POWER AUTHORITY

SUSITNA HYDROELECTRIC PROJECT

PLANNING AND DESIGN OF EHV TRANSMISSION AND CONTROL SYSTEMS

APA-83-R-025

HARZA-EBASCO

JOINT VENTURE

Volume I PART 2 of 2

PROPOSAL

December 13, 1982

E. EVALUATION CRITERIA - WORK PLAN

This section describes the work plan that the Joint Venture will follow. Ths work plan will assure that the project is carried out in accordance with specific technical, cost and schedule requirements. The work plan is based on the organization of the project according to four major activity headings, and then subdivided into tasks and subtasks.

The four major activities are:

- o Route Selection and Station Siting
- o Technical Design of transmission lines and substations
- o Collateral Support
- o Design Management and Scheduling

Each of the major activities of the work plan are described according to the outline required by the Request for Proposal letter. The manpower budget for each of the four major activities is shown in the Cost Proposal.

DETAILS OF THE TASKS

The total engineering effort for the EHV Transmission Project has been separated by the Joint Venture into 38 tasks. Each task will be further divided into a number of sub-tasks. This section of our proposal presents the detailed content of the 38 tasks and their subtasks. The deliverables - reports, memoranda, contract/contract documents and drawings - are shown under the OUTPUT heading of each task. These deliverables are summarized in the table that follows.

LIST OF DELIVERABLES

	Description of Task	Reports	Memos	Contract/Contract Documents	Drawings: Arch	Civil	Elec	Geot Mech	Envtl	Transmsn	Total
E1	Route selection and station siting										
E1.1	Review corridor selection and prior studies	1									
E1.2	Selection of ROW and station siting study	3	4								
E1.3	Public Participation Meeting Supports	3	4								
E1.4	Land Acquisition Support		3								
E2	Technical Design										
E2T1	Review of Prior Studies	1	2			3				10	13
E2T2	Transmission Line Structure	4	1	2		4				4	8
E2T3	Conductor and Accessories	2	1	2						1	1
E2T4	Shield Wire and Guy Wire	2	1	2						3	-
E2T5	Insulators and Hardware	2	1	2						1	3
E2T6	Anchors and Guy Fittings	2	1	2						220	224
E2T7	Construction - Watana Gold Creek	2	2	1	4					80	84
E2T8	Construction - Healy-Willow	2	2	1	4					185	189
E2T9	Construction - Ester Sub - Healy	2	2	1	4					220	224
E2T10	Construction - Willow - University	2	2	1	4					125	129
E2T11	Submarine 345 kV Cables										
E2S1	Switching Arrangement Study	1									
E2S2	SF_6 Versus Open Air Study	1									
E2S3	Insulation Coordination Study	1									
E2S4	Line Protection Study	1									
E2S5	Controls and Annunciation Study	1									
E2S6	Communication System		1	1		27					27

LIST OF DELIVERABLES

	Description of Task	Reports	Memos	Contract Documents	Drawings Arch	Civil	Elec	Geot	Mech	Envtl	Transmsn	Total
E257	Autotransformers and Surge Arrestors		1	1								
E258	Shunt Reactors	1	1	1								
E259	Static Var System	1	1	1								
E2S10	Power Circuit Breakers	1	1	1								
E2S11	Disconnecting Switches	1	1	1								
E2S12	Coupling Capacitor Voltage Devices	1	1	1								
E2S13	Substation Structures, Buses and Insulators	1	1	1			10					10
E2S14	Control Switchboards	1	1	1								
E2S15	Station Service Equipment	1	1	1								
E2S15	Station Service Equipment	1	1	1								
E2S16	Knik Arm Substation Construction	1	4	1	9	14	54		4			81
E2S17	Willow Substation Construction	1	4	1	9	14	60		4			87
E2S18	Gold Creek Substation Construction	1	4	1	9	14	55		4			82
E2S19	University Substation Construction	1	4	1	9	14	83		4			110
E2S20	Ester Substation Construction	1	4	1	9	14	75		4			102
E.3	Collateral Support											
E3.1	Archeological Survey	2	1	1								
E3.2	Visual Simulation	1	1	1								
E3.3	Line Route Survey	5	5	1		540						540
E3.4	Soil Test	4	4	1								
E3.5	RIV & TIV Preconstruction Measures	2		1								
E3.6	Field Assistance and After Award Services	5	5									
E4	Design Management and Scheduling											
E4.1	Project Management	10	10									
E4.2	Project Scheduling and Support Services	10	10									

WORK PLAN

E.1 Route Selection and Station Siting

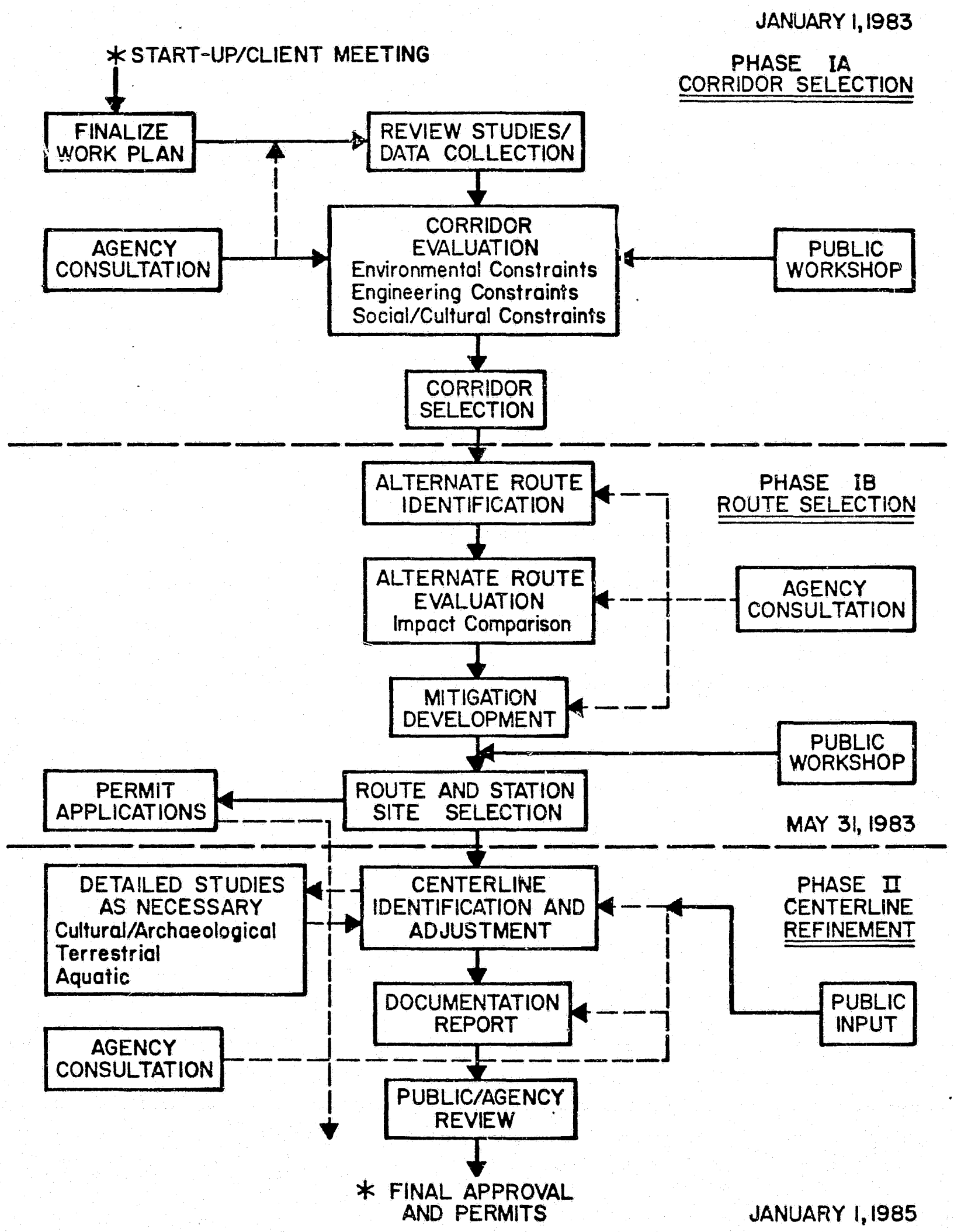
E.1.a Methodology

General Approach. The Joint Venture proposes an intensive work effort within the first year to obtain line route approval as soon as possible. This will ensure that design and construction tasks can proceed as scheduled. The majority of the work effort related to environmental aspects and public participation will be completed upon submittal and approval of a final route documentation report, which is expected to occur in December of 1983. A lower level of environmental and public participation involvement will continue through granting of the Susitna Hydroelectric Project FERC License early in 1985. Beyond that milestone, the environmental and public participation work effort will be minor and will therefore be integrated into the on-going programs for construction and collateral support, and the work program of the Power Authority's Public Participation Office (PPO). These long-term efforts will primarily involve monitoring and communication, as environmental mitigation and management measures will be incorporated into the transmission line and substation construction documents during design activities.

A generalized sequence of work activities for the overall environmental program related to this project is illustrated in Figure E-1. As indicated in the project organization chart (Figure A-3) presented in Section A, the key staff for the route selection and siting tasks will be Lead Environmental Scientist, a Public Participation Coordinator, and an interdisciplinary environmental routing studies team. The Lead Environmental Scientist and Public Participation Coordinator will reside in Anchorage so that close contact can be maintained with the Power Authority, agencies, and the public. The remainder of the environmental team for route selection and siting will be based in Bellevue to make maximum effective use of the Joint Venture support office in that location, although the resources of the Joint

FIGURE E-1

ROUTE AND STATION SITE SELECTION PROCESS



Venture's Anchorage office will also be available if needed. The Lead Environmental Scientist will report to the Project's Resident Manager, and he will also coordinate work efforts with environmental and regulatory personnel from the Susitna Hydroelectric Project. This will provide for a very efficient and cost effective work effort.

The Lead Environmental Scientist will be in overall responsible charge of the environmental component of the transmission design project. He will oversee a major portion of the route selection and station siting effort, ensure close coordination between the environmental and engineering studies, monitor subcontracts within the environmental program, and will be the primary contact for agency involvement on routing and environmental matters. The Lead Environmental Scientist position will be filled by Mr. R. Suttle of the Joint Venture staff, due to his background in aesthetics, recreation, and cultural resources work. Mr. Suttle will also be responsible for technical input to the routing studies in these fields.

A position description for the Public Participation Coordinator was previously included in Section A of this proposal. Additional detail concerning the functions of this program and the coordinator position is included in Section E.1.c. In general the Public Participation Coordinator will work directly with the Project Manager, the Lead Environmental Scientist, and the Power Authority's Public Participation Office to ensure that the public has adequate information and opportunity to provide the desired input to the routing and design processes. Mr. D. Towne of Jones and Jones has been selected to fill this role, due to his experience in public participation, his professional contacts in Alaska, and his background in various aspects of environmental assessment.

The provision of technical environmental input to the route selection and station siting process will primarily be the responsibility of an environmental routing study team based in the Joint Venture's Bellevue support office. Mr. Suttle, the Lead Environmental Scientist, will

also be a member of this team, while Jones and Jones personnel based in Seattle will fulfill overlapping functions involving both public participation materials and the routing/siting studies. The basic staffing plan for the environmental team is as follows:

Staff Member	Responsibilities
R. Suttle	Supervision; agency contact; visual resources and recreation
C. Lawson	Route study Coordination; socioeconomics
W. Blair	Jones and Jones role; visual simulations
T. Atkins	Land use
R. Fairbanks	Terrestrial ecology
D. Beyer	Aquatic ecology
K. Erickson	Water resources
R. Acker	Geology/soils

This staffing arrangement will provide for complete representation of the social, biological, and physical sciences on the environmental team. All team members are conversant with engineering factors from previous experience, but formal input on such concerns will be provided by the project engineering staff. Due to the need for engineering input and the placement of some project functions in Anchorage, Mr. C. Lawson of the Joint Venture staff will be responsible for ensuring proper coordination within the environmental team, and with the remainder of the project organization in Bellevue. In addition to his technical responsibilities for socioeconomics, Mr. Lawson will work with the Lead Transmission and Substation Engineer to incorporate engineering factors into the routing studies, and with the Lead Environmental Scientist and Public Participation Coordinator to ensure that adequate technical information is provided to agencies and the public.

Additional supervisory or coordination responsibilities have been assigned to two other members of the environmental team. As indicated above, Mr. Suttle will have a dual role as a technical contributor and supervisor of the overall environmental program. A supervisory contact is also needed within Jones and Jones, to ensure a smooth flow of work between the routing study and public participation efforts, and between the Joint Venture and Jones and Jones. Mr. W. Blair will assume this role, in addition to his technical responsibilities for visual simulations and related matters. The remaining five members of the routing study team (T. Atkins, R. Fairbanks, D. Beyer, K. Erickson, and R. Acker) will be the responsible technical specialists for their respective disciplines. Depending upon the level of effort required, these discipline specialists may be responsible for arranging additional support within their disciplines from the Joint Venture's Bellevue or Anchorage offices.

Work Plan Assumptions. Several key assumptions underlie the proposed route selection work plan and corresponding time and cost estimates. These include the following:

- The Intertie section from Willow to Healy will not be involved in the route selection process because the Susitna line will parallel and utilize this right-of-way, which has undergone extensive study and public involvement.

- Definitions of basic transmission line terms used in the RFP and this proposal are as illustrated in Figure E-2, which has been adapted from the Kake-Petersburg Intertie Feasibility Study. Specifically, a transmission corridor is a broad band of from 1 to 10 miles in width, which would generally correspond to the 3-to-5 mile wide corridors identified in the previous Susitna transmission studies. A transmission route is a narrower band usually one-quarter to one-half mile wide, although a width of up to one mile might be appropriate for some portions of the Susitna lines. A centerline and cleared right-of-way are subsequently located within this route, which

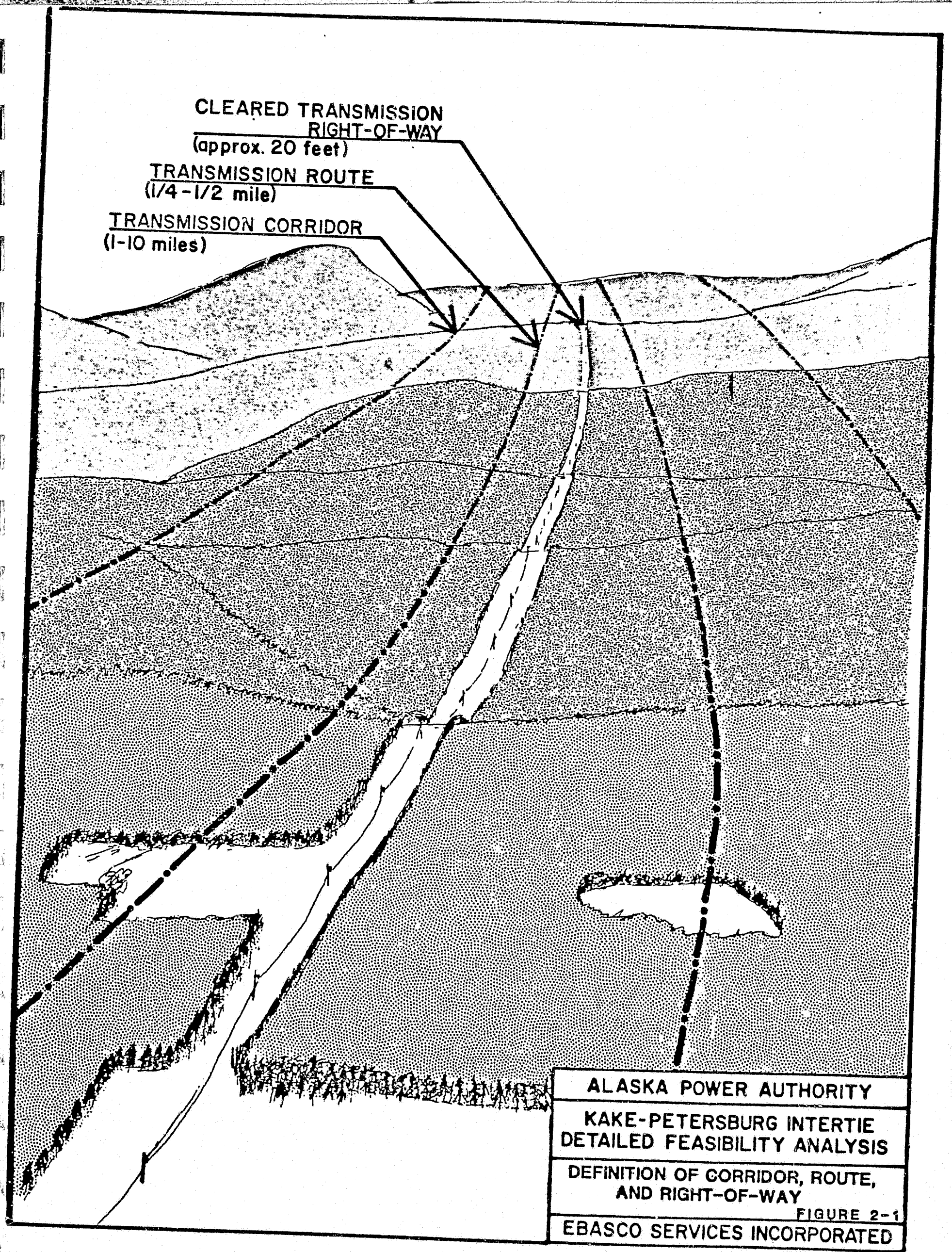

CLEARED TRANSMISSION RIGHT-OF-WAY
(approx. 20 feet)
TRANSMISSION ROUTE
(1/4 - 1/2 mile)
TRANSMISSION CORRIDOR
(1-10 miles)
ALASKA POWER AUTHORITY
KAKE-PETERSBURG INTERTIE
DETAILED FEASIBILITY ANALYSIS
DEFINITION OF CORRIDOR, ROUTE, AND RIGHT-OF-WAY
FIGURE 2-1
EBASCO SERVICES INCORPORATED

FIGURE E-2

allows for flexibility in centerline or structure location to avoid difficult or sensitive sites. The term "route" as used in this propsal is synonymous with "alignment."

- o Preferred or preliminary routes for the three study areas (Healy-Fairbanks, Intertie connection, Willow-Anchorage) have not been selected, but considerable corridor work has already occurred. The starting point for the scope of work required for this contract will be the alternate corridors identified by Acres American in the 1982 corridor screening report. However, the proposed scope, schedule, and level of effort are predicated upon public and agency concurrence that the three corridors (one in each study area) selected by Acres are acceptable. If agreement cannot be reached that the lines should be within these three corridors, additional routing studies will have to be negotiated.

- o Consensus on the basic alignments will be based on existing studies or forthcoming studies to be supplied by current environmental contractors. Some field studies will be conducted during the centerline refinement process, but these studies generally are not included within the proposed scope of work. These additonal studies are not accounted for due to uncertainty over what studies will be needed and the nature of continuing arrangements with existing contractors.

- o The contractor's involvement in public participation will largely be in the areas of technical liaison and general support, while the Power Authority's Public Participation Office will actually guide the effort.

- o The FERC License will be obtained by January 1, 1985.

- o Construction will start immediately upon issuance of the FERC License.

Work Plan. The main goal of the work plan described below is to provide a process through which an acceptable transmission line route can be determined. It is designed to meet two principal objectives:

- o use of existing studies to the extent possible to determine preferred alignment and substation locations.

- o involve agencies and the public in the selection process.

Through partial review of some of the previous studies, it appears that much of the effort put into the route selection study should focus on the development of mitigation measures and public participation. The Joint Venture team proposes to utilize a suitability/constraint mapping and analysis process to identify the preferred route. The reasons for selecting this projcess are as follows:

- o the process is flexible
- o it allows for ready review and input on specific project features
- o it is well suited to presentation purposes
- o the process is credible and efficient.

The Joint Venture will also implement and maintain a matrix methodology for displaying and evaluating individual and cumulative environmental impacts of route alternatives. The matrix will present project impacts in both qualitative and quantitative terms where applicable. The approach used on previous projects has been to quantify effects and impacts as much as possible, to facilitate comparison of project alternatives and route or design options. Such a comparison table from the Flathead Valley Reinforcement Project DEIS is presented in Figure E-3 as an example of this matrix methodology. This function will assist project permitting and design and ensure systematic environmental analysis of each route and station site alternative.

TABLE 2-2
COMPARISON OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES
ON THE FLATHEAD VALLEY REINFORCEMENT PROJECT

	PLAN 1				PLAN 2			
	Basic Plan	Option A Elmo Reroute	Option B Double Circuit Wood	Option B Double Circuit Steel	Option A	Option B	Option C Double Circuit Wood	Option C Double Circuit Steel
FORESTRY								
Land removed from production (acres)	52.1	67.8	48.9	48.9	336.3	331.1	294.0	294.0
Lost productivity (MBF/yr)	11.3	15.0	10.5	10.5	79.7	79.1	69.3	69.3
RESIDENTIAL, INDUSTRIAL AND COMMERCIAL LAND USE								
Number of Residences within 500' of right-of-way	32	0	9	9	27	33	10	10
Number of subdivisions within 500' of right-of-way	6	0	0	0	4	7	5	5
Number of commercial or industrial properties within 500'of right-of-way	1	1	1	1	1	0	0	0
VISUAL RESOURCES								
Number of scenic highway crossings	6	7	3	4	5	6	3	5
Number of river crossings	1	1	1	1	0	1	1	1
Number of ridge crossings	4	4	4	4	2	2	2	2
Number of recreation sites	3	3	0	3	4	2	0	2
Number of residential area	2	2	0	2	2	1	0	1
Length of probable visual impact sections								
moderate (miles)	9.5	9.5	6.5	8.7	14.8	3.6	0	2.8
insignificant (miles)	55.0	55.1	58.0	55.8	44.3	54.7	58.3	55.5
SOILS								
miles of access roads in high erosion hazard areas	4.6	4.6	4.6	4.6	1.8	1.8	1.8	1.8
WATER RESOURCES								
miles of access roads in high or moderate sediment yield areas	2.7	2.7	2.7	2.7	3.2	0.2	0.2	0.2
VEGETATION-CLEARING								
All vegetation (new access roads)								
grassland (acres)	2.3	16.7	2.3	2.3	0.6	0.4	0.4	0.4
shrubland (acres)	0.5	2.1	0.5	0.5	0.3	0.2	0.2	0.2
forest (acres)	4.8	12.8	4.8	4.8	14.4	9.2	9.2	9.2
lowland riparian (acres)	+1/	+	+	+	0.1	0.1	0.1	0.1
upland riparian (acres)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
wetlands (acres)	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2
Tall vegetation (right-of-way)								
forest (acres)	45.2	55.1	44.2	44.2	324.2	285.1	284.1	284.1
lowland riparian (acres)	3.3	3.3	3.1	2.3	2.2	3.6	3.4	2.6
upland riparian (acres)	1.4	1.4	1.4	1.4	2.6	1.8	1.8	1.8
wetlands (acres)	2.6	2.6	1.5	0.0	12.1	11.1	10.0	8.5
WILDLIFE								
Habitat modification (acres)	see Vegetation	see Vegetation	see Vegetation		see Vegetation		see Vegetation	
White-tailed/mule deer winter range habitat modification (acres)	16.7	16.7	16.7	16.7	112.3	129.0	129.0	129.0
Elk winter range habitat modification (acres)	4.9	11.4	4.9	4.9	10.9	10.9	10.9	10.9
AGRICULTURE								
Number of structures on agricultural lands (net change from existing condition)	69	69	139	69	133	73	143	73
Important and other farmland removed from production net change (acres)	1.31	1.31	0	.79	.82	.79	.57	.18

1/ + indicates less than 0.05 acres.

FIGURE E-3

The generalized sequence of work activities related to the route selection process is shown in Figure E-1. We propose a three-step effort with integration of agency and public input throughout. For consistency with the public participation attachment to the RFP, the first two steps of the process are labelled as Phases IA and IB, with Phase II corresponding to the detailed work of refining the centerline of the selected route.

Phase IA - Corridor Selection. Previously identified alternative corridors for the three study areas will be evaluated with respect to environmental, engineering and sociocultural characteristics. It is expected that this will involve, for the most part, review of existing studies as well as discussions with agencies to determine or verify evaluation criteria and important issues. The evaluation criteria will be developed into composite suitability/constraint maps and matrices, which will be presented at a series of public workshops for review and discussion. General information on the environmental effects of transmission lines will also be presented at these workshops, as is discussed further in Section E.1.c. After achieving consensus on the selection of the preferred corridor, citizens' suggestions for alternative routes within the selected corridor will be gathered for evaluation in the next phase. A report on the evaluation process, consensus on the corridor selected, and the public workshops in general will be made to document the results of the first work effort.

Phase IB - Route Alternative and Substation Site Selection. The purpose of this phase of the study will be to identify, through agency and public cooperation, preferred route alignments and station locations for the three study areas (Watana to the Intertie, Willow to Anchorage and Healy to Fairbanks). The result of this part of the study would be the identification of a route, representing a band of from one-quarter to one-half mile wide in most cases, and a nominal centerline within this route. At this stage, more detail will be placed on the effect the line would have on various characteristics as compared to the more generalized constraint analysis done in the

Phase IA. Alternative routes within the selected corridors will be identified through the constraint analysis process, and the environmettal effects of these alternatives will be estimated for comparison and evaluation. Particular emphasis at this time will be placed on urban issues and the effects the line and substations might have on urban characteristics. Input from agencies and the public will be particularly valuable in selecting substation locations and in determining suitable mitigation measures for these facilities.

Evaluation criteria that will be reviewed for the urban areas include:

- o Residential and commercial development
- o Population density
- o Transportation/circulation patterns
- o Safety issues
- o Noise
- o Visual impact
- o Open space/access potentials

Additional urban and rural criteria and concerns will likely be added as a result of public and agency comment. The effects of the proposed lines on the above factors will be identified and placed in matrix form for evaluation, as shown previously in Figure E-3, along with other environmental variables such as acres of wildlife habitat affected, vegetation clearing requirements, and stream and floodplain crossings.

Data for this phase will be obtained through review of existing studies and discussions with agencies, organizations and the public in general. City and borough planning departments will be contacted to determine what future plans they may have for areas under consideration. The Joint Venture team will conduct an independent comparison and evaluation of route alternatives from this data base. This process will require the development of visual simulations for purposes of assessing visual impacts, determining route suitability, and presenting information to be the public. The simulations will be particularly useful in helping the public compare the visual effects of alternative route and substation locations. A cultural resource

reconnaissance will also be needed at this stage, because previous studies indicate that such information is lacking for at least one of the three corridors. The avoidance of such sites is important in ensuring that the selected route is approved, thereby reducing overall transmission line costs and construction delays. Such a study is included in this scope of work through a subcontract, although there again is some uncertainty over existing Power Authority contractual commitments.

Mitigation measures and their effect on project impacts will be included in the final evaluation of the alternative routes and stations. For example, impacts relating to certain alignments and station locations may be more amenable to mitigation than others, thus reducing the overall residual impact of that particular alternative. Consideration will be given to means of transportation and erection during construction, and to maintenance when in place. Input concerning reasonable and appropriate construction and operation mitigation measures will be obtained from agencies and the public during this phase of work.

Selection of the final or preferred route and substation locations will be made after comments and review by agencies and the public are completed. It is anticipated that completion of this phase will occur toward the end of May, 1983. As in Phase IA, an interim report will document the completion of Phase IB and the consensus on the preferred route alignment and substation locations. Applications for some required permits can probably be initiated at this stage, based upon the identifcation of a route and nominal centerline.

Phase II - Centerline Refinement The final step in the transmission line route selection process is to refine the selected centerline and substation locations as needed. This may necessitate that some detailed studies be conducted on areas with potential for impact to particular resources, or to verify the construction or structural feasibility of the line. Detailed studies may include spot inventories of vegetation/wildlife associations, endnagered plant surveys, and cultural surveys of areas of high interest found in the previous

phase. The necessity of these detailed studies will depend largely on what has been done in previous studies and the outcome of agency and public coordination.

Individual land owners and other local residents who would be directly affected by the preferred alignment will be contacted at this time for subsequent work to refine the alignment. Additional review and study of areas along the Intertie right-of-way may also be needed at this time to verify and refine the proposed centerline route from Willow to Healy. After revisions to the alignment are made, a final report documenting the entire decision process and the final line route and substation locations will be prepared. The report will include a discussion of project impacts and mitigation measures which apply to the routing of the line, addressing both construction and maintenance activities. These mitigation measures will be incorporated into the transmission line and substation construction drawings and specifications, which will help ensure that such measures are implemented during construction. The final report will serve as the basis for obtaining necessary permits and ultimate approval, and will describe arrangements which have been made to accommodate and respond to ongoing public and agency concerns.

Regulatory Assistance During the FERC licensing period (calendar years 1983-1984), a number of licensing, permitting, and related tasks will need to be accomplished with regard to the transmission line work. These tasks are an important part of the overall environmental and regulatory program, and include:

1. FERC licensing process coordination and production activities.

2. Permitting coordination and production activities.

3. FERC license application and permit tracking.

4. Land use rights/access coordination.

Because the transmission line is an integral part of the Susitna Hydroelectric Project, and transmission line issues will play a prominent role in the FERC licensing process and the permitting process, the Joint Venture proposes that Tasks 1, 2, and 3 above be conducted through the contract Licensing and Permitting Team under J. Robinson. Mr. Robinson will have minor direct involvement, but it will be important to retain these activities within one structure to avoid duplication.

A Transmission Line Permits Coordinator is provided under this proposal to take on most of the additional regulatory work load related to the corresponding transmission line, primarily to Tasks 2 and 3 above. The Permits Coordinator will report to Mr. Robinson as well as to the Transmission Line Lead Environmental Scientist. This position will be filled by Mr. R. Froemling of the firm of Frank Moolin and Associates (FMAA), an existing component of the Joint Venture organization, due to the expertise of Mr. Froemling and FMAA in this field. Additional staff time within Mr. Robinson's office will be assigned to the FERC license process and license and permit tracking.

This organization and staffing arrangement will ensure that transmission line FERC license and permitting matters are handled in a timely and cost-effective manner. Given the close relationship between the transmission line and the remainder of the Susitna Hydroelectric Project, efficient action and clear communication can be best provided by operating these functions for both projects from the same office. For example, during the FERC licensing process, response to FERC and agency review comments on the License Application, Draft EIS, and Final EIS must be developed quickly so that the licensing schedule is maintained. An organization totally separate from the already established Joint Venture licensing and permitting team would have difficulty in accomplishing this goal. There also will be a considerable degree of duplication in permit requirements between the two work programs. A preliminary listing of required permits and authorization for the transmission line is included as Table E-1; many of these items will also be required for access and studies related to the Susitna dams.

We propose that FERC license application and permit tracking related to the transmission line be performed on the system now being set up for the Harza-Ebasco design contract licensing and permitting team. This management tracking system, which is fully compatible with FERC's tracking system, is to be on-line by approximately about February 15, 1983, when the license application is formally submitted to FERC. Transmission line-related license application milestones can easily be incorporated into the overall license application network. For each permit required for the transmission line, a network will be developed and added to the design contract permit tracking system.

In matters related to Task 4, the Permits Coordinator will work with Land Field Services, Inc., through the Power Authority, in addition to his role within the project structure. The Permits Coordinator will identify and obtain land use rights required for environmental and engineering studies, and perform ancillary tasks such as ownership identification. The nature of this function, particularly as it relates to land acquisition and construction monitoring, is also described in Section E.3.f.

SAMPLE WORKSHOP MATERIALS

FLATHEAD VALLEY TRANSMISSION REINFORCEMENT ALTERNATIVES

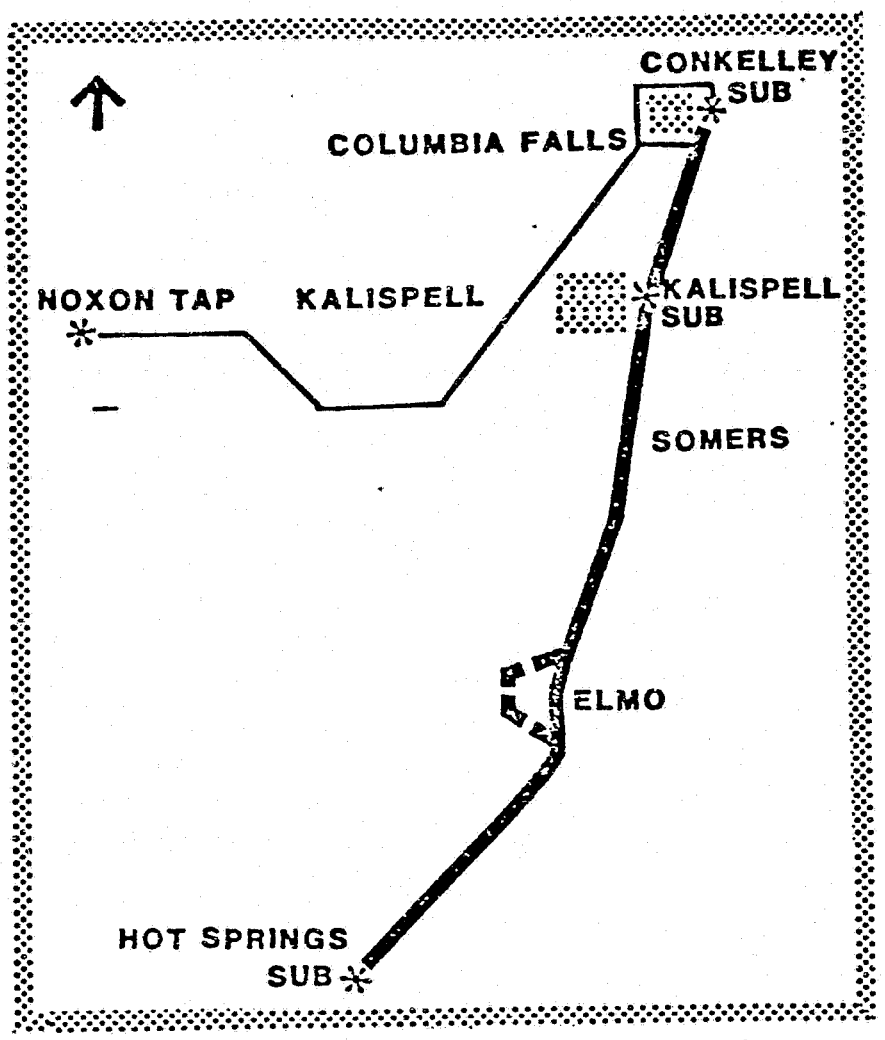
Several route and corridor design alternatives have been identified for the Flathead Valley Reinforcement project.

Plan 1 involves building a 230 kV line between Hot Springs and Conkelley Substations, about 64 miles. Although the new line would primarily parallel or replace existing lines, BPA will also consider relocating the line in certain areas if the nature of potential impacts warrants this. Within Plan 1 there are several design options on various route segments, including use of a single or double-circuit steel structures, and a double-circuit wood design.

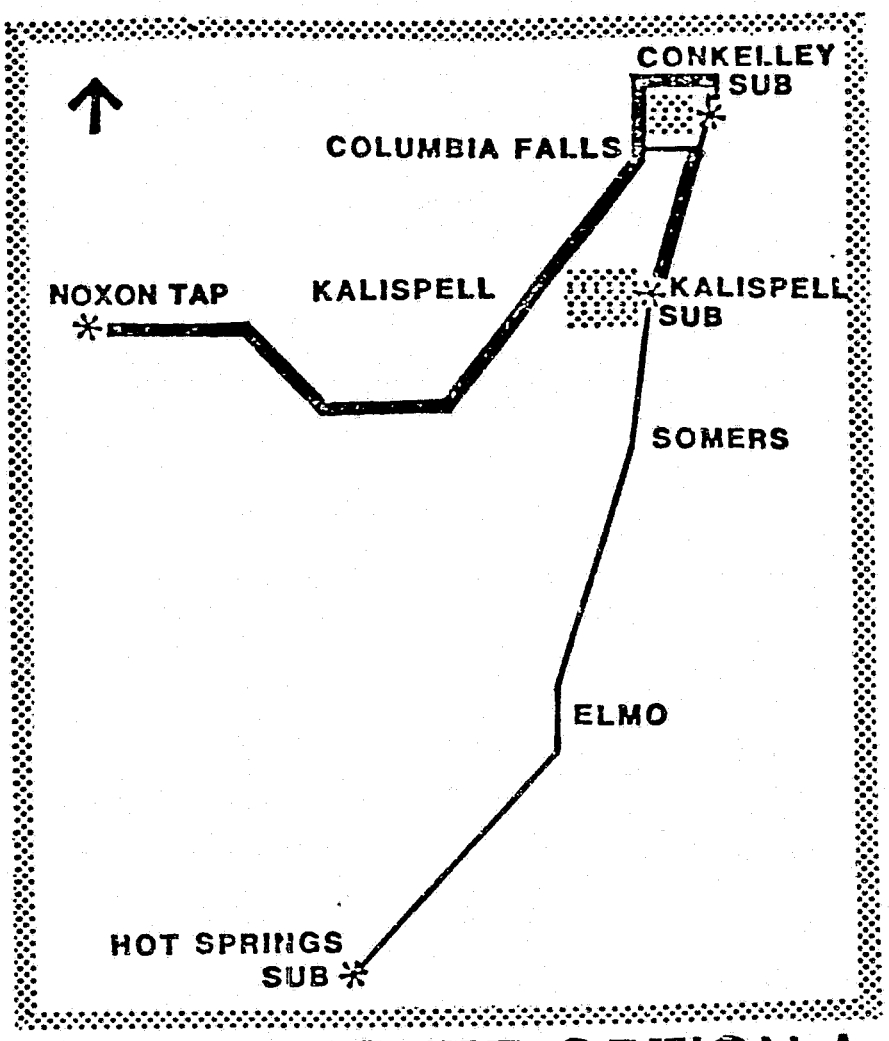
Plan 2 involves building a single-circuit 230 kV line from a "tap" point on the existing line between Noxon and Libby Dams, just west of Pleasant Valley, to a "tap" point west of Kalispell (about 37 miles). From here, BPA would either; A) build a new line northeast for 22 miles to Conkelley Substation paralleling or utilizing existing lines which run north of Columbia Falls, B) continue the line up the west side of the Valley, through Flathead Substation following lines which run south of Columbia Falls into Conkelley Substation, or C) connect the line from the Noxon-Libby tap to an existing line up the west side of the Valley, disconnect the existing line between this connection point and Lion Mountain Substation, and then build a new line up the east side of the Valley as in Plan 1. In addition, for either Option A or B in Plan 2, the existing line between the Columbia Falls and Kalispell Substations would need to be reconductored.

These alternative plan and route options are illustrated in the diagrams on the next page. In reviewing these options, it should be noted this information is preliminary and subject to change. It is, however, the most current information available and provides a basis for discussion and public comment.

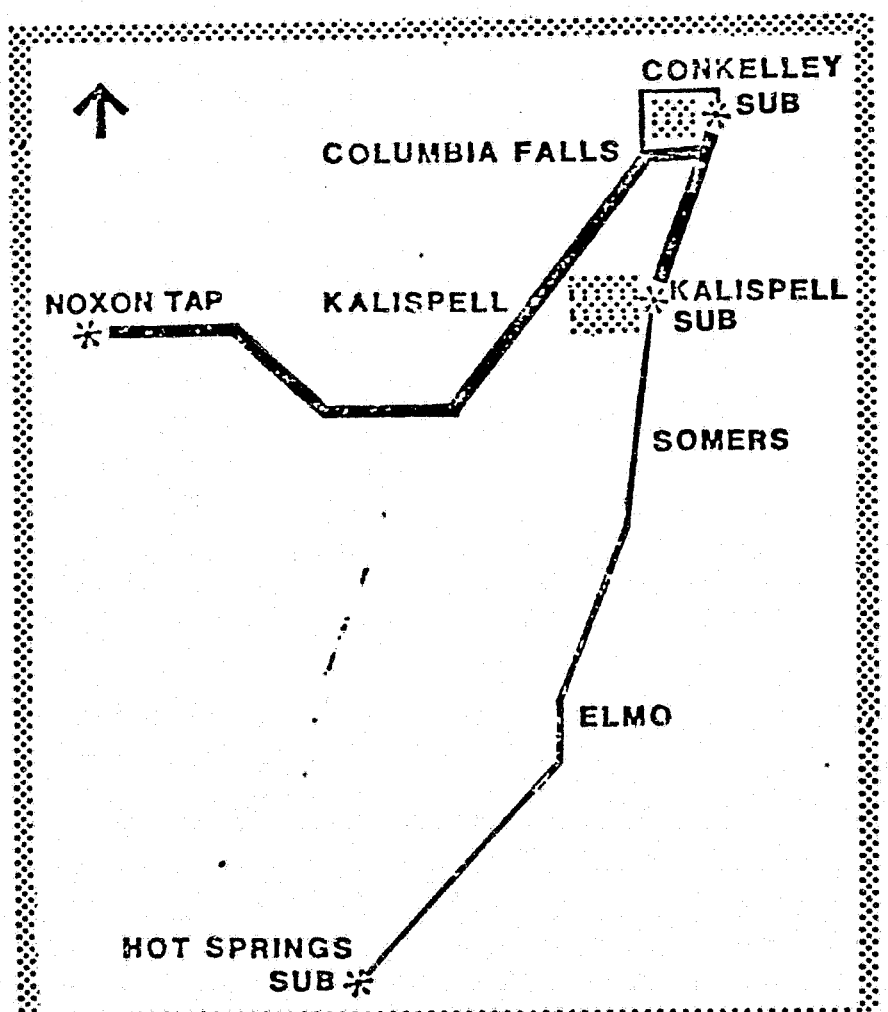
ALTERNATIVE PLANS AND ROUTE OPTIONS



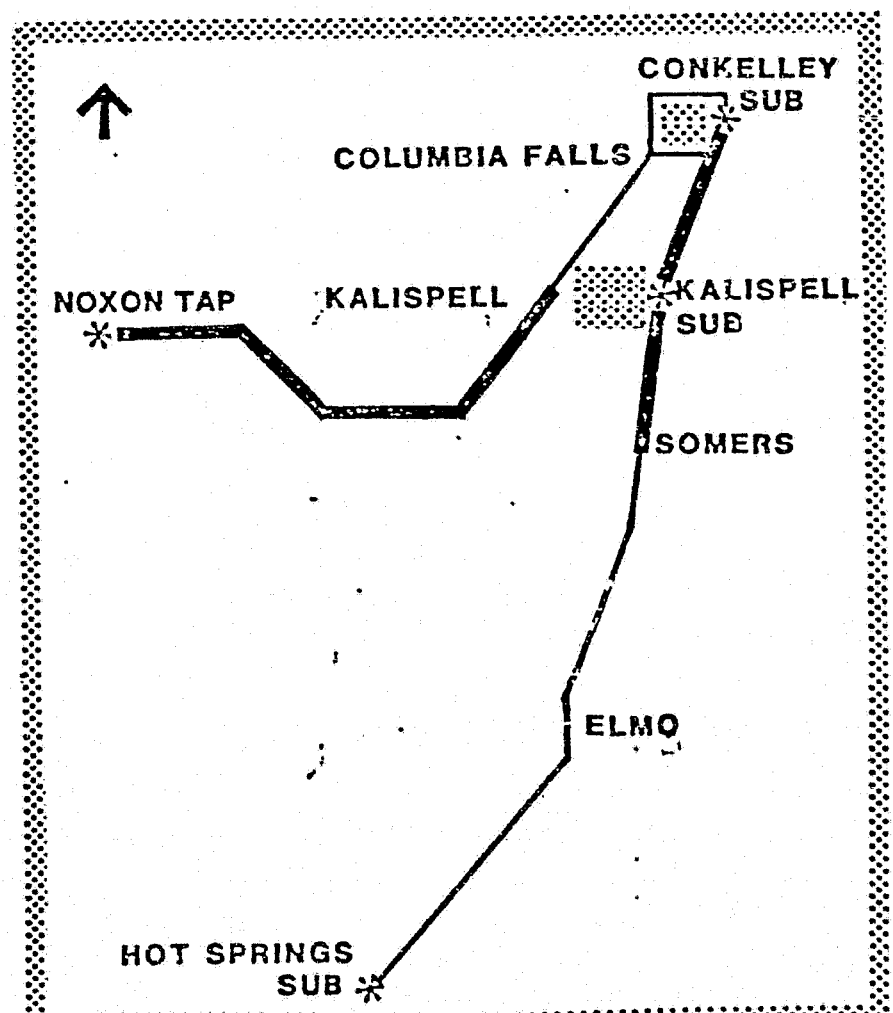
PLAN 1



PLAN 2, ROUTE OPTION A

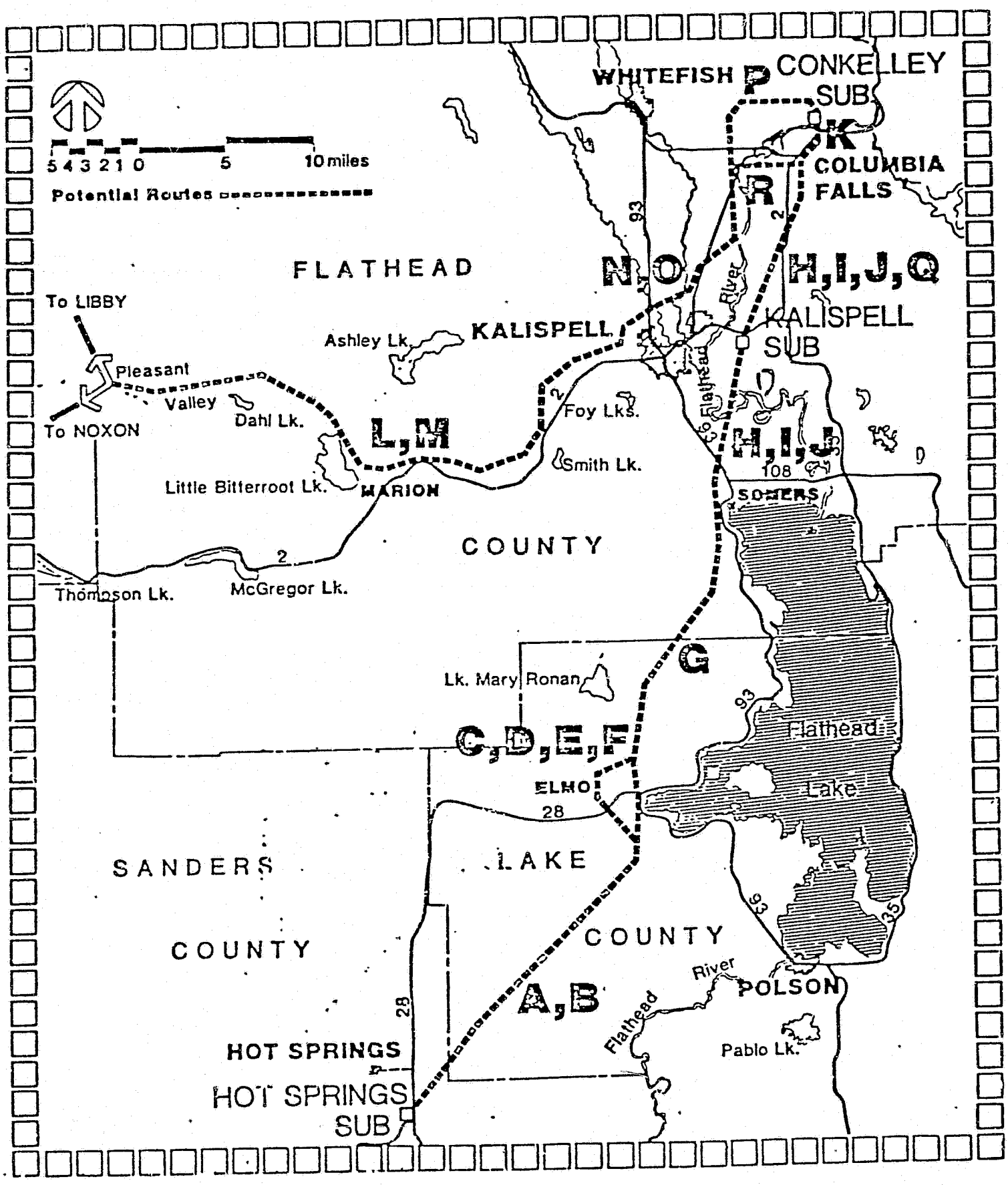


PLAN 2, ROUTE OPTION B

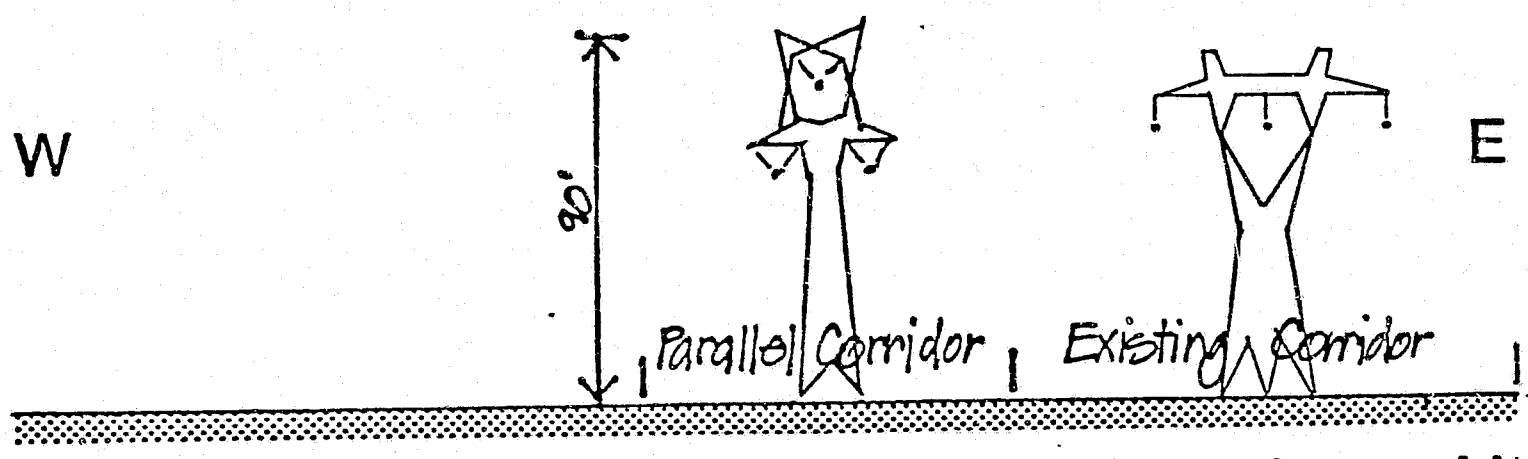


PLAN 2, ROUTE OPTION C

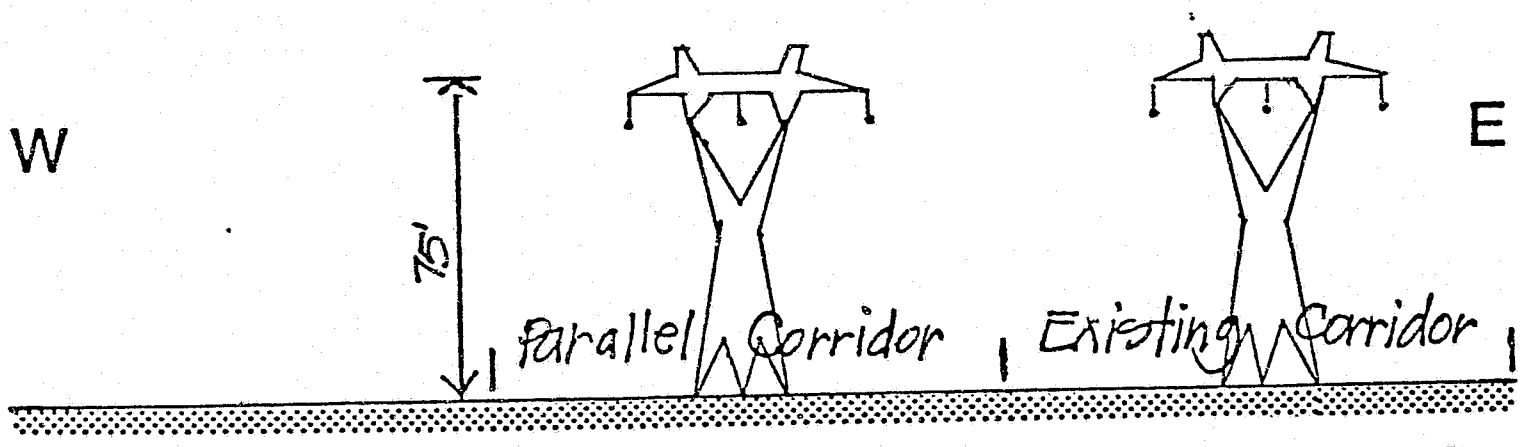
CORRIDOR DESIGN OPTIONS



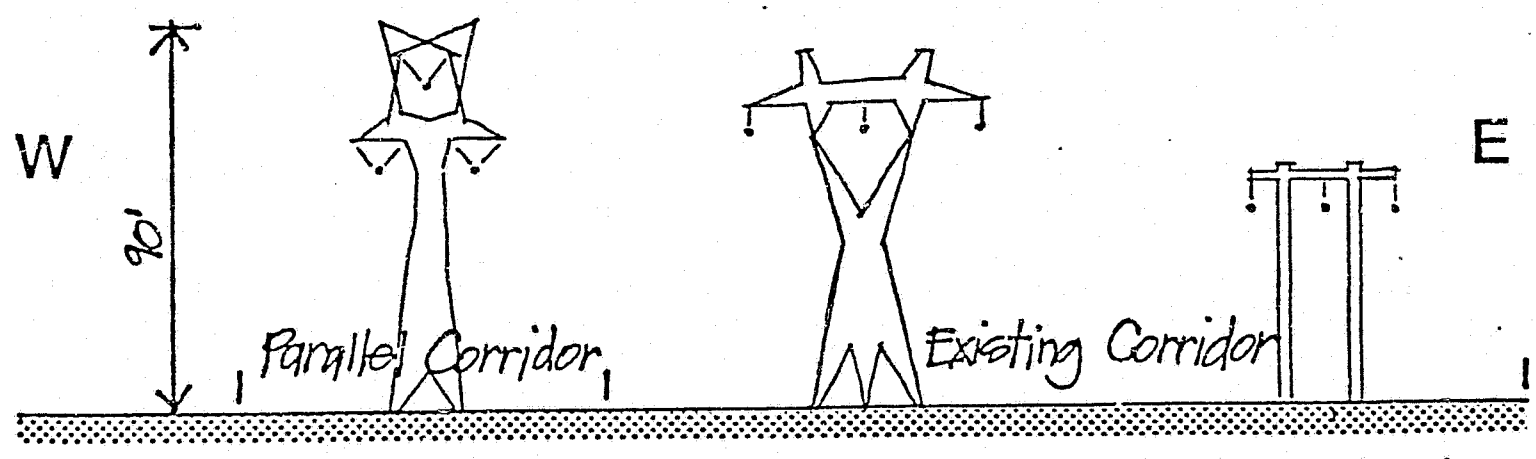
The capital letters on this map indicate the possible corridor design options along each segment of the alternative transmission routes. The letters are keyed to the diagrams which follow. These diagrams show the possible designs for the structures needed to support the new transmission line. Please notice that these designs differ not only in their height and visual appearance, but also in the additional right of way they would require.



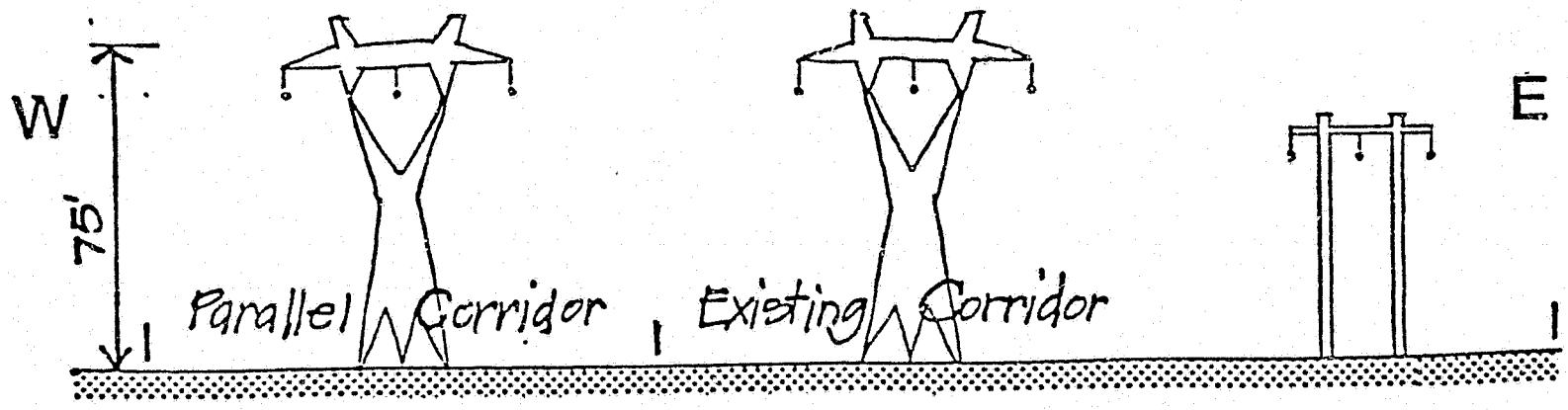
(A) Plan 1, Hot Springs to Elmo: 230 kV single circuit, steel tower, delta configuration.



(B) Plan 1, Hot Springs to Elmo: 230 kV single circuit, steel tower, flat configuration



(C) Plan 1, Immediate Elmo Area, Parallel alignment: 230 kV single circuit, steel tower, delta configuration.



(D) Plan 1, Immediate Elmo Area, Parallel alignment: 230 kV single circuit, steel tower, flat configuration.

Note: This form was used by workshop participants to provide written comments.

Concerns and Comments

FLATHEAD VALLEY TRANSMISSION REINFORCEMENT EIS

☐ Elmo 2/3 ☐ Kalispell 2/4 ☐ Columbia Falls 2/5

PLEASE TELL US OF ANY ISSUES, AREAS, OR SPECIFIC FEATURES THAT YOU FEEL SHOULD BE GIVEN SPECIAL CONSIDERATION IN PLANNING THE TRANSMISSION LINE NEAR YOUR AREA OR COMMUNITY:

WOULD YOU LIKE TO BE NOTIFIED OF FUTURE ACTIVITIES ON THIS PROJECT? ☐ Yes ☐ No

NAME _____

ADDRESS _____

_____

TELEPHONE _____

Note: This form was used to record verbal comments provided directly to Envirosphere, Jones & Jones, or BPA staff during the workshops.

Participant Comment Record

FLATHEAD VALLEY TRANSMISSION REINFORCEMENT EIS

☐ Elmo 2/3 ☐ Kalispell 2/4 ☐ Columbia Falls 2/5

WORKSHOP PARTICIPANT _____

RESIDENCE LOCATION _____

ORGANIZATION, IF ANY _____

BRIEF DIGEST OF CONCERNS AND COMMENTS:

IS FOLLOW-UP CONTACT NEEDED? ☐ Yes ☐ No

ADDRESS/TELEPHONE FOR CONTACT: _____

_____

STAFF _____

E.1.b Incorporation and Utilization of Previous Work

Much effort has been expended in conducting the previous studies concerning the Susitna transmission lines. In order to meet schedule deadlines and be as efficient and cost effective as possible, the Joint Venture will emphasize use of existing studies to accomplish corridor and route evaluation.

It is anticipated that Phases IA and IB of the route selection process described above can be conducted on the basis of existing studies and maps, supplemented by minimal independent research and field checking.

Upon startup of the project, the Joint Venture will conduct the following steps with respect to the previous studies:

a) Identify and review all work relevant to route selection and station siting for the Susitna transmission lines; this will include studies specifically related to the Susitna project and other works of general application due to geographic or subject nature
b) Discuss the previous studies and reviews of these studies with the Power Authority and various agencies
c) Present a report to the Power Authority on the adequacy of the studies and the extent to which they can be used directly in the subject route selection process
d) Use adequate data and maps from previous studies in the evaluation and selection process

E.1.c Public Participation Plan

The Joint Venture will supply effective assistance to the Power Authority's Public Participation Office (PPO) in providing necessary technical information to the public, evaluating public feedback on project alternatives and processes, and supporting functions related to achieving public and agency consensus on the Susitna transmission line route. It is anticipated that the Public Participation Office will assume the lead responsibility for coordinating the program and actually presenting material to the public, while the efforts of the Joint Venture will be concentrated in the area of information processing and analysis, graphics, and short-term tasks which require substantial personnel resources. The public participation program for the transmission line design project will involve a concerted effort during the first six months of 1983 and a lesser level of effort through the end of the licensing process. During the latter stage, mechanisms will be established whereby continuing post-license public concerns can be accomodated through the construction environmental monitoring program and the ongoing PPO program for the Susitna Project.

Overview of Activities The Joint Venture's basic activities in public participation will include planning; technical liaison between the environmental and engineering specialists, the PPO, and the public; preparation of brochures, maps, simulations, displays and other materials for public consumption; recording and analysis of public comments; and miscellaneous as-needed support activities such as identifying groups or individuals who should receive project-related mailings.

The key items that are proposed for the transmission line public participation program are two series of public workshops, tentatively planned for March and May of 1983. Each series will probably consist of three workshops, to be held in Anchorage, Talkeetna, and Fairbanks. These two series of workshops will be designed to provide the appropriate types of public input for the major decision points of

corridor selection and route and station site selection, respectively. Following initial program planning activities in January of 1983, the bulk of the public participation effort will be geared to developing the necessary materials for the workshps and providing for a two-way exchange of information between the technical routing work and the public participation effort. During Phase II, corresponding to the center line refinement process (see Figure E-1), the scope of the public participation program will narrow to involve primarily working with residents and user groups who would be directly affected by the selected line route. This part of the effort will consequently require the public participation program to inform interested parties of ongoing studies, and to relay the concerns of these parties to the project engineering and environmental staffs.

Organization and Staffing. The transmission line public participation program can be implemented effectively and efficiently by linking it closely with the corresponding Joint Venture organization for the rest of the Susitna design work. Establishing inter-relationships or dual relationships in this manner will provide for close coordination between the two concurrent projects, and minimize the risk of confusing the interested public or dividing its attention.

In organizational terms, the desired linkage with the established Joint Venture Susitna Hydroelectric Project Team will be achieved by placing the public participation function for the transmission line at the same staff level as the public participation support program for the remaining Susitna work (see Figures A-3 and A-5, the project organizational chart presented in Section A of this proposal). Consequently, public participation activities relating to the transmission line will be headquartered within the office of Mr. William Kitto, the Joint Venture's overall Public Participation Programs Manager. Mr. Kitto's basic responsibilities will be to work with the Public Participation Office and the transmission line project team to plan and establish an organizational framework for the transmission line efforts and to provide for overall supervision and monitoring of progress. Direct supervision will come from the

Transmission Line Project Manager, due to the organizational structure of the project team, and the Lead Environmental Scientist will also work closely with the public participation staff.

The day-to-day administration of the transmission line public participation program will be the responsibility of a new position that will be created within the Joint Venture organization. The Public Participation Coordinator for the transmission line will be based in Anchorage full-time through the more intensive early phase of the project, although the transmission line project will not demand all of the Coordinator's time; the workload for this position is estimated at approximately half-time during Phase I and declining somewhat after that. This position will be filled by Mr. D. Towne of Jones and Jones, who has a strong background in public participation, capital planning, and environmental assessment. The Public Participation Coordinator will receive technical and administrative support from the Joint Venture's office staff in Bellevue, and from the Jones and Jones office staff in Seattle. This division of responsibility is proposed as the best way to coordinate all Susitna-related public participation activities, provide the high level of attention needed initially for public activities on the transmission line, and mobilize the substantial staff resources required for the concerted efforts at key points in the selection process.

Objectives. The public participation effort for the Susitna transmission line will have a number of specific objectives that will vary over the course of the project. Broad project goals will include the establishment of a full and open coordination process, consideration of public concerns at all stages of selection and evaluation, and thorough documentation of public involvement. Within these broad goals, the public participation program will be designed to meet more specific objectives geared to the needs of individual project tasks. These specific objectives are seen as follows:

1. Inform the public about the environmental impacts of EHV transmission lines and substations, particularly in regard to such sensitive areas as visual impacts, noise and electrical and magnetic effects.
2. Explain the previous work done on the Susitna transmission line, and the process and schedule to be used in achieving consensus on the ultimate route alignments.
3. Obtain public input on the identity and importance of evaluation criteria to be used in selecting and evaluating potential corridors, routes, and substation locations.
4. Solicit public suggestions of alternative corridors and routes.
5. Generate feedback on the adequacy of the evaluation process and the suitability of the recommended routes.
6. Provide a means for the discussion and resolution of differences between technical or economic requirements and public desires and concerns.
7. Obtain public comment on proposed mitigation measures and suggestions of possible additional measures.
8. Establish a framework for continuing interaction and communication between the Power Authority, its field agents, the Joint Venture's environmental and design teams, and individuals who would be directly affected by the routing decision.

Detailed Work Plan and Schedule A firm, comprehensive, public participation work plan and schedule cannot be established at this time for several reasons. Currently identified project needs will be subject to change, particularly during the early stages of the project, due to input from the public and the Power Authority. The uncertain status of the plan and schedule for the larger Susitna program will also have an effect on the configuration of the transmission line effort, because these two work elements should be coordinated for maximum efficiency. (The two programs will not and should not be conducted strictly in tandem, but aspects of the transmission line

program could be incorporated into some of the internal meetings and materials preparation tasks of the larger public participation program). Given these qualifiers, it is anticipated that the public participation program for the Susitna transmission line will be designed as outlined below.

The initial task will be the establishment of a draft public participation plan. The Joint Venture will develop a preliminary draft of this plan, which will set forth an overall schedule and budget and will identify responsibilties, objectives, approaches, necessary informational materials and mechanisms for disseminating information. The Power Authority will then review the preliminary plan in consultation with FERC representatives and the Joint Venture project team, with the Public Participation Office (PPO) in the lead role. Necessary revisions to the plan will be developed at a working session involving PPO staff, the Joint Venture public participation staff and Lead Environmental Scientist, and the transmission line project managers from both the Power Authority and the Joint Venture. The final version of the plan, subject to amendment as a result of additional needs which occur, should be developed by the end of January, 1983. This plan will serve as a guide for meeting the public participation requirements of both the Power Authority and FERC.

Following the planning tasks, the public participation effort will focus upon preparatory tasks for the first public workshop. The first workshop will likely be scheduled for early March, although it would be desirable to accelerate this scheduling to maximize the time available for route evaluation and selection. This will involve two parallel activities, the preparation of materials for the workshop and the generation of publicity about the workshop and the overall process. The Joint Venture technical staff will have the primary input responsibility for workshop materials, under the direction of the Public Participation Coordinator, while the PPO and the Joint Venture public participation staff would work cooperatively to disseminate

project and workshop information to the public. In addition to providing these basic details, media releases at this stage of the project will also solicit advance public feedback about corridor alternatives and evaluation criteria.

The first workshop will be designed to meet the first four objectives listed previously in this discussion. It is envisioned that PPO staff will direct the workshop, explaining the history of the project and the complete process to be used for selection of the final route alignment. Technical specialists from the project team will contribute to the preparation of brochures and educational displays on the generic effects of transmission lines and substations. Issues that generally need to be addressed include:

noise
visual effects
ozone and corona discharge
ecological impacts
property value effects
recreation and access impacts
other social effects
construction and operation practices

Following a presentation of the corridors already identified and the reasons for their identification, public comment will be solicited on the adequacy of these results, the criteria that should be used to evaluate and screen the corridors, and possible alternative corridors that were not identified. Public input will be recorded by means of registration cards and comment sheets. The comments will then be analyzed, with the results of the analysis included in the brief Phase IA report to be submitted to the Power Authority. A sample of workshop materials used on the Flathead Valley Project is included at the end of this subsection, following the task and deliverables list for line routing and station siting.

The second public workshop, to be scheduled for the early part of May, 1983, will be a somewhat more formal proceeding geared toward objectives 5, 6 and 7. Considerable preparatory work similar to that required for the first workshop will take place during March and April, although the emphasis will be completely upon the route selection process and its results. Following a presentation by PPO staff, a combined panel of public participation and technical personnel will respond to questions and comments about the route selection and station siting effort. This activity and subsequent small-group working sessions will hopefully provide the necessary feedback and resolution to meet the objectives. Again, public comments will be recorded, analyzed and incorporated into the Phaze 1B report. The results of this workshop and the comment analysis, together with the technical work and agency coordination, will lead to any route (not centerline) refinements necessary to identify general consensus on the preferred alignments and mitigation measures.

Phase II of the public participation program will include two significant elements that will be designed to meet objective 8. The first element will be a short-term task that will take place during the centerline refinement process. This work will involve mailings to individuals or user groups .ng the preferred route alignments, provision of a mechanism for the continuing concerns of these people to be relayed to the Power Authority and the Joint Venture project team, and implementing some type of responsive action.

The level of involvement of the Public Participation Coordinator will decline during the remainder of 1983 after this task is under way, and will remain at a reduced level through granting of the license. The coordinator will be assigned added responsibilities elsewhere within the Joint Venture orgnization or his parent firm. The second task during Phase II will be to develop a long-term plan or procedures manual, which will detail the ongoing minor responsibilities of the PPO, the larger Susitna public participation program and the

construction environmental monitoring program. Collectively, these entities will respond to public concerns that arise after the licensing of the transmission line. Prior to the securing of a license in 1985, the Public Participation Coordinator will continue to be reponsible for input to public information releases from the PPO, and will be available for unforeseen tasks related to the licensing process.

E.1.d Agency/Public Coordination and Consultation

The Joint Venture project team recognizes the importance of the flow of information to the various agencies, utilities and citizens concerned. To ensure that such coordination and consultation takes place throughout the design contract, the Joint Venture proposes to implement the following actions:

- o The status of the transmission line routing and design effort will be included in monthly progress reports to the Power Authority by project management

- o Agency coordination will be a specific topic of discussion during final work planning sessions in January, 1983. In conjunction with the Power Authority, key members of the project team will develop an internal working guide for agency contact. This guide will identify agencies and utilities that must be contacted, responsible agency officials and the points during the process at which contacts must be made. The guide will also assign responsibilities for making these contacts to appropriate team members. The agency contact guide will represent a master list that will be updated thorughout the route selection process. The Project Manager, Lead Environmental Scientist, and Lead Engineers will monitor progress on this element.

- o Project Consultation Packages (PCP) will be prepared during phases of the route selection process to document the extent of consultation with agencies and their comments.

- o Technical assistance will be provided to the Power Authority Public Participation Office in developing issue-oriented reports or newsletters to the public.

- The Lead Environmental Scientist and/or Public Participation Coordinator will arrange informal meetings with the Power Authority, agencies, and/or staff personnel from the serviced utilities at such times as this communication appears to be desirable. Environmental and engineering specialists from the project organization will participate in these meetings as needed.

- Formal presentations will be made to the Power Authority and other designated audiences by principal members of the transmission line project team on request. A file of presentation materials will be maintained to document and facilitate these presentations.

- All agency and utility contacts will be documented. Detailed notes will be taken at all meetings, and memos will be prepared for all meetings and telephone conversations. A master project file of such contact documentation will be maintained, and key project staff (the Project Manager, Lead Environmental Scientist, and Lead Engineers will receive copies of all contact memos prepared by team members under thier superivison.

E.1.e Deliverables

The major deliverables for the line routing and station siting studies will be a series of reports corresponding to the significant decision points in this process. Three brief interim reports will be delivered during the first six months of the project, and a final report on route selection and station siting will be completed by the end of 1983. Two other significant documents will be required to provide a framework for the public participation effort, while some pamphlets, simulations and other ancillary materials will also need to be prepared for public and agency coordination activities.

The four reports that appear to be necessary to document the route selection and station siting process include the following:

- o A letter report on the review of previous studies. A key purpose of this report, in addition to presenting conclusions as to the adequacy of existing work, will be to identify geographic or subject areas where additional studies are required. This report will be submitted during the third week of February, 1983.

- o An interim report on corridor selection (Phase IA). This report will be scheduled for delivery near the end of March, 1983, and will primarily deal with the results of the first public workshop. Data, narrative, and maps concerning evaluation criteria and corridor selection will be included, but most of the report will consist of documentation of public and agency coordination during the corridor selection phase.

- o An interim report on route selection. Similar to the report on corridor selection, an interim report will also be prepared at the end of Phase IB. This report will be submitted as soon as possible after the second public workshop in May, and will document the consensus on basic alignments reached through public involvement, agency contact, and technical evaluation.

- o A final route documentation report. This major report will document the entire route and station site selection process, including the centerline refinement phase, and provide a detailed environmental assessment of the complete transmission project. Anticipated completion dates for the draft and final editions of this report are October and December of 1983, respectively.

The structuring of reports in the above manner is intended to provide documentation at all necessary points in the process, yet constrain the resources devoted to report preparation during the critical corridor and route selection process. Given the limited time availaole to reach consensus on the basic alignments, staff resources during Phases IA and IB need to be concentrated on public participation, agency contact, and actual evaluation of corridors, routes, and station sites. Consequently, documentation of the full environmental analysis desired by the Power Authority (but not the analysis itself) will be deferred to the final report.

Two additional reports will be required for the public participation effort. As described in Section E.1.c., the initial document will be a public participation plan for Phases I and II of the route selection process. This document will outline the respective responsibilities of all parties involved, set forth a schedule and budget, and identify materials and methods to be used in obtaining public input. The public participation plan will be developed during January and February of 1983, but will be open to amendment as additional needs are identified. The second public participation deliverable will be a guide for long-term public coordination, covering post-license design and construction activities. This document will be developed as an addendum to the overall public participation plan, and will be prepared late in 1984.

Supporting materials that will ultimately be delivered to the Power Authority will be required for both the technical and public participation activities, but these materials cannot be completely identified at this time. Such materials would include maps, visual simulations, displays and brochures for workshops, and the project consultation packages for agency representatives. Due to the nature and importance of the visual simulations, a separate discussion of this element of Jones and Jones' effort is included in Section E.3.a (Collateral Support). Regular progress reports will also be transmitted to the Power Authority.

ROUTE SELECTION & STATION SITING
TASK LIST WITH SCHEDULE
OF DELIVERABLES

Task E1.1

Task: Review of Corridor Selection of Prior Studies

Subtasks

Management Subtasks

- Issue and control manpower budgets and schedule of tasks/subtasks, work schedule, and staffing
- Conduct client start-up meeting
- Finalize work plan
- Initiate work

Environmental Subtasks

- Review prior studies on corridor/route selection and related environmental aspects to determine their adequacy and completeness
- Confirm and/or identify principles issues and criteria

Transmission Line Engineering Substasks

- Evaluation of corridor and route alternatives as they relate to technical and economic aspects

Output

Management Output

- Monthly progress reports

Environmental Output

- Report on adequacy and completeness of prior studies

Engineering Output

- Input to corridor and route selection documentation

Task E1.2

Task: Line Routing and Station Siting

Subtasks

Management Subtasks

- Issue and control manpower budgets and schedule of tasks/subtasks, work schedule, and staffing
- Conduct client start-up meeting
- Finalize work plan
- Initiate work

Environmental Subtasks

- Incorporate public and agency concerns into corridor evaluation
- Evaluate transmission line design requirements and components as they relate to environmental compatibility
- Evaluate impacts of corridor alternatives on environmental and sociocultural resources
- Select corridor for each study area
- Identify alternative routes
- Evaluate impacts of alternative routes
- Incorporate public and agency concerns into route and station site selection

- Develop mitigation measures
  - General measures applicable to routing, construction and maintenance
  - Specific plan for preferred route and substations
- Select preferred route and station sites
- Provide input for permit applications
- Work with agencies and public to refine centerline and station locations as necessary
- Conduct necessary detailed studies of selected route segments
- Document all environmental activities

Transmission Line Engineering Substasks

- Evaluation of corridor and route alternatives as they relate to technical and economic aspects
- Study of construction, maintenance, and design requirements
- Cost comparisons of potential centerline refinements
- Preliminary spotting and determination of ROW
- Study of structural and foundation requirements as related to environmental aspects

Output

Management Output

- Monthly progress reports

Environmental Output

- Interim reports documenting phases of completion
- Final report on selection, detailing issues, impacts to resources and mitigation measures
- Resource evaluation and suitability/constraint maps
- Impact evaluation matrixes

Engineering Output

- Input to corridor and route selection documentation
- Selection of construction methods based on environmental and engineering constraints
- Selection of types of structures and foundations
- Compilation of soil and hydrology data related to route

Task E1.3

Task: Public Participation

Subtasks

Management Subtasks

- Issue and control manpower and budget for subtasks, work schedule and staffing

Public Participation Subtasks

- Prepare public participation plan
- Coordinate selection and preparation of visual aids and other material for public workshops, and arrange participation of Joint Venture personnel, subcontractor personnel and outside consultants
- Obtain input from engineering and environmental disciplines required for preparation of publication and presentation material
- Conduct public workshops and document results
- Distribute information to residents along selected route
- Establish and implement means of working with public during centerline refinement phase
- Develop long-term plan for post-license activities

Output

Management Output

- Progress reports

Public Participation Output

- Public participation plan
- Exhibits, memos, brochures, and workshop announcements to public and agencies
- Visual simulations
- Presentation/workshops to public and agencies
- Documentation of public participation activities and results for interim and final reports

- Long-term plan for post-license activities

Task E1.4

Task: FERC Licensing, Permitting, and land Use Rights/Access Support Activities

Subtasks

Management Subtasks

- Issue and control budgets for subtasks
- Initiate work

FERC Licensing Process Subtasks

- Coordinate FERC license application needs regarding transmission line with the Susitna Hydroelectric Project
- Perform all necessary activities related to FERC licensing including provision of supplemental information, responses to agency comments, and responses to comments in the draft and final EIS

Permitting Subtasks

- Coordinate all permitting needs for the project
- Obtain all temporary permits
- Identify needs and perform activities necessary for Power Authority agents to obtain construction related permits and legal aquisition requirements

Licensing and Permit Monitoring Subtasks

- Identify permits and milestones, and incorporate into the Joint Venture's permit tracking system

Output

Management Output

- Progress reports

FERC Licensing Output

- Responses to comments
- Additional information as requested

Permitting Output

- Temporary permits
- Ownership maps
- Memoranda on issues and needs

Licensing and Permit Monitoring Output

- Periodic computer output on permitting schedules, completions, and revisions
- Periodic memoranda on system and conclusions and/or changes

Schedule of Deliverables

Route Selection and Station Siting

TASK	DELIVERABLES	STARTING DATE	COMPLETION DATE
E1.1	Corridor Selection and Prior Studies		
	Report on Adequacy of Previous Studies	1/83	2/83
E1.2	Line Routing and Station Selection		
	Phase 1A Interim Report and Maps	3/83	4/83
	Phase 1B Interim Report and Maps	4/83	6/83
	Phase 2 Final Report	8/83	12/83
E1.3	Public Participation		
	Public participation plan	1/83	2/83
	Exhibits, memos, brochures, and announcements for public and agencies	1/83	12/84
	Visual simulations	3/83	6/83
	Input to routing reports	2/83	12/83
	Long-term plan	9/84	12/84
E1.4	Licensing, Permitting, and Related Support		
	Responses to comments	2/83	12/84
	Permits	6/83	12/84
	Ownership maps	3/83	9/83
	Memoranda	1/83	12/84

E.2. Work Plan - Technical Design

a. Methodology

The Susitna Joint Venture has organized an engineering design team of experienced professionals and specialists to implement the technical design of the transmission lines and substations planned for the Susitna hydroelectric project.

The members of the design team will follow tested and proven engineering procedures to create the required drawings and documents. This proposal represents the first step towards the implementation of the planning work already carried out by the Power Authority for the Susitna project.

The initial effort of the Susitna Joint Venture was to prepare the work plan given in the proposal. This work plan is based on the concept that the technical design of a major engineering project can be divided and subdivided into a set of discrete tasks and subtasks.

The methodology to be followed in the implementation of the detailed designs is to mobilize the design professionals and specialists and to proceed with the preparation of the necessary calculations, field surveys, design memos, and drawings. These activities would be carried out according to the individual tasks and subtasks and in accordance with the time sequence as given on the design schedule. The design schedule is presented in Section E.4 "Design Management and Schedule" of this proposal.

The necessary design work will be done in the offices of the Susitna Joint Venture at Bellevue, Washington. As described in Section A "Organization" of this proposal, members of the design team will be located in the Bellevue office. At this office the required ergineering calculations and designs will be made for each task and according to the project design schedule.

Using the existing planning reports available from the Power Authority, the Joint Venture engineering staff will carry out detailed studies and will prepare design memoranda for the required individual facilities. The design memoranda will set out the equipment parameters and describe the engineering and technological philosophy upon which the design is based. The equipment parameters will be established according to the unique requirements of the Susitna River hydroelectric plant, and the electric utility systems and facilities in existence and those being planned for the Anchorage and Fairbanks load centers. The necessary characteristics and parameters to be stated in the technical specifications portion of the contract documents and on the drawings will be based on appropriate standards and electric utility practices.

The Design Memoranda will be submitted to the Power Authority for discussions and review. After concurrence on the design memoranda has been obtained, the required contract documents will be prepared and issued for bid. Bidding will be in accord with requirements of the Power Authority procedures.

Following evaluation and award of contract to manufacturers, shop drawings will be submitted for review and comments by the engineers and designers. Following approval of manufacturers' drawings, actual manufacture, testing and delivery of equipment will be coordinated by the project scheduling specialists. Using the approved drawings for the equipment, detailed construction drawings will be prepared. These drawings will be based on the actual equipment to be installed by the construction contractor for the transmission lines and substation facilities. As required by the project schedule, the construction documents will be prepared and issued for bid.

After award of the construction contracts, the engineering staff will interface with the Power Authority's Construction Manager, and provide required engineering after award.

b. Incorporation & Utilization of Previous Work

The Joint Venture will utilize the studies by Acres American, Gilbert/Commonwealth, and others as well as the studies being prepared for the Susitna Dam contract (task 7). The results of these studies will be incorporated in a design memo for use by the transmission line and substation design engineers. This memo will provide the design criteria for the engineers to:

- o Determine the line switching surge level
- o Establish the line energizing and switching transient and sustained voltage levels
- o Determine the ratings and insulation level for substation transformers, shunt reactors, static var compensators, and other equipment
- o Set the surge arrestor ratings
- o Establish the volt ampere ratings of the reactor and capacitor banks with regard to the static var compensators
- o Set the overall gain and time constant for the primary control loop of the static var compensation control system
- o Interact with the static var compensator manufacturer in order to achieve the necessary level at dynamic system performance

In much of the rural area through which the transmission lines pass, it is anticipated that structures and foundations designed for the Healey-Willow Intertie Line can be used perhaps with slight modifications.

Since the Alaska Power Authority and its several consultants have developed design criteria for the 345 kV Healy-Willow Intertie, the Joint Venture plans to review and utilize as much existing criteria as possible.

Prior to Project Design, substation site investigations and borings at selected locations along the line must be planned and initiated. Some of the intertie borings will be adequate, but the Joint Venture is aware that along this portion of the line they must be supplemented.

For urban areas through which the line passes, towers as used on the Intertie Line will be re-evaluated and it is anticipated that conceptual tower designs need to be established and reviewed during meetings with the utilities and regulatory bodies. If necessary, a new tower series will be developed and the joint venture will prepare tower specifications and documents which include loading trees, clearance diagrams, etc. The successful bidder will design and fabricate the structures. A review of design and detailing will be carried out in-depth by the Joint Venture and full scale tower tests made as deemed appropriate. Tower and foundation application charts will be prepared to facilitate relocation of towers in the field or to provide for unanticipated soil conditions.

c. Coordination & Approval of Design Documents

Documents including specifications and subcontract agreements will be prepared in draft form, following similar ones in use by the Power Authority, reviewed internally by the Joint Venture and submitted in draft form to the Power Authority for comments and/or approval. A schedule and details of preparing regular progress reports, numbering of correspondence and lists of persons to receive copies will be worked out in an early meeting at the inception of the project after award and signing of the contract for engineering services.

e. Tower Selection and Design

Although every effort will be made to use previously-designed structures, the Joint Venture has computer tower design and analysis capability and can actually design any required new structure. However, it is felt that the most economical way to handle new designs is to provide loading information to the designer/fabricator, who is usually equipped for such design and detailing and may have an advantage in creating or modifying a design to adapt to his particular fabrication methods and availability of materials which results in a lower cost structure overall. The Joint Venture's structural Analytical Capability can be called upon for design review in this case.

Climatic data and tower design loading conditions will be established including seismic, wind, snow and ice loads. The hinged-guyed steel towers will be reviewed for economy, adaptability to permafrost conditions and seasonal changes. Studies will be carried out to establish the final number of tower types and loading criteria. Alternate tower designs as required will be analyzed. Applicable criteria will be incorporated into tower design and supply structure specifications that will be prepared by the Joint Venture. Towers will be adaptable for helicopter erection. Detailed evaluation of the tower supply bids will be carried out. Structure designs of the manufacturer will be analyzed and reviewed for structural stability and flexibility. The Joint Venture will also review tower shop drawings, establish tower testing criteria, witness tower tests and review test reports.

The Joint Venture will review the soil investigation report prepared by the Subcontractor, select the soil parameters to be used for design of the tower foundations, initially establish preliminary foundation types and groupings and later carry out detailed foundation design. The foundation types selected will be adaptable to permafrost conditions at required sites and logistics of construction activities in Alaska, where helicopter operation during construction will be necessary. Main

tower foundation types considered are anchors and steel H-piles. It is planned that several foundation types will be provided that will be suitable for the different soil conditions along the line and the most suitable type will be selected for specific locations. Foundation design drawings prepared will be detailed enough for construction. The Joint Venture will prepare construction specifications, review bids and make award recommendations.

The Joint Venture will also prepare material estimates for towers and foundations.

f. Conductor Selection

Economical conductor selection involves many of the parameters of a transmission line design. Electrical losses, thermal capacity and surge impedance loading for long lines constitute one aspect of conductor selection. System studies resulting in load flows under various system conditions will determine a minimum electrical cross section required. Varying this cross section can result in a most economical size based upon power flow load and line length. However, system conditions are not constant throughout the life of a transmission line, and they will be included in the system studies.

Weight/strength ratios of conductors result in different tower costs due to the loading imposed on them by the tension and weight of the conductors. These factors must be optimized in order to have an economical line design, however, maintenance considerations may outweigh other factors as the utility strives for uniformity of conductor and accessories in their system. Because the Power Authority has specified preferred conductors, the studies will be limited to checking for conformance with the system requirements.

g. Insulation Coordination

General Insulation coordination of extra-high voltage (EHV) substations is essential to ensure the proper selection of equipment for safe and reliable operation of substations. Coordination of the insulation requires careful consideration of lightning impulse voltages which can be imposed on the transmission lines, and consideration of switching surges which can be produced by circuit switching in the power system.

Power frequency overvoltages which occur during abnormal power system conditions, such as during single line-to-ground short circuits or load rejections, must be evaluated in the selection of surge arresters.

Environmental factors such as contamination and reduced air density must be considered in their effect on the performance of apparatus insulation and air gap clearances. Although the substations may not all be exposed to the same environmental conditions, it is desirable to establish one set of design criteria and apparatus parameters that can be applied to all substations, as this will simplify the design, facilitate the interchangeability of equipment, and reduce the number of different spare parts such as insulators and bushings.

Selection of Arresters The selection of arresters generally will involve:

1. The determination of power frequency voltages (60 Hz) to which the arresters are subjected during system disturbances, and

2. Coordination of the arrester protective characteristics with the impulse and switching surge voltage withstand capabilities of apparatus insulation.

Power Frequency Voltages Two types of system disturbances which produce abnormally high power frequency voltage on arresters will be investigated as follows:

1. Single line-to-ground short-circuits which produce higher than normal power frequency voltage on arresters connected to the unfaulted phases.

2. Sudden load rejections which cause a momentary increase in generated voltage until automatic voltage regulators can restore normal voltage.

Arrester and Apparatus Insulation Coordination The impulse and switching surge voltages which apparatus insulation can withstand without failure are determined by the basic insulation level (BIL) of the apparatus.

The results of the sytem studies performed as part of the Susitna Phase II Project will be used to establish switching surge and low frequency overvoltage levels. These will serve as a basis for selection of the station surge arresters and, consequently, the insulation coordination of the station equipment.

Selection of Apparatus Insulation When selecting the equipment insulating ratings, special consideration will be afforded the following items:

1. Line shunt reactors are generally exposed to greater surge voltages than the station transformers; therefore, their insulating ratings will be separately evaluated.

2. The location of the surge arresters in the station will be evaluated. This factor significantly affects the surge level impressed upon the equipment.

3. The withstand voltage capabilities of insulator unit assemblies for rigid and strain bus will be defined. In particular, the ability of insulator assemblies to withstand normal power frequency overvoltages under conditions of surface contamination will be a critical factor in the station design.

4. Because submarine cable surge characteristics are significantly different from overhead transmission line conditions, the cable ratings and protection for the cable will be developed separately.

Equipment ratings and characteristics will be selected as a result of these studies. The physical arrangement of the station equipment will be determined after evaluating the minimum permissible phase-to-phase and phase-to-ground clearances.

Shielding will be designed to protect the station from direct lightning strokes.

Clearances Air gap clearances from energized parts to ground and between energized parts will be examined with reference to the electrical breakdown of rod-plane and rod-rod electrodes. As flashover voltages for switching surges are usually lower than for impulse voltages, air gap clearances for the EHV substations will be studied with emphasis on the critical flashover voltages for switching surges.

The minimum air gap clearance to ground will be calculated and consideration given to the following:

1. The air gap length must be sufficient to give a high probability of withstand.

2. The air gap length must provide for the reduced withstand strength at low relative humidity.

3. The air gap length must provide for the reduced withstand strength at low relative air densities.

The minimum phase-phase air gap clearance between conductors will be computed using a conservative method of determining the minimum phase-phase air gap clearance providing sufficient clearance between conductors to withstand the maximum expected phase-phase switching surge voltage.

h. Station Design

General The substation design will be based on modern HV and EHV substation concepts taking into consideration all relevant criteria including environmental, electrical, civil, mechanical, and architectural features, as well as ease of operation, maintenance, and coordination with client's practices and operating constraints, if any. Hardware and equipment will be standardized whenever possible to reduce spare parts storage and maintenance. Before initiating design of the substations, a detailed and comprehensive technical and economic evaluation of the following studies will be undertaken for each substation to finalize station design criteria and to establish major design parameters. The conceptual layouts and switching arrangements shown in the Acre's Feasibility Report, and other substation drawings and information prepared by Gilbert/Commonwealth and others for the project will be reviewed for inclusion in the studies and design insofar as applicable. System studies performed by the Joint Venture will be reviewed and additional studies will be initiated and performed as required to establish all system information that will be needed for the detailed design of the transmission system. System reliability criteria will be developed and coordinated with Power Authority.

Switching Arrangements Arrangements such as ring bus, breaker-and-a-half, etc., will be evaluated to optimize an arrangement consistent with pre-established reliability criteria, capital cost, and with operational and maintenance requirements.

SF6 Gas Insulated Substations A comparison will be made to determine the suitability of SF6 GIS type versus conventional air insulated substation. The analysis will include indoor and outdoor GIS systems. Both technical and economic factors will be considered and evaluated. This study will be made at the request of the Power Authority.

Insulation System Design A detailed study of the substation insulation system will be performed as discussed elsewhere in this proposal. Open-air phase-to-phase and phase-to-ground clearances will be established, together with dielectric levels for buses and station equipment.

Substation Layout Layouts will be studied to determine the best possible configuration compatible with cost, transmission line entry, space requirements, and other factors.

Control System Substation control systems will be designed for reliable and safe remote unattended operation. Remote terminal units (RTU's) will be provided under the present scope of Harza-Ebasco work and will be fully integrated with local controls to provide supervisory control of critical functions and complete data logging of substation metered functions. In addition, since the RTU's will suport event recording, substation function will be monitored and recorded. Local switchboard instrumentation will be provided for control and indication for attended operation during and maintenance periods. A hierarchy of controls will be selected to provide simple, clear operations in both the local and remote operating modes.

Communication System The communication system will be designed for noise, data and protection circuits. This system will be fully coordinated with other proposed work and the Harza-Ebasco work presently scheduled. Both primary and back-up system concepts will be thoroughly considered and analyzed to provide a highly reliable, low maintenance system. The system equipment will be specified for modular expansion and future compatibility for power system additions. All telephone equipment for a noise maintenance communications system will be included in the design as will the dual transfer trip relaying equipment.

Grounding System The grounding system will effectively ground all non-current carrying metallic parts of the substations, as well as all equipment neutral connections selected for grounding. Calculations will be developed for touch and step voltages and station potential rise to guide station design and verify compliance with all safety requirements for personnel and equipment.

Lighting System Lighting systems will be designed to illuminate the substation and its approach roads. Outdoor lighting will be appropriate for maintenance and access requirements. Indoor lighting will be coordinated with the tasks to be performed in the control storage, and maintenance locations.

Equipment Ratings Ratings of various substation equipment such as circuit breakers, disconnecting switches, buses, insulators, instrument transformers, surge arresters, shunt reactors, etc., will be coordinated with the results of various system studies such as short circuit, load flow, insulation coordination, etc.

Documents and Drawings Upon completion of the studies, basic design parameters will be selected, detail design will be undertaken to prepare contract specifications and station drawings such as one-line diagrams, equipment layouts, raceway layouts, lighting and grounding layouts, conduit and cable schedules, etc. The preparation of interconnection diagrams which depend upon the detailed equipment terminal arrangements of successful equipment manufacturers will be undertaken during the construction phase of the substations as they become available.

Civil and Structural Design At the outset, soil investigations for the substations and buildings will be carried out by the same subcontractor that will be used for the transmission lines. The joint venture will review the soil investigations report prepared by the subcontractor and select the soil parameters to be used for design of the substation and building foundations.

Additional Criteria Seismic, wind, snow and ice loads and other environmental factors wil be assembled for all civil and structural project features and special analysis developed for the foundation design because of permafrost conditions. Architectural concepts for the control house and storage building will be developed. The criteria and architectural concepts will be pesented in a design memorandum for review and approval of APA.

Applicable criteria from the approved design memorandum will be incorporated into equipment supply structure specifications to ensure coordination of the structure design with project requirements. Shop drawings of all structures will be reviewed for contract compliance.

The foundation design will be based upon the criteria and analysis presented in the design memorandum as applied to the particular structure designs supplied by equipment contractors furnished under their contracts. Loadings will be established for all take-off and equipment structures and foundation designs will be finalized. Site locations selected will be developed for grading, drainage, building location, facilities, road and yard access, etc. Building designs will be established for all required facilities. Technical specification sections will be developed for all civil, structural and architectural features required. These sections such as excavation re-bars, concrete, architectural treatment will be incorporated in the general construction contract along with general electrical and mechanical work and installation of owner-furnished equipment for all substations. All related services associated with contract documentation, preparation, issue and bid evaluation will be included.

Other Design Services The design will be monitored for compliance with contract requirements and technical accuracy and correctness through review of manufacturers' shop drawings, shop inspection of major equipment assemblies, and assistance in commissioning.

i. Protective Relays and Control Systems Selection and/or Design

Protection systems will be selected and specified based on well established principles, using state of the art relay hardware consistent with system reliability criteria, selected communication links and client's practices and operating constraints, if any, and compatibility with existing relay schemes of interconnected power systems.

In any protection system, protective relaying and communication equipment are required to detect all phase and ground faults, to provide clearance times compatible with system stability requirements and to have intrinsic reliability through selective redundance and/or overlapping zones of protection. The protection will provide discriminative tripping throughout the system. Relay settings will be determined from calculations incorporating load flow and system fault studies and coordinated to provide integrated system protection. Consideration will be given for interfacing with interconnected relay systems provided by others and coordinating relay equipment where the substation transmission system connects with other utilities or systems. Relay hardware types will be minimized to simplify and standardize maintenance and operation.

The following features are typical of those which will be considered to provide suitable overall protection for selective project requirements

345 kV Transmission Lines - two sets of duplicate transmission line relays, each set operating from separate CTs, with separate breaker trip coils and separate D.C. tripping circuits.

One relay set would incorporate static impedance measuring distance relays operating in a permissive over-reach mode, with the second set a complement of static impedance measuring distance relays operating in a blocking mode (relay schemes are chosen to work on different principles for added reliability). Each set would provide three zones of protection and be immune to power swings and load encroachments. The protection would provide fast clearance for all 3 phase, 2 phase and phase-to-ground faults over the entire protected length. Close-in faults and evolving faults would be detected and relays would be immune to CCVT transients and switching surges. Compatibility with auto reclosure relays will be assured and operation for 1-pole and/or 3-pole tripping and instantaneous reclosing will be included. In addition, the capability of slow reclosing supervised by synchro-check relays or by dead line/live bus selection will be included.

In the event that system stability considerations require faster operating times or system parameters make impedance measuring relay unsuitable, alternate transmission line protective schemes will be investigated. These would include ASEA's travelling wave propogation relays or line relays using a combination of negative and positive sequence directional comparison schemes or other suitable schemes.

Communication link selection could be coordinated with protective relay requirements and reliability considerations. Instrument transformer characteristics would be coordinated with relay and communication equipment requirements.

Shunt Connected Reactors - high impedance differential relays would be examined initially. These relays provide sensitive settings, fast operating times and are stable against external faults and magnetization inrush current. Voltz/Hertz relay will be selected to protect the reactor from prolonged operation at higher than rated voltage.

Power Transformers - high speed differential relays with second harmonic restraint would be considered. These relays would be stable against magnetizing inrush currents, external faults and operate positively on heavy internal faults. High set instantaneous overcurrent relays would be included to provide fast redundant tripping for severe internal faults. Volts/Hertz relay would be selected to protect the transformer from prolonged operation at higher than rated voltage or abnormal frequencies.

Bus - high impedance differential relays providing sensitive settings, fast operating times and stability against external faults would be considered.

Breaker Failure Protection - provision for local back-up tripping of affected circuit breaker, in the event of an individual stuck circuit breaker and for appropriate remote circuit breaker trip by transfer tripping, would be considered for all bus schemes.

Static Var Compensation Equipment - the protection equipment normally included with packaged protection furnished by the equipment supplier would be verified to include as a minimum, differential protection of the transformers and back-up over-current relays, individual or overall protection of reactors, capacitors and thyristors.

Relay engineers will determine and specify the required relay hardware and evaluate the merits of alternate relaying proposals, prepare necessary associated circuitry, calculate settings required, liaison with manufacturers and the Power Authority.

j. Other

To maximize system and economic benefits from the application of the Static Var Control System (SVS) and the shunt reactors at University, Ester and Knik Arm Substations, the Joint Venture will evaluate system technical requirements and select reactors and SVS to achieve the system and economic objectives. Special considerations will be given to the type [fixed capacitor-thyristor control reactor (FC-TCR) or thyristor switched capacitor - thyristor control reactor (TSC-TCR)] of SVS relative loss versus VAR output characteristic, harmonic generation and performance under large and small system disturbances. The loading effect of the SVS on the autotransformer tertiary winding will affect the transformer size selection and this will be considered in the application of the SVS and the selection of the transformer.

Environmental mitigation measures for construction (EMMC) will be prepared by the Joint Venture during the design and contract document phases of the project. The EMMCs will ensure that the mitigation measures developed in the route selection and substation siting phase are considered or carried out during construction of the transmission facilities.

EMMCs will be prepared in conjunction with the transmission line and the substation construction drawings. Identified mitigation measures will be added to the transmission line construction drawings. This will consist of notes to the contractor regarding such aspects as vegetation clearing, stream crossings, debris removal and construction access. Mitigation plans will be developed for the project substations. The plans will be working drawings with specifications suitable for contract bidding. Measures will include site planning, vegetation and architectural treatments.

Monitoring of the transmission line construction by agencies or a qualified Alaskan environmental firm will assure that the EMMCs are carried out. The firm of Frank Moolin and Associates of Anchorage would be a logical entity to perform this activity due to the firm's experience and role in the proposed work, although this function has been left open at this time.

k. Deliverables

The Joint Venture plans to submit a system study review report to establish the general design of the transmission line. All available power system studies and basic design manuals for the Interie will be evaluated along with critical design criteria such as operation and reliability. After Power Authority approval, the results of this study will be used to prepare a conceptual design manual for the transmission line. As part of this manual, the following criteria documents will be delivered to the Power Authority:

- o Structure selection study
- o Conductor selection study
- o Shielding and grounding study
- o Insulation selection study
- o Foundation selection study

These documents will recommend optimum design relative to construction, maintenance, operation, reliability and cost. They will be prepared in a preliminary form and all comments resolved before the conceptual design manual is finalized. Then this manual will be used as the basis for procurement of the transmission line materials and installation.

In addition to design documents, the Joint Venture plans to submit a master design schedule with any operational details necessary to coordinate with the Watana hydroelectric project construction. Also, a preliminary cost estimate for the transmission line will be prepared.

In addition to procurement documents, the Joint Venture prepares deliverables such as substation and transmission line design criteria and reports. The criteria documents will be based on project environmental data, project requirements, industry standards and practices, system parameters and Power Authority preferences.

One set of substation design criteria will be prepared for each substation unless physical and electrical similarities at stations dictate otherwise. These criteria will specify the basic requirements for equipment and material selection and/or design, electrical clearances, structural loads, grounding, lighting, control and communication. They will be selected to achieve an overall optimum electrical and physical switchyard design relative to construction, maintenance, operation, reliability and cost. The substation design criteria will be originally prepared by the Joint Venture in a preliminary form and issued to Power Authority for comments. A final draft incorporating the resolved comments will be issued to Power Authority for approval and this final document approved will be the basis for the design of the substation and its equipment and materials.

A report will be prepared for all substation studies such as Insulation Coordination, Protection, etc. These reports, in addition to containing details relative to their inputs, procedures and outputs, will contain a summary of findings and, where necessary, make recommendations.

The transmission line design criteria will be prepared in two stages. In the first stage the proposed line parameters will be analyzed in the sense of their conformity to environmental conditions and system data. As a result of this review, in the second stage broad spectrum design criteria will be formulated with the intent of optimization in subsequent detailed studies. This design criteria, following approval by the Power Authority, will form the base for conceptual and final design. Any additional information that may be required will be formulated.

The following data base will be studied and addressed for establishing the design criteria:

- Weather conditions
- Route environmental conditions, topography
- Sensitive areas
- Soil conditions
- Conductors and sag/tension data
- Insulation
- RI and Audible noise, line influence
- Structures
- Foundations
- Clearances

1. Procurement Documents

The Joint Venture plans to prepare fixed price material procurement contracts for the following transmission line materials:

- o transmission line structures
- o conductors and accessories
- o shield wire and guy wire
- o insulators and hardware
- o anchors and guy fittings

One procurement document will be prepared to furnish each of these items after the design is complete. Furthermore, the Watana to Gold Creek materials will be bid separately from the rest of the line. As an alternate, this line section could be bid on the basis of a furnish and install contract to meet the construcion power deadline. Each document will contain all technical specifications for the item and estimated quantities. Also, the technical specifications will include test procedures as required to verify the manufacturer's design. For example, full load testing of the structures could be required. Quantities will be confirmed in the field by Joint Venture personnel.

After the material procurement documents are finished, the Joint Venture plans to prepare fixed price construction contracts for the following sections of the transmission line:

- o Watana to Gold Creek Substation
- o Healy to Willow Substation
- o Ester Substation to Healy
- o Willow to University Substation

These contracts will include all labor, furnishing miscellaneous materials (e.g., ground wire, etc.), clearing of right of way and construction of the transmission line. Furthermore, they will include all plan-profiles, structure lists, foundation drawings, installation

specifications, and wire stringing data to insure proper construction. Also, right-of-way clearing surveys will be part of these contracts. It is planned that tower staking will be made by the surveyors to assure that the design data and quantities will be as close as possible to "as built" and to minimize field changes.

The submarine cable crossing will be prepared as a separate furnish and install construction contract. The Joint Venture will provide technical specifications for procurement and installation of the cable, but the contractor will actually supply the cable as part of his bid. In this way, the latest cable technology can be utilized.

All documents will be prepared in a preliminary form and submitted to the Power Authority for approval along with a list of recommended bidders and the engineer's cost estimate. Then the Joint Venture will prepare a final draft for issue to bidders, and any addendums which are required. Also, the Joint Venture will commercially, technically, and economically evaluate bids and issue recommendations for purchase.

Substation procurement documents will be prepared for transformers, circuit breakers and current transformers, air switches, reactor switches, static VAR control systems, line traps, coupling capacitors, potential devices, structures, reactors, communication and control equipment, station service equipment and buses and insulators. One procurement document will be prepared for each project item. For instance, one document will be prepared for all the transformers, one for all the circuit breakers, one for all the reactors, and so on. This approach is considered to be more economically beneficial than that of generating procurement documents on a substation basis.

Design of construction packages will be initiated after receiving all equipment data. One construction package will be prepared for each of the five substations.

TRANSMISSON LINE TASK LIST WITH SCHEDULE OF DELIVERABLES

HARZA-EBASCO

Task Number: E2.T1
Task: Review Prior Studies and Develop Conceptual Design Manual

SUBTASKS

Management Subtasks

Issue and control manpower and budget for tasks and subtasks, work schedule and staffing

Environmental Subtasks

Assess environmental aspects of construction methods

Access roads

Environmentally sensitive areas

Transmission Line Engineering Subtasks

Collect data

Review and study:
- Climatological conditions
- System study criteria
- Existing intertie transmission line design
- Insulation and conductor clearances
- Conductor Selection
- Conductor and shiledwire vibration protection
- Selection of transmission line materials
- Grounding criteria
- Structures and Foundations
- Transmission line environmental/influence
- Geotechnical and route conditions

Prepare conceptual design operational requirements manual

Coordinate, assist and review all interface work between other disciplines

Civil Engineering Subtasks

Review and study:
- Geological and hydrological data
- Meterological data
- Structures and foundations
- Permafrost/seismic conditions

System Studies
- Review Harza-Ebasco Task 7 Studies
- Prepare electric system design memo
- TNA study for static var control gain and time constraints
- Provide system data to manufacturer of static var

2108B

Task Number: E2.T1
Task: Review Prior Studies and Develop Conceptual Design Manual

SUBTASKS

Management Subtasks

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Environmental Subtasks

Assess environmental aspects of construction methods

Access roads

Environmentally sensitive areas

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- Climatological conditions
- System study criteria
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- Insulation and conductor clearances
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- Selection of transmission line materials
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- Structures and Foundations
- Transmission line environmental/influence
- Geotechnical and route conditions

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Civil Engineering Subtasks

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- Geological and hydrological data
- Meterological data
- Structures and foundations
- Permafrost/seismic conditions

System Studies
- Review Harza-Ebasco Task 7 Studies
- Prepare electric system design memo
- TNA study for static var control gain and time constraints
- Provide system data to manufacturer of static var

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Support Services Subtasks

Issue conceptual design manual

Prepare master design schedule

Task Number: E2.T1
Task: Review Prior Studies & Develop Conceptual Design Manual

OUTPUT

Management Output

Coordinate conceptual design manual

Environmental Engineering Output

Input of environmental considerations and guidance to other disciplines in accomplishing work on their subtasks

Mitigation measures required

Transmission Line Engineering Output

Input and preparation of conceptual design manaual in form of texts, drawings and sketches

The following data to be addressed:

Design condition
Design loadings
Conductor selection
Vibration/galloping
Insulation
Structure selection
Foundation alternatives
Grounding
RI, TVI and line influence and mitigation
ROW width selection
Submarine cable criteria

Civil Engineering Output

Civil/structural assistance as required for preparation of conceptual design manual

Sketches and drawings as required

System Studies
Electric system design memo

Support Services Output

Prepare master design schedule

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Task Number: E2.T2
Task: Contract Document
Transmission Line Structures

SUBTASKS

Management Subtasks

Issue and control manpower budgets and schedule or task and subtasks

Initiate work

Structural Engineering Subtasks

Prepare conceptual design and drawings for new structures as required

Prepare technical specifications and bid forms

Engineer's estimates

Assist in bidding

Prepare bid evaluation

Assist in contract award

Review shop drawings

Witness structure tests

Transmission Line Engineering Subtasks

Study selection of different types of structures, its application and capabilities (maximum spans and angle)

Prepare outline drawings with clearnaces diagrams and loading schedule for new structure designs

Prepare technical specification and bid form

Assist in bidding

Prepare bid evaluation

Assist in contract award

Review shop drawings

Coordinate, assist and review all interface work between other disciplines

Support Services Subtasks

Contract Preparation Phase Services

Revise standard conditions to fit specific contract

Prepare contract document and addenda from design department's drafts: review copies, final reproduction

Assist with bidding and award: Prequalification, Document Issue and Follow-up, Receipt and Recording of Bids, Edit Technical Evaluation of Bids by Design Departments, Commercial Evaluation of Bids, Prepare Letter of Recommendation for Award, Contract/Purchase Order Negotiation.

Task Number: E2.T2
Task: Contract Document
Transmission Line Structures

OUTPUT

Management Subtasks

Issue and control manpower budgets and schedule for task and subtasks

Initiate work

Structural Engineering Output

Technical specifications for new structures

Engineer's Estimates

Bid evaluation

Review drawings for structure fabrication

Structure test reports

Transmission Line Engineering Output

Outline drawings and loading schedule for new structures

Specification and Bid Form

Bid Evaluation

Review Shop Drawing

Coordinate, assist and review all interface work between other disciplines

Support Services Output

Contract Documents and addenda

Cost Estimate

Bids evaluation

Letter of recommendation for award

Task Number: E2.T3
Task: Contract Document
Conductor and Accessories

SUBTASKS

Management Subtasks

Issue and control manpower budgets and schedule for task and subtasks

Initiate work

Transmission Line Engineering Subtasks

Prepare technical specifications and bid forms

Prepare drawings for conductor accessories

Prepare Engineer's estimates

Assist in bidding

Prepare bid evaluation

Assist in contract award

Review supplies drawings

Provide shop inspection

Coordinate, assist and review all interface work between other disciplines

Support Services Subtasks

Contract Preparation Phase Services

Revise standard conditions to fit specific contract

Prepare contract documents and addenda from design department's drafts: review copies, final reproduction

Review and process engineer's estimate

Assist with bidding and award: Prequalification, Document Issue and Follow-up, Receipt and Recording of Bids, Edit Technical Evaluation of Bids by Design Departments, Commercial Evaluation of Bids, Prepare Letter of Recommendation for Award, Contract/Purchase Order Negotiation.

Task Number: E2.T3
Task: Contract Document
Conductor and Accessories

OUTPUT

Management Subtasks

Issue and control manpower budgets and schedule for task and subtasks

Initiate work

Transmission Line Engineering Output

Specification and Bid Form

Drawings for conductor accessories

Engineer's Estimate

Bid Evaluation

Reviewed Drawings for Fabrication

Inspection Reports

Support Services Output

Contract Documents and addenda

Cost Estimate

Letter of recommendation for award

Task Number: E2.T4
Task: Contract Document
Shield Wire and Guy Cable

SUBTASKS

Management Subtasks

Issue and control manpower budgets and schedule for task and subtasks

Initiate work

Transmission Line Engineering Subtasks

Prepare technical specifications and bid forms

Prepare Engineer's estimates

Assist in bidding

Prepare bid evaluation

Assist in contract award

Coordinate, assist and review all interface work between other disciplines

Support Services Subtasks

Contract Preparation Phase Services

Revise standard conditions to fit specific contract

Prepare contract documents and addenda from design department's drafts: review copies, final reproduction

Review and process engineer's estimate

Assist with bidding and award: Document Issue and Follow-up, Receipt and Recording of Bids, Edit Technical Evaluation of Bids by Design Departments, Commercial Evaluation of Bids, Prepare Letter of Recommendation for Award, Contract/Purchase Order Negotiation.

Task Number: E2.T4
Task: Contract Document
Shield Wire and Guy Cable

OUTPUT

Management Subtasks

Isssue and control manpower budgets and schedule for task and subtasks

Initiate work

Transmission Line Engineering Output

Specification and Bid Form

Engineer's Estimate

Bid Evaluation

Inspection Reports

Support Services Output

Contract Documents and addendums

Cost Estimate

Letter of recommendation for award

Task Number: E2.T5
Task: Contract Document
Insulators and Hardware

Management Subtasks

Issue and control manpower budgets and schedule or task and subtasks

Initiate work

Transmission Line Engineering Subtasks

Prepare hardware assembly drawings

Prepare technical specifications and bid forms

Engineer's estimates

Assist in bidding

Prepare bid evaluation

Assist in contract award

Review suppliers drawings

Provide shop inspection as required

Coordinate, assist and review all interface work between other disciplines

Support Services Subtasks

Contract Preparation Phase Services

Revise standard conditions to fit specific contract

Prepare contract documents and addenda from design department's drafts: review copies, final reproduction

Review and process engineer's estimate

Assist with bidding and award: Document Issue and Follow-up, Receipt and Recording of Bids, Edit Technical Evaluation of Bids by Design Departments, Commercial Evaluation of Bids, Prepare Letter of Recommendation for Award, Contract/Purchase Order Negotiation.

Task Number: E2.T5
Task: Contract Document
Insulators and Hardware

OUTPUT

Management Subtasks

Issue and control manpower budgets and schedule or task and subtasks

Initiate work

Transmission Line Engineering Output

Hardware assembly drawings

Specification and Bid Form

Engineer's Estimate

Bid Evaluation

Review Drawings for Fabrication

Inspection Reports

Support Services Output

Contract Documents and addendums

Cost Estimate

Letter of recommendation for award

Task Number: E2.T6
Task: Contract Document
Anchors and Guy Fittings

SUBTASKS

Management Subtasks

Issue and control manpower budgets and schedule for task and subtasks

Initiate work

Transmission Line Engineering Subtasks

Prepare conceptual design for anchors and guy fittings

Prepare technical specifications and bid forms

Prepare anchor and guy assembly drawings

Prepare estimates

Assist in bidding

Prepare bid evaluation

Assist in contract award

Review shop drawings

Provide shop inspection

Coordinate, assist and review all interface work between other disciplines

Support Services Subtasks

Contract Preparation Phase Services

Revise standard conditions to fit specific contract

Prepare contract documents and addenda from design department's drafts: review copies, final reproduction

Review and process engineer's estimate

Assist with bidding and award: Document Issue and Follow-up, Receipt and Recording of Bids, Edit Technical Evaluation of Bids by Design Departments, Commercial Evaluation of Bids, Prepare Letter of Recommendation for Award, Contract/Purchase Order Negotiation.

Task Number: E2.T6
Task: Contract Document
Anchors and Guying Fittings

OUTPUT

Management Subtasks

Issue and control manpower budgets and schedule or task and subtasks

Initiate work

Transmission Line Engineering Output

Anchor and guy assembly drawings

Specification and Bid Form

Engineer's Estimate

Bid Evaluation

Review Drawings for Fabrication

Inspection Reports

Support Services Output

Contract Documents and addenda

Cost Estimate

Letter of recommendation for award

Task Number: E2.T6
Task: Contract Document
Anchors and Guying Fittings

OUTPUT

Management Subtasks

Issue and control manpower budgets and schedule or task and subtasks

Initiate work

Transmission Line Engineering Output

Anchor and guy assembly drawings

Specification and Bid Form

Engineer's Estimate

Bid Evaluation

Review Drawings for Fabrication

Inspection Reports

Support Services Output

Contract Documents and addenda

Cost Estimate

Letter of recommendation for award

Task Number: E2.T7
Task: Contract Document
Watana-Gold Creek Intertie Substation Line Construction

SUBTASKS

Management Subtasks

Issue and control manpower budgets and schedule or task and subtasks

Initiate work

Transmission Line Engineering Subtasks

Prepare contract documents

Prepare structure spotting

Prepare conductor and shield wire stringing tables

Prepare guidelines for foundation application

Prepare guidelines for guy and anchor application

Prepare guidelines for structure grounding

Prepare contract/construction drawings

Prepare Bill of Materials

Prepare structure and components list

Prepare specifications

Prepare list of materials supplied by contractor: grounding and miscellaneous

Prepare Engineer's estimate

Assist with bidding process: Bidder prequalifications, jobsite pre-bid meetings, bid evaluation and recommendation

Coordinate, assist and review all interface work between other disciplines

Environmental

Implement mitigation measures

Civil/Structural Engineering Subtasks

Participate in preparation of technical specifications

Soil boring analysis/studies

Prepare contract/construction drawings

Structure foundation design

Provide assistance as required to Transmission Section

Support Services Subtasks

Revise standard conditions of bidding and construction contracts to carry through remainder of construction contracts

Develop detailed bases for cost estimating and prepare engineer's estimate

Prepare construction schedule for this Contract

Edit, word process and revise, as necessary, specification and technical sections and bid forms; reproduce and bind

Provide constructability review of technical specifications written by the design department

Prepare addendums as necessary

Assist with bidding and award: bidder prequalification, issue of documents, bid receipt and recording, bid evaluation and letter of recommendation

Note: Management and Support Services Subtasks budgets are included with Task Number E4.1 Management and Task Number E4.2 Support Services

Task Number: E2.T7
Task: Contract Document
Watana-Gold Creek Line Construction

OUTPUT

Management Subtasks

Contract Document

Contract award

Transmission Line Engineering Output

Technical specifications

Construction/contract drawings

Foundation application guidelines

Guy and Anchor application guidelines

Structure grounding guidelines

Plan and profile drawings with structure spotting

Structure and components list

Stringing charts for conductor and shield wire

Engineer's estimates

Civil/Structural Engineering Output

Technical specifications for structure erection

Contract/construction drawings for structure erection

Support Services Output

Contract Documents and addenda

Cost Estimate

Letter of recommendation for award

Task Number: E2.T8
Task: Contract Document
Healy-Willow Substation Line Construction

SUBTASKS

Management Subtasks

Issue and control manpower budgets and schedule or task and subtasks

Initiate work

Transmission Line Engineering Subtasks

Prepare contract documents

Prepare structure spotting

Prepare conductor and shield wire stringing tables

Prepare guidelines for foundation application

Prepare guidelines for guy and anchor application

Prepare guidelines for structure grounding

Prepare contract/construction drawings

Prepare Bill of Materials

Prepare structure and components list

Prepare specifications

Prepare list of materials supplied by contractor: grounding and miscellaneous

Prepare Engineer's estimate

Assist with bidding process: Bidder prequalifications, jobsite pre-bid meetings, bid evaluation and recommendation

Coordinate, assist and review all interface work between other disciplines

Environmental

Implement mitigation measures

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Civil/Structural Engineering Subtasks

Participate in preparation of technical specifications

Soil boring analysis/studies

Prepare contract/construction drawings

Structure foundation design

Provide assistance as required to Transmission Section

Support Services Subtasks

Revise standard conditions of bidding and construction contracts to fit this contract.

Develop detailed bases for cost estimating and prepare engineer's estimate

Prepare construction schedule for this Contract

Edit, word process and revise, as necessary, specification and technical sections and bid forms; reproduce and bind

Provide constructability review of technical specifications written by the design department

Assist with bidding and award: bidder prequalification, issue of documents, bid receipt and recording, bid evaluation and letter of recommendation

Prepare addenda as necessary

Note: Management and Support Services Subtasks budgets are included with Task Number E4.1 Management and Task Number E4.2 Support Services

Task Number: E2.T8
Task: Contract Document
Healy-Willow Substation Line Construction

OUTPUT

Management Subtasks

Contract Document

Contract award

Transmission Line Engineering Output

Technical specifications

Construction/contract drawings

Foundation application guidelines

Prepare guy and anchor application guidelines

Prepare structure grounding guidelines

Plan and profile drawings with structure spotting

Structure and components list

Stringing charts for conductor and shield wire

Engineer's estimates

Civil/Structural Engineering Output

Technical specifications for structure erection

Contract/construction drawings for structure erection

Support Services Output

Contract Documents and addenda

Cost Estimate

Letter of recommendation for award

Task Number: E2.T9
Task: Ester Substation - Healy Line Construction

SUBTASKS

Management Subtasks

Issue and control manpower budgets and schedule or task and subtasks

Initiate work

Transmission Line Engineering Subtasks

Prepare contract documents

Prepare structure spotting

Prepare conductor and shield wire stringing tables

Prepare guidelines for foundation application

Prepare guidelines for guy and anchor applications

Prepare contract/construction drawings

Prepare Bill of Materials

Prepare structure and components list

Prepare list of materials supplied by contractor: grounding and miscellaneous

Prepare Engineer's estimate

Assist with bidding process: Bidder prequalifications, jobsite pre-bid meetings, bid evaluation and recommendation

Coordinate, assist and review all interface work between other disciplines

Environmental

Implement mitigation measures

Civil/Structural Engineering Subtasks

Participate in preparation of technical specifications

Soil boring analysis/studies

Prepare contract/construction drawings

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Structure foundation design

Provide assistance as required to Transmission Section

Support Services Subtasks

Develop standard conditions of bidding and construction contracts to fit this contract

Develop detailed bases for cost estimating and prepare engineer's estimate

Prepare construction schedule for this Contract

Edit, word process and revise, as necessary, specification and technical sections and bid forms; reproduce and bind

Provide constructability review of technical specifications written by the design department

Assist with bidding and award: bidder prequalification, issue of documents, bid receipt and recording, bid evaluation and letter of recommendation

Prepare addenda as necessary

Note: Management and Support Services Subtasks budgets are included with Task Number E4.1 Management and Task Number E4.2 Support Services

Task Number: E2.T9
Task: Contract Documents
Ester Substation - Healy Line Construction

OUTPUT

Management Subtasks

Contract Document

Transmission Line Engineering Output

Technical specifications

Construction/contract drawings

Foundation application guidelines

Guy and anchor application guidelines

Structures grounding guidelines

Plan and profile drawings with structure spotting

Structure and components list

Stringing charts for conductor and shield wire

Engineer's estimates

Civil/Structural Engineering Output

Technical specifications for structure erection

Contract/construction drawings for structure erection

Contract award

Support Services Output

Contract Documents and addenda

Cost Estimate

Letter of recommendation for award

Task Number: E2T.10
Task: Contract Document
Willow-University Substation Line Construction

SUBTASKS

Management Subtasks

Issue and control manpower budgets and schedule or task and subtasks

Initiate work

Transmission Line Engineering Subtasks

Prepare contract documents

Prepare structure spotting

Prepare conductor and shield wire stringing tables

Prepare guidelines for foundation application

Prepare guidelines for guy and anchor application

Prepare guidelines of structure grounding

Prepare contract/construction drawings

Prepare Bill of Materials

Prepare structure and components list

Prepare specifications

Prepare list of materials supplied by contractor: grounding and miscellaneous

Prepare Engineer's estimate

Assist with bidding process: Bidder prequalifications, jobsite pre-bid meetings, bid evaluation and recommendation

Coordinate, assist and review all interface work between other disciplines

Environmental

Implement mitigation measures

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Civil/Structural Engineering Subtasks

Participate in preparation of technical specifications

Soil boring analysis/studies

Prepare contract/construction drawings

Structure foundation design

Provide assistance as required to Transmission Section

Support Services Subtasks

Revise standard conditions of bidding and construction contracts to fit this contract.

Develop detailed bases for cost estimating and prepare engineer's estimate

Prepare construction schedule for this Contract

Edit, word process and revise, as necessary, specification and technical sections and bid forms; reproduce and bind

Provide constructability review of technical specifications and addenda written by the design department

Prepare addenda as necessary

Assist with bidding and award: bidder prequalification, issue of documents, bid receipt and recording, bid evaluation and letter of recommendation

Prepare addenda as necessary

Note: Management and Support Services Subtasks budgets are included with Task Number E4.1 Management and Task Number E4.2 Support Services

Task Number: E2.T10
Task: Contract Document
Willow-University Substation Line Construction

OUTPUT

Management Subtasks

- Contract Document
- Contract award

Transmission Line Engineering Output

- Technical specifications
- Construction/contract drawings
- Foundation application guidelines
- Guy anchor application guidelines
- Structure grounding guidelines
- Plan and profile drawings with structure spotting
- Structure and components list
- Stringing charts for conductor and shield wire
- Engineer's estimates

Civil/Structural Engineering Output

- Technical specifications for structure erection
- Contract/construction drawings for structure erection

Support Services Output

- Contract Documents and addendums
- Cost Estimate
- Letter of recommendation for award

Task Number: E2.T11
Task: Contract Document
Furnish and Install 345kV Submarine Cable

Subtasks

Management Subtasks

Issue and control manpower budgets and schedule or task and substasks

Initiate work

Environmental Subtask

Input of environmental considerations and guidance to other disciplines in accomplishing work on their subtasks

Transmission Line Engineering Subtasks

Prepare specifications and bid form

Prepare contract drawings

Prepare Engineer's estimate

Assist in bidding

Prepare bid evaluation

Assist in contract award

Review construction and shop drawings

Provide shop inspection

Coordinate, assist and review all interface work between disciplines.

Environmental

Implement mitigation measures

Electrical Engineering Subtasks

Prepare cable terminal layouts

Prepare electrical equipment and cable protection design criteria

Provide shop inspection

Civil Engineering Subtasks

Assist in preparing design criteria on civil/structural part

Support Services Subtasks

Contract Preparation Phase Services

Revise standard conditions to fit specific contract

Prepare contract documents from design department's drafts: review copies, final reproduction

Review and process engineer's estimate

Assist with bidding and award: Prequalification document issue and follow-up, receipt and recording of bids, edit technical evaluation of bids by design departments, commercial evaluation of bids

Task Number: E2.T11
Task: Contract Document
Furnish and Install 345kV Submarine Cables

OUTPUT

Management Output

Contract Documents

Contract Award

Transmission Line Engineering Output

Design memorandum

Construction/Contract Drawings

Specification and bid form

Engineer's estimate

Bid evaluation

Review shop drawings

Inspection reports

Electrical/Engineering Output

Layout of terminals

Electrical equipment and cable protection design criteria

Inspection reports

Review shop drawings

Civil Engineering Output

Review comments

Support Services Output

Contract Preparation Phase Services

Contract documents

Cost estimate

Letter of recommendation for award

Task Number: E2T-12
Task: Land Surveying

SUBTASKS

Management Subtasks

Issue and control manpower and budget for tasks and subtasks

Initiate Work

Civil Engineering Subtasks

Coordinate survey permits with Power Authority and landowners

Prepare technical specifications for surveys

Supervise transmission line route survey done by a subcontractor

Supervise aerial photography done by a subcontractor

Prepare permits to cross U.S. Government lands

Prepare permits to cross State and Native lands

Prepare miscellaneous permits such as highway and railroad crossings

Coordinate Right-of-Way acquisition by the Power Authority

Prepare legal description of transmission ROW and substation sites

Supervise tower locations

Establish substation baselines and grades

Support Construction Manager in surveying matters

Transmission Line Subtask

Assist Civil Engineer as required

Task Number: E2T-12
Task: Land Surveying

OUTPUT

Civil Engineering Output

Technical Specifications for RFP's

Government Land Permits

State or Native Land Permits

Legal Description of Land

Miscellaneous Permits

SCHEDULE OF DELIVERABLES
TRANSMISSION LINE

		STARTING DATE	COMPLETION DATE
Transmission Line			
E2T1	System Study Review	3/83	5/83
	Structure/Foundation Selection	6/83	8/83
	Conductor Study	4/83	5/83
	Shielding and Grounding Study	5/83	6/83
	Insulation Study	5/83	6/83
	Foundation Selection	6/83	8/83
	Master Design Schedule	3/83	4/83
	Preliminary Cost Estimate	9/83	1/84
	Conceptual Design Manual	1/84	6/84
E2T2	Structures Procurement Bid Package	3/84 (6/86)	1/85 (3/87)
	Structure Technical Specifications	3/84 (6/86)	9/84 (1/87)
	Structure Contract Documents	9/84 (1/87)	1/85 (3/87)
	Structure Cost Estimate	9/84 (1/87)	1/85 (3/87)
	Structures Bid Evaluation Award	1/85 (1/89)	6/85 (6/89)
	Manufacturer Drawings Review	6/85 (6/89)	9/85 (9/89)
	Structure Test Evaluation	10/85 (10/89)	1/86 (1/90)
E2T3	Conductor Procurement Bid Package	9/84 (6/86)	3/85 (3/87)
	Conductor & Accessories Technical Specifications	9/84 (6/86)	1/85 (1/87)
	Conductor & Accessories Contract Documents	1/85 (1/87)	3/85 (3/87)
	Conductor & Accessories Cost Estimate	1/85 (1/87)	3/85 (3/87)
	Bid Evaluation/Award	3/85 (10/89)	9/85 (4/90)
	Inspection Report Evaluation	9/85 (4/90)	11/85 (6/90)
E2T4	Shield Wire & Guy Cable Procurement Bid Package	9/84 (8/86)	3/85 (3/87)
	Shield Wire & Guy Cable Accessories Technical Specifications	9/84 (8/86)	1/85 (1/87)
	Shield Wire & Guy Cable Contract Documents	1/85 (1/87)	3/85 (3/87)
	Shield Wire & Guy Cable Cost Estimate	1/85 (1/87)	3/85 (3/87)
	Bid Evaluation/Award	3/85 (10/89)	9/85 (4/90)
	Inspection Report Evaluation	9/85 (4/90)	11/85 (6/90)
E2T5	Insulator & Hardware Procurement Bid Package	6/84 (8/86)	1/85 (3/87)
	Insulator & Hardware Technical Specifications	6/84 (8/86)	9/84 (1/87)

( ) - Dates for Healy to Willow; Ester to Healy and Willow to University lines.

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TASK	DELIVERABLES	STARTING DATE	COMPLETION DATE
E2T5 (cont'd)	Insulator & Hardware Contract Documents	9/84 (1/87)	1/85 (3/87)
	Insulator & Hardware Cost Estimate	9/84 (1/87)	1/85 (3/87)
	Bid Evaluation/Award	1/85 (10/89)	6/85 (4/90)
	Manufacturer Drawings Review	6/85 (4/90)	9/85 (8/90)
	Inspection Report Evaluation	7/85 (5/90)	9/85 (8/90)
E2T6	Anchor & Guy Fittings Procurement Bid Package	6/84 (8/86)	1/85 (3/87)
	Anchor & Guy Fittings Technical Specifications	6/84 (8/86)	9/84 (1/87)
	Anchor & Guy Fittings Contract Documents	9/84 (1/87)	1/85 (3/87)
	Anchor & Guy Fittings Cost Estimate	9/84 (1/87)	1/85 (3/87)
	Bid Evaluation/Award	1/85 (10/89)	6/85 (4/90)
	Manufacturer Drawings Review	6/85 (4/90)	9/85 (8/90)
	Inspection Report Evaluation	7/85 (5/90)	9/85 (8/90)
E2T7	Line Construction Contract Bid Package - Watana to Gold Creek Substation	3/84	1/85
	Plan - Profite Drawings	3/84	6/84
	Structure & Components List	6/84	9/84
	Foundation Drawings	3/84	9/84
	Permit Drawings	9/84	1/85
	Right-of-way Clearing Units	6/84	9/84
	Technical Specifications	6/84	9/84
	Contract Documents Package	9/84	1/85
	Construction Cost Estimate	9/84	1/85
	Bid Evaluation/Award	1/85	5/85
	"As Built" Drawings	3/87	6/87
E2T8-10	Line Construction Contract Bid Package - Healy to Willow Substation	1/86	3/87
	Ester Substation to Healy	1/86	3/87
	Willow to University Substation	1/86	3/87
	Plan - Profite Drawings	1/86	4/86
	Structure & Components Lists	6/86	10/86
	Foundation Drawings	3/86	9/86
	Permit Drawings	9/86	1/87
	Right-of-way Clearing Units	6/86	10/86
	Technical Specifications	6/86	10/86
	Contract Documents	10/86	1/87
	Construction Cost Estimates	10/86	1/87
	Bid Evaluation/Awards	6/89	1/90
	"As Built" Drawings	6/92	9/92

( ) - Dates for Healy to Willow; Ester to Healy and Willow to University lines.

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TASK	DELIVERABLES	STARTING DATE	COMPLETION DATE
E2T11	Vicinity Map - Knik Arm Crossing	6/86	6/87
	Underwater Contour/Route Drawings	6/86	6/87
	Submarine Cable Design Memorandum	6/86	6/87
	Submarine Cable Technical Specifications	6/86	6/87
	Cable Termination Drawings	6/86	6/87
	Cable Termination Technical Specifications	6/86	6/87
	Cable Protection Equipment Drawings	6/86	6/87
	Cable Protection Technical Specifications	6/86	6/87
	List of Materials	6/86	6/87
	Contract Documents & Addenda	3/87	9/87
	Bid Evaluation/Award	9/89	6/90
	Fabrication Drawings Review	6/90	9/90
	Inspection Report Evaluation	8/90	1/91
	"As Built" Drawings	9/91	9/92
	Construction Support Correspondence	6/91	6/92

SUBSTATION TASK LIST WITH SCHEDULE OF DELIVERABLES

Task Number: E2S1
Task: Switching Study

SUBTASKS

Management Subtasks

Issue and control manpower budgets and schedule for task and subtasks

Initiate work

Electrical Engineering Subtasks

To carry out complete study for the switching and bus configuration for substation

Electrical Engineering Output

Summary report for all substations

Task Number: E2S2
Task: SF6 VS Open Air Equipment

SUBTASKS

Management Subtasks

Issue and control manpower budgets and schedule for task and subtasks

Initiate Work

Electrical Engineering Subtasks

Investigate advantages and disadvantages of SF6 versus open air equipment for system for the substation, including cost comparisons

Electrical Engineering Output

Summary report for all substations

NOTE

This study will be performed at the request of the Power Authority on the basis of extra work if it is found to be necessary.

Task Number: E2S3
Task: Insulation Coordination Study

SUBTASKS

Management Subtasks

Issue and control manpower budgets and schedule for task and subtasks

Initiate work

Electrical Engineering Subtasks

Conduct insulation coordination study based on system study data and select appropriate BIL insulation classes and voltage levels

Electrical Engineering Output

Summary report for all substations

Task Number: E2S4

Task: Protection Study

SUBTASKS

Management Subtasks

Issue and control manpower budgets and schedule for task and subtasks

Initiate work

Electrical Engineering Subtasks

To carry out complete protective relaying study for transmission lines and substations.

Electrical Engineering Output

Summary report for all transmission lines and substations.

Task Number: E2S5
Task: Control and Annunciation Study

SUBTASKS

Management Subtasks

Issue and control manpower budgets and schedule for task and subtasks

Initiate work

Electrical Engineering Subtasks

To carry out substations control system study including instrumentation and annunciation provisions.

Electrical Engineering Output

Summary report for all substations.

Task Number: E2S6
Task: Communication System

SUBTASKS

Management Subtasks

Issue and control manpower budgets and schedule for task and subtask
Initiate work

Electrical Engineering Subtasks

Prepare design memorandum
Prepare technical specification and bid form
Prepare cost estimate
Assist during bidding
Prepare bid evaluation
Assist in Contract award
Review shop drawings
Provide shop inspection

Support Services Subtasks

Contract Preparation Phase Services

Revise standard conditions to fit specific contract
Prepare contract documents from design department's drafts:
review copies, final reproduction
Review and process engineer's estimate
Assist in bidding and award: Prequalification, Document Issue and Follow-up, Receipt and Recording of Bids, Edit Technical Evaluation of Bids by Design Departments, Commercial Evaluation of Bids, Prepare Letter of Recommendation for Award, Contract Order Negotiation.

Task Number: E2S6

Task: Communication System

OUTPUT

Management Subtasks

Issue and control manpower budgets and schedule for task and subtask

Initiate work

Electrical Engineering Output

Design memorandum communication

Specification and Bid Form

Cost Estimate

Bid Evaluation

Reviewed Shop Drawing

Inspection Reports

O/M Manuals

Support Services Output

Contract Preparation Phase Services

Contract Documents and Addenda

Engineer's Estimate

Assistance in Bid Evaluation

Letter of Recommendation

Task Number: E2S7

Task: Contract Document E-2 - Power Transformers and Surge Arresters

SUBTASKS

Management Subtasks

Issue and control manpower budgets and schedule for task and subtasks

Initiate work

Electrical Engineering Subtasks

Prepare design memorandum

Prepare technical specification and bid form

Prepare cost estimate

Assist during bidding

Prepare bid evaluation

Assist in Contract award

Review shop drawings

Provide shop inspection

Support Services Subtasks

Contract Preparation Phase Services

Revise standard conditions to fit specific contract

Prepare contract documents from design department's drafts: review copies, final reproduction

Review and process engineer's estimate

Assist with bidding and award: Prequalification, Document Issue and Follow-up, Receipt and Recording of Bids, Edit Technical Evaluation of Bids by Design Departments, Commercial Evaluation of Bids, Prepare Letter of Recommendation for Award, Contract Negotiation.

Task Number: E2S7

Task: Contract Document E-2 - Transformers and Surge Arresters

OUTPUT

Management Output

- Contract Document E-2
- Contract Award

Electrical Engineering Output

- Design memorandum transformers and surge arresters
- Specification and Bid Form
- Cost Estimate
- Bid Evaluation
- Reviewed Shop Drawings
- Inspection Reports
- O/M Manuals

Support Services Output

Contract Preparation Phase Services

- Contract Documents and Addenda
- Engineer's Estimate
- Assistance in Bid Evaluation
- Letter of Recommendation

Task Number: E2S8
Task: Contract Document E-3 - Shunt Reactors

SUBTASKS

Management Subtasks

Issue and control manpower budgets and schedule for task and subtasks

Initiate work

Electrical Engineering Subtasks

Prepare design memorandum

Prepare technical specification and bid form

Prepare cost estimate

Assist during bidding

Prepare bid evaluation

Assist in Contract Award

Review shop drawings

Provide shop inspection

Support Services Subtasks

Contract Preparation Phase Services

Revise standard conditions to fit specific contract

Prepare contract documents from design department's drafts: review copies, final reproduction

Review and process engineer's estimate

Assist with bidding and award: Prequalification, Document Issue and Follow-up, Receipt and Recording of Bids, Edit Technical Evaluation of Bids by Design Departments, Commercial Evaluation of Bids, Prepare Letter of Recommendation for Award, Contract Negotiation.

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Task Number: E2S8

Task: Contract Document E-3 - Shunt Reactors

OUTPUT

Management Output

- Contract Document E-3
- Contract Award

Electrical Engineering Output

- Design memorandum Shunt Reactors
- Specification and bid form
- Cost estimate
- Bid evaluation
- Reviewed shop drawing
- Inspection reports
- O/M Manual

Support Services Output

Contract Preparation Phase Services

- Contract Documents and Addenda
- Engineer's Estimate
- Assistance in Bid Evaluation
- Letter of Recommendation

Task Number: E2S9
Task: Contract Document E-4 - Static Var System

SUBTASKS

Management Subtasks

Issue and control manpower budgets and schedule for task and subtasks

Inititate work

Electrical Engineering Subtasks

Prepare design memorandum

Prepare technical specification and bid form

Prepare cost estimate

Assist during bidding

Prepare bid evaluation

Assist in Contract award

Review shop drawings

Provide shop inspection

Support Services Subtasks

Contract Preparation Phase Services

Revise standard conditions to fit specific contract

Prepare contract documents from design department's drafts: review copies, final reproduction

Review and process engineer's estimate

Assist with bidding and award: Prequalification, Document Issue and Follow-up, Receipt and Recording of Bids, Edit Technical Evaluation of Bids by Design Departments, Commercial Evaluation of Bids, Prepare Letter of Recommendation for Award, Contract Negotiation.

Task Number: E2S9
Task: Contract Document E-4 - Static Var System

OUTPUT

Management Output

- Contract Document E-4
- Contract Award

Electrical Engineering Output

- Design memorandum Static Var System
- Specification and bid form
- Cost estimate
- Bid evaluation
- Reviewed shop drawing
- Inspection reports
- O/M Manuals

Support Services Output

Contract Preparation Phase Services

- Contract Documents and Addenda
- Engineer's Estimate
- Assistance in Bid Evaluation
- Letter of Recommendation

Task Number: E2S10

Task: Contract Document E-5 - Power Circuit Breakers and Current Transformers

SUBTASKS

Management Subtasks

Issue and control manpower budgets and schedule for task and subtasks

Initiate work

Electrical Engineering Subtasks

Prepare design memorandum

Prepare technical specification and bid form

Prepare cost estimate

Assist during bidding

Prepare bid evaluation

Assist in contract award

Review shop drawings

Provide shop inspection

Support Services Subtasks

Contract Preparation Phase Services

Revise standard conditions to fit specific contract

Prepare contract documents from design department's drafts: review copies, final reproduction

Review and process engineer's estimate

Assist with bidding and award: Prequalification, Document Issue and Follow-up, Receipt and Recording of Bids, Edit Technical Evaluation of Bids by Design Departments, Commercial Evaluation of Bids, Prepare Letter of Recommendation for Award, Contract Negotiation.

Task Number: E2S10

Task: Contract Document E-5 - Power Circuit Breakers and Current Transformers

OUTPUT

Management Output

- Contract Document E-5
- Contract Award

Electrical Engineering Output

- Design memorandum Power Circuit Breakers and Current Transformers
- Specification and bid form
- Cost estimate
- Bid evaluation
- Reviewed shop drawings
- Inspection reports
- O/M Manuals

Support Services Output

Contract Preparation Phase Services

- Contract Documents and Addenda
- Engineer's Estimate
- Assistance in Bid Evaluation
- Letter of Recommendation

Task Number: E2S11
Task: Contract Document E-6 - Disconnecting Switches

SUBTASKS

Management Subtasks

Issue and control manpower budgets and schedule for task and subtasks

Initiate work

Electrical Engineering Subtasks

Prepare design memorandum

Prepare technical specification and bid form

Prepare cost estimate

Assist during bidding

Prepare bid evaluation

Assist in Contract award

Review shop drawings

Provide shop inspection

Support Services Subtasks

Contract Preparation Phase Services

Revise standard conditions to fit specific contract

Prepare contract documents from design department's drafts: review copies, final reproduction

Review and process engineer's estimate

Assist with bidding and award: Prequalification, Document Issue and Follow-up, Receipt and Recording of Bids, Edit Technical Evaluation of Bids by Design Departments, Commercial Evaluation of Bids, Prepare Letter of Recommendation for Award, Contract Negotiation.

Task Number: E2S11
Task: Contract Document E-6 - Disconnecting Switches

SUBTASKS

Management Subtasks

Issue and control manpower budgets and schedule for task and subtasks

Initiate work

Electrical Engineering Subtasks

Prepare design memorandum

Prepare technical specification and bid form

Prepare cost estimate

Assist during bidding

Prepare bid evaluation

Assist in Contract award

Review shop drawings

Provide shop inspection

Support Services Subtasks

Contract Preparation Phase Services

Revise standard conditions to fit specific contract

Prepare contract documents from design department's drafts: review copies, final reproduction

Review and process engineer's estimate

Assist with bidding and award: Prequalification, Document Issue and Follow-up, Receipt and Recording of Bids, Edit Technical Evaluation of Bids by Design Departments, Commercial Evaluation of Bids, Prepare Letter of Recommendation for Award, Contract Negotiation.

Task Number: E2S11
Task: Contract Document E-6 - Disconnecting Switches

OUTPUT

Management Output

Contract Document E-6

Contract Award

Electrical Engineering Output

Design memorandum disconnecting switches

Specification and bid form

Cost estimate

Bid evaluation

Reviewed shop drawing

Inspection reports

O/M Manuals

Support Services Output

Contract Preparation Phase Services

Contract Documents and Addenda

Engineer's Estimate

Assistance in Bid Evaluation

Letter of Recommendation

Task Number: E2S12

Task: Contract Document E-7 - Coupling Capacitor Voltage Transformers

SUBTASKS

Management Subtasks

Issue and control manpower budgets and schedule for task and subtasks

Initiate work

Electrical Engineering Subtasks

Prepare design memorandum

Prepare technical specification and bid form

Prepare cost estimate

Assist during bidding

Prepare bid evaluation

Assist in Contract award

Review shop drawings

Provide shop inspection

Support Services Subtasks

Contract Preparation Phase Services

Revise standard conditions to fit specific contract

Prepare contract documents from design department's drafts: review copies, final reproduction

Review and process engineer's estimate

Assist with bidding and award: Prequalification, Document Issue and Follow-up, Receipt and Recording of Bids, Edit Technical Evaluation of Bids by Design Departments, Commercial Evaluation of Bids, Prepare Letter of Recommendation for Award, Contract Negotiation.

Task Number: E2S12

Task: Contract Document E-7 - Coupling Capacitor Voltage Transformers

OUTPUT

Management Output

- Contract Document E-7
- Contract Award

Electrical Engineering Output

- Design memorandum Coupling Capacitor Voltage Transformers
- Specification and bid form
- Cost estimate
- Bid evaluation
- Reviewed Shop drawing
- Inspection reports
- O/M Manuals

Support Services Output

Contract Preparation Phase Services

- Contract Documents and Addenda
- Engineer's Estimate
- Assistance in Bid Evaluation
- Letter of Recommendation

Task Number: E2S13

Task: Contract Document E-8 - Substation Structures, Buses and Insulators

SUBTASKS

Management Subtasks

Issue and control manpower budgets and schedule for task and subtasks

Initiate work

Electrical Engineering Subtasks

Prepare design memorandum

Prepare technical specification and bid form

Prepare cost estimate

Assist during bidding

Prepare bid evaluation

Assist in Contract award

Review shop drawings

Provide shop inspection

Support Services Subtasks

Contract Preparation Phase Services

Revise standard conditions to fit specific contract

Prepare contract documents from design department's drafts: review copies, final reproduction

Review and process engineer's estimate

Assist with bidding and award: Prequalification, Document Issue and Follow-up, Receipt and Recording of Bids, Edit Technical Evaluation of Bids by Design Departments, Commercial Evaluation of Bids, Prepare Letter of Recommendation for Award, Contract Negotiation.

Task Number: E2S13

Task: Contract Document E-8 - Substation Structures and Insulation Buses

OUTPUT

Management Output

- Contract Document E-8
- Contract Award

Electrical Engineering Output

- Design memorandum Substation Structures and Buses
- Specification and bid form
- Cost estimate
- Bid evaluation
- Reviewed shop drawing
- Inspection reports

Support Services Output

Contract Preparation Phase Services

- Contract Documents and Addenda
- Engineer's Estimate
- Assistance in Bid Evaluation
- Letter of Recommendation

Task Number: E2S14

Task: Contract Document E-9 - Control Switchboard Equipment

SUBTASKS

Management Subtasks

Issue and control manpower budgets and schedule for tasks and subtasks

Initiate work

Electrical Engineering Subtasks

Prepare design memorandum

Prepare technical specification and bid form

Prepare cost estimate

Assist during bidding

Prepare bid evaluation

Assist in Contract award

Review shop drawings

Provide shop inspection

Support Services Subtasks

Contract Preparation Phase Services

Revise standard conditions to fit specific contract

Prepare contract documents from design department's drafts: review copies, final reproduction

Review and process engineer's estimate

Assist with bidding and award: Prequalification, Document Issue and Follow-up, Receipt and Recording of Bids, Edit Technical Evaluation of Bids by Design Departments, Commercial Evaluation of Bids, Prepare Letter of Recommendation for Award, Contract Negotiation.

Task Number: E2S14

Task: Contract Document E-9 Control Switchboard Equipment

OUTPUT

Management Output

- Contract Document E-9
- Contract Award

Electrical Engineering Output

- Design memorandum Substation Controls
- Specification and bid form
- Cost estimate
- Bid evaluation
- Reviewed shop drawings
- Inspection reports
- O/M Manuals

Support Services Output

Contract Preparation Phase Services

- Contract Documents and Addenda
- Engineer's Estimate
- Assistance in Bid Evaluation
- Letter of Recommendation

Task Number: E2S15

Task: Contract Document E-10 - Station Service Equipment

SUBTASKS

Management Subtasks

Issue and control manpower budgets and schedule for tasks and subtasks

Initiate work

Electrical Engineering Subtasks

Prepare design memorandum

Prepare technical specification and bid form

Prepare cost estimate

Assist during bidding

Prepare bid evaluation

Assist in Contract award

Review shop drawings

Provide shop inspection

Support Services Subtasks

Contract Preparation Phase Services

Revise standard conditions to fit specific contract

Prepare contract documents from design department's drafts: review copies, final reproduction

Review and process engineer's estimate

Assist with bidding and award: Prequalification, Document Issue and Follow-up, Receipt and Recording of Bids, Edit Technical Evaluation of Bids by Design Departments, Commercial Evaluation of Bids, Prepare Letter of Recommendation for Award, Contract Negotiation.

Task Number: E2S15
Task: Contract Document E-10 - Station Service Equipment

OUTPUT

Management Output

- Contract Document E-10
- Contract Award

Electrical Engineering Output

- Design memorandum Station Service
- Specification and bid form
- Cost estimate
- Bid evaluation
- Reviewed shop drawings
- Inspection reports
- O/M Manuals

Support Services Output

Contract Preparation Phase Services

- Contract Documents and Addenda
- Engineer's Estimate
- Assistance in Bid Evaluation
- Letter of Recommendation

Task Number: E2S16

Task: Contract Document C-1 - Knik Arm Substation Construction Contract

(1) Constructing Civil Works in Substation
(2) Control Building and Storage Building
(3) Supply and installation of Lighting, Heating, Plumbing, Ventilating and General Electrical Systems
(4) Installation and testing of all Owner-supplied equipment
(5) Painting and Other Surface Treatments
(6) Landscaping, Fencing, Project Cleanup

SUBTASKS

Management Subtasks

Issue and control manpower budgets and schedule for tasks and subtasks

Initiate work

Civil Engineering Subtasks

Prepare design memo

Prepare technical specifications

Perform structural analysis and design of all substation features

Prepare contract/construction drawings

Coordinate and review drawings from other disciplines

Prepare quantity take-offs for the engineer's estimate

Review manufacturers' drawings and computations

Input to O&M manuals

Provide office assistance to field

Review shop drawings of structures and buildings

Environmental

Implement mitigation measures

Electrical Engineering Subtasks

Prepare general electrical design

Prepare design memorandum

Review design memoranda of other disciplines

Prepare technical specifications and Bid forms
Prepare electrical drawings
Review specifications of other disciplines
Review drawings of other disciplines
Prepare cost estimate
Assist in bidding and bid evaluation
Review shop drawings
Provide office assistance to field
Provide scheduling assistance

Mechanical Engineering Subtasks

Evaluate and establish control building and storage building requirements as related to mechanical equipment (includes equipment sizing)
Coordinate with other disciplines control building layout and arrangement as related to mechanical equipment
Prepare design memo outlining control building's mechanical systems and the basis of their design
Perform design studies to establish type and size of mechanical systems
Prepare mechanical equipment specifications and contract/construction drawings
Assist in bid evaluation
Review shop drawings
Prepare cost estimate

Architectural Subtasks

Prepare control and storage building design and design memo
Coordinate control and storage building features, all disciplines
Prepare technical specifications
Prepare architectural drawings
Prepare cost estimate
Review shop drawings

Support Services Subtasks

Revise standard conditions of bidding and construction contracts to fit this contract

Make civil quantity take-off, develop detailed bases for cost estimating, prepare engineer's estimate

Prepare detailed construction schedule for this contract

Edit word process and revise, as necessary, specifications and bid forms; reproduce and bind.

Provide construability review of technical specifications

Prepare addendum as necessary

Assist with bidding and award; bidders qualifications, issue of documents, bid receipt and recording, bid evaluation and letter of recommendation

Task Number: E2S16

Task: Contract Document C-1 - Knik Arm Substation Construction Contract

OUTPUT

Management Output

- Contract Document C-1
- Contract Award

Civil Engineering Output

- Design memo
- Technical Specifications
  - Metalwork
  - Sitework
  - Structural Steel
- Quantity take-off of civil items
- Review of manufacturers' drawings and computations
- Civil/structural contract/construction drawings
  - General Project Layout
  - Standard Details, Sheets 1-5
  - Control Building, Sheets 1-2
  - Storage Building, Sheets 1-2
  - Yard and Foundations, Sheets 1-4

Architectural Output

- Architectural Treatment Memo

Architectural Contract/Construction Drawings

- Control Building - Elevations and sections
- Control Building - Floor and ceilings
- Control Building - Sections and details

Task Number: E2S16

Task: Contract Document C-1 - Knik Arm Substation Construction Contract

OUTPUT

Management Output

- Contract Document C-1
- Contract Award

Civil Engineering Output

- Design memo
- Technical Specifications
  - Metalwork
  - Sitework
  - Structural Steel
- Quantity take-off of civil items
- Review of manufacturers' drawings and computations
- Civil/structural contract/construction drawings
  - General Project Layout
  - Standard Details, Sheets 1-5
  - Control Building, Sheets 1-2
  - Storage Building, Sheets 1-2
  - Yard and Foundations, Sheets 1-4

Architectural Output

- Architectural Treatment Memo

Architectural Contract/Construction Drawings

- Control Building - Elevations and sections
- Control Building - Floor and ceilings
- Control Building - Sections and details

Storage Building - Ceiling
Storage Building - Sections and Elevations
Storage Building - Sections and Details

Electrical Engineering Output

Design memorandum including lighting, cable tray, grounding and site distribution

Specification text section

General Electrical Work includes furnishing and installing and testing conduit, grounding, insulated wire and cable, lighting, cable tray, etc., distribution equipment; miscellaneous equipment

Installation of Owner-furnished equipment includes the installation and field testing of the equipment specified in the following separate procurement contracts: Communication System, Transformer and Surge Arresters, Shunt Reactors, Power Circuit Breakers, and current transformers, Disconnecting Switches & Reactor switch, Coupling Capacitor Voltage Transformer, Substation Structures, Buses and Insulators, Control Switchboard Equipment, Station Service Equipment.

Reviewed shop drawings

Cost estimate

Electrical Construction Drawings

I-L Diagrams, 3-L Diagrams (4 Dwgs)

Abbreviations, Symbols and Designations (2 Dwgs)

Physical Drawings (conduit, arrangement details) (11 Dwgs)

Grounding Drawing (2 Dwgs)

Lighting Drawing (3 Dwgs)

Schematic Diagram (10 Dwgs)

Interconnection Diagram (14 Dwgs)

Conduit and Cable Schedules (6 Dwgs)

Communication Drawings (1 Dwg)

Tray System (1 Dwg)

Bill of Materials (1 Dwg)

Mechanical Engineering Output

- Specifications for control building
- Design memo
  - Mechanical Features for the Control and Storage Building
  - Features
- Mechanical/Construction Drawings
  - Abbreviation/Symbols and Piping Schedule
  - Plan sheets 1 and 2
  - Sections
  - Details
  - Plumbing and Drainage Details Sheets 1 and 2

Support Services Output

- Contract Documents
- Engineers Estimate
- Letter of Recommendation Award
- Report of Status of Contractor Equipment Drawing Submittal

Task Number: E2S17

Task: Contract Document C-2 - Willow Substation Construction Contract

(1) Constructing Civil Works in Substation
(2) Control Building and Storage Building
(3) Supply and installation of Lighting, Heating, Plumbing
(4) Ventilating and General Electrical Systems
(5) Installation and testing of all Owner-supplied equipment
(6) Painting and other surface treatments
(7) Landscaping, fending, project cleanup

SUBTASKS

Management Subtasks

Issue and control manpower budgets and schedule or task and subtasks
Initiate work

Civil Engineering Subtasks

Prepare design memo
Prepare technical specifications
Perform structural analysis and design of substation features
Prepare contract/construction drawings
Coordinate and review drawings from other disciplines
Prepare quantity take-offs for the engineer's estimate
Review manufacturers' drawings and computations
Provide office assistance to field
Review shop drawings of structures and buildings

Environmental

Implement mitigation measures

Electrical Engineering Subtasks

- Prepare general electrical design
- Prepare design memorandum
- Review design memoranda of other disciplines
- Prepare technical specifications and bid forms
- Prepare electrical drawings
- Review specifications of other disciplines
- Review drawings of other disciplines
- Prepare cost estimate
- Assist in bidding and bid evaluation
- Review shop drawings
- Provide office assistance to field
- Provide scheduling assistance

Mechanical Engineering Subtasks

- Evaluate and establish control building and storage building requirements as related to mechanical equipment (includes equipment sizing)
- Coordinate with other disciplines layout and arrangement as related to mechanical equipment
- Prepare design memo outlining mechanical systems and the basis of their design
- Perform design studies to establish type and size of mechanical systems
- Prepare mechanical equipment specifications and contract/ construction drawings
- Assist in bid evaluation
- Review shop drawings
- Prepare cost estimate

Architectural Subtasks

- Prepare control and storage building design and design memos
- Coordinate control and storage building features, all disciplines
- Prepare technical specifications
- Prepare architectural drawings
- Prepare cost estimate
- Review shop drawings

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Support Services Subtasks

Revise standard conditions of bidding and construction contracts to fit this contract

Make civil quantity take-off, develop detailed bases for cost estimating, prepare engineer's estimate

Prepare detailed construction schedule for this contract

Edit word process and revise, as necessary, specifications and bid forms; reproduce and bind.

Provide construability review of technical specifications

Prepare addendum as necessary

Assist with bidding and award; bidders qualifications, issue of documents, bid receipt and recording, bid evaluation and letter of recommendation

Task Number: E2S17
Task: Contract Document C-2 - Willow Substation Construction Contract

OUTPUT

Management Output
- Contract Document C-2
- Contract Award

Civil Engineering Output
- Design memo
- Technical Specifications
  - Metalwork
  - Site Work
  - Structural Steel
- Quantity take-off of civil items
- Review of manufacturers' drawings and computations
- Civil/structural Contract/construction drawings
  - General project layout
  - Standard details, sheets 1-5
  - Control building, Sheets 1-2
  - Storage building, Sheets 1-2
  - Yard and foundation, Sheets 1-4

Architectural Output

Architectural Treatment Memo

Architectural Contract/Construction Drawings
- Control Building - Elevations & Sections
- Control Building - Floor & Ceilings
- Control Building - Sections & Details

Storage Building - Floors & Ceilings
Storage Building - Sections and Elevations
Storage Building - Sections and Details
Framing Plans

Electrical Engineering Output
Design memorandum including Lighting, Cable Tray, Grounding, and Site Distribution
Specification text section
General electrical work includes furnishing and installing and testing conduit, grounding, insulated wire and cable, lighting, cable tray, etc.; distribution equipment; miscellaneous equipment
Installation of Owner-furnished equipment includes the installation and field testing of the equipment specified in the following contracts:
Transformer and Surge Arresters
Control Switchboard Equipment
Power Circuit Breakers and Current Transformers
Disconnecting Switches and Reactor Switches
Coupling Capacitor Voltage Transformer
Communication Equipment
Station Service Equipment
Structures, Buses and Insulators
Reviewed shop drawings
Cost Estimate
Electrical Construction Drawings
I-L Diagrams, 3-L Diagrams (5 dwgs)
Abbreviations Symbols and Designations (2 dwgs)
Physical Drawings (conduit, arrangement details) (11 dwgs)
Grounding Drawing (2 dwgs)
Lighting Drawing (4 dwgs)
Schematic Diagram (11 dwgs)
Interconnection Diagram (15 dwgs)

Conduit and Cable Schedules (7 dwgs)
Communication Drawings (1 dwg)
Tray System (1 dwg)
Bill of Materials (1 dwg)

Mechanical Engineering Output
- Specifications for control building
- Design memo
  - Mechanical Features for the Control and Storage Building
    - Features
- Mechanical Construction Drawings
  - Abbreviations/Symbols and Piping Schedule
  - Plan sheets 1 and 2
  - Sections
  - Details
  - Plumbing and Drainage Details Sheets 1 and 2

Support Services Output
- Contract Documents
- Engineers Estimate
- Letter of Recommendation of Award
- Report of Status of Contract Equipment Drawing Submittal

Task Number: E2S18
Task: Contract Document C-3 - Gold Creek Substation Construction Contract

(1) Constructing civil works in substation
(2) Control building and storage building
(3) Supply and installation of lighting, heating, plumbing, ventilating and general electrical systems
(4) Installation and testing of all Owner-supplied equipment
(5) Painting and other surface treatments
(6) Landscaping, fencing, project cleanup

SUBTASKS

Management Subtasks

Issue and control manpower budgets and schedule or task and subtasks
Initiate work

Civil Engineering Subtasks

Prepare design memo
Prepare technical specifications
Perform structural analysis and design of substation features
Prepare contract/construction drawings
Coordinate and review drawings from other disciplines
Prepare quantity take-offs for the engineer's estimate
Review manufacturers' drawings and computations
Input to O&M manuals
Provide office assistance to field
Review shop drawings of structures and buildings

Environmental

Implement mitigation measures

2108B

Electrical Engineering Subtasks

Prepare general electrical design

Prepare design memorandum

Review design memoranda of other disciplines

Prepare technical specifications and bid forms

Prepare electrical drawings

Review specifications of other discplines

Review drawings of other disciplines

Prepare cost estimate

Assist in bidding and bid evaluations

Review shop drawings

Provide office assistance to field

Provide scheduling assistance

Mechanical Engineering Subtasks

Evaluate and establish control building and storage building requirement as related to mechanical equipment (includes equipment sizing)

Coordinate with other disciplines layout and arrangement as related to mechanical equipment

Prepare design memo outlining mechanical systems and the basis of their design

Perform design studies to establish type and size of mechanical systems

Prepare mechanical equipment specifications and contract/ construction drawings

Assist in bid evaluation

Review shop drawings

Prepare cost estimate

Architectural Subtasks

Prepare control and storage building design and design memo

Coordinate control and storage building features, all disciplines

Prepare technical specifications

Prepare architectural drawings

Prepare cost estimate

Review shop drawings

2108B

Support Services Subtasks

Revise standard conditions of bidding and construction contracts to fit this contract

Make civil quantity take-off, develop detailed bases for cost estimating, prepare engineer's estimate

Prepare detailed construction schedule for this contract

Edit word process and revise, as necessary, specifications and bid forms; reproduce and bind.

Provide construability review of technical specifications

Prepare addendum as necessary

Assist with bidding and award; bidders qualifications, issue of documents, bid receipt and recording, bid evaluation and letter of recommendation

Task Number: E2S18

Task: Contract Document C-3 - Gold Creek Substation Construction Contract

OUTPUT

Management Output

- Contract Document C-3
- Contract Award

Civil Engineering Output

- Design Memo
- Technical Specifications
  - Metalwork
  - Sitework
  - Structural Steel
- Quantity take-off of civil items
- Review of Manufacturers' drawings and computations
- Civil/structural Contract/construction drawings
  - General Project Layout
  - Standard Details, Sheets 1-5
  - Control Building, Sheets 1-2
  - Storage Building, Sheets 1-2
  - Yard and Foundation, Sheets 1-4

Architectural Output

Architectural Treatment Memo

- Architectural Contract/Construction Drawings
- Control Building - Elevations and sections
- Control Building - Floor and ceilings
- Control Building - Sections and details
- Storage Building - Floor & Ceiling
- Storage Building - Sections and Elevations
- Storage Building - Sections and Details
- Framing plans

2108B

Electrical Engineering Output

Design memorandum including Lighting, Cable Tray, Grounding, and Site Distribution

Specification text section

General electrical work includes furnishing and installing and testing conduit, grounding, insulated wire and cable, lighting, cable tray, etc.; distribution equipment; miscellaneous equipment

Installation of Owner-furnished equipment includes the installation and field testing of the equipment specified in the following contracts:

Control Switchboard Equipment

Power Circuit Breakers

Station Service Equipment and Current Transformers

Structures, Buses and Insulators

Disconnecting Switches

Coupling Capacitor Voltage Transformers

Communication Equipment

Reviewed shop drawings

Cost estimate

Electrical Construction Drawings

I-L Diagrams, 3-L Diagrams (4 Dwgs)

Abbreviations, Symbols and Designations (2 Dwgs)

Physical Drawings (conduit, arrangement details) (11 Dwgs)

Grounding Drawing (2 Dwgs)

Lighting Drawing (3 Dwgs)

Schematic Diagram (10 Dwgs)

Interconnection Diagram (14 Dwgs)

Conduit and Cable Schedules (6 Dwgs)

Communication Drawings (1 Dwg)

Tray System (1 Dwg)

Bill of Materials (1 Dwg)

Mechanical Engineering Output

- Specifications for buildings
- Design memo
  - Mechanical Features for the Control Building and Storage Building Features
- Mechanical Construction Drawings
  - Abbreviation/Symbols and Piping Schedule
  - Plan sheets 1 and 2
  - Sections
  - Details
  - Plumbing & Drainage Details Sheets 1 and 2

Support Services Output

- Contract Documents
- Engineers Estimate
- Letter of Recommendation of Award
- Report of Status of Contractor Equipment Drawing Submittal

Task Number: E2S19

Task: Contract Document C-4 - University Substation Construction Contract

(1) Constructing Civil Works in Substation
(2) Control Building & Storage Building
(3) Supply and installation of lighting, heating, plumbing, ventilating and general electrical systems
(4) Installation and testing of all Owner-supplied equipment
(5) Painting and other surface treatments
(6) Landscaping, fencing and project cleanup

SUBTASKS

Management Subtasks

Issue and control manpower budgets and schedule or task and subtasks
Initiate work

Civil Engineering Subtasks

Prepare design memo
Prepare technical specifications
Perform structural analysis and design of all substation features
Prepare contract/construction drawings
Coordinate and review drawings from other disciplines
Prepare quantity take-offs for the engineer's estimate
Review manufacturers' drawings and computations
Input to O&M manuals
Provide office assistance to field
Review shop drawings of of structures and buildings

Environmental

Implement mitigation measures

Electrical Engineering Subtasks

- Prepare general electrical design
- Prepare design memorandum
- Review design memoranda of other disciplines
- Prepare technical specifications and bid forms
- Prepare electrical drawings
- Review specifications of other disciplines
- Review specifications of other disciplines
- Review drawings of other disciplines
- Prepare cost estimate
- Assist in bidding and bid evaluation
- Review shop drawings
- Provide office assistance to field
- Provide scheduling assistance

Mechanical Engineering Subtasks

- Evaluate and establish control building and storage building requirements as related to mechanical equipment (includes equipment sizing)
- Coordinate with other disciplines layout and arrangement as related to mechanical equipment
- Prepare design memo outlining mechanical systems and the basis of their design
- Perform design studies to establish type and size of mechanical systems
- Assist in bid evaluation
- Review shop drawings
- Prepare cost estimate

Architectural Subtasks

- Prepare control and storage building design and design memo
- Coordinate control and storage building features, all disciplines
- Prepare technical specifications
- Prepare architectural drawings
- Prepare cost estimate
- Review shop drawings

Support Services Subtasks

Revise standard conditions of bidding and construction contracts to fit this contract

Make civil quantity take-off, develop detailed bases for cost estimating, prepare engineer's estimate

Prepare detailed construction schedule

Edit word process and revise, as necessary, specifications and bid forms; reproduce and bind.

Provide construability review of technical specifications

Prepare addendum as necessary

Assist with bidding and award; bidders qualifications, issue of documents, bid receipt and recording, bid evaluation and letter of recommendation

Task Number: E2S19
Task: Contract Document C-4 - University Substation
Construction Contract

OUTPUT

Management Output
- Contract Document C-4
- Contract Award

Civil Engineering Output
- Design Memo
- Technical Specifications
  - Metalwork
  - Sitework
  - Structural Steel
- Quantity take-off of civil items
- Review of Manufacturer's drawings and computations
- Civil/structural contract/construction drawings
  - General Project Lyout
  - Standard Details, Sheets 1-5
  - Control Building - Concrete and Reinformcement, Sheets 1-2
  - Storage Building, Sheets 1-2
  - Yard and Foundations, Sheets 1-4

Architectural Output

Architectural Treatment Memo

Architectural Contract/Construction Drawings
- Control Building - Elevations and sections
- Control Building - Floor and ceilings
- Control Building - Sections and details
- Storage Building - Floor & Ceiling

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Storage Building - Sections and Elevations
Storage Building - Sections and Details
Framing plans

Electrical Engineering Output

Design memorandum including Lighting, Cable Tray, Grounding and Site Distribution
Specification text section
General electrical work includes furnishing, installing and testing conduit, grounding, insulated wire and cable, lighting, cable tray, etc.; distribution equipment; miscellaneous equipment
Installation of Owner-furnished equipment includes the installation and field testing of the equipment specified in the following contracts:
Transformers and Surge Arresters
Control Switchboard Equipment
Power Circuit Breakers and Current Transformers
Station Service Equipment
Structures, Buses and Insulators
Disconnecting Switches
Coupling Capacitor Potential Devices
Communication Equipment
Static Var System
Reviewed shop drawings
Cost Estimate
Electrical Construction Drawings
I-L Diagrams, 3-L Diagrams (7 Dwgs)
Abbreviations, Symbols and Designations (2 Dwgs)
Physical Drawings (conduit, arrangement details) (17 Dwgs)
Grounding Drawing (3 Dwgs)
Lighting Drawing (4 Dwgs)

Schematic Diagram (14 Dwgs)
Interconnection Diagram (24 Dwgs)
Conduit and Cable Schedules (10 Dwgs)
Communication Drawings (1 Dwg)
Bill of Materials (1 Dwg)

Mechanical Engineering Output
- Specifications for buildings
- Design memo
  - Mechanical Features for the Control Building and Storage Building Features
- Mechanical Construction Drawings
  - Abbreviations/Symbols and Piping Schedule
  - Plan sheets 1 and 2
  - Sections
  - Details
  - Plumbing & Drainage Details Sheets 1 and 2

Support Services Output
- Contract Documents
- Engineers Estimate
- Letter of Recommendation of Award
- Report of status of contract equipment drawing submittal

Task Number: E2S20

Task: Contract Document C-5 - Ester Substation Construction Contract

(1) Constructing Civil Works in Substation
(2) Control Building and Storage Building
(3) Supply and installation of lighting, heating, plumbing, ventilating and general electrical systems
(4) Installation and testing of all Owner-supplied equipment
(5) Painting and other surface treatments
(6) Landscaping, fencing, project cleanup

SUBTASKS

Management Subtasks

Issue and control manpower budgets and schedule or task and subtasks

Initiate work

Civil Engineering Subtasks

Prepare design memo

Prepare technical specifications

Perform structural analysis and design of all substation features

Prepare contract/construction drawings

Coordinate and review drawings from other disciplines

Prepare quantity take-offs for the engineer's estimate

Review manufacturers' drawings and computations

Provide office assistance to field

Review shop drawings of structures and buildings

Environmental

Implement mitigation measures

Electrical Engineering Subtasks

Prepare General Electrical Design

Prepare Design Memorandum

2108B

Review design memoranda of other disciplines
Prepare technical specifications and bid forms
Prepare electrical drawings
Review specifications of other disciplines
Review drawings of other disciplines
Prepare cost estimate
Assist in bidding and bid evaluation
Review shop drawings
Provide office assistance to field
Provide scheduling assistance

Mechanical Engineering Subtasks

Evaluate and establish control building and storage building requirements as related to mechanical equipment (includes equipment sizing)
Coordinate with other disciplines layout and arrangement as related to mechanical equipment
Prepare design memo outlining mechanical systems and the basis of their design
Perform design studies to establish type and size of mechanical systems
Prepare mechanical equipment specifications and contract/construction drawings
Assist in bid evaluation
Review shop drawings
Prepare cost estimate

Architectural Subtasks

Prepare control and storage building design and design memo
Coordinate control and storage building features, all disciplines
Prepare technical specifications
Prepare architectural drawings
Prepare cost estimate
Review shop drawings

Support Services Subtasks

Revise standard conditions of bidding and construction contracts to fit this contract

Make civil quantity take-off, develop detailed bases for cost estimating, prepare engineer's estimate

Prepare detailed construction schedule for this contract

Edit word process and revise, as necessary, specifications and bid forms; reproduce and bind.

Provide construability review of technical specifications

Prepare addendum as necessary

Assist with bidding and award; bidders qualifications, issue of documents, bid receipt and recording, bid evaluation and letter of recommendation

Task Number: E2S20
Task: Contract Document C-5 - Ester Substation Construction Contract

OUTPUT

Management Output
- Contract Document C-5
- Contract Award

Civil Engineering Output
- Design memo
- Technical Specifications
  - Metalwork
  - Sitework
  - Structural Steel
- Technical Specifications
  - Metalwork
  - Sitework
  - Structural Steel
- Quantity take-off of civil items
- Review of manufacturers' drawings and computations
- Civil/structural contract/construction drawings
  - General Project Layout
  - Standard Details, Sheets 1-5
  - Control Building, Sheets 1-2
  - Storage Building, Sheets 1-2
  - Yard and Foundations, Sheets 1-4

Architectural Output

Architectural Treatment Memo

Architectural Contract Construction Drawings

Control Building - Elevations & Sections

Control Building - Floor & Ceilings

Control Building - Sections & Details

Storage Building - Ceiling

Storage Building - Sections & Elevations

Storage Building - Sections & Details

Framing Plan

Electrical Engineering Output

Design memorandum including Lghting, Cable Tray, Grounding and Site Distribution

Specification text section

General electrical work includes furnishing, installing and testing conduit, grounding, insulated wire and cable, lighting, cable tray, etc.; distribution equipment; miscellaneous equipment

Installation of Owner-furnished equipment includes the installation and field testing of the equipment specified in the following contracts:

Transformers and Surge Arresters

Control Switchboard Equipment

Power Circuit Breakers and Current Transformers

Station Service Equipment

Structures, Buses and Insulators

Disconnecting Switches

Coupling Capacitor Voltage Transformer

Communication Equipment

Static Var System

Shunt Reactors

Reviewed Shop Drawings

Cost Estimate

Electrical Construction Drawings

I-L Diagrams, 3-L Diagrams (5 Dwgs)

Abbreviations, Symbols and Designations (2 Dwgs)

Physical Drawings (conduit, arrangement details) (16 Dwgs)

Grounding Drawing (3 Dwgs)

Lighting Drawing (4 Dwgs)

Schematic Diagram (14 Dwgs)

Interconnection Diagram (21 Dwgs)

Conduit and Cable Schedules (8 Dwgs)

Communication Drawings (1 Dwg)

Bill of Materials (1 Dwg)

Mechanical Engineering Output

Specifications for buildings

Design memo

Mechanical Features for the Control Building and Storage Building Features

Mechanical Construction Drawings

Abbreviation/Symbols and Piping Schedule

Plan sheets 1 and 2

Sections

Details

Plumbing & Drainage Details Sheets 1 and 2

Support Services Output

Contract Documents

Engineers Estimate

Letter of Recommendation of Award

Report of status of contractor equipment drawing submittal

SCHEDULE OF DELIVERABLES - SUBSTATIONS

Substations			
E2S1	Switching Study Report	8/83	4/84
E2S2	SF_6 Study Report	To be established if study is required	
E2S3	Insulation Coordination Report	8/83	4/84
E2S4	Protection Study Report	8/83	4/84
E2S5	Control Study Report	8/83	4/84
E2S6	Communication Bid Package	6/83	5/85
	Communication Bid Evaluation Report	2/86	9/86
E2S7	Power Transformer & SA Bid Package	4/84	4/85
	Power Transformer & SA Bid Evaluation Report	10/85	5/86
E2S8	Shunt Reactor Bid Package	1/85	11/85
	Shunt Reactor Bid Evaluation Report	4/86	11/86
E2S9	Static VAR System (SVS) Bid Package	11/84	5/86
	SVS Bid Evaluation Report	12/86	8/87
E2S10	Power Circuit Breaker & CT's Bid Package	11/84	12/86
	Power Circuit Breaker & CT's Bid Evaluation Report	2/87	10/87
E2S11	Disconnecting Sw & Reactor Sw Bid Package	10/85	10/86
	Disconnecting Sw & Reactor Sw Bid Evaluation Report	4/87	11/87
E2S12	CCUT & Power Line Carrier (PLC) Bid Package	5/86	2/87
	CCUT & PLC Bid Evaluation Report	9/87	3/88
E2S13	Substation Structure Bid Package	1/86	7/87
	Buses, Insulators and Hardware Bid Package	1/86	7/87
	Substation Structures Bid Evaluation Report	1/88	8/88
	Buses, Insulator & Hardware Bid Evaluation Report	1/88	8/88

TASK	DELIVERABLES	STARTING DATE	COMPLETION DATE
E2S14	Control Switchboard Bid Package	6/84	2/86
	Control Switchboard Bid Evaluation Report	10/86	6/87
E2S15	Station Service Equipment Bid Package	2/86	2/87
	Station Service Equipment Bid Evaluation Report	7/87	3/88
E2S16	Knik Arm Substation Construction Drawings and Specifications	3/88	12/88
	Knik Arm Substation Construction Bid Evaluation Report	5/89	11/89
	Knik Arm Substation As Built Drawings	1/92	3/92
	Knik Arm Substation Design Criteria	3/84	12/84
E2S17	Willow Substation Construction Drawings and Specification	6/88	3/89
	Willow Substation Construction Bid Evaluation Report	10/89	4/90
	Willow Substation As Built Drawings	11/91	3/92
	Willow Substation Design Criteria	3/84	12/84
E2S18	Gold Creek Substation Construction Drawings and Specifications	1/86	11/87
	Gold Creek Substation Construction Bid Evaluation Report	6/88	12/88
	Gold Creek Substation As Built Drawings	8/91	12/91
	Gold Creek Substation Design Criteria	3/84	12/84
E2S19	University Substation Construction Drawings and Specifications	11/87	11/88
	University Substation Construction Bid Evaluation Report	5/89	12/89
	University Substation As Built Drawings	3/92	6/92
	University Substation Design Criteria	3/84	12/84
E2S20	Ester Substation Construction Drawings and Specifications	2/88	11/88
	Ester Substation Construction Bid Evaluation Report	6/89	2/90
	Ester Substation As Built Drawings	5/92	8/92
	Ester Substation Design Criteria	3/84	12/84

E.3 Work Plan - Collateral Support

As required by the RFP letter, we have structured our work plan and project organization to include qualified Alaska firms as subcontractors for support services that are better supplied from firms outside of the joint venture. Our work plan and project schedule is in accord with the RFP letter that required support services will be subcontracted according to RFP procedures established by the Power Authority and that selection and subcontract awards will be subject to approval of the Power Authority. Close liaison betwen the Joint Venture and APA will contribute to well coordinated, complete, on-schedule Engineering of each phase of the project.

We will follow the required Power Authority procedures for competitive subcontracts. However, it should be noted that there are already in place a large number of subcontractors, many with the capabilities required by the transmission project, as part of the Susitna project with the Harza-Ebasco joint venture. The services of these subcontractors could be utilized in the transmission line project by way of a simple change in scope to the existing contract rather than with a more lengthy RFP procedure. Use of the scope change approach could improve scheduling on critical items related to the licensing activities.

a. Subcontracts

The Joint Venture proposes to engage in one subcontract to augment design capability and five subcontracts for various field-oriented collateral support services. The "augmenting" type of subcontract will be primarily for major contributions to the key effort of public participation, along with some technical responsibilities in the fields of land use and visual resources during the route selection and station siting process. This subcontract will be with the landscape architecture firm of Jones and Jones, of Seattle, Washington. This subcontract and the five collateral support subcontracts are described in more detail below.

Public Participation and Environmental Support

Jones and Jones will provide a variety of services to the public participation and environmental components of the transmission line project. In general terms, these services will come under the headings of public participation coordination, graphics for both technical and public participation work, preparation of visual impact simulations and related materials (for which a separate discussion follows), and land use aspects of the route selection and siting work. These services will be fully integrated into the project's environmental and public participation structure, as described previously in section E.1.a.

Three project staff positions will be filled by Jones and Jones personnel, including the Public Participation Coordinator and two members of the routing study team. The Public Participation Coordinator will be based in Anchorage, and will be responsible for conducting the day-to-day public involvement activities associated with the transmission line. A major function of this responsibility will be working with technical specialists, primarily the Lead Environmental Scientist and the environmental team members, to develop adequate materials for presentation to the public. The two Jones and Jones members of the routing team will be a Land Use Specialist and a Visual/Graphics Specialist. The latter will be responsible for the preparation of visual impact simulations, direction of graphics preparation, communication between the Joint Venture and Jones and Jones, and possible participation in the public workshops.

The staff time and other costs that will be incurred by Jones and Jones are incorporated into the overall work-hour and budget estimates for public participation and the environmental program, since Jones and Jones' work will be integrated with the Joint Venture team. However, a separate discussion is provided concerning the visual simulations, since these items will be important deliverables and will require a significant effort. Work by Jones and Jones will account for a large

proportion of the mapping and the public participation budgets, including the Public Participation Coordinator's time and materials preparation, and a relatively small percentage of the staff time for the environmental team. Jones and Jones personnel will have specific reporting and coordination arrangements with the Project Manager, Lead Environmental Scientist, and the overall Susitna Public Participation Program Manager. The subcontract between the Joint Venture and Jones and Jones will also be subject to the review and approval of the Power Authority.

Field and Related Services

The Joint Venture plans to subcontract the following collateral support services:

- o Cultural Resources/Archaeology Survey
- o Visual Impact Simulations
- o Field Survey and Photogrammetric Compilations of Line Profiles
- o Soil Testing and Geotechnical Services
- o Radio and Television Interference Measurements
- o Transient Network Analyzer Study

The Joint Venture plans to provide construction support engineering from Ebasco's Construction Department.

The Joint Venture will select these subcontractors (with the exception of visual simulations by Jones and Jones) using Request for Proposal (RFP) procedures similar to those used by the Power Authority. After award of the Susitna Transmission Line Design Contract, a draft of the terms and the technical specifications will be prepared for each subcontract. These will be incorporated into five RFP's which will be submitted to the Power Authority, along with cost estimates, for approval. Then the RFP's will be sent to qualified subcontractors who are preferably located in Alaska.

After receipt of the proposals, an evaluation will be made and any negotiations completed. The subcontracts will then be awarded subject to the Power Authority's approval. The successful subcontractors will be required to prepare a master schedule and attend public participation or other important meetings. Also, they will be responsible for obtaining the required permits from the Power Authority for ingress on the right-of-way. Their progress will be monitored by the Joint Venture through the use of monthly progress reports.

The scope of services furnished by the collateral support subcontractors will be as follows:

3.1. Cultural Resources/Archaeological Survey. The cultural resources subcontract proposed here is based on an understanding of the extent of the survey work that has been done to date, and the need for additional work prior to selection of a route. The cultural resources subcontractor will conduct a two-phased cultural resource inventory program. In the first phase, the subcontractor will conduct a baseline reconnaissance study of the preferred corridors for the three study areas. Areas of identified low priority or potential as determined through consultations with the State Historic Preservation Officer will not be covered in as much detail as other areas. The subcontractor will then furnish a report documenting the baseline cultural historical overview, agency consultation, known sites, potential sites and their significance.

The second phase of the cultural resource subcontract will occur after the transmission line right-of-way is surveyed and the structures are spotted. At this time a more detailed survey within the right-of-way, particularly in the areas to be disturbed by construction activities and facilities, will take place. The subcontractor will document all sites and determine their mitigation potential and costs. It may, for example, be more expensive to re-route the line than to excavate or move a cultural site. All aspects of the cultural resources inventory

will be documented in a report and sent to the Power Authority and the State Historic Preservation Officer (SHPO). Findings will be included for the Alaska Historic Resource Survey (AHRS) of the office of the State Archaeologist.

3.2. Visual Impact Simulation Study Since the visual impact of transmission lines is a dominant concern voiced by public officials and private citizens, Jones and Jones will develop a photo simulation methodology to help determine the degree of visual impact various transmission line alignment alternatives might have. This information will help in the final selection of the alignment. Use of photographically based visual simulations creates an objective decision base and provides the opportunity to test mitigating measures, as well as serving as valuable communication aides for focusing the attention of interested public participants. Most of this effort will be concentrated in the "urban" areas, placing emphasis on design details such as tower configuration and material, conductors, and substation appearance.

Jones and Jones will work closely with the Lead Environmental Scientist and Public Participation Coordinator, as described previously, and will also be expected to participate in public meetings. The simulation methodology will incorporate variables related to four categories:

1. the object being simulated
2. the viewer
3. the setting
4. the technical accuracy of the simulations

The photosimulations will be evaluated according to the degree of contrast the various route alternatives and substations create in their respective settings. General tasks the subcontractor will perform are:

1. Determine critical viewpoints and viewsheds.
2. Produce photosimulations (assume 8-12) from critical viewpoints.
3. Evaluate impacts
4. Develop and apply mitigation measures
5. Report documentation for input to interim and final routing reports

Findings and conclusions from the simulation work will be included in the Joint Venture final route and station site selection report to the Power Authority, while the simulations themselves will be important display items.

3.3. Field Survey and Photogrammetric Compilations of Line Profiles

The field survey subcontractor will be required to locate the transmission line centerline in the field within the right-of-way constraints established by the route selection study. This subcontractor shall be licensed to do professional land surveys in Alaska and shall be familiar with Alaskan land survey systems. The subcontractor will mark the control points for aerial photography and establish horizontal and vertical control. The subcontractor will then produce the photogrammetric plan and profile sheets and computerized plan-profile data. At the same time, the subcontractor will furnish property descriptions, as required by the Power Authority, to procure the right-of-way.

After the transmission line engineer has spotted the structures on the plan-profile, the field survey subcontractor will be required to locate and reference these structures in the field. In addition, he will furnish structure site cross-sections necessary to determine the leg extensions. However, all right-of-way clearing surveys will be done by the line construction contractor.

The same field survey subcontractor will be required to survey the Knik Arm submarine cable crossing and the substation sites in the field. The substation site surveys shall meet the Alaskan Land Survey codes and acceptable plats shall be filed. Also, a hydrographic or

topographical map will be produced for each location, and the access roads will be laid out according to the directions of the substation engineer. Property descriptions will be furnished as required by the Power Authority.

Only about 1000 feet of access road is assumed to be required to connect each substation site with the existing road, rail, sea, or air facilities. If additional access roads are required, the survey work will be done by the substation contractor.

3.4. Soil Testing and Geotechnical Services The objective of geotechnical investigations will be detailed delineation of the varied geotechnical conditions along the transmission corridor. These conditions are the existence and distribution of seasonally and perennially frozen areas and the type and distribution of ice. Delineation will also be made of the types and properties of soils and rock, groundwater conditions, thickness of the active layer, depth of seasonal frost penetration in unfrozen soils in the discontinuous permafrost zone, presence of unfrozen layers and ground temperatures. Such delineation is essential, as the above factors are not only variable areally, but also with depth, and will therefore influence the location of the transmission line within the corridor, structure locations, foundation designs and construction methods to be used.

The scope of geotechnical investigations will depend to a large extent on the type and amount of information already available. Therefore, the initial task will be a detailed study and review of all existing information for the proposed transmission corridor. Such information will not only include that gathered during the Feasibility Phase, but that acquired for any existing adjacent project structures. In addition, all other potential sources of information and assistance will be considered such as: local experience, topography, hydrology, geology (surfical as well as bedrock), geomorphology, effects of exploration (on vegetation, wildlife habitats), land use and population (social aspects) and local government regulations (permits).

For preparation of this proposal we have assumed that the scope of geotechnical investigations for the Anchorage to Willow line section, Nenana to Fairbanks line section and Watana dam site to Parks Highway line section, consists of:

Terrain Analysis
Field Explorations
Geophysical Explorations (as required in lieu of subsurface explorations)
Subsurface Explorations
250 - 40 foot deep borings
100 by overland access
150 by helicopter access

It is our understanding that geotechnical information is available for the intertie between Willow and Nenana. Should additional explorations of limited extent be required in this area, the above program could accommodate such needs.

Following review of existing information, a knowledge of project geology, geomorphologyt, engineering requirements, construction requirements and terrain will have been acquired, and a terrain analysis can commence. Such analysis will consist of review of existing analyses, extension of existing analyses and/or performance of a new analysis. As a terrain analysis will be useful for project activities other than geotechnical investigations, such analysis will be coordinated with these activities. The main objectives of terrain analysis for geotechnical investigations will be the delineation of landforms, identification of surface materials and areas of permafrost and identification of areas requiring detailed field investigations. As the cost of subsurface investigations are high, for reasons of climate and access, terrain analyses will be used to the greatest extent possible.

Following study and review of existing information and completion of the terrain analysis, a program of field explorations will be established. This program will be designed to supplement conclusions reached by these activities and provide additional data for final design of project structures. The field exploration program will consider use of geophysical and subsurface exploration techniques. Geophysical techniques which will be considered are seismic for acquisition of compressional wave velocity data, electrical resistivity and possibly radar. Subsurface explorations will be by auger, wash or coring techniques. The extent to which each technique will be used will be based on the information desired, site access and conditions, time of year and costs. Subsurface explorations will include the acquisition of samples for laboratory testing. Field explorations will also include the acquisition of information on the ground thermal regime, as required.

3.5 Radio Frequency and TVI Interference Measurements The RFI and TVI measurements subcontractor will be required to measure the background noise level before the energization of the transmission line, using instruments and procedures approved by the transmission line engineer. This test data will be supplied to the transmission engineer for analysis and permanent records. Finally, after the transmission line is energized, the subcontractor will repeat these tests to verify the performance of the line.

3.6 Transient Network Analyzer Study The Transient Network Analyzer (TNA) subcontractor will perform switching transient studies for the transmission lines and substations which correlate with those done for the hydroelectric project. Of particular interest is the operating parameters for the reactance compensation units discussed in Work Plan Section E.2.j. The TNA studies will presumably be done by the same subcontractor for the hydroelectric project so that no duplication of effort will be necessary. This contractor will be either General Electric, IREQ (Hydro Quebec), McGraw-Edison or Westinghouse.

The TNA subcontractor will be required to model the system and produce the necessary data to establish the:

- o Establish overall gain and time constants for the SVC primary control loop
- o Basic Impulse Insulation Level (BIL)
- o Basic Switching Surge Level (BSL)
- o Reactive Compensation Switching Requirements
- o Lightning/Switching Surge Protection
- o System Grounding Requirements
- o Single-Pole Circuit Breaker Reclosing Criteria

E.3.b. Plan for interface with other design contractors

The EHV Transmission Facilities for Susitna Hydroelectric Project are an important, but separable, aspect of the overall project. The approach to this assignment proposed by the Joint Venture will provide the Power Authority with a basic team of engineers and scientists specifically devoted to the Transmission Studies. This team will utilize the in-place facilities and personnel of the Joint Venture's principal contract for the Susitna Project to assist in those areas where integration of efforts will be highly beneficial to the project and the Power Authority or where level of effort for the transmission and substation design will be intermittent and cannot justify full-time persons to duplicate/supplement comparable infrastructure in place under the principal contract.

This approach will permit the Power Authority to supervise the transmission system design as a discrete activity while minimizing overall costs and greatly simplifying necessary communication and coordination between the transmission and principal contract design teams.

The project organization for the Transmission Study is shown in Figure A1-3. Figures A1-2 and A1-4 show the integration of this organization with the Harza-Ebasco Joint Venture organization for the primary contract. Two task functions for the Transmission Study are subordinate, to a degree, to the established structure of the Joint Venture Design Project Team. These tasks are:

- Public Participation
- Licensing and Permitting Coordination

Methodologies and lines of communications to efficiently accomplish these tasks require careful development and nurturing. By incorporating this aspect of the Transmission Study into the existing infrastructure, as described in Section E.1.a., much duplication of effort will be avoided and chances for conflicting efforts will be minimized.

Three other aspects of the Transmission System Design, namely the Geotechnical and Environmental investigations and the substation detailed design will be closely coordinated with counterpart personnel within the existing Joint Venture organization in order to minimize duplication of effort. The substation design, including protection, communication, control and data logging will be closely coordinated with the Susitna Project overall design of the communication, control and data acquisition (SCADA), and energy management systems already included in the scope of the principal contract. Establishment of design principles, as well as detailed coordination and interface for these features of substation design will be achieved by the same team that will be responsible for the overall systems design in the principal contract. Again, this close coordination will permit better coordinated designs, with significant increases in efficiency and economy.

The overall management of the Transmission System Engineering Operations will be conducted by a Manager who will serve as a Deputy Manager under Dr. R. S. LaRusso, Project Manager for the overall Harza-Ebasco Joint Venture Susitna Project Team. On technical matters, the Transmission System Engineering Operations Manager would communicate directly with his designed contact person within the Power Authority organization.

E.3.c. Logistics

The Joint Venture plans the following logistics to support the Susitna transmission project:

- o personnel food and lodging
- o personnel transportation
- o communication
- o special equipment
- o material procurement support

These facilities will be required for a safe and comfortable working environment for the field personnel. Furthermore, the special equipment and construction material must be supplied in an expeditious manner to improve the productivity of the field personnel and the constructability of the project.

1. Personnel Food and Lodging Facilities A 120 man construction camp will be built by the Joint Venture for the Susitna Hydroelectric project. This camp will be designed with modular units which can be easily expanded. Therefore, only a negligible amount of extra facilities will be needed to feed and house the field personnel for the transmission line and substation effort near Watana. In addition to office, sleeping and dining facilities. They will have access to all recreational, medical, mail, banking, security, and laundry facilities available to the hydroelectric personnel.

In the vicinity of Anchorage and Fairbanks, the Joint Venture plans to use existing restaurants and motels for food and lodging facilities. Both towns are large enough to provide complete services to the field personnel. Also, Morrison-Knudsen will have three construction camps along the Parks Highway which may be used to reduce the travel time.

Personnel Transportation Since the project site is presently undeveloped wilderness, considerable airplane and helicopter air transportation will have to be used near Watana. Consequently, the Joint Venture plans to use the air support available at the site as mentioned in the RFP. However, the Joint Venture will probably have several full time aircraft for the hydroelectric personnel. Therefore, these aircraft could be more economically utilized if they are also used by transmission and substation personnel.

The Joint Venture will furnish land vehicle transportation when the transmission line corridor is near the Parks Highway. Also, access by wilderness trails is anticipated, but helicopter transportation will be utilized whenever travel time is inordinately high. Only existing access trails will be used along the Intertie, if possible.

Most of the field work will be done in the summer to avoid the inclement winter weather. This will improve the working conditions and safety of the field personnel. Also, the aerial photgraphy will be easier. However, the fuel and food supplies will be more easily transported into the wilderness areas during the winter. Therefore, a cost benefit will result if the Joint Venture is able to stockpile fuel and supplies for both the hydroelectric and transmission line venture.

Communication Presently, only one telephone line exists to Watana, but satellite and/or microwave communication is being planned as part of the hydroelectric project. Therefore, the Joint Venture will plan to utilize this new system with minimal extra cost.

Special Equipment The Joint Venture or its subcontractors will furnish all special equipment necessary for the field work by using existing air, truck or rail transportation. At the discretion of the professional land surveyor, the following special surveying instruments may be provided to establish horizontal control:

Satellite Receiver - If horizontal control is established by satellite track, one or more satellite receivers will be furnished to measure the Dopler Shift in sound when a satellite passes over the area. The number of receivers will be determined by the order of the survey.

Inertial Guidance System - If horizontal control is established by an inertial guidance system, a specially equipped helicopter with an inertial guidance system will be provided. This helicopter will be used to find a bearing and distance from a known point.

Electronic Distance Measuring Device - Since the country is very rough, an electronic distance measuring device will definitely be provided which will determine distances to the required order of survey.

The following additional special equipment will also be furnished to make field measurements:

Field Strength Meter - To make RI and TVI measurements, a special portable high frequency field strength meter or frequency analyzer with antenna will be provided. It will probably be transported by helicopter to initially make a background noise level survey along the route of the line. Later the survey will be repeated to verify the interference level of the transmission line.

Material Procurement Support In addition to writing the procurement documents, the Joint Venture will provide material procurement support to insure that the transmission line and substation materials will arrive in a timely manner. Most bulk materials will probably be shipped by ship or barge to Anchorage. From there, they will be off loaded and stored until they can be moved by truck or rail to the project site. Consequently, the Joint Venture will plan a material storage yard in the vicinity of Anchorage and similar yards adjacent to the Parks Highway or the Alaska Railroad where there is access to the transmission line and substations.

The scheduled rail service to Talkeetna and Gold Creek is usually limited to three days per week during the winter months. Lots less than a car load are delivered only once a week. Consequently, the supply of materials will be limited especially during the winter months when inclement weather limits truck traffic. As a result, the Joint Venture will study methods to expedite the transportation system in conjunction with the hydroelectric project.

E.3.d. Required Field Investigations

All required field investigations are included in Section E.3.a - Subcontracts.

E.3.e. Construction Support

Construction support will be provided to the construction Management Contractors as required by the Power Authority.

This phase is undertaken after the advertisement for the bids by the Authority.

The basic services will include the following:

- o Assistance in securing bids, tabulation and analysis of bid results and recommendations
- o Assistance in the preparation of formal contract documents for the award of contract
- o Consultation and advice during construction
- o Preparation of elementary sketches and supplementary studies required to resolve actual field conditions encountered
- o Checking detailed construction and erection drawings submitted by Contractors for compliance with design concepts
- o Observe work compliance with the contract documents
- o Reviewing Change Orders requested by the Contractor
- o Reviewing shop test reports of material and witnessing of shop testing
- o Issue certificates of completion on construction contracts
- o Provide "As Build" record drawings of the completed project

E.3.f. Land Use Rights Acquisition Support

This function is described in Section E.1.a, under Transmission Line FERC Licensing, Permitting, and Land Use Rights/Access Support.

Collateral Support Task List With Schedule Of Deliverables

HARZA-EBASCO

Task Number E.3.1

Task: Management of subcontract
Cultural Resources/Archaeology Survey

SUBTASK

Management Subtasks

Present list of qualified contractors to APA for acceptance (optional)
Prepare draft terms of contract to include in RFP
Prepare RFP and after APA approval send to local Alaskan contractors
Negotiations leading to award of contract
Monitor contractor progess with respect to budgets and schedules
Prepare monthly progress report
Coordinate rights-of-entry and permitting needs

Environmental/technical subtasks

Prepare scope of work including technical criteria for RFP
The following will be addressed:
- line/corridor length
- tower numbers
- construction activities and methods
- access requirements
- schedule
- deliverables
- permits/authorizations

Receive, evaluate qualifications and present list of qualified contractors
Incorporate APA review comments and issue RFP to qualified contractors
Receive and evaluate proposals in accordance with APA evaluation procedure

Assist in negotiations leading to award of contract
Assistance and review of contractor's work

OUTPUT

Management Output

Monthly progress reports on subcontract
Recommendation and award of contract

Environmental/Technical Output

RFP/Contract
Cost Estimates/Bid Evaluation
Phase 1 reconnaissance report
Phase 2 detailed ROW inventory report

Task Number: E3.2
Task: Visual Impact Simulation Study

SUBTASKS

Management Subtasks

Monitor contractor progress with respect to budgets and schedules
Prepare monthly progress reports
Coordinate with permitting coordinator for right-of-entry needs regarding field work

Environmental/Technical Subtasks

Provide necessary input to contractor on details and issues
Review contractor's work and incorporate comments and revisions as necessary
Incorporate contractor's work into final routing report

Task Number: E3.2
Task: Visual Impact Simulation Study

OUTPUT

Management Output

Progress reports on subcontract

Environmental/Technical Output

Visual sensitivity maps
Photosimulations
Report documenting findings and process

Task Number: E3.3

Task: Management of Subcontract
Field Survey and Photogrammetric Compilations of Line Profiles

SUBTASKS

Management Subtasks

Present list of qualified contractors to APA for acceptance (optional)

Prepare draft terms of contract to include in RFP

Prepare RFP and after APA approval send to local Alaskan contractors

Negotiations leading to award of contract

Monitor contractor progress with respect to budgets and schedules

Prepare monthly progress report

Participate in identification of project lands, acquisition of land use rights and rights of entry

Transmission Line Engineering Subtasks

Receive, evaluate qualifications, and present list of qualified contractors

Prepare draft scope of work including technical criteria for RFP.
The following will be addressed:

Horizontal and Vertical Control
Control Point Survey
Reference Control Points for Aerial Photograph
Stake Tower Locations

Tower Site Cross-sections
Aerial Photography
Plan - Profile Drawings
Submarine Cable Route Profile
Property Description as required by APA
Substation Property Surveys
Substation Topography Surveys
Access Road Maps for existing roads
Access Road Property description

Incorporate APA review comments and issue RFP to qualified contractors

Receive and evaluate proposals in accordance with APA evaluation procedure

Assist in negotiations leading to award of contract

Technical Assistance and review of contractors' work

Task Number: E3.3
Task: Management of Subcontract
Field Survey and Photogrammetric Compilations of Line Profiles

OUTPUT

Management Output

Monthly progress reports on subcontract
Reports on decisions taken in meetings with Power Authority

Transmission Line Engineering Output

Specifications and bid form
Cost estimates
Bid evaluation
Analysis and compiling of survey

Land Surveyor Output

Plan-Profile Drawings/Computer input data
Tower site crossection drawings
Submarine Cable Route and contour map
Substation property surveys
Substation topography maps
Access road maps
Property descriptions

Task Number: E3.4
Task: Management of Subcontract
Soil Testing - Geotechnical Services

SUBTASKS

Management Subtasks

Present list of qualified contractors to AP for acceptance (optional)

Prepare draft terms of contract to include in RFP

Prepare RFP and after APA approval send to local Alaskan contractors

Negotiations leading to award of contract

Monitor contractor progress with respect to budgets and schedules

Prepare monthly progress report

Participate in identification of project lands and rights of entry

Transmission Line/Geotechnical Engineering Subtasks

Receive, evaluate qualifications and present list of qualified contractors

Prepare draft scope of work including technical criteria for RFP. The following will be addressed:

Subsurface investigations including core drilling and seismic refraction studies
Soils Laboratory Tests
Soild resisitivity tests
Permafrost location and depth
Seismic evaluation
Tower site inspection
Submarine cable route inspection
Hydrometerological data collection

Incorporate APA in review comments and issue RFP to qualified contractors

Receive and evaluate proposals in accordance with APA evaluation procedure

Assist in negotiations leading to award of contract

Technical assistance and review of contractors' work

Task Number: E3.4
Task: Management of Subcontract
Soil Testing/Geotechnical Services

OUTPUT

Management Output

Monthly progress reports on subcontract

Transmission Line Engineering Output

Specifications and bid form
Cost estimates
Bid evaluation
Analysis and compiling of engineering data

Transmission Line/Geotechnical Engineering Output

Soils/Rock test evaluation
Permafrost/Seismic evaluation
Tower site geotechnical analysis
Submarine cable geotechnical analysis

Task Number: E3.5
Task: Management of Subcontract
RI and TVI Measurements

SUBTASKS

Management Subtasks

Present list of qualified contractors to APA for acceptance (optional)

Prepare draft terms of contract to include in RFP

Prepare RFP and after APA approval send to contractors

Negotiations leading to award of contract

Monitor contractor progress with respect to budgets and schedules

Prepare monthly progress report

Participate in identification of project lands and rights of entry

Transmission Line Engineering Subtasks

Receive, evaluate qualifications and present list of qualified contractors

Prepare draft scope of work including technical criteria for RFP. Before and after energization measurements will be addressed.

Incorporate APA review comments and issue RFP to qualified contractors.

Receive and evaluate proposals in accordance with APA evaluation procedure.

Assist in negotiations leading to award of cntract.

Technical assistance and review of contractors work.

Task Number: E3.5
Task: Management of Subcontract

OUTPUT

Management Output

Recommendations and award of contract

Progress report on subcontract

Transmission Line Engineering Output

Specifications and bid form

Cost estimates

Bid evaluation

Analysis of test data

Electrical Engineering Output

RI & TVI evaluation report

Task Number: E3.6
Task: Management of Subcontract
Transient Network Analyzer Studies

SUBTASKS

Management Subtasks

Present list of qualified contractors to the Power Authority for acceptance (optional)
Prepare draft terms of contract to include in RFP
Prepare RFP and after Power Authority send to qualified contractors
Negotiations leading to award of contract
Monitor contractor progress with respect to budgets and schedules

Transmission Line Engineering Subtasks

Present list of qualified contractors
Prepare draft scope of work including technical criteria for RFP.
The following will be addressed:
- Basic Impulse Insulation Level (BIL)
- Basic Switching Surge Level (BSL)
- Static Var Compensators gain and time constants
- Reactive Compensation Switching Requirements
- Lightning/Switching Surge Protection
- System Grounding Requirements
- Single-Pole Reclosing Criteria

Incorporate Power Authority review comments and issue RFP to qualified contractors
Receive and evaluate proposals in accordance with Power Authority evaluation procedure
Assist in negotiations leading to award of contract
Provide system data for TNA study
Coordinate with hydroelectric project TNA study
Assist subcontractor in technical matters
Review subcontractor's TNA data

Task Number: E3.6
Task: Management of Subcontract
Transient Network Analyzer Studies

OUTPUT

Management Output

Reports on decisions taken in meetings with Power Authority

Transmission Line Engineering Output

Specifications and Bid Form
Cost estimates
Bid Evaluation
System Data for TNA study
Analysis of TNA study
Field Tests

Subcontractor Output

TNA Study Data
TNA Study Report

Task Number: E3.7
Task: Construction Support

SUBTASKS

Management Subtasks

Control and coordinate home office support to Construction Manager and resident field personnel

Transmission Line Engineering Subtasks

Provide assistance and advice to field staff during construction including engieering after award. Surveillance for conformity with design concepts, such as structural application, foundations, stringing.

Review and recommendations regarding required field changes.

Revise and update construction inspection procedures as required.

Coordinate, assist and review all interface work between construction and design.

Civil Engineering Subtasks

Assist and advise field personnel on civil/structural matters.

Task Number: E3.7
Task: Construction Support

OUTPUT

Management Outputs

Expediting response to field support requests

Engineering Output

General correspondence, special instructions, trip and miscellaneous memos/studies/sketches advising field associated with line construction and line materials.

TASK	DELIVERABLES	STARTING DATE	COMPLETION DATE
E3.1	Bid package	1/83	1/83
	Proposal Evaluation/Award	1/83	1/83
	Phase 1 Reconnaissance Report	3/83	5/83
	Phase 2 Detailed ROW Inventory Report	6/83	9/83
E3.2	Visual Sensitivity Maps	2/83	5/83
	Photosimulations	2/83	5/83
	Report	4/83	5/83
E3.3	Survey Bid Package and Bid Awards	3/83	5/83
	Proposal Evaluation/Award	6/83	7/83
	Subcontractor Progress reports		
	Aerial Photogrammetric Data	7/83	3/84
	Plan-Profile Sheets/Computer Input Data		
	Watana to Gold Creek	10/83	3/84
	Healy to Willow	6/85	1/86
	Ester to Healy	6/85	1/86
	Willow to University	6/85	1/86
	Tower Staking and Tower site and ROW		
	Clearing Surveys - Watana to Gold Creek	3/84	9/84
	Healy to Willow	3/86	9/86
	Ester to Healy	3/86	9/86
	Willow to University	3/86	9/86
	Submarine Cable Route & Contour Map	3/85	8/85
	Substation Property Surveys		
	Knik Arm Substation	3/83	9/83
	Willow Substation	3/84	9/84
	Gold Creek Substation	3/83	9/83
	University Substation	3/83	9/83
	Ester Substation	3/84	9/84
	Substation Topography Maps		
	Knik Arm Substation	6/87	9/87
	Willow Substation	6/87	9/87
	Gold Creek Substation	6/86	9/86
	University Substation	6/87	9/87
	Ester Substation	6/87	9/87
E3.4	Soil Tests Bid Package & Bid Award	4/83	8/83
	Tower Site Soil Tests		
	Watana to Gold Creek	6/84	9/84
	Healy to Willow	6/86	9/86
	Ester to Healy	6/86	9/86
	Willow to University	6/86	9/86
E3.5	RI Measurement Contract Bid Package	3/83	6/83
	Pre-energization RI & TVI Measurements Report	5/83	9/83
	Post-energization RI & TVI Measurements Report	6/93	9/93

TASK	DELIVERABLES	STARTING DATE	COMPLETION DATE
E3.1	Bid package	1/83	1/83
	Proposal Evaluation/Award	1/83	1/83
	Phase 1 Reconnaissance Report	3/83	5/83
	Phase 2 Detailed ROW Inventory Report	6/83	9/83
E3.2	Visual Sensitivity Maps	2/83	5/83
	Photosimulations	2/83	5/83
	Report	4/83	5/83
E3.3	Survey Bid Package and Bid Awards	3/83	5/83
	Proposal Evaluation/Award	6/83	7/83
	Subcontractor Progress reports		
	Aerial Photogrammetric Data	7/83	3/84
	Plan-Profile Sheets/Computer Input Data		
	Watana to Gold Creek	10/83	3/84
	Healy to Willow	6/85	1/86
	Ester to Healy	6/85	1/86
	Willow to University	6/85	1/86
	Tower Staking and Tower site and ROW		
	Clearing Surveys - Watana to Gold Creek	3/84	9/84
	Healy to Willow	3/86	9/86
	Ester to Healy	3/86	9/86
	Willow to University	3/86	9/86
	Submarine Cable Route & Contour Map	3/85	8/85
	Substation Property Surveys		
	Knik Arm Substation	3/83	9/83
	Willow Substation	3/84	9/84
	Gold Creek Substation	3/83	9/83
	University Substation	3/83	9/83
	Ester Substation	3/84	9/84
	Substation Topography Maps		
	Knik Arm Substation	6/87	9/87
	Willow Substation	6/87	9/87
	Gold Creek Substation	6/86	9/86
	University Substation	6/87	9/87
	Ester Substation	6/87	9/87
E3.4	Soil Tests Bid Package & Bid Award	4/83	8/83
	Tower Site Soil Tests		
	Watana to Gold Creek	6/84	9/84
	Healy to Willow	6/86	9/86
	Ester to Healy	6/86	9/86
	Willow to University	6/86	9/86
E3.5	RI Measurement Contract Bid Package	3/83	6/83
	Pre-energization RI & TVI Measurements Report	5/83	9/83
	Post-energization RI & TVI Measurements Report	6/93	9/93

TASK	DELIVERABLES	STARTING DATE	COMPLETION DATE
E3.6	Construction Engineering Support		
	Watana to Gold Creek	5/85	6/87
	Healy to Willow	6/89	9/91
	Ester to Healy	6/89	9/91
	Willow to University	6/89	9/91

E.4 Work Plan - Design Management and Schedule

a. Planning, Scheduling and Management of Design Activities

The Joint Venture participation in the Susitna Transmission Line Project will be developed through regulatory, environmental, and engineering phases that may be categorized generally as:

1 Line Routing and Station Siting
2 Licensing Permitting and Land Use Rights
3 System Studies
4 Design Services
5 Collateral Support
6 Construction Support

Regardless of the number of work tasks or the complexity of their interrelationships, all tasks of the Work Plan lend themselves to control by documents. Some of these documents serve to control technical quality of the work; some serve to control cost and schedule. Satisfactory control of all three factors: cost, quality, and schedule, provides maximum assurance of a successfully completed project. The Joint Venture will use several key documents in execution of the Transmission Line Project Work Plan. All have proven to be very effective in past project performance.

Specific key documents such as design memoranda, quality control and quality assurance memoranda, inspection report forms, test report forms, and other documents applicable to each phase of work will be prepared. In each of these categories, work is to be identified in detail prior to the execution of the work. In most instances, examples of similar work completed previously on other projects will be referenced and included so that maximum benefit of prior experience is gained.

A design memorandum will be prepared for each of the work efforts described in the task listings. The design memorandum will identify what work is to be done, what specific methods will be used (including

reference to applicable national and/or international standards), who will do the work (including any subcontract groups), where the activity will be conducted, when the activity will start and finish, how much is budgeted in the work, what interim and final products are expected, and how the products are to be used.

The design memorandum preparation will be ordered formally by the Transmission Line and Substation Manager from appropriate members of the Project Team (e.g., the Transmission Line Design Lead Engineer). The Lead Controls Engineer will then insert the approved work program into the overall Project Control System (EPICS), which is described in detail in Section 4.b of the proposal.

Each of the memoranda discussed above (e.g., design memoranda, procurement memoranda, etc.) will have a specific document as its result. These project documents will be combined and form a single document known as the Transmission Line Project Specification. Supplementing the memoranda forming the Project Specification will be procedures for documentation control and assignment of task responsibilities.

The procedures discussed above will be similar, if not the same procedures, to be prepared by the Joint Venture for the Susitna Hydroelectric Project. The tasks and task responsibilities would be unique to the Transmission Line Project, however, all other facets of the procedures would be consistent with the Hydroelectric Project procedures.

The formalized document control procedure developed and administered by the Hydroelectric Project Control Manager will be utilized on the Transmission Line Project and administered by the Lead Project Control Engineer. This will allow consistency among Project documents for both the Hydroelectric Project and the Transmission Line Project. The purpose of this procedure will be to delineate for all the technical products, the distribution to and designation of these parties having

responsibility for review and signoff of each document. It will be the Lead Controls Engineer's responsibility to ensure that the procedure is followed and that proper control of all reviews is performed.

The Project Specification will include a listing of the key project documents and the discipline or individual responsible for the item. This discipline/individual will be responsible for all technical and project related matters concerning the document. Generic documents prepared by the responsible discipline/individual will be passed on to the Lead Engineer for acceptance and to the Transmission Line and Substation Manager for Project approval. The Project Specification Document Control section will clearly delineate all Project Documents and the review cycle associated with each document. It will be the responsibility of the Lead Controls Engineer to insure that the Discipline Responsibility Listing is accurate and up-to-date. The Lead Controls Engineer will report status to the Project Manager on a frequent, informal basis as well as providing formal, regularly scheduled status reports to the Project Manager and the respective Lead Engineers. The Project Manager, through the Lead Controls Engineer, will ensure issuance of significant results to all affected units of the Project organization. The Lead Controls Engineer will maintain the master file of these and all project documents, including subcontracts and formal communication in significant matters.

The above routine of document flow and control will be practiced in general for all activities taking place throughout the period of development of the Transmission Line Project.

A summary listing of reports, design memoranda, drawings and other documents which are the "deliverables" of the Joint Venture work plan is presented in the section "Tasks."

Environmental and Regulatory Program work and Public Participation Program activity will be monitored and controlled in a fashion similar to that described above. The products of these portions of the Work Plan, while not comprised of design, manufacture, installation, and construction of Project components, are nevertheless tangible commodities against which a budget forecast can be made, progress monitoring can be exercised, and interrelationship control can be applied. These products will take the form of licensing and permitting milestones, newsletter reports, mitigation programs, milestone achievement meetings, and the like. The Lead Controls Engineer will include these functions within the EPICS-CPM for the overall work program.

Fundamental elements of the Joint Venture project control system include these items commonly found in general engineering practices:

- Timesheets, logged and checked by supervisors with entries coordinated to authorized sub-task nomenclature (digitized)
- Drafting Standards Manual
- Design Guide Manual
- Earned value records based on division of tasks into multiple weighted segments
- Progress reports of types suitable for general management overview, and other forms suitable for detailed section and squad-level analysis
- Standard details
- Standard procedures of checking drawings

b. Cost, Quality and Schedule Control

In order to manage the diverse elements of the Project, the Joint Venture will utilize a fully integrated cost and schedule system, EPICS, to coordinate engineering, design and related services in terms of costs and schedules, as well as control the capital cost of the Project. The system will consist of an integrated set of methods, techniques, procedures and tools for organizing, planning, monitoring, and controlling Project work and required resources.

Work Breakdown Structure (WBS) The Joint Venture will establish a "Description of Technical Services" which are to be provided on the Project. This description will serve as a baseline for any adjustment of the Scope of Services necessary as the Project progresses and will be used to define specific work elements and tasks which will be required to complete all technical work on the Project. The specific work elements will be reflected in a Project Work Breakdown Structure (WBS) that will correspond with and complement the WBS being developed for the Susitna Hydroelectric Project.

A WBS is a product-oriented family tree of work elements which organizes and defines the items of work associated with the Project and shows their relationships with the work elements (see sample WBS Exhibit 1). The WBS will divide the total Project into classes such as Project control services, licensing, engineering and design. Each of these major classes will then be divided into more detailed work elements and, if desired, into specific tasks until the lowest practical level is reached. The WBS therefore will define specific Project work categories and the corresponding tasks required to complete each category while comforming to the overall WBS for the Hydroelectric Project. It is at this task level that basic Project control takes place.

The WBS satisfies two of the basic needs of Project Management. It clearly defines the total scope of work, organizing it in a logical fashion to prevent tasks from being omitted or duplicated and provides a basis for cost and performance monitoring and control. After completion of the development of the WBS, the budgeted work hours for the Project will be allocated to all tasks in the Work Breakdown Structure. The budgeted work hours, therefore, will be assigned to unique activities in the schedule and will be used in resource planning.

Each task is assigned to a Project Team member who is directly responsible for its completion. Therefore, while Project Management personnel will use the WBS to assess the overall performance of the Project, individual Team Members will use it to isolate their own work elements and assess status and performance.

Scheduling System After identification of all of the Project work elements using the WBS and the Project Specification, the Joint Venture will develop a resource-loaded Project Schedule. This schedule will be specific for the Transmission Line Project, however, the flexibility of the EPICS system will allow this schedule to be incorporated into the overall Hydroelectric Project Schedule, should the Power Authority request this. The scheduling system which we will employ consists of three basic types of planning.

Time Planning. The Joint Venture will develop a time-phased Critical Path Method (CPM) schedule consisting of all of the Project work elements defined in the WBS. To develop the CPM, we will use network-based logic diagrams for each specific task. The logic diagram will reflect the specific activities required to complete a task and will also contain, where applicable, constraints on each activity which are caused by the activities of other tasks (e.g., vendor information requirements). The interrelationships between related activities in the Hydroelectric Project and the transmission line activities will also be considered and incorporated into an overall Project Schedule, if desired.

logic diagrams permit a direct correlation of the work elements and the overall WBS and, therefore, ensure that all Project work elements are included in the CPM. Based on the confines of the Project scope, the interdependencies of the Project activities, and the known key milestone dates, early start/late start and early finish/late finish boundaries for activities will be established. Consideration will be given to early and late dates for activities during the resource planning.

Resource Planning. In order to obtain a logical and smooth assignment of personnel to the Project and make the most effective use of the Project Team, the Joint Venture will carefully plan the allocation of manpower resources. In this planning, consideration will be given to the early start/late start and early finish/late finish dates identified during the time planning phase of CPM development. By making a correlation between the workdays required to complete each task (see WBS) and the early/late dates, resource envelopes (or pairs of S-shape curves) will be developed to review cumulative early start and late finish usage of resources.

Action Planning. The final step in development of the resource-loaded CPM involves a review of required manpower resources relative to their availability and most effective usage. This information is entered into a resource planning and scheduling program to test the possible allocation against each activity. The feasibility of staying within the early-late boundaries is examined by going back through the Resource Planning Program as often as necessary to achieve a satisfactory optimum. At this point the Budget Baseline or Resource-Constrained schedule is ready.

Dates established by the Baseline Schedule are then transferred to the Specification and Procurement Schedule and Drawing Schedule as target dates for completing Engineering and Design activities.

The logic diagrams permit a direct correlation of the work elements and the overall WBS and, therefore, ensure that all Project work elements are included in the CPM. Based on the confines of the Project scope, the interdependencies of the Project activities, and the known key milestone dates, early start/late start and early finish/late finish boundaries for activities will be established. Consideration will be given to early and late dates for activities during the resource planning.

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Dates established by the Baseline Schedule are then transferred to the Specification and Procurement Schedule and Drawing Schedule as target dates for completing Engineering and Design activities.

Engineering Progress Measurement System (EPMS) Completion of the resource-loaded CPM schedule will allow the objective measurement of cost and schedule through use of an Earned-Value System.

The system proposed is in no way different from that being developed for the Hydroelectric Project. Essentially, this Earned Value System measures the actual performance of the Project in cost and schedule relative to established budgets and schedules. It provides a numerical indication of this performance. The system contains several types of control. Two basic areas, however, cost and schedule control, are the primary considerations.

Cost Control. Assessment of cost performance relative to the Project Baseline is provided through identificaton of two numerical factors - the Budgeted Cost of Work Performed (BCWP) and the Actual Cost of Work Performed (ACWP). At any point in time when a specific task is in progress, it has achieved a certain level of physical completion, measured in work hours. The resource-loaded CPM schedule will identify the budget (in work hours) to complete that portion of the task actually accomplished. This is the BCWP. The ACWP is the actual number of work hours which were required to complete the same portion of the task. By comparing the BCWP to the ACWP for the task, it can be established whether the cost of the task is under budget, on target, or over budget. The ratio of ACWP to BCWP provides a Cost Performance Index (CPI) which is calculated for each individual task as well as for the total Project.

The following example shows how the system will be applied:

Example 1

Assume:

- o Task is preparation of engineering equipment specification.
- o Total task budget is 400 workhours.
- o CPM indicates that the first draft of the spec was to be issued during the month.
- o A budget of 240 workhours has been allocated to preparation of the first draft.
- o The first draft was issued during the month and a total of 210 workhours have been expended.

Therefore:

- o BCWP = 240
- o ACWP = 210
- o $CPI = \frac{BCWP}{ACWP} = \frac{240}{210} = 1.14$
- o Cost performance-to-date is 14% better than anticipated on the task.

Schedule Control. In a similar manner, a Schedule Performance Index (SPI) is calculated which identifies task or overall Project performance relative to the established baseline. The items which are compared are, once again, the BCWP and another factor, the Budgeted Cost of Work Scheduled (BCWS). The BCWS reflects the budget in work hours of the work which was scheduled to be completed during the specific time period under consideration. By comparing the BCWS to the BCWP, the SPI can be calculated. This numerical value will indicate whether the task or overall Project is ahead of schedule, on target, or behind schedule. Example 2 demonstrates the manner in which schedule control of tasks will operate.

Example 2

Assume:

- Same as Example 1

Therefore:

- BCWP = 240 (workhours budgeted for first draft)
- BCWS = 240 (because first draft was scheduled to be issued during the month)
- $SPI = \frac{BCWP}{ACWA} = \frac{240}{240} = 1.00$
- Task is on schedule.

Summary. By comparing the CPI (1.14) and the SPI (1.00) it is determined that the task is on schedule and under budget.

CPM Update. Each month, as part of the assessment of Engineering Performance, each Team Member and/or Task Leader responsible for a scheduled task (or series of tasks) updates his respective part of the Project schedule. The purpose of this update is to report actual activity durations or start/complete dates during the previous month and to forecast realistic activity durations or start/complete dates for future activities. The impact of this update is assessed by the Cost/Schedule Engineer in terms of the Project Baseline Schedule. Exhibit 2 is a sample Schedule Progress Report.

Use of the Earned Value System as a Management Tool Objective cost and schedule performance measurement can be used as an effective management tool to control the Project tasks. Variances or deviations identified by these indices are reported to the Project Manager in the form of a Variance Analysis Report. While variances are monitored at the task level of the Work Breakdown Structure (WBS) only significant variances at higher levels of the WBS are reported to the Project Manager.

Significance will be defined by establishing variance thresholds at the start of the Project for Cost, Schedule and Critical Path Activities. When a threshold is exceeded, a Variance Analysis Report (Exhibit 3) will be prepared. This analysis will include identification of the variance, definition of the problem or reason for the variance and a recommended plan for corrective action. These Variance Analysis Reports comprise an early warning system for the Project as they immediately identify trends which indicate potential problems areas requiring the Project Manager's attention.

Project Change Control Recognizing that potential changes to a Project can have a significant impact on services cost, capital cost and schedule, the Joint Venture will implement the same change control procedure on this Project as the one being developed for the Hydroelectric Project. This procedure requires that potential changes in the Project be identified to the Project Manager as soon as they are recognized and dictates that no work be performed on a change until an appropriate disposition has been made. Responsibility for identification and notification of potential changes rests with each Project team member and each changes is processed through use of a Project Change Request (Exhibit 4). The Project Change Request is immediately sent to the Project Manager for information and action, as well as to the Project's Cost and Schedule Team for impact evaluation. The evaluation includes such items as:

- Total cost of the change including services and capital cost
- Effect on the critical path or end date of the Project
- Effect on current schedule
- Effect on cash or staffing requirements for the Project.

Following receipt of this information by the Project Manager, a decision can be made which can take the following forms:

- o Proceeding or not proceeding with the change

- o Determining what corrective action is necessary and possible to bring the Project back in line with the schedule.

Potential changes and their associated impacts are summarized once each month in a Monthly Potential Cost/Schedule Report (Exhibit 5) which is accompanied by a brief narrative that provides salient explanations for cost variances.

Estimates of Overall Project Capital Cost During the course of the Project, the Joint Venture will prepare three formal estimates of overall Project cost in the Federal Energy Regulatory Commission (FERC) Code of Accounts. These estimates will increase in accuracy as the amount of detailed Project information available at the time of the estimate increases and, if so desired, can be included in the Hydroelectric Project estimate. The estimates which will be prepared are defined below.

Conceptual Cost Estimates. The Joint Venture recognizes that a significant amount of cost data has been prepared for this Project and will utilize this data as the basis for preparation of a conceptual estimate. The specific work involved will consist of refining the existing data to reflect the optimization of Project features that will occur during a review of the existing Project design. This estimate will include conceptual quantities of material and installation resources, engineering workhours, construction workhours and cost of these items together with a cash flow schedule by year. Variations between this estimate and the previous estimates will be explained in detail. This estimate will be performed at 0% engineering.

Preliminary Cost Estimates. At approximately 30 to 35% of engineering completion the Joint Venture will prepare a Preliminary Project Estimate which will replace the Conceptual Project Estimate as an assessment of overall Project cost. This estimate will

consider all cost data available to date and will include actual cost information received from vendors and project contractors as well as our estimate of the installed cost of our detailed design with a cash flow schedule by quarter. Any variances between this estimate and previous estimates will be explained in detail in the form of a variance analysis. A contingency analysis will be provided, indicating allowances by major account for protection against changes in costs that occur because of variances in quantities, design refinement, wages, labor productivities, pricing and escalation.

Definitive Project Estimates. When engineering is approximately 60% to 65% complete, the Joint Venture will prepare a Definitive Project Estimate. This estimate will replace the Preliminary Project Estimate and will reflect the current engineering, design and procurement costs, it provides a detailed estimate of the total installed cost of the Project, incorporating the Project Contractor's estimates. It will include a cash flow schedule by quarter. Any variances between the estimate and previous estimate will be explained in detail. The cost data will be accumulated by FERC accounts for each contract package and then compiled into a total cost estimate. The resulting products will consist of an Engineer's Estimate for each contract, as well as a total Project cost estimate.

A contingency analysis will be provided indicating allowances by major account for protection against changes in costs that occur because of variances in quantities, design refinement, wages, labor productivities, pricing and escalation. This analysis provides management with the following information:

- Maximum potential Project cost overrun and underrun, as well as the probabilities of various overruns and underruns between these extremes.

- Probability of overrunning the estimate

- o Level of confidence of the estimate
- o Ranking of the potential critical items

Furthermore, this analysis permits the selection of an appropriate contingency amount and brings the chance of overrunning the estimate to an acceptable risk level.

Engineers Estimates

Equipment or Materials Inquiries In order to establish a reasonable basis for comparison of Vendors equipment or materials quotations, the Joint Venture will prepare "fair value" estimates of the cost of the major equipment and materials specifications which are to be purchased for the Project. One estimate will be prepared for each bid Package and will be based on the same inquiry documents which are sent to prospective bidders. These estimates are not intended to identify the low quotation figure but rather to provide a reasonable assessment of cost.

Construction Packages In addition to the Engineer's Estimate for equipment or material which identifies costs for these items, the Joint Venture will prepare Engineer's Estimates for each of the proposed construction contracts.

These Engineer's Estimates will be based upon the same inquiry documents as will be sent to the prospective bidders. The format of the estimates will be identical to the bid format required of each bidder, in order to facilitate review of proposals. It will allow a direct comparison with any values generated by the contractors. Preparation of these estimates will include:

- o Quantity take-off from the contract/construction drawings
- o Collection of data by examination of the site and Project area and research of published data:

- Labor Rates
- Material Sources
- Access to Site
- Port facilities, roads, railroads
- Climatic Conditions
- Seasonal Conditions
- Geological Conditions

o Evaluation of construction method, plant and equipment

o Determination of production rates for labor, equipment and sequences of work

o Utilization of construction schedules

o Calculation of Contractor's direct costs

o Calculation of Contractor's indirect cost

o Determination of Contractor's profits and contingency allowances

o Unit cost potential

o Any other cost factors unique to the Project

By using the Engineer's Estimates during the bid evaluation process, we will be able to establish whether or not each contractor completely understands the scope of work in the package and whether or not the bid is comprehensive enough to support his fixed price. In this way we will be better able to determine the validity of the bids, minimize the unit price approach to the base bid and minimize potential changes.

All of the estimates described above, will be performed in a similar manner by the same individual assigned to the Susitna Hydroelectric Project. This affords not only the consistency between estimating

techniques and bases but will allow ease in rolling up the transmission line capital cost estimates to the hydroelectric project estimates in an expeditious manner when requested by the Power Authority.

Susitna Hydroelectric Project Construction Power Analysis

The Joint Venture has prepared an annual cost comparison of on-site diesel generation versus Intertie construction power for the Susitna Hydroelectric Project (Tables E4-1,2,3). Three alternate plans were developed to determine the feasibility of tapping the Anchorage-Fairbanks Intertie line for 138 kV construction power. These plans may be summarized as follows:

Plan A - In plan A, diesel generators are proposed for camp and construction power during the dam construction period (1985-1993). The construction power diesel generators are amortized at a contractor's normal cost of debt and depreciation rate. Fuel costs are based on truck delivery at Watana after completion of the access road.

Plan B - In plan B, the Watana to Gold Creek 345 kV transmission line construction is accelerated to have Intertie construction power available for the heavy tunnel work in 1987, thus eliminating the need for additional diesel generators. Since most of the 345 kV transmission system will be constructed during 1991 and 1992, speedup charges are assessed for five years of premature debt. Power costs are based on the current industrial end block rate at Fairbanks because there is reserve generation. After 1986, existing diesel generators are assumed to be on "standby" status.

Plan C - In plan C, a temporary wood pole 138 kV transmission line from Watana to Gold Creek is proposed as an alternate to accelerating the 345 kV line. This line would be built on the 345 kV line right-of-way, and would be removed after one circuit of the 345 kV line is finished in 1992. The removal costs are assumed to be equal to the material salvage value when the line is removed.

Plan B has the lowest annual cost. This plan shows that if the Watana to Gold Creek 345 kV transmission line is used for a source of temporary 138 kV construction power by tapping the Intertie line, the

annual costs will be 10-20 million dollars less than diesel generation (Item AB on Table 4-1). Therefore, the Join Venture proposes an accelerated design schedule for the Watana to Gold Creek line construction in order to have Intertie power avalable at Watana by 1987. This short design time is possible because Harza-Ebasco has a large engineering staff who are familiar with the job site and no interface is needed with another A/E.

The reasons for the large annual cost difference between on-site diesel generation and intertie construction power are as follows:

1. Contractor Investment Costs The Watana contractor will depreciate all diesel generators which he has to furnish in a very short period, generally about 5 years with 45% in the first year. Furthermore, his cost of debt will be 13-15% and the diesel engines must be continuously maintained and overhauled every 8,000 hours. Consequently, the direct costs of contractor furnished diesel generation should be much higher than would be expected for a similar utility power plant which has a longer service lifetime.

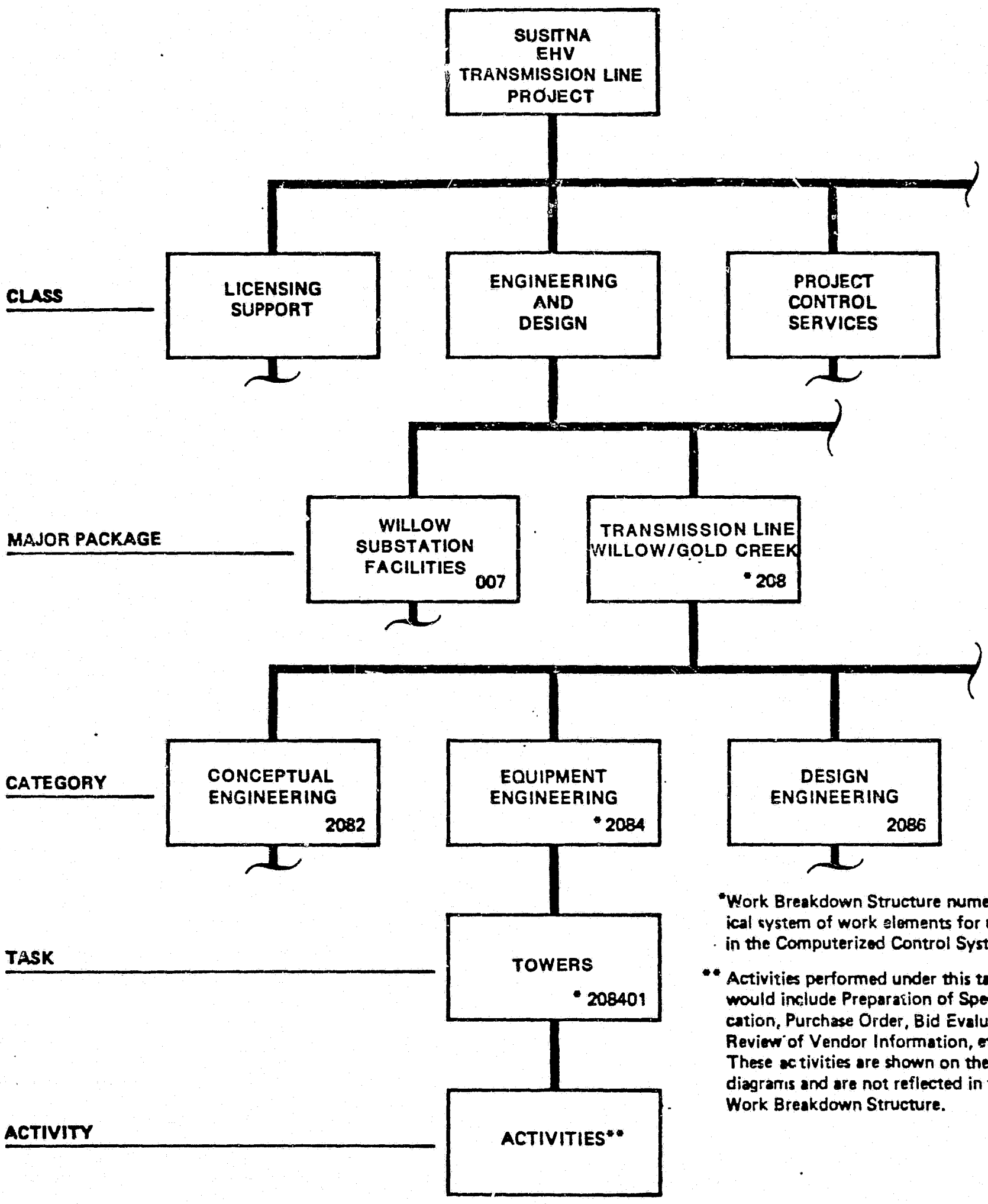
2. Intertie Connection A temporary connection to the Intertie line at Gold Creek should be easy to make with a minimum cost. This tap should not be detrimental to the reliability of the Intertie if a 138 kV power circuit breaker is installed. The voltage regulation should be within workable limits, depending on the results of a power flow study. The PCB can be installed adjacent to the Intertie line and a "shoefly" made to connect the tap. Then Gold Creek Substation can be built at a later date and the PCB moved to a different location.

3. Intertie Power Cost The Intertie power cost should be cheaper than the variable costs of preparation, maintenance and fuel for on-site diesel generation which is estimated at 150 miles per KWH, assuming that about 20 megawatts of power is available at Anchorage or Fairbanks. The current industrial rate for power is about 30 mils per KWH at Anchorage and 75 mils per KWH at Fairbanks. Since Golden Valley

Electric Association at Fairbanks has reserve generation capacity, their industrial rate of 75 mils per KWH was used in the economic analysis, but other rates may be used with similar results. The line losses are insignificant with 2/954 KCmil conductor.

The Joint Venture concludes that it will be worthwhile for the Power Authority to secure a block of power at Anchorage or Fairbanks and to build the Watana to Gold Creek transmission line on an accelerated schedule. Furthermore, the Joint Venture should have the best chance to get the line design done and assist the contractor within the limited time frame.

Exhibit 1



*Work Breakdown Structure numerical system of work elements for use in the Computerized Control System.

** Activities performed under this task would include Preparation of Specification, Purchase Order, Bid Evaluation, Review of Vendor Information, etc.. These activities are shown on the logic diagrams and are not reflected in the Work Breakdown Structure.

HARZA-EBASCO

SAMPLE ENGINEERING
WORK BREAKDOWN
STRUCTURE

SCHEDULE PROGRESS REPORT

PROJECT NAME: ••••••••••••••••••PROJECT X•••••••••••••••••• MASTER FILE: (PLAN)SITEW/MST1300637, STATUS DATE: 01MAY80 PAGE 171

EBASCO SERVICES 87730 CPM RUN TUESDAY 05/13/80, TIME IS 01:19:21 PM.

SORTED BY: PREDECESSOR / SUCCESSOR — BARCHART SCALE = 8 SYMBOLS PER MONTH; BARCHART START = 01MAR80; STATUS DATE MARKER (A) = 01MAY80; STATUS PERIOD END (1) = 01JUN80

REPORTING PROGRAM: (ECPM)P/ARCPMREPORT, VERSION = 01P

CURRENT = X (STATUS DATE: 01MAY80) (PLAN)SITEW/MST1300637,
CURRENT (ACTUAL = A, CRITICAL = C)

PREVIOUS = P (STATUS DATE: 01APR80) (PLAN)SITEW/MST0990686,

TARGET = T (STATUS DATE: 01JAN80) (PLAN)SITEW/MST0390907,

1980 — M A M J J A — A P A U U U — R Y N L G

PRED EVENT	SUCC EVENT	ACTIVITY DESCRIPTION	EARLY START	REQ (D)	EARLY FINISH
15240521	15240523	RECEIVE PROPOSAL=MOTOR CONTROL CENTERS	9ND		
15240523	15240525	BID EVAL & RECMD=MOTOR CONTROL CENTERS	NEF		
15240525	15240527	CLI PURCH AUTH =MOTOR CONTROL CENTERS	TNU		
15240527	15240528	PREP PURCH REQ =MOTOR CONTROL CENTERS	8N		04SEP80
15240527	15240529	PREP PURCH SPEC =MOTOR CONTROL CENTERS	8N		13SEP80
15240529	15240531	ISSUE P.O. =MOTOR CONTROL CENTERS	8NY		09SEP80
15240729	15240731	ISSUE P.O. =480 VOLT POWER CENTERS	TNY		11SEP81
			A03JAN80		
			A03JAN80		
15240731	15240732	VDR SUB,REVWSRFP=480 VOLT POWER CENTE	22JAN80	8NX	
		VDR SUBMIT DWGS =480 VOLT POWER CENTERS		8NW	
15240732	15240732	0=VDR SUB,REVWSRFP=480 VOLT POWER CENTERS			
		REVWSREL FOR FAB=480 VOLT POWER CENTERS	8NX		
15240752	15240753	FAB & DELIVER =480 VOLT POWER CENTERS	8NY		21OCT80
					08JAN81
					29JAN81
15240931	15240933	VDR SUBMIT DWGS = TAND-BY POWER TRANS	08JAN80	8NW	
		VDR SUBMIT DWGS =STAND-BY POWER TRANSA	24JAN80		
			A24JAN80		

Exhibit 2

COST PROPOSAL

HARZA-EBASCO

VARIANCE ANALYSIS REPORT

SHEET _____ OF _____

WBS NO. _____ FILE NO. _____

WBS TITLE _____ DATE ____/____/____

VARIANCE TYPE: ☐ COST ☐ SCHEDULE

CAUSE OF VARIANCE (Explanation of the problems separately for Cost and Schedule)
POTENTIAL IMPACT (On project, other tasks and this task; new Estimate at Completion (EAC) if required)
CORRECTIVE ACTION (If required)
STATUS OF PREVIOUS CORRECTIVE ACTION

	CURRENT MONTH	CUM TO DATE	AT COMPLETION		EXCEEDS THRESHOLD	ACTION REQUIRED BY: (Responsible Individual(s)/ Organization)
BCWS			*	CUMULATIVE SCHEDULE VARIANCE BCWP-BCWS	MH _____ ☐	☐ CLIENT _____
BCWP				CUMULATIVE COST VARIANCE BCWP-ACTUALS	MH _____ ☐	☐ PROJECT MGMT _____
ACTUAL COST			†	AT COMPLETION COST VARIANCE BAC-EAC	MH _____ ☐	☐ OTHERS _____

SUBMITTED BY			APPROVED BY		
SIGNATURE	DATE	PRINT NAME & TITLE	SIGNATURE	DATE	PRINT NAME & TITLE

LEGEND: † Estimate at completion * Total Budget

Exhibit 3

EBASCO SERVICES INCORPORATED
PROJECT CHANGE REQUEST

CHANGE ORDER NO.			
WBS NO.	Change is Considered to be: In-Scope ☐ Out-of-Scope ☐ Performance ☐		
CHARGE NO.			

IMPACTS OTHER PARTICIPANTS NO ☐ YES ☐ LIST:

DESCRIPTION OF CHANGE COST ☐ SCHEDULE ☐ SERVICES ☐

REASON FOR CHANGE

IMPACT ON BUDGET (Include present budget, change, and new total – by participant)

IMPACT ON SCHEDULE

ATTACHMENTS AS REQUIRED

☐ REVISED CPM ☐ MANPOWER SPREAD EPMS & CPMS FORMS ☐ REVISED SCOPE OF WORK OR REVISED TASK DESCRIPTION

APPROVALS	DATE	APPROVALS	DATE
TASK LEADER		COST/SCHEDULE CONTROL ENGINEER	
DISCIPLINE SUPERVISOR		CLIENT APPROVAL ☐ HAS BEEN RECEIVED FROM _____	
PROJECT ENGINEER		☐ HAS NOT BEEN RECEIVED	
EBASCO PROJECT MANAGER		EPMS & CPMS INPUT-COMPLETED DATE	/ /

PREPARED BY

DISTRIBUTION

	CLIENT	E
PROJECT MANAGER	☐	☐
PROJECT ENGINEER	☐	☐
TASK LEADER	–	☐
COST/SCHEDULE CONTROL	☐	☐
SERVICES COST ENGINEER	☐	☐

DISPOSITION

☐ FORECAST APPROVED - BUDGET APPROVED - PROCEED WITH WORK

☐ FORECAST APPVD - BUDGET NOT APPVD - PROCEED WITH WORK

☐ FORECAST NOT APPROVED - DO NOT PROCEED WITH WORK

HARZA-EBASCO

EBASCO SERVICES INCORPORATED

POTENTIAL PROJECT COST/SCHEDULE SUMMARY REPORT

(ALL AMOUNTS IN $1000)

DATE OF ISSUE: MAY 1980

CLIENT: ABC LIGHTING & POWER COMPANY

PREPARED BY: J D

PROJECT: TYPICAL POWER PLANT

APPROVED BY: R L Y

EST. NO. ABC 1234 D-1 DATE June 1, 1979 ADJ. FOR APPROVED SCOPE Δ'S	PROBABLE COST FORECAST DATE March 1980	POTENTIAL COST CHANGE *		TOTAL POTENTIAL PROJECT COST
		THIS PERIOD	TO DATE	
$ 750 000	$ 760 000	$ 6000	$ (1000)	$ 759 000

REMARKS:

	SCHEDULED	ACTUAL
% COMPLETE: ENGINEERING	80.0 %	82.0
CONSTRUCTION	25.0 %	23.0
BOOKED		$ 150 000
COMMITTED, NOT BOOKED		$ 20 000

The following is a list of potential variances which may significantly impact the Project Cost, but have not yet been included in the Total Potential Project Cost.

1) Potential increase to material and installation costs resulting from escalation exceeding the 8%-per-year currently estimated — $ 20 000

2) Potential increase in installation cost resulting from poorer performance in structural steel erection than estimated — $ 2 000

3) Possible delay of one (1) month in Trial Operation due to Boiler-maker strike — $ 4 000

EXPLANATION OF POTENTIAL COST CHANGES:

1) Increase in estimated quantity of power and control cable — $ 1 000

2) Cost savings resulting from Ebasco performing electrical work on a Force Account basis — ($ 5 000)

3) Increase in allowance for funds during construction from 8%/year to 9%/year — $10 000

*Potential cost changes are defined as significant changes recognized during the current reporting period. Those estimated on an order-of-magnitude basis will be re-evaluated when more definitive information is available.

Exhibit 5

COST PROPOSAL

Task Number: E4.1
Task: Project Management

SUBTASKS

Project Management Subtasks

Review Proposed work plan with Power Authority
Assemble project team leaders for review of previous studies and to establish project conceptual design
Establish manpower budgets for all tasks and their subtasks
Develop detailed work plan task schedule
Direct and control the staffing of Bellevue office
Maintain liaison with Power Authority and its external review panel
Plan, support and participate in Power Authority's public information meetings
Support Power Authority in coordination and responses to regulatory agencies
Monitor work plan cost and schedule performance and take corrective action as required to maintain goals
Control technical disciplines in the project design work
Submit progress reports to Power Authority
Schedule internal review board participation in the project design work
Coordinate construction manager interaction with design work

Task Number: E4.1
Task: Project Management

OUTPUT

Project Work Plan and Schedule

Monthly progress reports showing design work completed, work in progress and fiscal status of the JV contracted work

Agenda for and reports on decision made at conferences and meetings

Project cost estimates and updated estimates

Coordinated contract documents for the equipment supply and construction contracts of the project

Contract awards in accordance with APA directives and procedures

Coordination of home office support and field support to APA's construction manager

Task Number: E4.2
Task: Project Support Services

SUBTASKS

Project Management Subtasks

Coordinate and collect monthly progress reports information from engineering operations, project control and environmental and regulatory programs

Direct preparation of monthly JV progress reports

Support Services Subtasks

Implement "EPICS system" to control work

Finalize tasks with subtask lists and establish "description of technical service"

Develop project work breakdown schedule and CPM

Using updated monthly task progress reports, generate monthly project progress report

Generate monthly variance analysis report

Generate "budget baseline project estimate"

Generate study estimates as required

Generate monthly potential cost/schedule report

Generate engineers estimates for each construction contract

Generate "preliminary project estimate"

Generate "definitive project estimate"

Develop standard contitions of contract - Revise them on subsequent contract to fit the contract

Prepare drafts and final contract documents for issue to bidder

Prepare notice to bidders for Power Authority approval issue addenda to contract documents to bidder as required

Participate in evaluation of contractual terms of bids

Prepare and update project construction schedule

Coordinate with vendor and participate in vendor QA inspections

Task Number: E4.2
Task: Project Support Services

SUBTASKS

Project Management Subtasks

Coordinate and collect monthly progress reports information from engineering operations, project control and environmental and regulatory programs

Direct preparation of monthly JV progress reports

Support Services Subtasks

Implement "EPICS system" to control work

Finalize tasks with subtask lists and establish "description of technical service"

Develop project work breakdown schedule and CPM

Using updated monthly task progress reports, generate monthly project progress report

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Participate in evaluation of contractual terms of bids

Prepare and update project construction schedule

Coordinate with vendor and participate in vendor QA inspections

Task Number: E4.2
Task: Project Support Services

OUTPUT

Support Services Output

"EPICS" control system applied to JV work program

Description of technical services for the JV work

Project CPM

Monthly progress reports for Power Authority submitted to Project Manager for

- Baseline project estimate
- Study estimates
- Engineers estimates
- Preliminary project estimates

Definitive project estimate

Standard conditions of contract

Contract ocuents, prepared, assembled and issued

Notices to bidders

Addenda to contract documents issued to bidder

Project construction schedule and updates

Vendor QA inspections

COST PROPOSAL

DESIGN SCHEDULE

HARZA-EBASCO

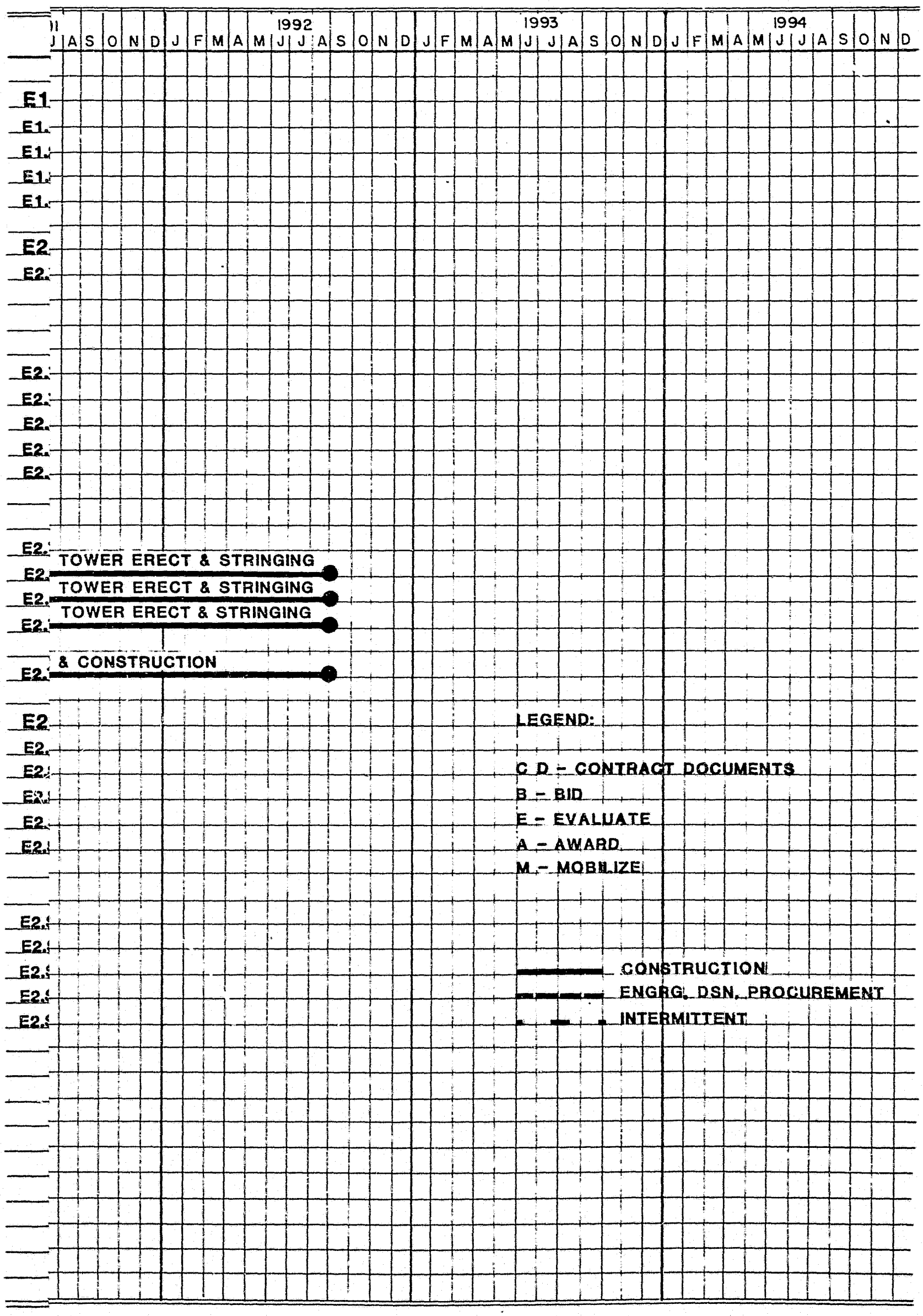
Design Schedule A bar chart is presented in this section and it indicates calendar time and the sequence in which the various work tasks will be carried out. This schedule has been prepared taking into account several dates and activities required by the schedule of the hydroelectric project.

The schedule assumes that the necessary FERC license will be obtained by January 1985. The schedule also provides for the construction of the Watana to Gold Creek line section by 1987. This is proposed to provide construction power at the site in conjunction with major tunneling and rock excavation work. Using the transmission line for construction power is based on the assumption that generating capacity is available from Fairbanks and Anchorage utilities. Although there will be local diesels at the site, there are economic and practical reasons for the use of the line as a construction power supply. The main reasons are:

1. Reduced investment in construction diesel generator capacity
2. Minimize logistics of transporting diesel fuel
3. Reduce energy cost for construction power
4. Diversity of power supply

A detailed analysis of the advantages for early construction of the Watana-Gold Creek section is included in this section of the proposal following the design schedule figures.

As noted in the RFP letter, the Power Authority has indicated that it has budgeted $500,000 for the transmission and control system project up to the end of June 1983. The work identified in the design schedule should not exceed the budgeted amount within the first six months of the project.


J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1992
1993
1994
E1
E1.
E1.
E1.
E1.
E2
E2.
E2.
E2.
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E2.
E2.
E2.
E2.
E2.
E2.
TOWER ERECT & STRINGING
TOWER ERECT & STRINGING
TOWER ERECT & STRINGING
& CONSTRUCTION
E2
E2.
E2.
E2.
E2.
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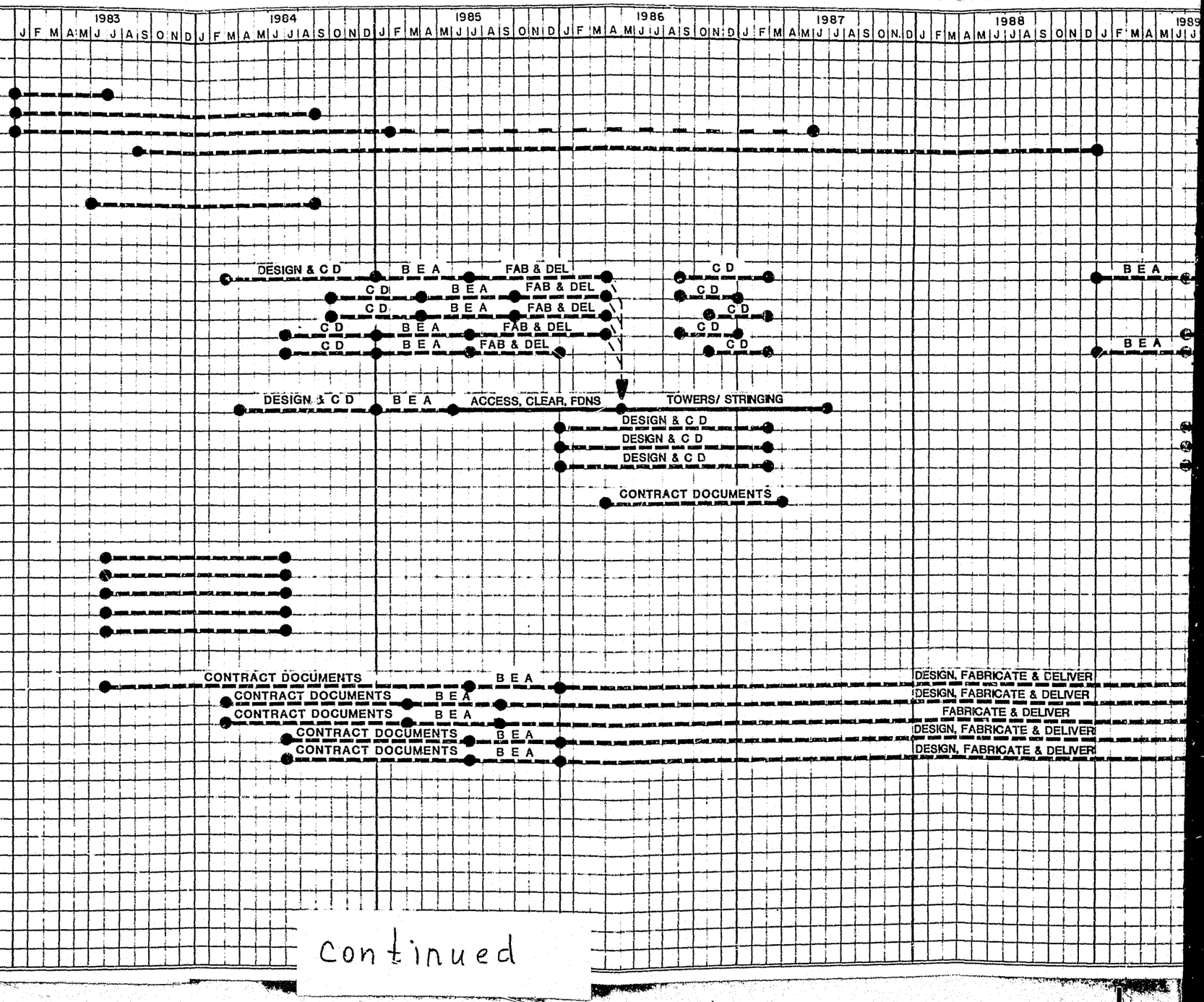
E2.
E2.
E2.
E2.
E2.
LEGEND:
C D - CONTRACT DOCUMENTS
B - BID
E - EVALUATE
A - AWARD
M - MOBILIZE
CONSTRUCTION
ENGRG, DSN, PROCUREMENT
INTERMITTENT

PROJECT SCHEDULE
ALASKA POWER AUTHORITY
SUSITNA HYDROELECTRIC PROJECT
TRANSMISSION LINES AND SUBSTATIONS



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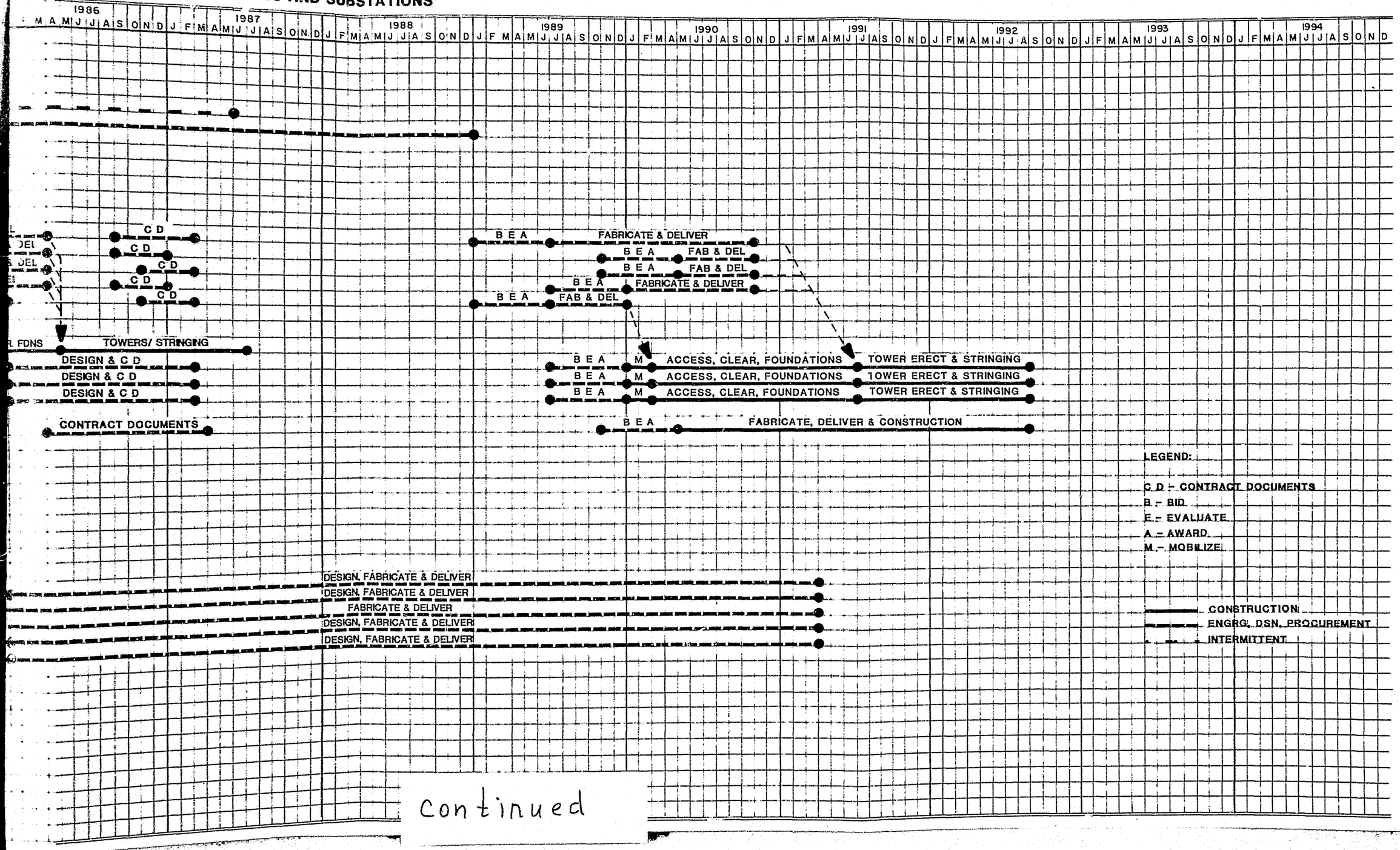
12

11

PROJECT SCHEDULE
ALASKA POWER AUTHORITY
SUSITNA HYDROELECTRIC PROJECT
TRANSMISSION LINES AND SUBSTATIONS



LEGEND:

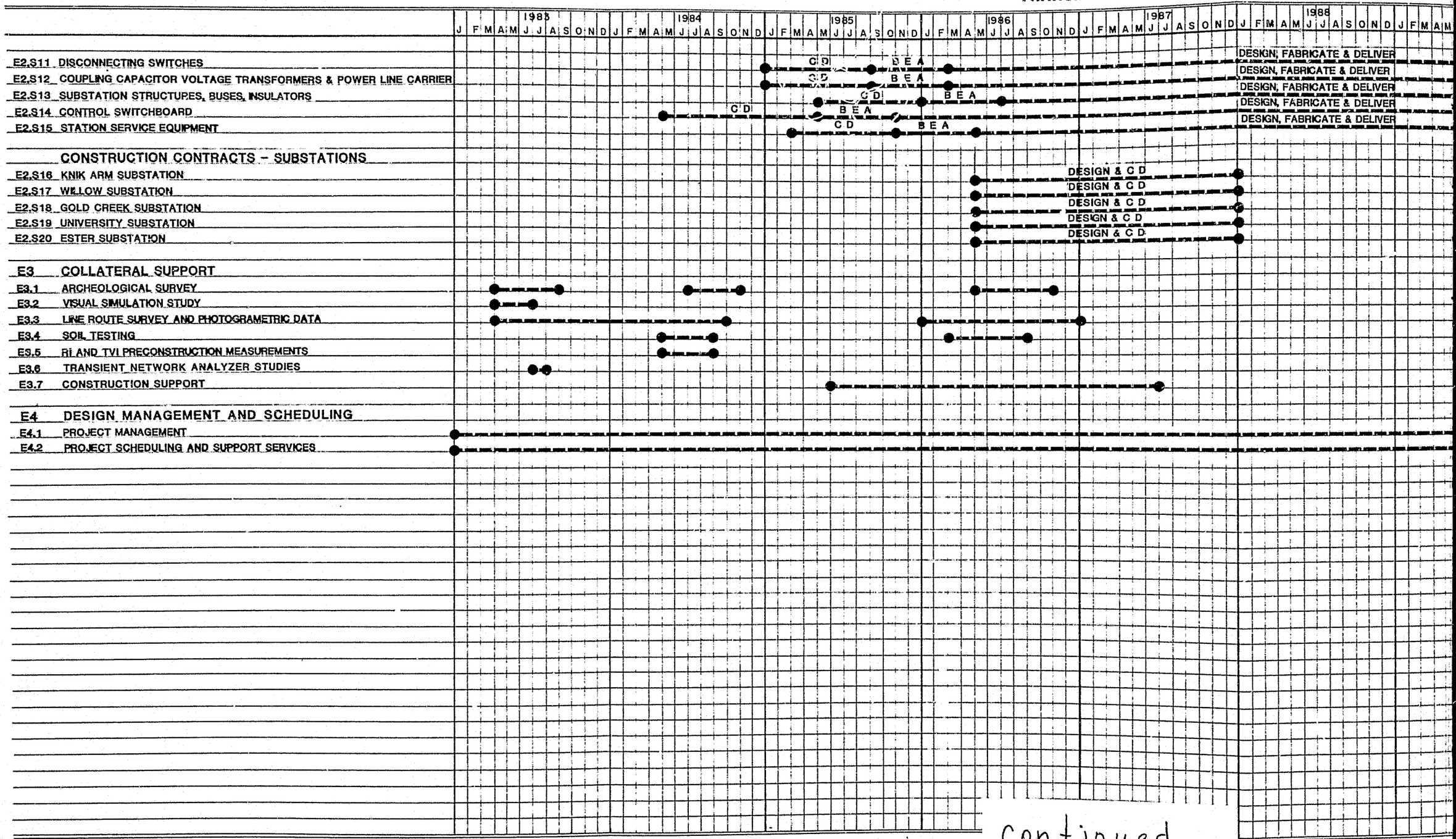
C.D. - CONTRACT DOCUMENTS
B. - BID
E. - EVALUATE
A. - AWARD
M. - MOBILIZE

——— CONSTRUCTION
——— ENGRG. DSN. PROCUREMENT
- - - - INTERMITTENT

continued

FOLD LENGTH
12
11
8.5
8
AUTO
MANUA
FEED

PROJECT SCHEDULE
ALASKA POWER AUTHORITY
SUSITNA HYDROELECTRIC PROJECT
TRANSMISSION LINES AND SUBSTATIONS



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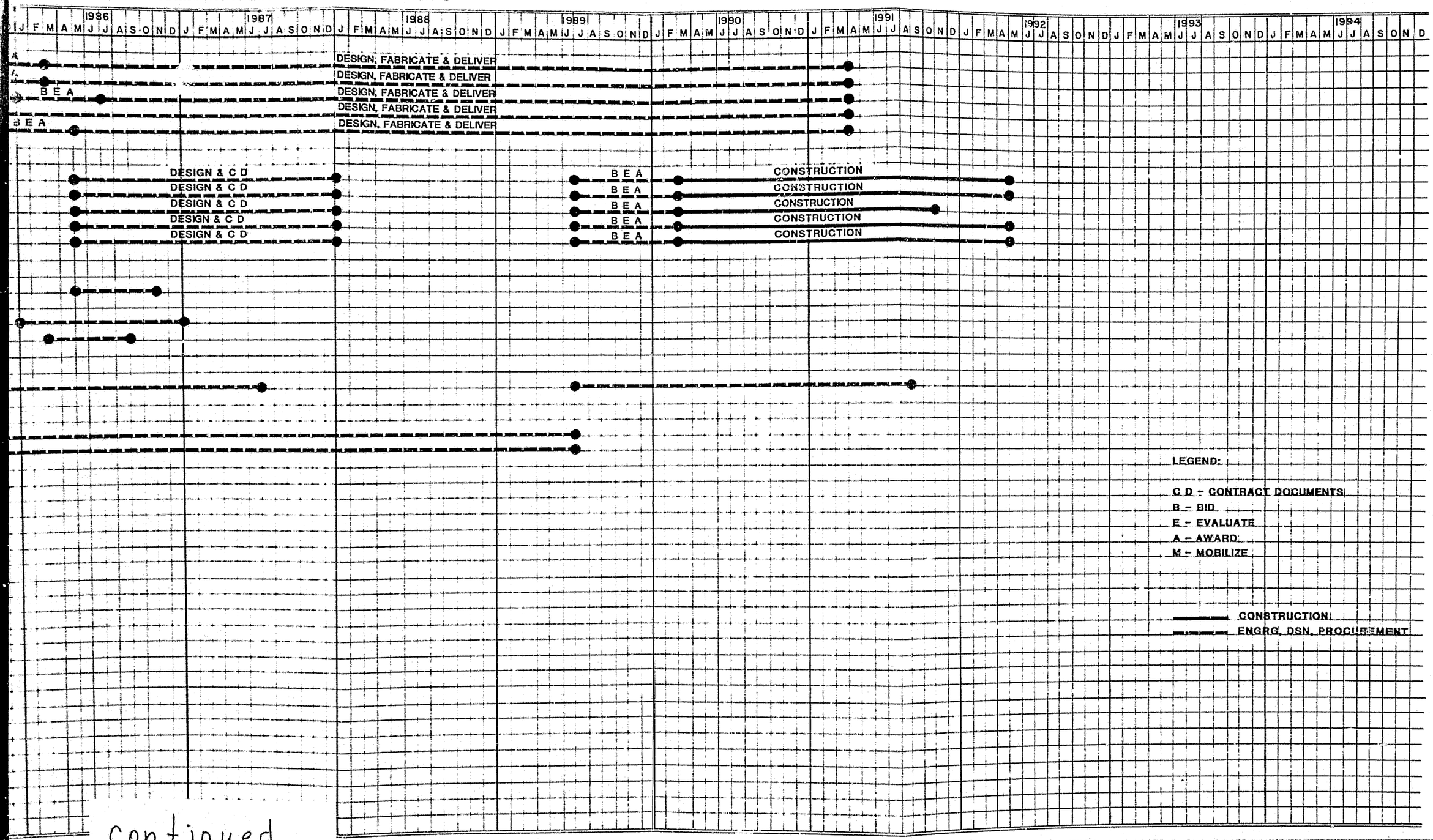
PROJECT SCHEDULE
ALASKA POWER AUTHORITY
SUSITNA HYDROELECTRIC PROJECT
TRANSMISSION LINES AND SUBSTATIONS



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FOLD
LENGT
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8
AUTO
MANUA
FEED

Alternative Design and Construction Schedule

The proposed design schedule is based on achieving the inservice dates given in the RFP letter, and the dates given in the Acres feasibility study. The resulting schedule has some apparent disadvantages.

The use of engineering effort is fragmented because of a gap with no effort between design-related activities and construction activities.

Another possible problem is with regard to the demand for construction labor. This is brought about by the fact that all transmission line sections and substations would be underway in parallel. If local Alaska labor supply is insufficient to meet the demand required by the construction of all line sections and substations, then out-of-state labor will be required. This will result in increased labor costs, and increased cost to the state after the work is completed and out-of-state laborers apply for unemployment benefits.

We understand that consideration is being given to a construction schedule for the dam and power generation facilities that would have the first generating unit on line by 1991.

If the earlier target date is to be achieved, then construction of the lines and substations can be advanced in time.

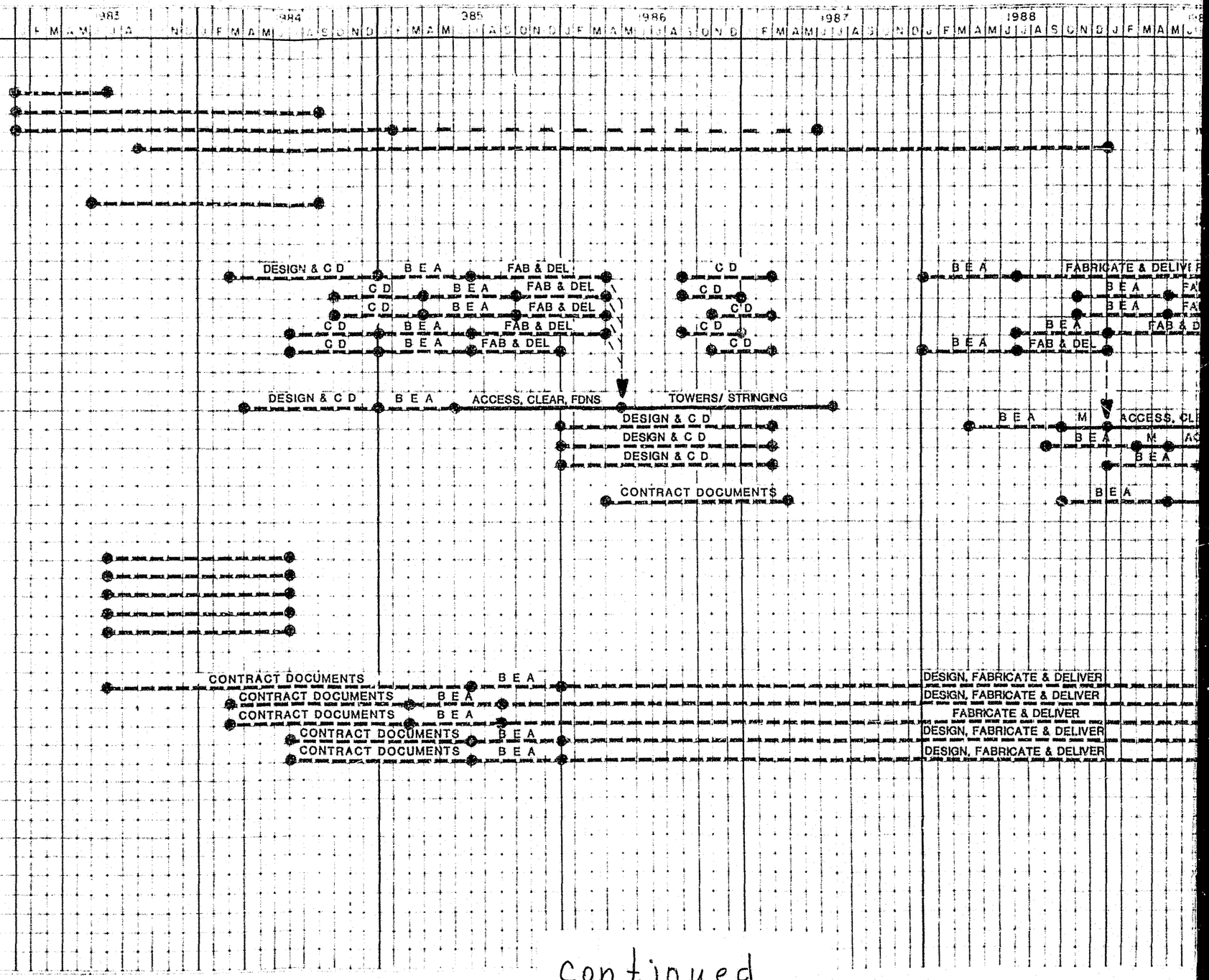
The construction schedule could be staggered to spread the construction of the lines and substations over the period 1986-1991. This would allow a more uniform level of employment for resident Alaska construction labor.

There may also be an advantage to the operation of the electric utilities of Anchorage or Fairbanks if the output from the first unit at Watana was available at an earlier date.

It should also be noted that the proposed and alternative design schedules accomplish the engineering and contract document preparation at an early time. The result is that there is a long time before material is actually needed by construction. From the point of view of the market variations in cost of raw materials, the Power Authority may be able to realize a significant cost savings if the purchase of certain materials is scheduled to match market variations. Two items needed for the transmission lines that fall into this category are: tower steel and aluminum conductor. In the category of substation equipment, the transformers and shunt reactors are candidates for consideration.

To account for these possibilities we have reviewed the work plan and prepared an alternative design schedule that shows the staged bidding and construction of lines and substations.

PROJECT SCHEDULE
ALASKA POWER AUTHORITY
SUSITNA HYDROELECTRIC PROJECT
TRANSMISSION LINES AND SUBSTATIONS



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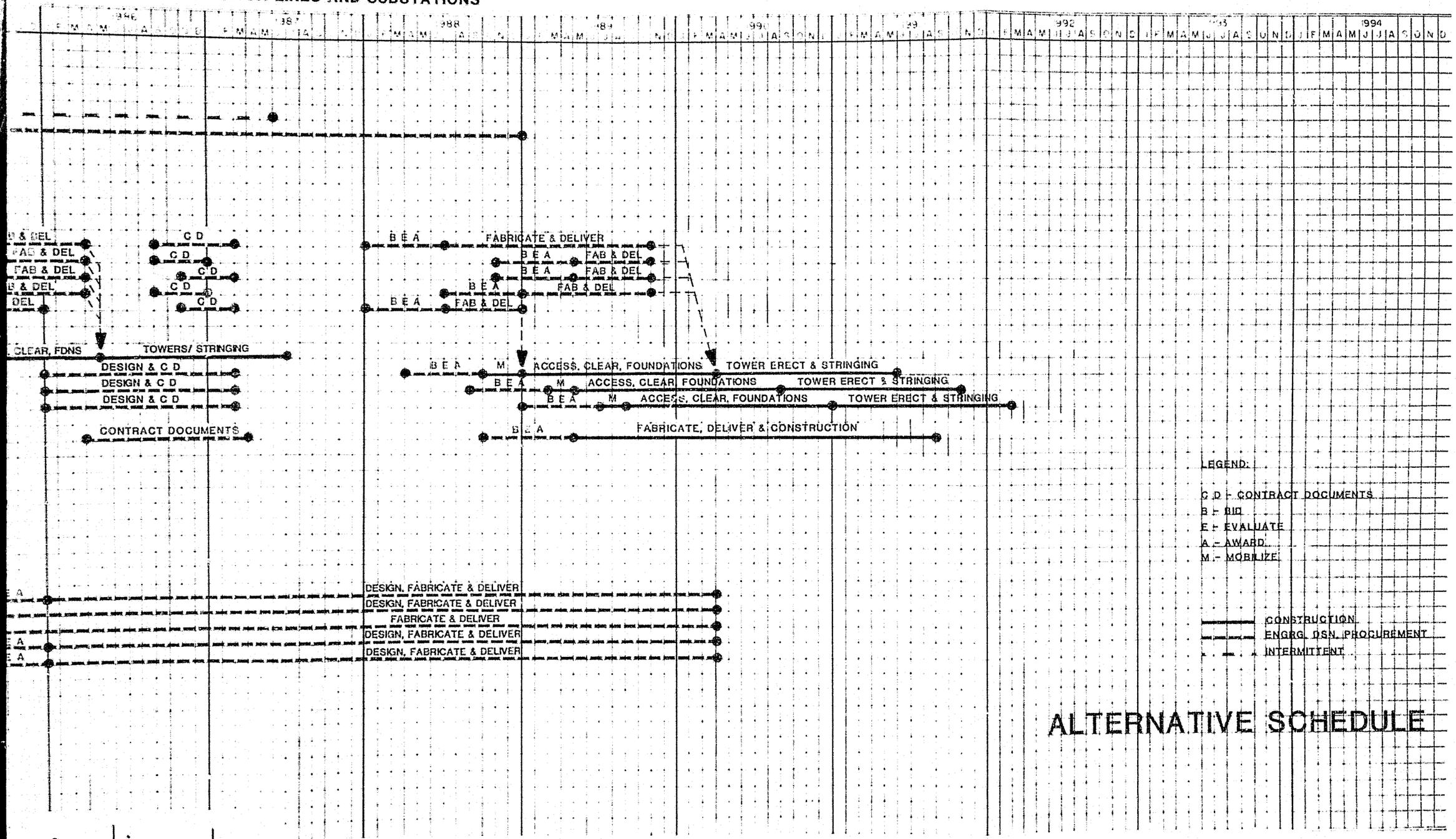
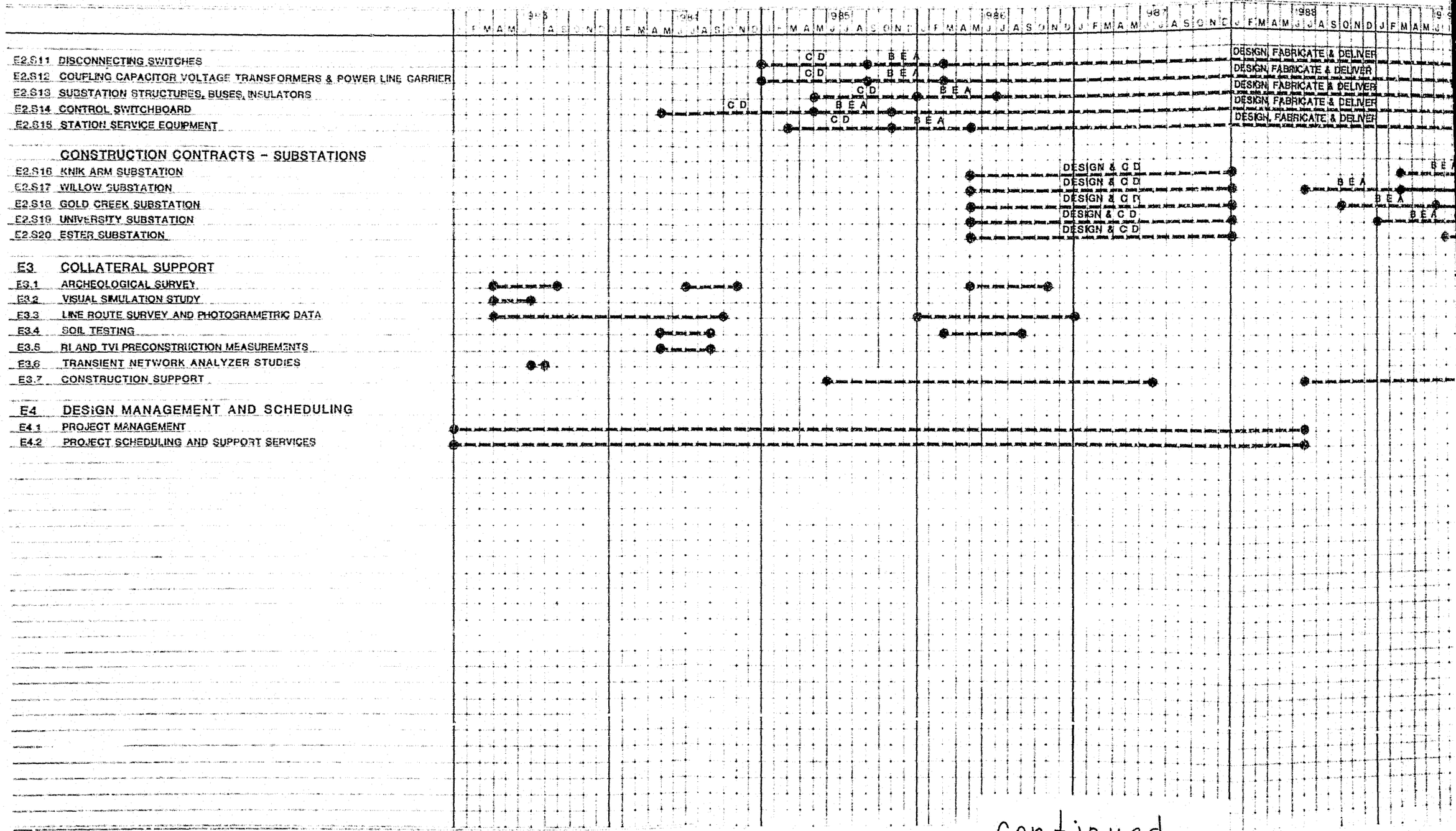
PROJECT SCHEDULE
ALASKA POWER AUTHORITY
SUSITNA HYDROELECTRIC PROJECT
TRANSMISSION LINES AND SUBSTATIONS



ALTERNATIVE SCHEDULE

continued

PROJECT SCHEDULE
ALASKA POWER AUTHORITY
SUSITNA HYDROELECTRIC PROJECT
TRANSMISSION LINES AND SUBSTATIONS



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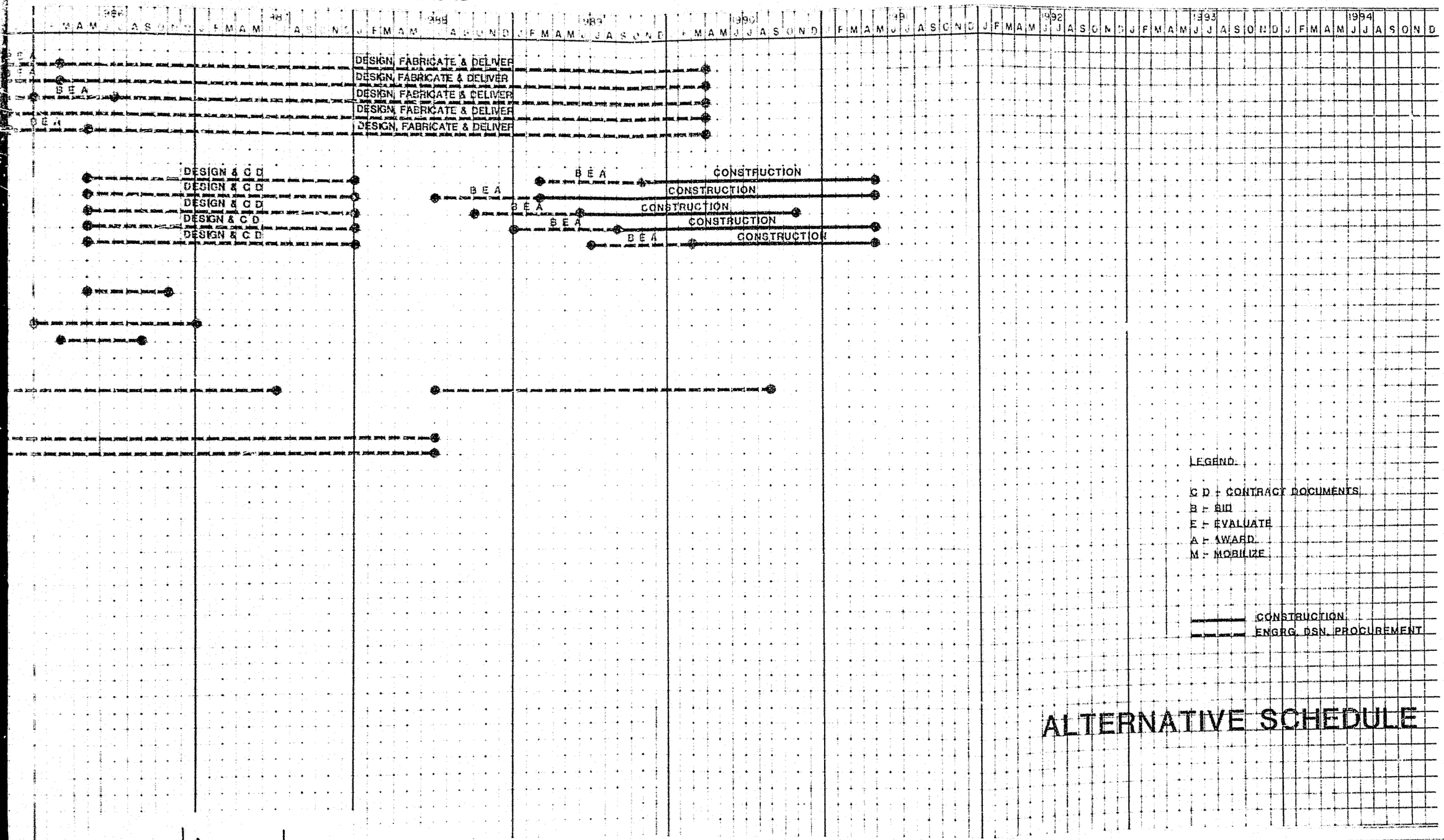
PROJECT SCHEDULE
ALASKA POWER AUTHORITY
SUSITNA HYDROELECTRIC PROJECT
TRANSMISSION LINES AND SUBSTATIONS



ALTERNATIVE SCHEDULE

continued

Susitna Hydroelectric Project Construction Power Analysis

The Joint Venture has prepared an annual cost comparison of on-site diesel generation versus Intertie construction power for the Susitna Hydroelectric Project (Tables E4-1,2,3). Three alternate plans were developed to determine the feasibility of tapping the Anchorage-Fairbanks Intertie line for 138 kV construction power. These plans may be summarized as follows:

Plan A - In plan A, diesel generators are proposed for camp and construction power during the dam construction period (1985-1993). The construction power diesel generators are amortized at a contractor's normal cost of debt and depreciation rate. Fuel costs are based on truck delivery at Watana after completion of the access road.

Plan B - In plan B, the Watana to Gold Creek 345 kV transmission line construction is accelerated to have Intertie construction power available for the heavy tunnel work in 1987, thus eliminating the need for additional diesel generators. Since the 345 kV transmission system is not needed until 1992, speedup charges are assessed for five years of premature debt. Power costs are based on the current industrial end block rate at Fairbanks because Golden Valley Electric Association has 212 MW of installed generation capacity and a peak load of 35 MW - summer, 70 MW - winter. After 1986, existing diesel generators are assumed to be on "standby" status.

Plan C - In plan C, a temporary wood pole 138 kV transmission line from Watana to Gold Creek is proposed as an alternate to accelerating the 345 kV line. This line would be built on the 345 kV line right-of-way, and would be removed after one circuit of the 345 kV line is finished in 1991. The removal costs are assumed to be equal to the material salvage value when the line is removed.

Plan B has the lowest annual cost. This plan shows that if the Watana to Gold Creek 345 kV transmission line is used for a source of temporary 138 kV construction power by tapping the Intertie line, the

annual costs will be 10-20 million dollars less than diesel generation (Item AB on Table 4-1). Therefore, the Join Venture proposes an accelerated design schedule for the Watana to Gold Creek line construction in order to have Intertie power avalable at Watana by 1987. This short design time is possible because the Joint Venture has a large engineering staff who are familiar with the job site and no interface is needed with another A/E.

The reasons for the large annual cost difference between on-site diesel generation and intertie construction power are as follows:

1. Contractor Investment Costs The Watana contractors will depreciate all diesel generators which they have to furnish in a very short period, generally about 5 years with 45% in the first year. Furthermore, their cost of debt will be 13-15% and the diesel engines must be continuously maintained and overhauled every 8,000 hours. Consequently, the direct costs of contractor furnished diesel generation should be much higher than would be expected for a similar utility power plant which has a longer service lifetime.

2. Intertie Connection A temporary connection to the Intertie line at Gold Creek should be easy to make with a minimum cost. This tap should not be detrimental to the reliability of the Intertie if a 138 kV power circuit breaker is installed. The voltage regulation should be within workable limits, depending on the results of a power flow study. The PCB can be installed adjacent to the Intertie line and a "shoefly" made to connect the tap. Then Gold Creek Substation can be built at a later date and the PCB moved to a different location.

3. Intertie Power Cost The Intertie power cost should be cheaper than the variable costs of operation, maintenance and fuel for on-site diesel generation which is estimated at 150 mils per KWH, assuming that about 20 megawatts of power is available at Anchorage or Fairbanks. The current industrial rate for power is about 30 mils per KWH at Anchorage and 75 mils per KWH at Fairbanks. Since Golden Valley

annual costs will be 10-20 million dollars less than diesel generation (Item AB on Table 4-1). Therefore, the Join Venture proposes an accelerated design schedule for the Watana to Gold Creek line construction in order to have Intertie power avalable at Watana by 1987. This short design time is possible because the Joint Venture has a large engineering staff who are familiar with the job site and no interface is needed with another A/E.

The reasons for the large annual cost difference between on-site diesel generation and intertie construction power are as follows:

1. Contractor Investment Costs The Watana contractors will depreciate all diesel generators which they have to furnish in a very short period, generally about 5 years with 45% in the first year. Furthermore, their cost of debt will be 13-15% and the diesel engines must be continuously maintained and overhauled every 8,000 hours. Consequently, the direct costs of contractor furnished diesel generation should be much higher than would be expected for a similar utility power plant which has a longer service lifetime.

2. Intertie Connection A temporary connection to the Intertie line at Gold Creek should be easy to make with a minimum cost. This tap should not be detrimental to the reliability of the Intertie if a 138 kV power circuit breaker is installed. The voltage regulation should be within workable limits, depending on the results of a power flow study. The PCB can be installed adjacent to the Intertie line and a "shoefly" made to connect the tap. Then Gold Creek Substation can be built at a later date and the PCB moved to a different location.

3. Intertie Power Cost The Intertie power cost should be cheaper than the variable costs of operation, maintenance and fuel for on-site diesel generation which is estimated at 150 mils per KWH, assuming that about 20 megawatts of power is available at Anchorage or Fairbanks. The current industrial rate for power is about 30 mils per KWH at Anchorage and 75 mils per KWH at Fairbanks. Since Golden Valley

Electric Association at Fairbanks has reserve generation capacity, their industrial rate of 75 mils per KWH was used in the economic analysis, but other rates may be used with similar results. The line losses are insignificant with 2/954 Kcmil conductor.

The Joint Venture concludes that it will be worthwhile for the Power Authority to secure a block of power at Anchorage or Fairbanks and build the Watana to Gold Creek transmission line on an accelerated schedule. Furthermore, the Joint Venture should have the best chance to get the line design done and assist the contractor within the limited time frame.

TABLE E4-1

SUSITNA TRANSMISSION LINE
WATANA-GOLD CREEK ANNUAL COST COMPARISON

Note: Projected Peak Demand: 13,500 KW - 1985; 20,000 KW - 1887 thru 1992; Load Factor 0.6.

PLAN ITEM	DESCRIPTION	1985	1986	1987	1988	YEAR 1989	1990	1991	1992	1993
	Diesel Generation									
A.1	Camp Generation Investment - 7000 KW (1985) ($3,808,900)(CRF 12%, 20 yrs)(1.07)^2	$583,800	$583,800	$583,800	$583,800	$583,800	$583,800	$583,800	$583,800	Susitna Energi-zation
A.2	Contractor Generation Investment - 6500 KW (1985) ($750/KW)(6500 KW)(CRF 15%, 5yr)(1.07)^2 1990 replacement	3,746,300	1,144,700	1,144,700	1,144,700	1,144,700	5,254,400	1,605,500	1,605,500	---
A.3	Contractor Generation Investment - 6500 KW (1987) ($750/KW)(6500KW)(CRF 15%, 5yr)(1.07)^4	0	0	4,289,200	1,310,600	1,310,600	1,310,600	0	0	---
A.4	Diesel Engine Operation and Maintenance ($0.02/KWH)(0.60)(8760)(7000KW)(1.07)^n	842,500	901,400	964,500	1,032,100	1,104,300	1,181,600	1,264,300	1,352,800	---
	($0.02/KWH)(0.60)(8760)(6500KW)(1.07)$^{n+1/2}$	391,100	837,000	895,600	958,300	1,025,400	1,097,200	1,174,000	1,256,200	---
	($0.02/KWH)(0.60)(8760)(6500KW)(1.07)$^{n+2}$	0	0	895,600	958,300	1,025,400	1,097,200	1,174,000	1,256,200	---
A.5	Diesel Fuel Cost ($0.13/KWH)(o.60)(8760)(7000KW)(1.095)^n	5,734,900	6,279,700	6,876,300	7,529,500	8,244,800	9,028,100	9,885,800	10,824,900	---
	($0.13/KWH)(o.60)(8760)(6500KW)(1.095)$^{n+1/2}$	2,662,600	5,831,200	6,385,100	6,991,700	7,655,900	8,383,200	9,179,600	10,051,700	---
	($0.13/KWH)(o.60)(8760)(6500KW)(1.095)$^{n+2}$	0	0	6,385,100	6,991,700	7,555,900	8,383,200	9,179,600	10,051,700	---
A.6	Salvage Value - Assume equal to unpaid debt	0	0	0	0	0	0	0	0	---
	SUBTOTAL - DIESEL GENERATION	13,961,200	15,577,800	28,419,900	27,500,700	29,750,800	36,319,300	35,357,200	36,982,800	---
AB	Difference In Annual Costs Between Plan A and Plan B (Plan A less Plan B)	0	(1,200,600)	14,836,600	13,171,600	14,623,600	21,482,900	20,807,900	21,455,900	---

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TABLE E4-2

SUSITNA TRANSMISSION LINE
WATANA-GOLD CREEK ANNUAL COST COMPARISON

Note: Projected Peak Demand: 13,500 KW - 1985; 20,000 KW - 1887 thru 1992; Load Factor 0.6.

PLAN ITEM	DESCRIPTION	1985	1986	1987	1988	YEAR 1989	1990	1991	1992	1993
B	Intertie Power - 345 kV Line/Oper. 138 kV									
B.1	Camp Generation Investment - 7000 KW (1985) ($3,808,900)(CRF 12%, 20 yrs)(1.07)^2	$583,800	$583,800	$583,800	$583,800	$583,800	$583,800	$583,800	$583,800	Susitna Energi-zation
B.2	Contractor Generation Investment-6500 KW (1985) ($750/KW)(6500 KW)(CRF 15%, 5yr)(1.07)^2	3,746,300	1,144,700	1,144,700	1,144,700	1,144,700	0	0	0	---
B.3	Diesel Engine Operation and Maintenance ($0.02/KWH)(0.60)(8760)(7000KW)(1.07)^n	842,500	901,400	0	0	0	0	0	0	--
	($0.02/KWH)(0.60)(8760)(6500KW)(1.07)$^{n+1/2}$	391,100	837,000	0	0	0	0	0	0	---
B.4	Diesel Fuel Cost ($0.13/KWH)(0.60)(8760)(7000KW)(1.095)^n	5,734,900	6,279,700	0	0	0	0	0	0	---
	($0.13/KWH)(0.60)(8760)(6500KW)(1.095)$^{n+1/2}$	2,662,600	5,831,200	0	0	0	0	0	0	---
B.5	Salvage Value - Assume equal to unpaid debt	0	0	0	0	0	0	0	0	---
B.6	345 kV T/Line & Substation Speedup Cost (1986-91) (17,303,900)(Speedup Charge for 5yrs)(1.07)^3	0	1,200,600	1,200,600	1,200,600	1,200,600	1,200,600	0	0	---
B.7	Power Costs from Fairbanks ($0.075/KWH)(0.60)((8760)(20,000KW)(1.07)$^{n+2}$	0	0	10,334,300	11,057,700	11,831,800	12,660,000	13,546,200	14,494,400	---
B.8	Transmission Line O&M-(1%)(1.07)$^{n+2}$	0	0	226,800	242,700	259,700	277,900	297,300	318,100	---
B.9	Transmission Line Losses - Fairbanks to Watana ($71,025)(1.07)$^{n+2}$	0	0	93,100	99,600	106,600	114,100	122,000	130,000	---
	SUBTOTAL-INTERTIE POWER (345 kV)	13,961,200	16,778,400	13,583,300	14,329,100	15,127,200	14,836,400	14,549,300	15,526,900	

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TABLE E4-3

SUSITNA TRANSMISSION LINE
WATANA-GOLD CREEK ANNUAL COST COMPARISON

Note: Projected Peak Demand: 13,500 KW - 1985; 20,000 KW - 1887 thru 1992; Load Factor 0.6.

PLAN ITEM	DESCRIPTION	1985	1986	1987	1988	YEAR 1989	1990	1991	1992	1993
C	INTERTIE POWER - 138 kV TEMPORARY LINE									
C.1	Camp Generation Investment - 7000 KW (1985) ($3,808,900)(CRF 12%, 20 yrs) $(1.07)^2$	583,800	583,800	583,800	583,800	583,800	583,800	583,800	583,800	Susitna Energi-zation
C.2	Contractor Generation Investment - 6500 KW (1985) ($750/KW)(6500 KW)(CRF 15%, 5 yrs)$(1.07)^2$	3,746,300	1,144,700	1,144,700	1,144,700	1,144,700	0	0	0	---
C.3	Diesel Engine Operation and Maintenance									
	($0.02/KWH)(0.60)(8760)(7000KW)$(1.07)^n$	842,500	901,400	0	0	0	0	0	0	---
	($0.02/KWH)(0.60)(8760)(6500KW)$(1.07)^n$	391,100	837,000	0	0	0	0	0	0	---
C.4	Diesel Fuel Cost									
	($0.13/KWH(0.60)(8760)(7000KW)$(1.095)^n$	5,734,900	6,279,700	0	0	0	0	0	0	---
	($0.13/KWH(0.60)(8760)(6500KW)$(1.095)^n$	2,662,600	5,831,200	0	0	0	0	0	0	---
C.5	Salvage Value - Assume equal to unpaid debt	0	0	0	0	0	0	0	0	---
C.6	138 kV Wood Pole T/Line & Substation Investment (1986) ($6,800,000)(CRF 12%, 6 yrs)$(1.07)^3$ +	0	2,026,200	2,026,200	2,026,200	2,026,200	2,026,200	2,026,200	0	---
	($1,194,800)(Spdup 5 yr)$(1.07)^3$		82,900	82,900	82,900	82,900	82,900	0	0	---
C.7	Power Costs from Fairbanks ($0.075/KWH)(0.60)(8760)(20,000 KW)$(1.07)^{n+2}$	0	0	10,334,300	11,057,700	11,831,800	12,660,000	13,546,200	14,494,400	---
C.8	Transmission Line O&M- (2%)$(1.07)^{n+2}$	0	0	178,300	190,700	204,100	218,400	233,700	250,000	---
C.9	Transmission Line Losses - Fairbanks to Watana ($81,960)$(1.07)^n$	0	0	107,400	115,000	123,000	131,600	140,800	150,700	---
C.10	Removal Cost - Assume equal to material salvage	0	0	0	0	0	0	0	0	---
	SUBTOTAL - INTERTIE POWER (138 kV)	13,961,200	17,686,900	14,457,600	15,201,000	15,996,500	15,702,900	16,530,700	15,478,900	---

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Summary of Cost Proposal

The engineering services will be executed through a series of tasks. The estimated cost of the engineering services has been prepared for and correlated with each of the four main tasks defined by the RFP.

All costs and fees have been estimated on a consistent basis at price levels prevailing as of June, 1982. No provision for escalation or inflation is included. The estimated cost of services has been determined from a detailed estimate of manhours by classification and corresponding average salary rates. The rates used are for the Joint Venture but are also representative of those for both Harza and Ebasco. Other components of the costs include fringe benefits, overhead, fee and direct costs to the Joint Venture. Examples of the direct costs include, in addition to out-of-pocket expenses, cost of the Anchorage office and subcontracts.

In response to the RFP, we have offered a fixed fee which is computed as a percentage of salaries, fringe benefits and overhead. The fixed fee proposed is $842,415 (approximately 12%). As an alternate, we suggest that the Power Authority consider an incentive fee program that corresponds to the incentive fee program now being defined as part of the present Susitna Design Contract discussions. A handling charge of 5% has been applied to subcontracts for services performed by others.

Our estimated cost of the engineering services, covered by this proposal, is distributed as follows:

Salaries Cost	$ 3,114,518
Fringe Benefits	1,245,807
PAYROLL COST	$ 4,360,325
Overhead at 61%	2,659,798
MANHOUR COST	$ 7,020,123
Handling Fee	228,750
Profit (Fixed Fee)	842,415
SUBTOTAL	$ 8,091,288
Direct Costs	1,821,475
SUBTOTAL, ENGINEERING SERVICES	$ 9,912,763
Subcontracts	4,575,000
GRAND TOTAL	$14,487,763

A breakdown for the main tasks defined by the RFP is found on the following pages.

The draft transmission line system contract embodies the same principles as those contained in the previous Susitna RFP, which is now serving as the basis for our final negotiations with the Power Authority. We anticipate using the final agreed upon Susitna Design Contract as the basis for providing the proposed transmission line system design services.

E1 Route Selection

Tasks E1.1 - E1.4

PRIME CONTRACTOR COSTS	Total
Salary Cost	$184,240
Fringe Benefits	73,696
Payroll Cost	$257,936
Overhead (61%)	157,341
Manhour Cost	$415,277
Profit (12% fee on services)	49,833
Subtotal	$465,110

DIRECT COSTS	
Equipment	0
Travel	$123,340
Other	14,300
Subtotal	$137,640

SUBCONTRACTS	0
GRAND TOTAL	$602,750

E2 Technical Design - Transmission Line

Tasks E2T1 - E2T11

PRIME CONTRACTOR COSTS	Total
Salary Cost	$ 594,101
Fringe Benefits	237,640
Payroll Cost	$ 831,741
Overhead (61%)	507,362
Manhour Cost	$1,339,103
Profit (12% fee on services)	160,692
Subtotal	$1,499,795

DIRECT COSTS	
Equipment	0
Travel	$ 250,756
Other	161,519
Subtotal	$ 412,275
SUBCONTRACTS	0
GRAND TOTAL	$1,912,070

E2 Technical Design - Substations

Tasks E2S1 - E2S20

PRIME CONTRACTOR COSTS	Total
Salary Cost	$1,192,575
Fringe Benefits	477,030
Payroll Cost	$1,669,605
Overhead (61%)	1,018,459
Manhour Cost	$2,688,064
Profit (12% fee on services)	322,568
Subtotal	$3,010,632

DIRECT COSTS	
Equipment	0
Travel	$ 785,478
Other	204,527
Subtotal	$ 990,005

SUBCONTRACTS	0
GRAND TOTAL	$4,000,637

E3 Collateral Support

Tasks E3.1 - E3.6

PRIME CONTRACTOR COSTS	Total
Salary Cost	$ 252,649
Fringe Benefits	101,060
Payroll Cost	$ 353,709
Overhead (61%)	215,762
Manhour Cost	$ 569,471
Profit (12% fee on services)	68,337
Handling Fee*	228,750
Subtotal	$ 866,558

DIRECT COSTS	
Equipment	0
Travel	$ 84,578
Other	7,540
Subtotal	$ 92,118

SUBCONTRACTS	
Cultural Resources Survey - Task E3.1	$ 80,000
Visual Simulation Study - Task E3.2	30,000
Field Survey & Photogrammetric Compilations of Line Profiles - Task E3.3	3,440,000
Soil Testing & Geotechnical Services - Task E3.4	800,000
Radio & Television Interference Measurements - Task E3.5	200,000
Transient Network Analyzer Studies - Task E3.6	25,000
Subtotal	$4,575,000
GRAND TOTAL	$5,533,676

* No profit is calculated on handling fee.

E4 Design Management

Tasks E4.1 - E4.2

PRIME CONTRACTOR COSTS	Total
Salary Cost	$ 890,953
Fringe Benefits	356,381
Payroll Cost	$1,247,334
Overhead (61%)	760,874
Manhour Cost	$2,008,208
Profit (12% fee on services)	240,985
Subtotal	$2,249,193

DIRECT COSTS	
Equipment	0
Travel	$ 145,167
Other	44,270
Subtotal	$ 189,437

SUBCONTRACTS	0
GRAND TOTAL	$2,438,630

Cost Proposal

Basis of Cost Estimate

The items included in the estimated cost of engineering services, together with their respective definitions, follow. Combined, these are the basis for the cost estimate.

The estimated cost of engineering services is intended to be in compliance with the Power Authority's RFP No. APA-83-R-025 for the transmission and control systems, with respect to both content and format. Should the Power Authority need any elaboration or amplification of the data submitted or require additional information, we will be pleased to comply with your request.

This cost information is an integral part of the Proposal, and, therefore, is in effect for 180 days following receipt by the Power Authority on December 13, 1982.

It is expected that the services covered by this Proposal will begin about January 1, 1983 and continue until energization of the project. The major part of the services to be furnished will be completed prior to the award for the construction contracts. Under the work program proposed, the major construction contracts will have been awarded by early 1990.

Our estimate of costs of services reflects the same detail as the definition of services. Through the design period, the work plan is set forth in detail and, during the construction period which follows, the services required of the Engineer are not as clearly defined. The forecast for the cost of engineering services during construction is, of necessity, shown in less detail than during the design phase.

Format of Cost Estimate

We are providing the estimated cost by task and in the format requested. All information and data shown in the cost estimate is for the Susitna Joint Venture and does not necessarily apply separately to either Harza or Ebasco.

Price Level and Escalation

All cost data in this estimate are based on salaries in effect or price levels of June, 1982. No adjustment for inflation or escalation is included in any cost item.

Manhour Estimate

Manhour estimates are in accordance with the definitions of the tasks provided in our proposal. Classifications of professional and support personnel conform to "Surveys of Engineering Salaries," Dietrich Associates, Inc.

Salary Rates

The hourly salary rates used in the estimate are derived by dividing the employee's actual annual salary by 2,080. No reduction in work hours has been made to reflect only the hours available for project work by omission of holidays, vacations, absent time, etc. The foregoing items are later defined as components of the fringe benefits.

Professional personnel are paid for all hours worked but at straight time rates (no premium for overtime). Clerical and subprofessional personnel are paid time and one-half for hours in excess of 40 per week. No overhead is applied to the premium portion of overtime.

For personnel assigned to Alaska on a long term basis, one year or more, salaries will be adjusted. The adjustments are nine thousand dollars ($9,000.00) plus ten percent (10%) of the annual salary up to $60,000. No adjustment is made for any portion of the salary in excess of $60,000.

Overhead

Overhead is divided into two parts: (1) "salary related charges" (fringe benefits) and (2) other costs of doing business, including general management and administrative expenses. Fringe benefits are defined as:

- vacation
- sick leave
- holiday
- unemployment and payroll taxes
- social security taxes
- workmen's security taxes
- retirement benefits
- medical and other group insurance benefits

Examples of general overhead are:

- general administrative payroll
- general stenographic and clerical payroll
- rent of office and drafting room space
- utilities
- depreciation of office equipment
- cost of maintaining customary liability and property insurance, etc.

Handling Fee

Because of the integrated participation of engineering subcontractors, no handling fee is applied to those subcontracts. Subcontracts for services and support held directly by the Joint Venture are assessed a handling charge of five percent (5%).

Fee

For the purpose of this estimate, we have included a fixed fee equal to twelve percent (12%) of the sum of salaries, fringes and overhead.

We suggest that the Power Authority consider an incentive fee program for this work equal (in concept) to that presently being negotiated for the Susitna Design Contract. The incentive fee program would embody a reduced (from 12%) fixed fee and an incentive fee "pool" that would be allocated to mutually established project milestones.

Equipment

Where subcontractors may be required to furnish equipment, such cost has been included in the subcontract cost identified in Task E3 Collateral Support.

Travel and Related Cost

This item includes, in addition to fares for travel, the related cost for lodging, food, incidentals, etc. Where applicable, the cost of relocation is included in this category.

Other

Included under this item are all other costs in conjunction with or for the benefit of the work. Where identification of sub-items is clear, they have been designated and covered, but are not limited to, charges for use of programs and computers, reproductions of all kinds, printing, word processing equipment, communications, postage, express delivery services, model tests, etc.

Subcontracts

Substantial portions of the engineering support is being furnished under subcontract. Each subcontract is listed. In several instances, the support facilities subcontract applies to more than one task. In those cases, subcontract costs have been allocated to the respective task.

The major items of support service cost included in the subcontracts are:

- cultural resources survey
- visual simulation study
- field survey and photogrammetric compilations of line profiles
- soil testing and geological services
- radio and television interference measurements
- transient network analyzer studies

Fee Proposal

Compensation

For the Engineering Services in conjunction with the Susitna Hydroelectric Project, and covered by this Proposal, the Joint Venture of Harza/Ebasco shall be paid the sum of:

1. Salaries
2. Salary Fringes
3. Overhead
4. Fixed Fee
5. Direct Costs

Definitions of Terms. Terms above used in the Fee Proposal are defined:

1. Salaries - Actual direct salary payments to all personnel, including officers, engineers, designers, supervisors, draftsmen, other technical personnel, word processors, and other personnel for a time directly engaged on the work.

2. Fringe Benefits - Payroll charges including vacation, sick leave and holiday pay, unemployment and payroll taxes, social security contributions, workmen's compensation insurance, retirement benefits, medical insurance and group insurance benefits.

3. Overhead - Costs which cannot be allocated to specific projects. Examples are Corporate Management expenses (other than officers' time spent directly on projects), general administrative payroll, general stenographic and clerical payroll, rent of office and drafting room space, depreciation of office equipment, cost of maintaining customary liability and property insurance.

4. Fixed Fee - Payment to the Joint Venture for interest on invested capital, readiness to serve and a limited profit.

5. Direct Costs - Costs which are directly applicable to the work such as transportation and subsistence expenses on travel in the interest of the work, project offices, relocation to and return from project offices, local and long distance telephone, telegraph and telex expenses, reproductions, special insurance, Harza/Ebasco (in-house) and outside electronic computer rental costs, usage of computer programs, model and laboratory testing, aerial and ground surveying, subsurface exploration and other expenses for the benefit of the work.