	8
4 - Non-energy Cost Escalation Per Year (%)	0	7
5 - Energy Price Escalation Per Year (%)		
5.1 - Natural Gas		
1980 - 2005	3.98	11.26
2006 - 2010	0	7.00
5.2 - Coal		
1980 - 2005	2.93	10.14
2006 - 2010	0	7.00
5.3 - Distillate		
1980 - 2005	3.58	10.83
2006 - 2010	0	7.00
6 - Economic Life (Years)		
6.1 - Large Steam Turbine	30	not applicable
6.2 - Small Steam Turbine	35	not applicable
6.3 - Hydro	50	not applicable
6.4 - Diesel and Gas Turbine (Gas-fired)	30	not applicable
6.5 - Gas Turbine (Oil-fired)	20	not applicable
7 - Amortization Period (Years)		
7.1 - Steam	not applicable	30
7.2 - Hydro	not applicable	50
7.3 - Diesel and Gas Turbine (Gas-fired)	not applicable	30
7.4 - Gas Turbine (Oil-fired)	not applicable	20

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* Note that economic and financial parameters apply to real dollar and escalated dollar analyses respectively.

TABLE 6 TEN YEAR BASE GENERATION PLAN MID LOAD FORECAST

YEAR	MW Committed	MW Retired	SYSTEM (MW) COAL	NG GT	OIL GT	OIL DIESEL	CC	HY	TOTAL CAPABILITY (MW)
1980	-	-	54	470	168	65	141	49	947*
1981	-	-	54	470	168	65	141	49	947
1982	60 CC	-	54	470	168	65	201	49	1007
1983	-	-	54	470	168	65	201	49	1007
1984	-	-	54	470	168	65	201	49	1007
1985	-	14 (NGGT)	54	456	168	65	201	49	993
1986	-	-	50	456	168	65	201	49	993
1987	-	4 (Coal)	50	456	168	65	201	49	989
1988	95 HY	-	50	456	168	65	201	144	1084
1989	-	5 (Coal)	45	456	168	65	201	144	1079
1990	-	-	45	456	168	65	201	144	1079

*This figures varies slightly from the 943.6 MW reported due to internal computer rounding.

TABLE 7 SUMMARY OF BASE GENERATION PLANS - MEDIUM LOAD FORECAST - 1200MW SUSITNA ALTERNATIVES

	SUSITNA ALTERNATIVES				
PARAMETER / JOB I.D.#	W/DC 2A-1-2E L5Y9	W/DC 3AE L8J9	HDC/VEE L601	HDC/CC LEB3	W/TUNNEL 7A** LAZ7-L607
1990 MW	1079 MW	1079 MW	1079 MW	1079 MW	1079 MW
1990-2010 THERMAL ADDS:					
Coal (MW)	200	300	300	300	200
NGGT (MW)	300	225	450	525	450
Diesels (MW)	0	0	20	220	30
TOTAL	500 MW	525 MW	770 MW	1045 MW	680 MW
RETIREMENTS (MW)	(734)	(734)	(734)	(734)	(734)
HYDRO ADDS:	1/92 W400				
MONTH/YEAR NAME MW	1/95 + Dam	6/93 W400	6/93 HDC400	6/93 HDC400	6/93 W400
	1/97 W400	1/96 W400	1/96 HDC400	1/96 HDC400	1/96 W400
	1/02 DC400	1/00 DC400	1/00 VEE400	1/00 CC500	1/00 T380
TOTAL FIRM* (2010)	1997 MW	2023 MW	2230 MW	2690 MW	2034 MW
$ x 10^6 (80$)					
10 Year PW	$ 873.7	$ 873.7	$ 873.7	$ 873.7	$ 873.7
20 Year PW	2509.4	2360.6	2487.8	2624.5	2591.0
TOTAL	$3383.1	$3234.3	$3361.5	$3273.2	$3464.7
LONG TERM (2040) PW	$6028	$5851	$6372	$6209	$6528

*In Peak Month (December)

** Two tunnel scheme

TABLE 8 · SUSITNA BASIN HYDROELECTRIC ALTERNATIVES

Plan	Stage	Description	On-line Month/Year	Construction Period (Yrs)	Total Cost* Million 1980$		Installed Capacity	Peak Month Firm Capacity
2A	1	Watana Low Dam	1/92	8	1774		400 MW	206 MW
	2	Raise Watana Dam	1/95	3	376			194 MW
	3	Add Capacity	1/97	3	136		400 MW	400 MW
	4	Devil Canyon Dam	1/02	7	999		400 MW	352 MW
						TOTAL	1200 MW	1152 MW
3AE	1	High Watana Dam	6/93	9	1984		400 MW	400 MW
	2	Add powerhouse capacity	1/96	3	157		400 MW	400 MW
	3	Devil Canyon Dam	1/00	7	999		400 MW	352 MW
						TOTAL	1200 MW	1152 MW
3A2	1	Watana High Dam	6/93	9	1984		400 MW	400 MW
	2	Devil Canyon Dam	1/00	7	999		400 MW	337 MW
						TOTAL	800 MW	737 MW
6A	1	High Devil Canyon Dam	1/94	8	1570		400 MW	351 MW
	2	Vee Dam	1/00	7	1177		400 MW	315 MW
						TOTAL	800 MW	666 MW
7A	1	Watana High Dam	6/93	9	1984		400 MW	400 MW
	2	Add powerhouse capacity	1/96	3	157		400 MW	400 MW
	3	Add tunnel capacity	1/00	5	1615 (1314)**		380 MW	194 ~~179~~ MW
						TOTAL	1180 MW	~~979~~ MW 994
Comp. Hydro	1	Chakachamna	1/93	10	1201		500 MW	500 MW
	2	Keetna	1/97	8	463		120 MW	77 MW
	3	Snow	1/02	6	223		50 MW	22 MW
						TOTAL	670 MW	599 MW

*Includes Interest During Construction (IDC)

** Two tunnel scheme

TABLE 9 SUMMARY OF GENERATION PLANS - MID LOAD FORECAST - 800 MW SUSITNA ALTERNATIVES

	SUSITNA ALTERNATIVES			
	W800	HDC800	W400/DC400	HDC/Vee
PARAMETERS / JOB I.D.#	L7W7	LE07	LCK5	LB25
1990 MW	1079 MW	1079 MW	1079 MW	1079 MW
1990-2010 THERMAL ADDS:				
Coal (MW)	500	500	200	400
NGGT (MW)	450	450	525	450
Diesels (MW)	-	30	50	60
TOTAL	950 MW	980 MW	775 MW	910 MW
RETIREMENTS (MW)	(734)	(734)	(734)	(734)
HYDRO ADDS:				
MONTH/YEAR NAME MW	6/93 W400 1/96 W400	6/93 HDC400 1/96 HDC400	6/93 W400 1/00 DC400	1/94 HDC 400 1/00 VEE 400
TOTAL FIRM* MW (2010)	2095 MW	2125 MW	1858 MW	1921 MW
$ x 10^6 (80$)				
10 year PW	$ 873.7	$ 873.7	$ 873.7	$ 873.7
20 year PW	2765.1	2628.0	2349.6	2624.5
TOTAL	$ 3638.8	$ 3501.7	$ 3223.3	$ 3498.2
LONG TERM (2040) PW	$ 6955	$ 6715	$ 5891	$ 6620

* In peak month - December

ALTERNATIVE MEDIUM

TABLE ..10 : SUMMARY OF ~~BASE~~ GENERATION PLANS - ~~MID~~ LOAD FORECAST

another year.

PARAMETER / JOB I.D.#	THERMAL RENEWS LME3	THERMAL NO RENEWS LME1	THERMAL AND OTHER HYDRO LFL7
1990 MW	1079 MW	1079 MW	1079 MW
1990-2010 THERMAL ADDS:	456 RN**		
Coal (MW)	900	900	700
NGGT (MW)	150	600	300
Diesels (MW)	40	50	10
TOTAL	1546 MW	1550 MW	1010 MW
RETIREMENTS (MW)	(734)	(734)	(734)
HYDRO ADDS:			1/93 Chaka 500 — Chala
MONTH/YEAR NAME MW	-	-	1/97 Keetna 120 — Keetna
			1/02 Snow 50
TOTAL FIRM* MW(2010)	1891 MW	1895 MW	1954 MW
$ x 10^6 (80$)			
10 Year PW	$ 873.7	$ 873.7	$ 873.7
20 Year PW	3308.3	3319.4	2802.2
TOTAL	$4182.0	$4193.1	$3675.9
LONG TERM (2040) PW	$8109	$8133	$7038

*In Peak Month (December)
**RN - renews

TABLE 11 SUMMARY OF SUSITNA GENERATION PLANS - HIGH LOAD FORECAST

	SUSITNA ALTERNATIVES			
PARAMETER / JOB I.D.#	3AE LA73	HDC/VEE LBV3	HDC/VEE/CC LBY1	W/W/DC/CC LBV7
1990 MW (+100 MW COAL)	1179 MW	1179 MW	1179 MW	1179 MW
1990-2010 THERMAL ADDS:				
Coal (MW)	900	1200	900	700
NGGT (MW)	750	750	675	450
Diesels (MW)	-	90	10	60
TOTAL	1650 MW	2040 MW	1585 MW	1210 MW
RETIREMENTS (MW)	(734)	(734)	(734)	(734)
HYDRO ADDS:				
MONTH/YEAR NAME MW	6/93 W400 1/96 W400 1/00 DC400	6/93 HDC400 1/96 HDC400 1/00 VEE400	6/93 HDC400 1/96 HDC400 1/00 VEE400 1/03 CC500	6/93 W400 1/96 W400 1/00 DC400 1/05 CC500
TOTAL FIRM* ~~MW~~ (2010)	3248 MW	3600 MW	3645 MW	3308 MW
$ x 10^6 (80$)				
10 year PW	$ 1060.5	$ 1060.5	$ 1060.5	$ 1060.5
20 year PW	4094.6	4462.4	4252.9	3946.3
TOTAL	$ 5155.1	$ 5522.9	$ 5313.4	$ 5006.8
LONG TERM (2040) PW	$10,678	$11,719	$11,037	$10,048

*In peak month - December

**~~RM~~ renews

TABLE 8.12 SUMMARY OF SUSITNA GENERATION PLANS - LOW LOAD FORECAST

	SUSITNA ALTERNATIVES				
PARAMETER / JOB I.D. #	W400/DC400 LC07	HDC/VEE LG0	HDC400 LBU1	W400 LBK7	W400/T** L609
1990 MW	1079MW	1079MW	1079MW	1079MW	1079MW
1990-2010 THERMAL ADDS:					
Coal (MW)	-	100	400	200	--
NGGT (MW)	150	225	300	300	375
Diesels (MW)	40	30	-	80	20
TOTAL	190MW	355MW	700MW	580MW	395MW
RETIREMENTS (MW)	(734)	(734)	(734)	(734)	(734)
HYDRO ADDS:					
MONTH/YEAR NAME MW	6/93 W400 1/02 DC400	6/93 HDC400 1/02 VEE400	6/93 HDC400	6/93 W400	6/93 W400 1/02 T380
TOTAL FIRM* (2010)	1272MW	1367MW	1396MW	1325MW	1319MW
$ x 10^6 (80$)					
10 year PW	$ 744.1	$ 744.1	$ 744.1	$ 744.1	$ 744.1
20 year PW	1835.8	1894.9	1961.6	2029.7	2048.5
TOTAL	$ 2579.9	$ 2639.0	$2705.7	$2773.8	$2792.6
LONG TERM (2040) PW	$ 4350	$ 4557	$4852	$4940	$4997.1

*In peak month - December

** Two tunnel scheme

TABLE 13. SUMMARY OF GENERATION PLANS - LOAD MANAGEMENT AND CONSERVATION FORECAST

PARAMETER / JOB I.D.#	THERMAL NO RENEWS LBT7	SUSITNA W400/D400 L7B7
1990 MW	1079 MW	1079 MW
1990-2010 THERMAL ADDS:		
Coal (MW)	500	-
NGGT (MW)	225	450
Diesels (MW)	90	50
TOTAL	815 MW	500 MW
RETIREMENTS (MW)	(734)	(734)
HYDRO ADDS: MONTH/YEAR NAME MW	-	1/97 W400 1/05 DC400
TOTAL FIRM* MW 2010	1160 MW	1582 MW
$ x 10^6 (80$)		
10 year PW	$ 721.9	$ 721.9
20 year PW	2034.3	1556.0
TOTAL	$ 2756.2	$ 2277.9
LONG TERM (2040) PW	$ 4931	$ 3648

*In peak month - December

TABLE 14. SUMMARY OF GENERATION PLANS - PROBABILISTIC LOAD FORECAST

PARAMETER / JOB I.D.#	THERMAL NO RENEWS LOF3	SUSITNA 3AE L8T5
1990 MW	1079 MW	1079 MW
1990-2010 THERMAL ADDS:		
Coal (MW)	1100	200
NGGT (MW)	1575	1275
Diesels (MW)	100	140
TOTAL	2775 MW	1615 MW
RETIREMENTS (MW)	(734)	(734)
HYDRO ADDS: MONTH/YEAR NAME MW	-	6/93 W400 1/96 W400 1/02 DC400
TOTAL FIRM* MW 2010	3120 MW	3112 MW
$ x 10^6 (80$)		
10 year PW	$ 873.7	$ 873.7
20 year PW	3353.6	2546.5
TOTAL	$4227.3	$3420.2
LONG TERM (2040) PW	$8324	$6292

*In peak month - December

TABLE 15 INPUT PARAMETERS - INTEREST RATE SENSITIVITY

Input Variable	Interest Rates 3 Percent	5 Percent	9 Percent
Annual Fixed Carrying Charges (%)			
30 Year Thermal	5.35%	6.75%	9.98%
20 Year Thermal	6.97	8.27	11.20
50 Year Hydro	3.99	5.58	9.37
Total Capital Costs ($ x 10^6)			
250 MW Coal	$ 686	$ 727	$ 815
75 MW NGGT	26	26.3	27
10 MW Diesel	10	10.3	10.4
1 - Watana 400	$ 1984	$ 2175	$ 2589
2 - Watana 400	157	161	168
3 - Devil Canyon 400	999	1069	1224

TABLE 16 SENSITIVITY ANALYSIS - INTEREST RATES

	THERMAL			SUSITNA - 3AE		
	BASECASE	SENSITIVITY		BASECASE	SENSITIVITY	
PARAMETER / JOB I.D.#	LME1	LEA9	LEB1	L8J9	LF85	LF87
ESCALATION/ INTEREST RATE	0% - 3%	0% - 5%	0% - 9%	0% - 3%	0% - 5%	0% - 9%
1990-2010 THERMAL ADDS:						
Coal (MW)	900	900	900	300	300	300
NGGT (MW)	600	600	600	225	225	225
Diesels (MW)	50	50	50	-	-	-
TOTAL	1550 MW	1550 MW	1550 MW	525 MW	525 MW	525 MW
RETIREMENTS (MW)	(734)	(734)	(734)	(734)	(734)	(734)
HYDRO ADDS:						
MONTH/YEAR NAME MW	-	-	-	6/93 W400 1/96 W400 1/00 DC400	6/93 W400 1/96 W400 1/00 DC400	6/93 W400 1/96 W400 1/00 DC400
TOTAL FIRM* MW 2010	1895 MW	1895MW	1895 MW	2023 MW	2023 MW	2023 MW
$ x 10^6 (80$)						
10 Year PW	$ 873.7	$ 791.1	$ 714.8	$ 873.7	$ 791.1	$ 714.8
20 Year PW	3319.4	2441.7	1367.2	2360.6	1977.3	1469.2
TOTAL	$4193.1	$3232.8	$2082.0	$3234.3	$2768.4	$2184.0
LONG TERM (2040) PW	$8133	$5172	$2609	$5851	$4226	$2691

*In Peak Month (December)

TABLE 17. SENSITIVITY ANALYSIS - FUEL COSTS

PARAMETER / JOB I.D.#	THERMAL BASECASE LME1	THERMAL SENSITIVITY L1K7	SUSITNA - 3AE BASECASE L8J9	SUSITNA - 3AE SENSITIVITY L533
FUEL COST ($/MMBTU)				
Coal	$1.15	$0.92	$1.15	$0.92
Natural Gas	$2.00	$1.60	$2.00	$1.60
Oil	$4.00	$3.20	$4.00	$3.20
1990-2010 THERMAL ADDS:				
Coal (MW)	900	800	300	100
NGGT (MW)	600	675	225	375
Diesels (MW)	50	70	-	20
TOTAL	1550 MW	1545 MW	525 MW	495 MW
RETIREMENTS (MW)	(734)	(734)	(734)	(734)
HYDRO ADDS:				
MONTH/YEAR NAME MW	-	-	6/93 W400	6/93 W400
			1/96 W400	1/96 W400
			1/00 DC400	1/00 DC400
TOTAL FIRM* MW 2010	1895 MW	1890 MW	2023 MW	1993 MW
$ x 10^6 (80$)				
10 year PW	$ 873.7	$ 716.5	$ 873.7	$ 716.5
20 year PW	3319.4	2880.0	2360.6	2145.2
TOTAL	$4193.1	$3596.5	$3234.3	$2861.7
LONG TERM (2040) PW	$8133	$7072	$5851	$5260

* In Peak Month (December)

NOTE: Sensitivity analysis performed using 0% escalation; 3% interest rate and the midload forecast.

TABLE : 18 SENSITIVITY ANALYSIS - FUEL COST ESCALATION

	THERMAL			SUSITNA - 3AE		
	BASECASE	SENSITIVITY		BASECASE	SENSITIVITY	
PARAMETER / JOB I.D.#	LME1	L547	L561	L8J9	L557	L563
FUEL COST ESCALATION RATES (%)						
Natural Gas	3.98%	0%	3.98%	3.98%	0%	3.98%
Coal	2.93%	0%	0%	2.93%	0%	0%
Oil	3.58%	0%	3.58%	3.58%	0%	3.58%
1990-2010 THERMAL ADDS:						
Coal (MW)	900	-	1100	300	-	300
NGGT (MW)	600	1500	525	225	450	225
Diesels (MW)	50	10	10	-	30	-
TOTAL	1550 MW	1510 MW	1635 MW	525 MW	480 MW	525 MW
RETIREMENTS (MW)	(734)	(734)	(734)	(734)	(734)	(734)
HYDRO ADDS:						
MONTH/YEAR NAME MW	-	-	-	6/93 W400 1/96 W400 1/00 DC400	6/93 W400 1/96 W400 1/00 DC400	6/93 W400 1/96 W400 1/00 DC400
TOTAL FIRM* MW 2010	1895 MW	1855 MW	1980 MW	2023 MW	1978 MW	2023 MW
$ x 10^6 (80$)						
10 year PW	$ 873.7	$ 721.8	$ 865.4	$ 873.7	$ 721.8	$ 865.4
20 year PW	3319.4	1835.0	2854.6	2360.6	1806.4	2307.1
TOTAL	$4193.1	$2556.8	$3720.0	$3234.3	$2528.2	$3172.5
LONG TERM (2040) PW	$8133	$4558	$6916	$5851	$4357	$5586

* In Peak Month (December)

NOTE: Sensitivity analysis performed using 0% escalation, 3% interest rate and the mid load forecast.

TABLE 19 : SENSITIVITY ANALYSIS - THERMAL PLANT RETIREMENT POLICY

PARAMETER / JOB I.D.#	THERMAL BASECASE LME1	THERMAL SENSITIVITY L583	SUSITNA - 3AE BASECASE L809	SUSITNA - 3AE SENSITIVITY L585
RETIREMENT POLICY (YRS.)				
Coal-fired Steam	30 Yrs	45 Yrs	30 Yrs	45 Yrs
Natural Gas GT	30 Yrs	45 Yrs	30 Yrs	45 Yrs
Oil GT	20 Yrs	30 Yrs	20 Yrs	30 Yrs
1990-2010 THERMAL ADDS:				
Coal (MW)	900	1100	300	-
NGGT (MW)	600	75	225	-
Diesels (MW)	50	-	-	-
TOTAL	1550 MW	1175 MW	525 MW	0 MW
RETIREMENTS (MW)	(734)	(290)	(734)	(290)
HYDRO ADDS: MONTH/YEAR NAME MW	-	-	6/93 W400 1/96 W400 1/00 DC400	6/93 W400 1/96 W400 1/00 DC400
TOTAL FIRM* MW 2010	1895 MW	1973 MW	2023 MW	1951 MW
$ x 10^6 (80$)				
10 year PW	$ 873.7	$ 873.7	$ 873.7	$ 873.7
20 year PW	3319.4	3318.3	2360.6	2382.7
TOTAL	$4193.1	$4192.0	$3234.3	$3256.4
LONG TERM (2040) PW	$8133	$7850	$5851	$6100

* In Peak Month (December)

NOTE: Sensitivity analysis performed using 0% escalation, 3% interest rate and the midload forecast.

TABLE 20 SENSITIVITY ANALYSIS - THERMAL PLANT CAPITAL COSTS (1980$)

PARAMETER / JOB I.D.#	THERMAL BASECASE LME1	THERMAL SENSITIVITY LAL9	SUSITNA - 3AE BASECASE L8J9	SUSITNA - 3AE SENSITIVITY LED7
THERMAL PLANT CAPITAL COSTS ($/kW)				
Coal-fired Steam (250 MW)	$2744/kW[1]	$2135/kW[2]	$2744/kW[1]	$2135/kW[2]
Natural Gas GT (75 MW)	350/kW	350/kW	350/kW	350/kW
Diesels (10 MW)	778/kW	778/kW	778/kW	778/kW
1990-2010 THERMAL ADDS:				
Coal (MW)	900	1100	300	300
NGGT (MW)	600	525	225	225
Diesels (MW)	50	10	-	-
TOTAL	1550 MW	1635 MW	525 MW	525 MW
RETIREMENTS (MW)	(734)	(734)	(734)	(734)
HYDRO ADDS:				
MONTH/YEAR NAME MW	-	-	6/93 W400 1/96 W400 1/00 DC400	6/93 W400 1/96 W400 1/00 DC400
TOTAL FIRM* MW 2010	1895 MW	1980 MW	2023 MW	2023 MW
$ x 10^6 (80$)				
10 year PW	$ 873.7	$ 873.7	$ 873.7	$ 873.7
20 year PW	3319.4	3095.3	2360.6	2344.6
TOTAL	$4193.1	$3969.0	$3234.3	$3218.3
LONG TERM (2040) PW	$8133	$7585	$5851	$5744

*In Peak Month (December)

NOTE: Sensitivity analysis performed using 0% excalation, 3% interest rate and the mid load forecast.

[1]1.8 Alaskan Adjustment Factor
[2]1.4 Alaskan Adjustment Factor

TABLE 21 SENSITIVITY ANALYSIS - SUSITNA CAPITAL COSTS (1980$)

WATANA/DEVIL CANYON

PARAMETER / JOB I.D.#	SUSITNA - 7 BASECASE LAZ7	SUSITNA - 7 SENSITIVITY L5F9	SUSITNA - 3AE BASECASE L8J9	SUSITNA - 3AE SENSITIVITY L5G1	SUSITNA - 3AE SENSITIVITY LD75
SUSITNA COST ($x10^6$) (80$)					
Watana Dam	$1984	$2418	$1984	$1984	$2976
Devil Canyon Dam	-	-	999	1110	1498
Tunnel	1314	1949	-	-	-
1990-2010 THERMAL ADDS:					
Coal (MW)	400	400	300	300	300
NGGT (MW)	300	300	225	225	225
Diesels (MW)	10	10	-	-	-
TOTAL	710 MW	710 MW	525 MW	525 MW	525 MW
RETIREMENTS (MW)	(734)	(734)	(734)	(734)	(734)
HYDRO ADDS:					
MONTH/YEAR NAME MW	6/93 W400 1/96 W400 1/00 T380	6/93 W400 1/96 W400 1/00 T380	6/93 W400 1/96 W400 1/00 DC400	6/93 W400 1/96 W400 1/00 DC400	6/93 W400 1/96 W400
TOTAL FIRM* MW 2010	2034 MW	2034 MW	2023 MW	2023 MW	2023 MW
$ x 10^6 (80$)					
10 year PW	$ 873.7	$ 873.7	$ 873.7	$ 873.7	$ 873.7
20 year PW	2584.6	2880.6	2360.6	2546.2	2836.3
TOTAL	$3458.3	$3754.3	$3234.3	$3419.9	$3710.0
LONG TERM (2040) PW	$6494	$7135	$5851	$6212	$6807

*In Peak Month (December)

NOTE: Sensitivity analysis performed using 0% escalation, 3% interest rate and the midload forecast.

WATANY/

TABLE 22 SENSITIVITY ANALYSIS - TUNNEL CAPITAL COSTS (1980

Table 12 — Table 7.

PARAMETER / JOB I.D.#	Low W400/T L603	Medium L607	TUNNEL COST HALVED** - MEDIUM LOAD W/T 7A L615	TUNNEL COST HALVED** - LOW LOAD W/T 7A L613
1990 MW			1079 MW	1079 MW
1990-2010 THERMAL ADDS:				
Coal (MW)			200	-
NGGT (MW)			450	375
Diesels (MW)			30	20
TOTAL			680 MW	395 MW
RETIREMENTS (MW)			(734)	(734)
HYDRO ADDS:				
MONTH/YEAR NAME MW			6/93 W400 1/96 W400 1/00 T	6/93 W400 1/02 T
TOTAL FIRM* (2010)				
$ x 10^6 (80$)				
10 Year PW			$ 873.7	$ 744.1
20 Year PW			2474.2	1955.8
TOTAL			$3347.9	$2699.9
LONG TERM (2040) PW			$6232	$4726

*In Peak Month (December)
**Scheme involving one - 40 ft. diameter tunnel utilized.

3 - SUSITNA BASIN DEVELOPMENT SELECTION - SUMMARY TABLES

SCHEME/PLAN EVALUATION CRITERIA:

- ECONOMIC
- ENVIRONMENTAL
- SOCIAL
- ENERGY CONTRIBUTION

TABLE 1 - Economic Backup Data for Evaluation of Plans

Parameter	Total Present Worth Cost for 1981-2040 Period $ Million (% Total) Generation Plan with High Devil Canyon/Vee	Generation Plan with Watana/ Devil Canyon	All Thermal Generation Plans
Capital Investment	2840 (44)	2750 (47)	2520 (31)
Fuel	3230 (50)	2750 (47)	5200 (64)
Operation and Maintenance	390 (6)	350 (6)	410 (5)
Total:	6460 (100)	5850	8130 (100)

TABLE 2

ECONOMIC EVALUATION OF DEVIL CANYON DAM AND TUNNEL SCHEMES AND WATANA/DEVIL CANYON AND HIGH DEVIL CANYON/VEE PLANS

		Present worth of Net Benefit ($ million) of total generation system costs for the:		
		Devil Canyon Dam over the Tunnel Scheme	Watana/Devil Canyon Dam over the High Devil Canyon/Vee Dams	Remarks
ECONOMIC EVALUATION: Base Case		680	520	Economic ranking: Devil Canyon dam scheme is superior to Tunnel scheme. Watana/Devil Canyon dam plan is superior to the High Devil Canyon dam plan.
SENSITIVITY ANALYSES: Parameter	Sensitivity Analyses			
LOAD GROWTH	Low High	650 N.A.	210 N.A.	The net benefit of the Watana/Devil Canyon Plan remains positive for the range of load forecasts considered. No change in ranking.
CAPITAL COST ESTIMATE		Higher uncertainty associated with tunnel scheme.	Higher uncertainty associated with H.D.C./Vee plan.	Higher cost uncertainties associated with higher cost schemes/plans. Cost uncertainty therefore does not affect economic ranking.
PERIOD OF ECONOMIC ANALYSIS	Period shortened to (1980 - 2010)	230	160	Shorter period of evaluation decreases economic differences. Ranking remains unchanged.
DISCOUNT RATE	5% 8% (interpolated) 9%	As both the capital and fuel costs associated with the tunnel scheme and H.D.C./Vee Plan are higher than for Watana/Devil Canyon plan any changes to these parameters cannot reduce the Devil Canyon or Watana/Devil Canyon net benefit to below zero.		Ranking remains unchanged.
FUEL COST	80% basic fuel cost			
FUEL COST ESCALATION	0% fuel escalation 0% coal escalation			
ECONOMIC THERMAL PLANT LIFE	50% extension 0% extension			

TABLE 3

COMPARISON OF ENVIRONMENTAL IMPACTS ASSOCIATED WITH WATANA/DEVIL CANYON AND HIGH DEVIL CANYON/VEE DEVELOPMENT PLANS

River Reach	Environmental Attributes	Concerns	Difference in impact of two plans	Identification of difference	Appraisal Judgement
Downstream of Devil Canyon	Ecological	Change in water quality and quantity as it affects fish and wildlife.	NO Significant difference between plans.		Not a factor in plan comparison.
	Cultural	No downstream archeological concern.	--		Not a factor in plan comparison.
		Possible socio-cultural effects on downstream communities.	NO Significant difference between plans.		
	Aesthetic/ Land Use	Change in flow as it affects utilization of the lower river.	NO Significant difference between plans.		Not a factor in plan comparison.
Devil Canyon	Ecological	Minimal ecological concern in the canyon.	Minimal difference in potential impact.		Not a factor in plan comparison.
	Cultural	Potential inundation of archeological sites.	Probable minimal difference due to rugged nature of the canyon.		Not a factor in plan comparison.
	Aesthetic/ Land Use	Inundation of unique Devil Canyon.	Minimal difference in impacts assuming a re-regulation dam is built downstream of HDC.		Not a factor in plan comparison.
Devil Canyon to Watana Dam Site	Ecological	Utilization of the river valley by moose and bear. Caribou crossing in Fog creek area.	Difference between plans.	In the upper portions of this reach more of the river valley would be inundated with the HDC/V plan (HDC pool elevation is 1750' - DC pool elevation is 1450') with a potential greater impact on wildlife resources.	The wildlife impacts in this section would be less with the W/DC plan however due to the relatively small area involved this difference is not a major factor in plan evaluation.
		Resident Fisheries	Minimal difference between plans.	Both plans inundate approximately the same reach of the Susitna River however the HDC/V plan would extend approximately 1 more mile up Devil Creek and 2.5 more miles up the Tsusena Creek.	The HDC/V plan would create a greater impact on resident fisheries although the relative difference in this section of the river is minimal. This difference is considered a minor factor in plan evaluation.

TABLE 3 (Cont'd)

COMPARISON OF ENVIRONMENTAL IMPACTS ASSOCIATED WITH WATANA/DEVIL CANYON AND HIGH DEVIL CANYON/VEE DEVELOPMENT PLANS

River Reach	Environmental Attributes	Concerns	Difference in impact of two plans	Identification of difference	Appraisal Judgement
	Cultural	Inundation of Archeological sites.	Minimal difference between plans.	Known and suspected archeological sites exist in this section of the river. HDC/V with its higher pool elevatio has a greater possibility of inundated more archeological sites	Since none of those archeological sites have been designated as having a major significance and mitigation measures are available, this minimal difference is considered a minor factor in plan evaluation.
	Aesthetic/ Land Use	Loss of land use potential. Loss of aesthetics.	Minimal difference between plans.	HDC reservoir would inundate the scenic Tsusena Falls loss of land use potential similar for both plans.	HDC/V plan results in a slightly greater loss of aesthetic and land use resources. The difference has a minor influence in the overall comparison of the plans.
Watana to Vee Dam Site	Ecological	Loss of moose habitat.	Difference between plans.	Watana reservoir floods to elevation 2200' HDC reservoir floods to elevation 1750'. The lower reach of the Watana Creek basin, identified as an important moose area, would be inundated by the Watana reservoir. The quality of the habitat and condition of the subpopulation of moose in this area appears to be decreasing.	The Watana plan would create a greater impact on moose in this reach of the river however considering the declining nature of this moose habitat the significance of this impact is considered less than impacts that could occur upstream in the Vee reservoir.
		Impacts on Caribou migration.	Potential difference between plans.	Caribou crossing has been documented in Kosina/Joy Creek area. Due to the large winter drawdown and potential for ice shelving the Watana reservoir could inhibit caribou crossing in the spring. Although the HDC reservoir could have a similar effect the probability of impact is greater for the Watana reservoir.	The Watana plan could create a greater restriction on caribou crossing in this section of the river. The potential impact on caribou is compared with potential impacts upstream and considered to be less significant.
		Loss of river bottom and valley habitat.	Difference in river valley habitat lost.	The loss of river bottom habitat is similar for both schemes. Loss of deciduous forest along the south facing valley slopes would be greater with the Watana scheme. This habitat has been identified as being important for birds and bears.	The Watana scheme would create a greater loss of important habitat along the valley slopes in this section of the river.

TABLE 3 (Cont'd)

COMPARISON OF ENVIRONMENTAL IMPACTS ASSOCIATED WITH WATANA/DEVIL CANYON AND HIGH DEVIL CANYON/VEE DEVELOPMENT PLANS

River Reach	Environmental Attributes	Concerns	Difference in impact of two plans	Identification of difference	Appraisal Judgement
	Cultural	Loss of archeological sites.	No significant difference identified to date.	Due to the larger area of the Watana reservoir in this section, the probability of inundating archeological sites is increased.	Not a factor in plan evaluation.
	Aesthetics/ Land Use	Resource agencies are concerned about creating access to extensive wilderness areas. On the other hand certain segments of the public desire improved access.	Location and extent of access could vary between plans.	More extensive road access would probably result from the HDC/V plan due to the construction requirements at Vee site. Access created directly by the reservoirs is similar for both schemes in this reach of the river.	Any Susitna development will increase access to this relatively wilderness area. As it is easier to extend access than to limit it, schemes with the least inherent access are considered superior.
Vee dam site and upstream	Ecological	Inundation of resident fisheries.	Difference between plans.	The Vee reservoir maximum pool elevation is 2300'. The Watana reservoir maximum pool elevation is 2200'. The additional 100' elevation associated with the Vee dam would result in the inudation of approximately 12 additional miles of the Susitna River in this reach, 1-1/2 additional miles of the Oshetna River and 5 miles of the Tyone River.	The HDC/V plan results in a significant increase in the loss of resident fisheries habitat in this reach of the river.
		Loss of moose habitat.	Significant difference between plans.	In addition to areas inundated by the Watana reservoir, the Vee impoundment would flood 5700 an additional acres of critical winter river bottom habitat utilized by at least three subpopulations of moose that range over large areas east of the Susitna and north of the MacLaren River reach.	The HDC/V plan would create a greater impact on moose in this section of the river. This impact on moose is judged to be of greater significance than the loss of moose habitat in the Watana Creek area resulting from the Watana reservoir.
		Impact on caribou migration.	Significant difference between plans.	Area flooded by HDC/V plan is historically used by Nelchina caribou herd. Due to increased length of river flooded the	This potential negative effect on caribou is considered a major factor in the evaluation of the HDC/V plan.

TABLE 3 (Cont'd)

COMPARISON OF ENVIRONMENTAL IMPACTS ASSOCIATED WITH WATANA/DEVIL CANYON AND HIGH DEVIL CANYON/VEE DEVELOPMENT PLANS

River Reach	Environmental Attributes	Concerns	Difference in impact of two plans	Identification of difference	Appraisal Judgement
				HDC/V plan would create a greater division of the Nelchina herd's range.	
		Impact of furbearers.	Difference between plans.	Area flooded by HDC/V plan considered important to some key furbearers, particularly red fox.	This furbearer loss is judged to be greater than furbearer losses associated with the inundation of the Watana Creek area.
	Cultural	Impact on archeological sites.	Potential difference between plans.	Preliminary studies indicate a high potential for discovery of archeological sites along lakes, streams and rivers in the easterly region of the Upper Susitna Basin. Additional sites are expected to be located near caribou crossing areas. The HDC/V plan has a greater probability of inundating potential sites.	The HDC/V plan is judged to have a greater potential for creating cultural impacts in this section of the river.
	Aesthetics/ Land Use	Loss of Vee Canyon.	No significant difference between plans.	With the HDC/V plan a dam would be situated in the lower reaches of the Vee canyon thus eliminating the existing aesthetic value of the canyon. With the W/DC plan the Vee canyon would be inundated to a depth of approximately 175'.	Not a factor in evaluation of plans.
		Access to wilderness areas.	Significant difference between plans.	In addition to the differences created by road access the formation of the Vee reservoir would open a amount of the northeast section of the basin, an isolated area presently used extensively by caribou and moose.	Due to the possible impacts on caribou the access into this region created by the HDC/V plan considered a major negative factor associated with this plan.

NOTE:
W = Watana dam
DC = Devil Canyon dam
HDC = High Devil Canyon dam
V = Vee dam

TABLE 4

ENVIRONMENTAL EVALUATION OF DEVIL CANYON DAM AND TUNNEL SCHEME

Environmental Attribute	Concerns	Appraisal (Differences in impact of two schemes)	Identification of difference	Appraisal Judgement	Scheme Judged to have the least potential impact	
					Tunnel	DC
Ecological						
Downstream Fisheries and Wildlife	Effects resulting from changes in water quantity and quality.	No significant difference between schemes regarding effects downstream of Devil Canyon.		Not a factor in evaluation of scheme.		
		Difference in reach between Devil Canyon dam and tunnel re-regulation dam.	With the tunnel scheme controlled flows between regulation dam and downstream powerhouse offers potential for anadromous fisheries enhancement in this 11 mile reach of the river.	If fisheries enhancement opportunity can be realized the tunnel scheme offers a positive mitigation measure not available with the Devil Canyon dam scheme. This opportunity is considered moderate and favors the tunnel scheme.	X	
Resident Fisheries	Loss of resident fisheries habitat.	Minimal differences between schemes.	Devil Canyon dam would inundate 27 miles of the Susitna River and approximately 2 miles of Devil Creek. The tunnel scheme would inundate 16 miles of the Susitna River.	This reach of river is not considered to be highly significant for resident fisheries and thus the difference between the schemes is minor and favors the tunnel scheme.	X	
Wildlife	Loss of wildlife habitat.	Minimal differences between schemes.	The most sensitive wildlife habitat in this reach is upstream of the tunnel re-regulation dam where there is no significant difference between the schemes. The Devil Canyon dam scheme in addition inundate the river valley between the two dam the two dam sites resulting in a moderate increase in impacts to wildlife.	The difference in loss of wildlife habitat is considered moderate and favors the tunnel scheme.	X	
Cultural	Inundation of archeological sites.	Potential differences between schemes.	Due to the larger area inundated the probability of inundating archeological sites is increased.	No significant sites have been identified. If discovered mitigation measures are easily implemented. Therefore this concern is not considered a factor in scheme evaluation.	-	-

TABLE 4 (Cont'd)

ENVIRONMENTAL EVALUATION OF DEVIL CANYON DAM AND TUNNEL SCHEME

Environmental Attribute	Concerns	Appraisal (Differences in impact of two schemes)	Identification of difference	Appraisal Judgement	Scheme Judged to have the least potential impact	
					Tunnel	DC
Aesthetics/ Land Use	Inundation of Devil Canyon.	Significant difference between schemes.	The Devil Canyon is considered a unique resource, 80 percent of which would be inundated by the Devil Canyon dam scheme. This would result in a loss of both an aesthetic value plus the potential for white water recreation.	The aesthetic and to some extent the recreational losses associated with the development of the High Devil Canyon dam is the main aspect favoring the tunnel scheme.	X	

OVERALL EVALUATION: The tunnel scheme has overall a lower impact on the environment.

TABLE 5

ENVIRONMENTAL EVALUATION OF WATANA/DEVIL CANYON AND HIGH DEVIL CANYON/VEE DEVELOMENT PLANS

ENVIRONMENTAL ATTRIBUTE	PLAN COMPARISON	APPRAISAL JUDGEMENT	PLAN JUDGED TO HAVE THE LEAST POTENTIAL IMPACT	
			HDC/V	W/DC
Ecological				
1) Fisheries	No significant difference in effects on downstream anadromous fisheries. HDC/V would inundate approximately 58 miles of the Susitna River and 28 miles of tributary streams. W/DC would inundate approximately 86 miles of the Susitna River and 30 miles of tributary streams.	Due to the lesser inundation of resident fisheries habitat and no significant difference in the effects on anadromous fisheries, the W/DC plan is judged to have less impact.		X
2) Wildlife a) Moose	HDC/V would inundate 86 miles of critical winter river bottom habitat. W/DC would inundate 116 miles of this river bottom habitat. HDC/V would inundate a large area upstream of Vee utilized by three subpopulations of moose that range of large areas of the northeast section of the basin. W/DC would inundate the Watana Creek area utilized by moose. The condition of this subpopulation of moose and the quality of the habitat they are using appears to be decreasing.	Due to the lower potential for direct impact on moose populations within the Susitna, the W/DC plan is judged superior.		X

TABLE S / CONT.

ENVIRONMENTAL EVALUATION OF WATANA/DEVIL CANYON AND HIGH DEVIL CANYON/VEE DEVELOMENT PLANS

ENVIRONMENTAL ATTRIBUTE	PLAN COMPARISON	APPRAISAL JUDGEMENT	PLAN JUDGED TO HAVE THE LEAST POTENTIAL IMPACT	
			HDC/V	W/DC
2) Wildlife b) Caribou	The increased length of river flooded, especially upstream from the Vee dam site, would result in the HDC/V plan creating a greater potential division of the Nelchina herd's range. In addition, an increase in range would be directly inudated by the Vee reservoir.	Due to the potential for a greater impact on the Nelchina caribou herd, the HDC/V scheme is considered inferior.		X
c) Furbearers	The area flooded by the Vee reservoir is considered important to some key fur-bearers, particularly red fox. This area is judged to be more important than the Watana Creek area that would be inundated by the W/DC plan.	Due to the lesser potential for impact on furberers the W/DC is judged to be superior.		X
d) Birds and Bears	Deciduous forest, a habitat important for birds and bears, exists along the south facing valley slopes. The loss of this habitat would be greater with the W/DC plan.	The HDC/V plan is judged superior.	X	
Cultural	There is a high potential for discovery of archeological sites in the easterly region of the Upper Susitna Basin. The HDC/V plan has a greater potential of affecting these sites. For other reaches of the river the difference between plans is considered minimal.	The W/DC plan is judged to have a lower potential effect on archeological sites.		X

TABLE 5 (CONT.

ENVIRONMENTAL EVALUATION OF WATANA/DEVIL CANYON AND HIGH DEVIL CANYON/VEE DEVELOMENT PLANS

ENVIRONMENTAL ATTRIBUTE	PLAN COMPARISON	APPRAISAL JUDGEMENT	PLAN JUDGED TO HAVE THE LEAST POTENTIAL IMPACT	
			HDC/V	W/DC
Aesthetics/ Land Use	With either scheme the aesthetic quality of both Devil Canyon and Vee Canyon would be impaired. The HDC/V plan would also inundate Tsusena Falls.	Both plans impact the valley aesthetics. The difference is considered minimal	-	-
	Due to construction of Vee Dam site and the size of the Vee reservoir, the HDC/V plan would inherently create access to a more wilderness are than would the W/DC plan.	As it is easier to extend access than to limit it, inherent access requirements were considered detrimental and the W/DC plan is judged superior. The ecological sensitivity of the area are opened by the HDC/V plan reinforces this judgement.		X

Overall Evaluation: Lesser impact on birds and bears associated with the HDC/V plan are considered to be nearly outweighed by all the other impacts which favour the W/DC plan.

Note: W = Watana Dam
DC = Devil Canyon Dam
HDC = High Devil Canyon Dam
V = Vee Dam

TABLE 6 - Social Evaluation of Susitna Basin Development Schemes/Plans

Social Aspect	Parameter	Tunnel Scheme	Devil Canyon Dam Scheme	High Devil Canyon/ Vee Plan	Watana/Devil Canyon Plan	Remarks
Potential non-renewable resource displacement	Million tons Beluga coal, over 50 years	80	110	170	210	Devil Canyon dam scheme potential higher than tunnel scheme. Watana/ Devil Canyon plan higher than High Devil Canyon/ Vee plan.
Impact on State economy	--	All projects would have similar impacts on the state and local economy.				
Impact on local economy	--					
Seismic exposure	Risk of major structural failure	All projects designed to similar levels of safety.				Essentially no difference between plans/schemes.
	Potential impact of failure on human life	Any dam failures would effect the same downstream population.				
Overall Evaluation	1. Devil Canyon dam superior to tunnel.					
	2. Watana/Devil Canyon superior to High Devil Canyon/Vee plan.					

TABLE -7

ENERGY CONTRIBUTION EVALUATION OF THE DEVIL CANYON DAM AND TUNNEL SCHEMES

Parameter	Devil Canyon	Tunnel	Remarks
Total Energy Production Capability			
Annual Average Energy GWH	2850	2240	Devil Canyon dam annually developes 610 GWH and 540 GWH more average and firm energy respectively than the the Tunnel scheme.
Firm Annual Energy GWH	2590	2050	
% Basin Potential Developed*	43	32	Devil Canyon schemes develops more of the basin potential
Energy Potential Not Developed GWH	0	950	Tunnel scheme incorporates friction losses in tunnels. Also the compensation flow released from re-regulation dam is not used in conjunction with head between re-regulation dam and Devil Canyon.

*Based on annual average energy. Full potential based on USBR four dam scheme (Reference _____).

TABLE -8

ENERGY CONTRIBUTION EVALUATION OF THE WATANA/DEVIL CANYON AND HIGH DEVIL CANYON/VEE PLANS

Parameter	Watana/ Devil Canyon	High Devil Canyon/Vee	Remarks
Total Energy Production Capability			
Annual Average Energy GWH	6070	4910	Watana/Devil Canyon plan annually develops 1160 GWH and 1650 GWH more average and firm energy repectively than the High Devil Canyon/Vee Plan.
Firm Annual Energy GWH	5520	3870	
% Basin Potential Developed*	91	81	Watana/Devil Canyon plan develops more of the basin potential
Energy Potential Not Developed GWH**	0	550	High Devil Canyon/Vee Plan does not develop 150 ft gross head between Vee site and Watana reservoir.

*Based on annual average energy. Full potential based on USBR four dam scheme (Reference _____).
**Includes losses due to unutilized head.

TABLE 9 OVERALL EVALUATION OF TUNNEL SCHEME AND DEVIL CANYON DAM SCHEME

ATTRIBUTE	SUPERIOR SCHEME
ECONOMIC	DEVIL CANYON DAM
ENERGY CONTRIBUTION	DEVIL CANYON DAM
ENVIRONMENTAL	TUNNEL
SOCIAL	NO DIFFERENCE
OVERALL EVALUATION	DEVIL CANYON DAM SCHEME IS SUPERIOR TRADE OFFS MADE: ECONOMIC ADVANTAGE OF DAM SCHEME IS JUDGED TO OUTWEIGH THE REDUCED ENVIRONMENTAL IMPACT ASSOCIATED WITH THE TUNNEL SCHEME.

TABLE 10 OVERALL EVALUATION OF GENERATION PLANS WITH HIGH DEVIL CANYON/VEE AND WATANA/DEVIL CANYON DAM PLANS

ATTRIBUTE	SUPERIOR PLAN
ECONOMIC	WITH WATANA/DEVIL CANYON
ENERGY CONTRIBUTION	WITH WATANA/DEVIL CANYON
ENVIRONMENTAL	WITH WATANA/DEVIL CANYON
SOCIAL	NO DIFFERENCE
OVERALL EVALUATION	PLAN WITH WATANA/DEVIL CANYON IS SUPERIOR

TRADEOFFS MADE: NONE

4 - COMPARISON OF THE SUSITNA BASIN DEVELOPMENT PLAN WITH THE ALL THERMAL OPTION

SCHEME/PLAN EVALUATION CRITERIA:

- ECONOMIC
- ENVIRONMENTAL
- SOCIAL
- ENERGY CONTRIBUTION

TABLE 1

ECONOMIC SENSITIVITY OF EVALUATION OF GENERATION PLAN WITH WATANA/DEVIL CANYON AND THE ALL THERMAL PLAN

Present worth of Net Benefit ($ million) of total generation system costs for the Watana/Devil Canyon plan over the all thermal plan.

Parameters		Present worth ($ million)	Remarks
ECONOMIC EVALUATION: Base Case		2280	Watana/Devil Canyon plan more economical than the all thermal plan.
SENSITIVITY ANALYSES: Parameter	Sensitivity Analyses		
LOAD GROWTH	Low LHC Low High	1280 1570 2840	The net benefit of the Watana/Devil Canyon Plan remains positive for the range of load forecasts considered.
CAPITAL COST ESTIMATE	Low Thermal Cost* High Hydroelectric Cost**	1850 1320	System costs relatively insensitive. Capital cost estimating uncertainty does not effect economic ranking.
PERIOD OF ECONOMIC ANALYSIS	Period shortened to (1980 - 2010)	2280 960	Shorter period of evaluation decreases economic differences. Ranking remains unchanged.
DISCOUNT RATE	5% 8% (interpolated) 9%	940 0 -80	Below discount rate of 8% the Watana/Devil Canyon plan is economically superior.
FUEL COST	Low***	1810	
FUEL COST ESCALATION	0% escalation for all fuels 0% escalation for coal only	200 1330	Watana/Devil Canyon plan remains economically superior for wide range of fuel prices and escalation rates.
ECONOMIC THERMAL PLANT LIFE	50% extension to all thermal plant life	1800	Economic benefit for Watana/Devil Canyon plan relatively insensitive to extended thermal plan economic life.

*Thermal capital cost decreased by 22%
**Based on estimated Susitna cost plus 50%
***Fuel Costs reduced by 20%

TABLE 2 - Social Evaluation of System Generation Plan with Watana/Devil Canyon and the All Thermal Plan

Social Aspect	Parameter	All Thermal Generation Plan	Generation Plan with Watana/Devil Canyon	Remarks
Potential non-renewable resource displacement	Million tons of Beluga coal, over 50 years	--	210	With Watana/Devil Canyon plan is superior.
Impact on state economy		Assumed equal for this evaluation		
Impact on local economy				
Seismic exposure	Risk of major structural failure	All projects designed to similar levels of safety		Essentially no difference between plans.
	Potential impact of failure on human life	Failure would effect only operating personnel. Forecast of failure would be impossible	Failure would effect larger number of people located downstream, however, some degree of forecasting dam failure would be impossible	
Overall Evaluation	Generation plan with Watana/Devil Canyon is judged to be superior due to the potential for conservation of non-renewable resources.			

TABLE 3 OVERALL EVALUATION OF ALL THERMAL GENERATION PLANS WITH THE GENERATION PLAN INCORPORATING WATANA/DEVIL CANYON DAMS

ATTRIBUTE	SUPERIOR PLAN
ECONOMIC	WITH WATANA/DEVIL CANYON
ENERGY CONTRIBUTION	NO DIFFERENCE
ENVIRONMENTAL	UNABLE TO DISTINGUISH DIFFERENCE IN THIS STUDY
SOCIAL	NO DIFFERENCE
OVERALL EVALUATION	PLAN WITH WATANA/DEVIL CANYON IS SUPERIOR TRADEOFFS MADE: NOT FULLY EXPLORED

5 - WATANA DAM CONSTRUCTION SCHEDULE

YEAR	1984	1985 1	1986 2	1987 3	1988 4	1989 5	1990 6	1991 7	1992 8	1993 9	1994 10	1995 11
MAIN ACCESS [3]		PIONEER ROAD										
CONSTRUCTION ACCESS												
DIVERSION TUNNELS												
COFFERDAMS			DEWATER									
MAIN DAM [1,2]			EXCAVATE ABUTMENTS	EXCAVATE INSIDE COFFERDAMS	FOUNDATION PREPERATION	FILL	PLACEMENT					
SERVICE SPILLWAY												
INTAKE STRUCTURE												
PENSTOCKS												
POWERHOUSE												
TAILRACE												
TURBINE/GENERATOR												
IMPOUNDMENT												
TEST AND COMMISSION									UNIT 1 ONLINE	UNIT 2 ONLINE	UNIT 3 ONLINE	UNIT 4 ONLINE

NOTES:

1. MAIN DAM SCHEDULE BASED ON FILL PLACEMENT RATES OF 2.5 TO 3.0 MILLION CUBIC YARDS PER MONTH
2. FIVE TO SIX MONTH FILL PLACEMENT SEASON ASSUMED
3. BASED ON ACCESS FROM DENALI HIGHWAY AND ASSUMES OVERLAND WINTER ACCESS AND AIRCRAFT SUPPORT DURING 1985

LEGEND

CRITICAL ACTIVITIES

EARLIEST START OF ACTIVITY

EARLIEST FINISH OF ACTIVITY

LATEST FINISH OF ACTIVITY

WATANA FILL DAM PRELIMINARY CONSTRUCTION SCHEDULE

FIGURE

ACRES

APPENDIX

4 Runs to come

TABLE 1 SENSITIVITY ANALYSIS - 1981 CAPITAL COSTS

PARAMETER / JOB I.D.#	"BASE CASE" ALASKAN ADJUSTMENT FACTOR 1.8 THERMAL LG07	"BASE CASE" ALASKAN ADJUSTMENT FACTOR 1.8 SUSITNA LGP3	"LOW THERMAL PLANT COSTS" ALASKAN ADJUSTMENT FACTOR 1.4 THERMAL LG09	"LOW THERMAL PLANT COSTS" ALASKAN ADJUSTMENT FACTOR 1.4 SUSITNA LGP5
THERMAL PLANT CAPITAL COSTS ($/kW)				
Coal-fired Steam (250 MW)	$3064/kW[1]	$3064/kW[2]	$2383/kW[3]	$2383/kW[4]
Natural Gas GT (75 MW)	390/kW	390/kW	390/kW	390/kW
Diesels (10 MW)	869/kW	869/kW	869/kW	869/kW
1990-2010 THERMAL ADDS:				
Coal (MW)	900	100	1100	200
NGGT (MW)	600	600	525	450
Diesels (MW)	50	20	10	80
TOTAL	1550 MW	720 MW	1635 MW	730 MW
RETIREMENTS (MW)	(734)	(734)	(734)	(734)
HYDRO ADDS: MONTH/YEAR NAME MW	-	6/93 W400 1/96 W400 1/00 DC600		6/93 W400 1/95 W400 1/00 DC600
TOTAL FIRM* MW 2010	1895 MW	2249 MW	1980 MW	2259 MW
$ x 10^6 (81$)				
10 year PW	$1001.8	$1001.8	$1001.8	$1001.8
20 year PW	3991.3	3333.6	3733.7	3325.7
TOTAL	$4993.1	$4335.4	$4735.5	$4327.5
LONG TERM (2040) PW	$9666	$7937	$9036	$7879

*In Peak Month (December)

[1]First unit transmission included $7034/kW

[2]First unit transmission included $4000/kW

[3]First unit transmission included $6260/kW

[4]First unit transmission included $3230/kW

NOTE: Sensitivity analysis performed using 0% escalation, 3% interest rate and the medium load forecast.

TABLE 2 SENSITIVITY ANALYSIS - 1981 CAPITAL COSTS

"0% COAL ESCALATION CASE"

ALASKAN ADJUSTMENT FACTOR 1.8

PARAMETER / JOB I.D.#	THERMAL LGP1	SUSITNA LGP7
THERMAL PLANT CAPITAL COSTS ($/kW)		
	1	2
Coal-fired Steam (250 MW)	$3064/kW	$3064/kW
Natural Gas GT (75 MW)	390/kW	390/kW
Diesels (10 MW)	869/kW	869/kW
1990-2010 THERMAL ADDS:		
Coal (MW)	1100	200
NGGT (MW)	525	450
Diesels (MW)	10	50
TOTAL	1635 MW	700 MW
RETIREMENTS (MW)	(734)	(734)
HYDRO ADDS:		6/93 W400
MONTH/YEAR NAME MW	-	1/96 W400
		1/00 DC600
TOTAL FIRM* MW 2010	1980 MW	2229 MW
$ x 10^6 (81$)		
10 year PW	$ 994.0	$ 994.0
20 year PW	3476.1	3287.1
TOTAL	$4470.1	$4281.1
LONG TERM (2040) PW	$8312	$7732

NOTE:

		$ x 10^6 (81$)*
Watana 1	400	$3667.5
Watana 2	400	167.3
DC	600	1623.5

*included AFDC and Transmission Line

1981 FUEL COSTS: W/ESC

Coal	$1.32/MMBTU
NG	2.32/MMBTU
Oil	4.62/MMBTU

*In Peak Month (December)

[1]First unit transmission included $7034/kW

[2]First unit transmission included $4000/kW

NOTE: Sensitivity analysis performed using 0% escalation, 3% interest rate and the medium load forecast. forecast.