Idaho National Engineering and Environmental Laboratory

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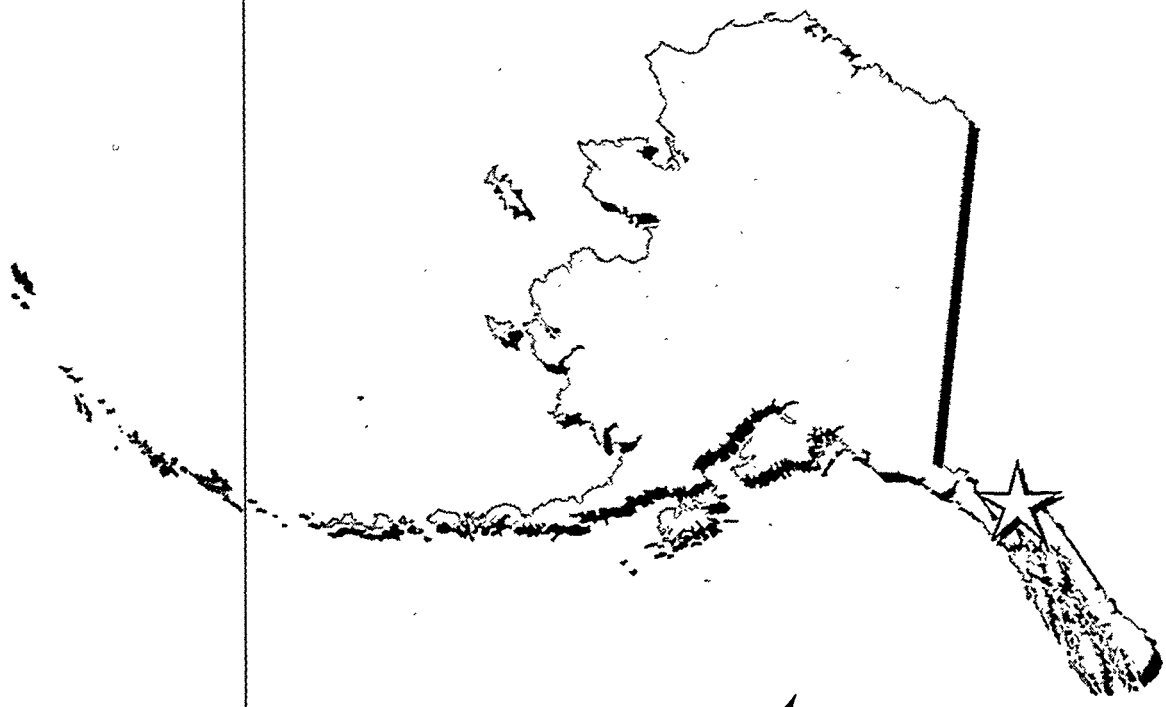
Final Technical and Construction Report

Glen Marin, Project Manager
Alan See, President, Goat Lake Hydro, Inc.
Alaska Power and Telephone Company

Bennie N. Rinehart, INEEL Consultant



LOCKHEED MARTIN

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Prepared by
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Idaho National Engineering and Environmental Laboratory
Renewable Energy Products Department
Lockheed Martin Idaho Technologies Company
Idaho Falls, Idaho 83415

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SECTION 1

1.0 INTRODUCTION

1.1 LOCATION

The submarine cable crossing from Skagway to Haines is located in Southeast Alaska at the head of Lynn Canal, in the Taiya and Chilkoot Inlet's, as in *Figure 1*. The USGS location is as follows: *T28S, R59E,* Sections 35, 34, 27, 23, 22, 15, 14; *T29S, R59E,* Sections 36, 25, 24; *T29S, R60E,* Sections 31, 30, 19, 18, 7, 6, 5; *T30S, R59E,* Sections 14, 13, 12, 11, 10, 1; *T30S, R60E,* Sections 18, 7, 6.

The project crossed from the Skagway City Limits into the Haines Borough. Both Skagway and Haines are terminuses of the Southeast Alaska Marine Highway System. This area is typified by rugged mountains, steep-walled valleys and glacial rivers, numerous glaciers, and ice-fields. Due to the high volume of freshwater and silt from the Taiya, Skagway, Chilkoot, Chilkat, and Katzehin Rivers and the deep, steep-sided nature of Taiya Inlet, the Inlet is not very productive for aquatic species.[1]

The Taiya Inlet consists of steep sides with mountains and glaciers in excess of 6,000 feet above sea level. The maximum water depth, along Taiya Inlet, is approximately 1,470 feet and it is in this deep channel that the cable was laid. At the Skagway end of Taiya Inlet, the cable was laid along hard bottom and some alluvial fill. The cable rests on bedrock at the Otter Creek Project landing. The remainder of the cable rests on a sediment covered seabed, until the cable reaches Haines where it crosses a gravel beach.

1.2 HISTORY

With the completion of the Goat Lake Hydroelectric Project (near Skagway) in November, 1997 and the community of Haines generating power with diesel generators, the Applicant proposed to connect both communities to share the power generating capacity of the hydro project. The reasons for connecting Haines via a submarine cable are as follows:

- To provide an environmentally friendly source of power generation to meet the long term needs of the Haines area. As a result, this action will avoid the burning of over 850,000 gallons of diesel fuel per year.

- To reduce environmental and visual impacts by not installing an over-head transmission line from Skagway to Haines along Taiya Inlet.

[1] Skagway Coastal Management Program, Prepared by the City of Skagway, June 1, 1994.

- To reduce the cost to consumers that are associated with the installation of an over-head transmission line.

- To provide stable rates for consumers. A decrease in the real cost of power (as adjusted for inflation) by maintaining stable rates in nominal dollars. The use of tax exempt bonds, thereby lowering the borrowing costs by almost 2%, will assist in maintaining stable, low cost rates.

- This project will further administration and legislative objectives of increased rural self-reliance, long term economic growth, joint local/state participation in infrastructure development, regionalization of rural energy systems and increased use of renewable resources.

1.3 KEY FEATURES

As Constructed in 1998

Type of Project	Laying of Submarine Cable
Type of Cable	35 kV, 3-Phase
Length	Approximately 15 Miles
Maximum Depth	Approximately 1500 feet
Number of Splice Vaults	3
Capacity	Conservatively, 15 MW continuous (at rated voltage)

1.4 CHRONOLOGICAL HISTORY

1. 1995 - Technical Proposal Design and Cost Estimate received from Pirelli-Jacobson.

2. September 1996 - After sending Pirelli-Jacobson maps and information from Harza Engineering Intertie Study, they submitted updated Proposal that included increases in costs and time frame.

3. November 1996 - Requested and received permitting requirements and application from DNR.

4. January 1997
- Met with Bryan Jacobson, Pirelli-Jacobson, to discuss their proposal, installation details, final cable design, and schedule.
- Survey Agreement signed. Will do survey when weather permits.

5. February 1997
- Received additional technical and commercial information and clarification from Pirelli-Jacobson.
- Signed Professional Service Agreement with RW Beck For Upper Lynn Canal Regional Power System Planning Review.

6. April 1997
- Interoffice Memo from Vern/Skagway: Review of Underwater Survey and inspection of Kasidaya Creek and Landfall area.

7. June 1997
- Notice to all participating agencies that the Submarine Cable Project is feasible.

8. July 1997
- Kevin (Craig) Keener, CRA, (sub-contractor for Pirelli-Jacobson) notified Pirelli of GPS Positioning and Temporary Survey Points. There are no hazards of concern along the survey route.
- Applied to U.S. Army Corps of Engineers for a Nation-Wide Permit.
- Request for Cost Estimate from Paul Gailey, Ph.D., Oak Ridge National Laboratory for Developing a Report on Submarine Cable Electro-Magnetic Fields.
- EMF Calculations received from Pirelli-Jacobson Re: the radiation effects of the submarine cable.

9. August 1997
- Issued Nationwide Permit #D-970592 from Army Corps of Engineers.

10. September 1997
- Confirmed with FERC that the Submarine Cable Project is not part of Otter Creek Hydroelectric Project – more in relation to Goat Lake Hydroelectric, if any.
- After communicating with ADF&G, notified Pirelli-Jacobson of commercial fisheries schedules in July and that we must schedule around those openings.
- Applied to DGC for ACMP Determination.
- Applied to DNR for R/W/E Land Use Permit.
- Applied to USFS for Special Use Permit for Cable Splice Vaults.
- House of Representatives make appropriations for Upper

Lynn Canal Regional Electric Project.

11. October 1997
- Congress passes FY98 legislation containing $1 million in grant funding for Skagway-Haines submarine cable.
- President Clinton signed into law the FY98 Energy and Water Development Bill containing the grant funding.
- Notified AIDEA of proposed installation – Haines Intertie.
- Received permission from the White Pass & Yukon Rail-Road to place equipment.
- Cable Installation Agreement signed with Pirelli-Jacobson.

12. November 1997
- Discussion with DGC, ADF&G, DEC, and USFS re: revegetation, trenching, and erosion control methods.
- Issued ACMP Final Consistency Determination by DGC.

13. December 1997
- Informed DNR of Classification of Submerged Lands – Maps showing Taiya Inlet as designated for submarine cable use.
- Sent DNR $3,200 for fees to process right-of-way (ROW) and classification of submerged lands.

14. January 1998
- USFS issued Request for Comments to Interested Parties, re: Proposal Cable Splice Vault on National Forest System Land at Kasidaya Creek.

15. February 1998
- Sent revised cable installation schedule to all agencies.

16. March 1998
- DNR public notice for Application for Right-of-Way Permit #ADL 106422.

17. April 1998
- Updated schedule received from Pirelli-Jacobson.
- #ADL 106422.
- Updated schedule sent to DNR.
- City of Skagway notified DNR that they have no objection to the proposed project.
- USFS sent Decision Memorandum authorizing the cable splice vault project – Special Use Permit will follow.
- Received Final Finding & Decision from DNR - Right-of-Way Permit #ADL106422.

18. May 1998
- Bennie Rinehart - DOE, reviews plans for laying the cable.
- Received draft Special Use Permit from USFS.
- Bill for Collection for $150 from USFS for the Special Use Permit #4306-03.

- Received Final Special Use Permit #4306-03.
- Sent DNR $6,000 for Right-of-Way Permit, $2,000 for the Bond along with signed permit.
- Received Right-of-Way/Early Entry Permit #ADL106422 from DNR (effective 6/1/98 to 5/31/99).
- Cable ship Sea Beach arrived in Southampton, England May 7th.
- Loading of Cable commenced on May 8th and departed on May 10th.

19. June 1998
- Cable ship Sea Beach arrived in Seattle June 23rd.
- DNR sent Instructions to Perform an As-Built Survey on State Land.
- Cable ship Sea Beach arrived in Skagway June 27th.
- Bennie Rinehart - DOE, observes the installation of the cable.

20. July 1998
- Cable installation completed July 3rd.
- Certification of Completion of Activity sent to U.S. Army Corps of Engineers July 14th.
- Informed USFS of signage requirements.
- Pirelli-Jacobson sent test results performed on two sections of cable – Delivered spare cable and "As-Laid" drawings under separate cover.

21. August 1998
- Amendment to USFS Special Use Permit FS-2700-23 authorizing AP&T to place warning signs.

22. September 1998
- Final "As-Laid" drawings sent to NOAA, NIMA, and U.S. Coast Guard-Juneau.
- Sent "As-Laid" drawings to Horan-Korak, Sitka, Alaska for survey of R/W/E.

2.0 PROJECT FEASIBILITY AND PLANNING

2.1 INTRODUCTION

The Haines to Skagway submarine cable project is located in Taiya Inlet, at the north end of Lynn Canal, in Southeast Alaska. The cable is approximately 15 miles long, with three landings and splice vaults. In *Figure 2*, the cable route and landfalls are shown. The cable is 35 kV, 3-Phase, and armored. The diagram in *Figure 3* shows a cross section of the cable. The cable interconnects the Goat Lake Hydro Project near Skagway with the

community of Haines. Both communities are now on 100% hydroelectric power.

The Haines to Skagway submarine cable is the result of AP&T's goal of an alternative, economic, and environmentally friendly energy source for the communities served and to eliminate the use of diesel fuel as the primary source of energy. Diesel units will continue to be used as a backup system.

2.2 INITIAL PLANNING

Once the Federal Energy Regulatory Commission (FERC) issued the license for the Goat Lake Hydroelectric Project the go-ahead was given to investigate the interconnection of Haines with Skagway to provide the customers of Haines with the excess hydro power the Goat Lake Project would generate. Despite the fact that Haines Light and Power (a subsidiary of AP&T) has a FERC preliminary permit to investigate the construction of a hydroelectric project, it was determined that the submarine cable would be more cost effective. With the Otter Creek Hydroelectric Project proposed 3 miles south of Skagway on Taiya Inlet, it would be a simple solution to plan for an eventual interconnection to the submarine cable via a splice vault and still be more economical than constructing Haines Light and Power's proposed hydro project.

The submarine cable plan called for a cable about 15 miles long, operated at 35 kilovolts, at 3-phase, alternating current. There would be three landfalls, one each at the ends and one at the Otter Creek Project site, about 3 miles south of Skagway, as shown in *Figure 4*.

The submarine cable would leave Skagway from the rock jetty on the south side of the Skagway River, where the ore terminal is located, as shown in *Figure 5*. The cable would descend into the Taiya Inlet and proceed along a relatively smooth seabed. The cable would ascend to the Otter Creek Project site on the east side of Taiya Inlet to connect with a splice-vault, as shown in *Figure 6*. The splice-vault is for tying into a future hydro project presently under a FERC preliminary permit No. 11588. The cable will then descend from the splice-vault back into Taiya Inlet and proceed to Haines. The slope at the Haines end of the cable will be approximately 45°. The cable will landfall along the south side of Lutak Inlet, tying into the present transmission system, as shown in *Figure 7*.

The proposed submarine cable was expected to be laid in July, 1998 using a single ship to lay approximately 87,000 feet of cable in one pass along Taiya Inlet. Depending upon the weather, it was expected to take approximately 1 week to lay the cable.

It was proposed that the submarine cable would leave Skagway from municipal/private land, cross into DNR tide lands and then into DNR submerged lands, NE ¼, NW ¼, Section 14. The cable continues through DNR submerged lands until it ascends to the Otter Creek Project site where it crosses DNR tide lands and enters into USFS managed lands (Tongass National Forest) to the cable splice-vault, W ½, NW ¼, Section 35. After the cable leaves the splice-vault, it again passes through DNR tide lands and DNR submerged lands until the cable lands at Lutak Inlet, near Haines, SE ¼, SW ¼, Section 10, mile 4.4 of the Lutak Highway. At Lutak Inlet, the cable again crosses DNR tide lands and then onto the DOT right-of-way to interconnect with our present transmission system.

Trenching for the cable was proposed at both ends (Skagway and Haines) and at the Otter Creek Project landing, to protect the cable from anchors, fishing, and forces of nature. The cable would not cross any streams or any significant aquatic beds of harvestable foods. The cable would not pose any significant threat to the environment, nor harm aquatic life or pose a threat or hindrance to navigation within the Taiya Inlet or Chilkoot Inlet.

Trenching for the cable landings would not be longer than 200 feet. In *Figure 8* the splice vault and buried portion of the cable landing is shown as it was proposed. The Applicant proposed to use a small excavator and backhoe to trench for the cable. The cable would be protected in an HDPE pipe from below the minimum low tide elevation to above the mean high tide elevation. The cable would then have a steel sleeve to protect the cable while crossing land above high tide to the splice vault. Trenching would take place during low tides for the area. Excavated material would be backfilled over the cable and its protective conduits.

After seeking qualified firms to supply and lay a submarine cable, Pirelli/Jacobson, Inc. of Seattle, Washington was hired to construct this 3-phase cable which would include a fiber-optic cable. A cable purchase and installation agreement was signed with Pirelli/Jacobson, Inc. on March 26, 1997. The price breakdown of the submarine cable is as follows:

♦ Purchase price for cable	$3,000,000
♦ Transportation of cable	$ 600,000
♦ Cable installation	$1,550,000
♦ Kasidaya Creek Landing (Otter Creek Project)	$ 110,000

Pirelli/Jacobson, Inc. manufactures parts of the cable in England and Italy and completes the manufacture of the cable in England. Photographs of the manufacturing of the cable are shown in the *Appendix B - Project Photographs*. The cable was then stored in England until AP&T could expect

to finished the installation of the splice vaults and when a special ship was available for transporting the cable.

Prior to laying the cable, the sea floor of Taiya Inlet also required a bathymetric survey to determine the exact length of cable needed which depended upon the bathymetry of the Inlets floor. The bathymetric survey also helped determine the feasibility of the project by evaluating the bathymetry at the landings and the composition of the Inlet's floor.

2.3 PERMITS

Initially we applied for permits from the following:

- U.S. Army Corps of Engineers for a Nationwide Permit 12 (NWP) #D-970592
- Alaska Dept. of Governmental Coordination for a Coastal Zone Management Program consistency determination, State ID #AK 9709-11JJ
- U.S. Forest Service for a special-use permit to use the Otter Creek Project site for a cable landing.
- Dept. of Natural Resources right-of-way easement (R/W/E) permit to use submerged lands.

The cable landing site in Skagway is owned by the City of Skagway. No permitting was required because the use of city property is covered under other agreements. However, because the White Pass & Yukon Route Railroad is leasing land from the city that the vault and some of the line poles would be on, we requested permission to cross this land. Permission was granted. In addition, this land is subleased by the Alaska Industrial Development and Export Authority (AIDEA). We requested authorization to cross this land also. They responded with a 'no objection'.

Initially, the U.S. Forest Service requested that FERC determine if this project was within their jurisdiction because of the interconnection of the Goat Lake Hydro Project with the cable. This would have required a license amendment of the Goat Lake Project FERC license to place the submarine cable. FERC issued a "no jurisdiction determination."

All of the permits required public notices. No comments objecting to the submarine cable were received. After the cable was laid, AP&T was required to have the right-of-way easement (R/W/E) assessed at the current market value for DNR to establish the annual fee.

3.0 PROJECT CONSTRUCTION

3.1 BATHYMETRIC SURVEY

Excerpts from the final Bathymetry & Side Scan Sonar Cable Route Survey, by Chris Ransome & Associates is included below. The report was issued on June 6, 1997.

"The bathymetric and side scan survey took place on April 21-28, 1997. The bathymetry data was collected using an Innerspace 440/441 single beam dual frequency system, which is capable of collecting data both in shallow and deep water environments. This system is coupled with a DGPS positioning system via a computer using software designed especially for this real-time acquisition. Data was collected moving parallel with the shore centering between land masses to place the cable in the middle of Taiya Inlet and Chilkoot Inlet and in the deepest part of the channels. As the most important part of this survey was to develop a route and then determine cable length, all bathymetry data was reduced for tides to give the highest vertical accuracy. The vertical control was provided by using tidal transfers with predicted tide tables. In addition, all three landing sites (Haines, Otter Creek Project, Skagway) a land survey was done to give a full data set for a comlete cable route design. This data was done using DGPS and a Lasertrak with a computer to give a full 3-D line strength calculations."

"The side scan sonar survey was performed in conjunction with the bathymetric survey. The survey was performed utilizing the same navigation system and vessel as used for the bathymetric survey. The side scan sonar system used for the survey was a Klein digital slant correction system, model 595. The side scan sonar was integrated with an "ISIS" data processing system allowing for real-time geocoding of the digital data from the side scan sonar sensor as it was towed along the bottom. The bottom features were displayed both on the side scan sonar recorder and on the data processor's PC monitor. The digital data was stored on optical disk for archive and generating a digital strip chart."

"During the field data collection the side scan sonar was towed along 100 meter track lines with the sonar scanning at a 200 meter swath. Using this configuration, a 200 percent overlap of side scan sonar coverage of each line was accomplished. Upon completion of the survey, a digital strip chart of the surveyed area was prepared. The digital strip chart includes geocoded imagery of the water bottom features and can be quickly recovered from the archive data."

"This survey has proved to be one of the most challenging for our team in recent years due to the isolation and remoteness of the survey area. The

area in question for study contained very deep water depths, up to 1500', with some very steep channels. This caused considerable need for monitoring the bathymetry data so as to ensure proper bottom tracking. In addition, the side scan sonar fish was towed at layout lengths of up to 2500'. The high mountains were initially a concern on the quality of GPS satellite signal reception, but the full GPS satellite constellation is in place and the survey encountered no problems with signals at any time."

3.2 PLACING THE SPLICE VAULTS

The splice vaults were pre-cast concrete, 8-foot diameter, water-main manholes type structures, as shown in *Figure 9* for Haines and Skagway. In Figure 10, the splice vault for the Otter Creek Project is shown. The splice vault lid has an HS-20 standard load rating which allows heavy vehicles to drive over it. This rating indicates that this structure is very strong and will withstand significant events of nature. AP&T personnel placed the splice vaults at the Skagway, Haines, and Otter Creek Project landings, prior to the cable laying ships arrival, by utilizing a barge and excavator. AP&T personnel also performed the trenching for laying the cable to the splice vaults through the intertidal zone with a backhoe. The trenching was completed during minus tides to provide the maximum amount of protection to the cable by burying it with rock. About 240-feet of 8-inch high density polyethylene chloride (HDPE) pipe was used at each site to sheath the cable as it crossed the intertidal zone for protection. Approximately 80-feet of 12-inch steel pipe was used at each site to sheath the cable as it crossed the above mean high tide zone for protection.

3.3 LAYING THE CABLE

The schedule for laying the cable was adjusted depending upon Pirelli/Jacobson, Inc. ships availability. A diagram in *Figure 11* shows the ship plan and profile that laid the cable. Photographs of the ship laying the cable are shown in *Appendix B - Project Photographs*. The cable was first shipped from England to Seattle, Washington. From there a special ship was configured to lay this particular cable project. The ship arrive June 27th and began laying the cable from the Otter Creek Project site to Skagway. Once this portion of the cable was laid the next phase was to lay the second piece of cable from the Otter Creek Project splice vault to Haines. The cable was completely laid by July 3, 1998. Photographs of the cable being laid are in *Appendix B - Project Photographs*. AP&T personnel then spliced the cable to both systems in Haines, Skagway, and at the Otter Creek Project site, as shown in *Appendix B - Project Photographs*. On August 25, 1998 the cable was energized and Haines began operations with 100% hydroelectric power. One-line diagrams of both Haines and Skagway are included in *Appendix A* as well as other project diagrams.

To complete the installation of the cable the areas trenched were returned to normal appearances and signs warning of this potential navigational hazard were placed at each of the cable landings.

4.0 PROJECT COSTS

4.1 COST ESTIMATES

Costs for the project are itemized below:

◆ Purchase price for cable	$3,000,000
◆ Transportation of cable	$ 600,000
◆ Cable installation	$1,550,000
◆ Kasidaya Creek Landing (Otter Creek Project)	$ 110,000
◆ AP&T Costs	$ 600,000

Funds for off-setting the total cost of this project are as follows:

◆ Federal Grant	$1,000,000

5.0 APPENDICES

Appendix A: Project Figures
Appendix B: Select Project Drawings
Appendix C: Project Photographs

HAINES - SKAGWAY

SUBMARINE CABLE INSTALLATION

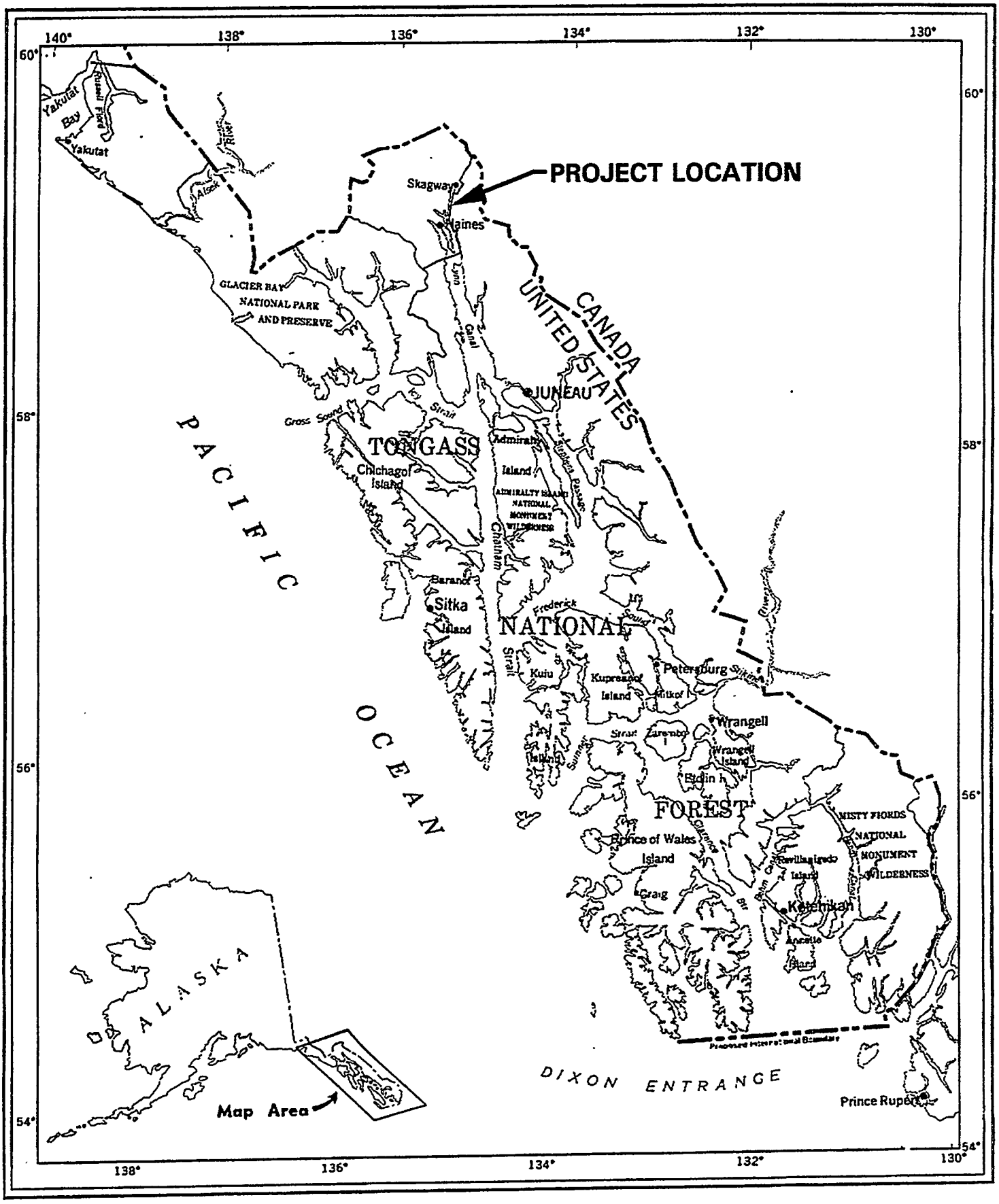
TECHNICAL REPORT

APPENDIX A

PROJECT FIGURES

(THE FIGURES REFERENCED THROUGHOUT THIS DOCUMENT)

FIGURE 1: PROJECT VICINITY MAP



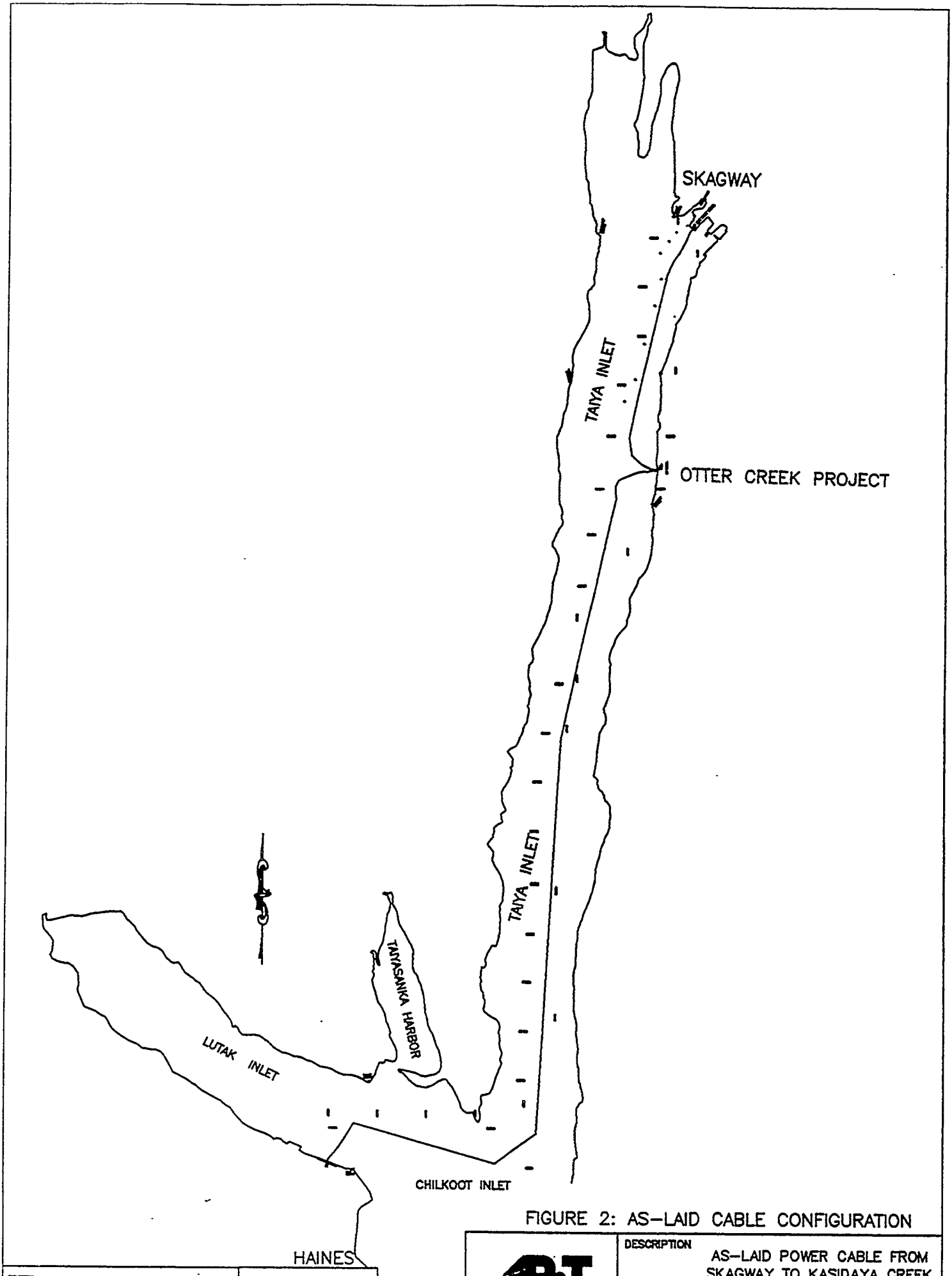


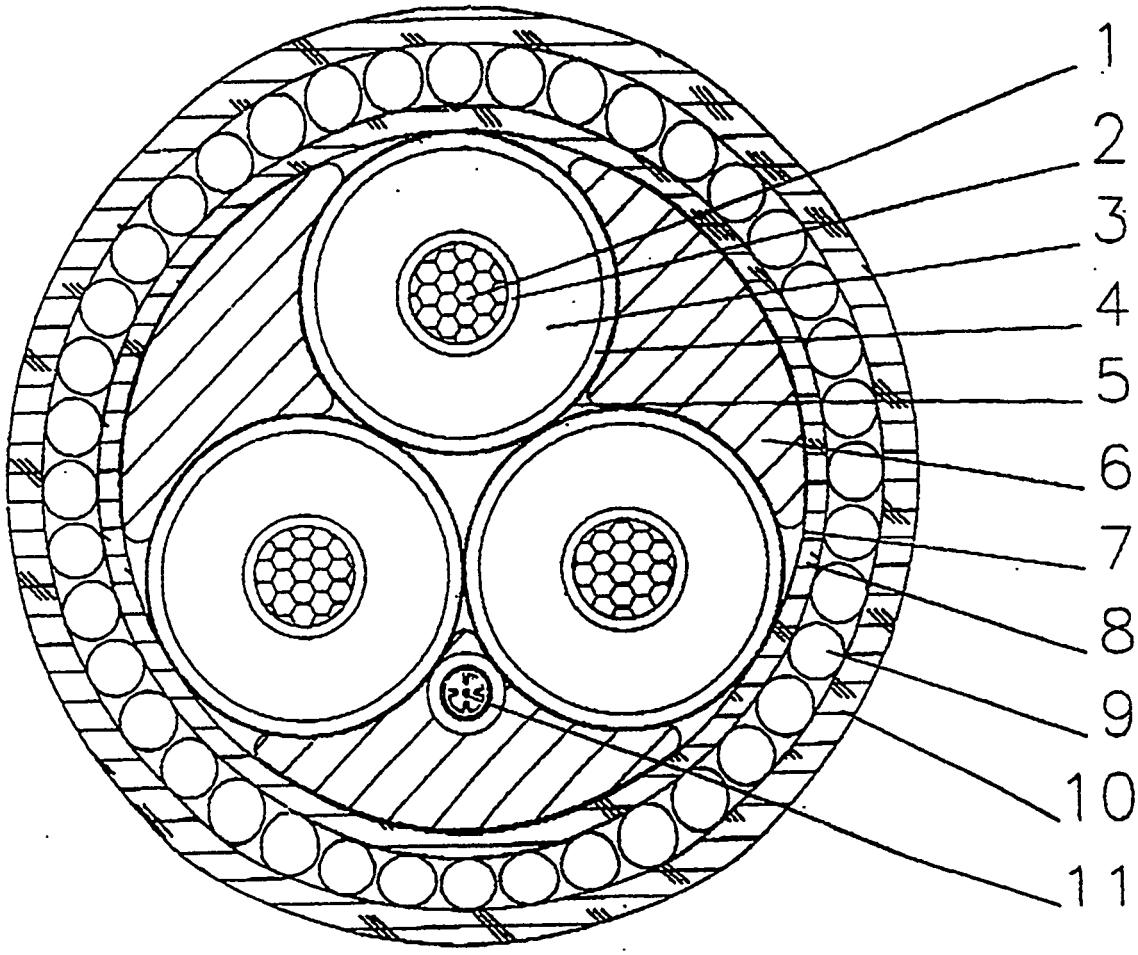
FIGURE 2: AS-LAID CABLE CONFIGURATION

	DESCRIPTION: AS-LAID POWER CABLE FROM SKAGWAY TO KASIDAYA CREEK
ALASKA POWER & TELEPHONE COMPANY	PROJECT: DEWEY LAKES HYDRO PROJECT
IRELLI JACOBSSON, INC.	

FIGURE 3

PIRELLI | ALASKA POWER & TELEPHONE Co. HAINES-SKAGWAY CROSSING | 04/02/97

SUBMARINE COMPOSITE CABLE CROSS SECTIONAL AREA



Not to scale

1. Tinned Copper Conductor
2. Semi-Conducting Conductor Shield
3. EPR insulation
4. Semi-Conducting Conductor Shield
5. Metallic Shield
6. Polypropylene Fillers
7. Binder Tape
8. Polypropylene Bedding
9. Galvanised Steel Wire Armour
10. Polypropylene Serving

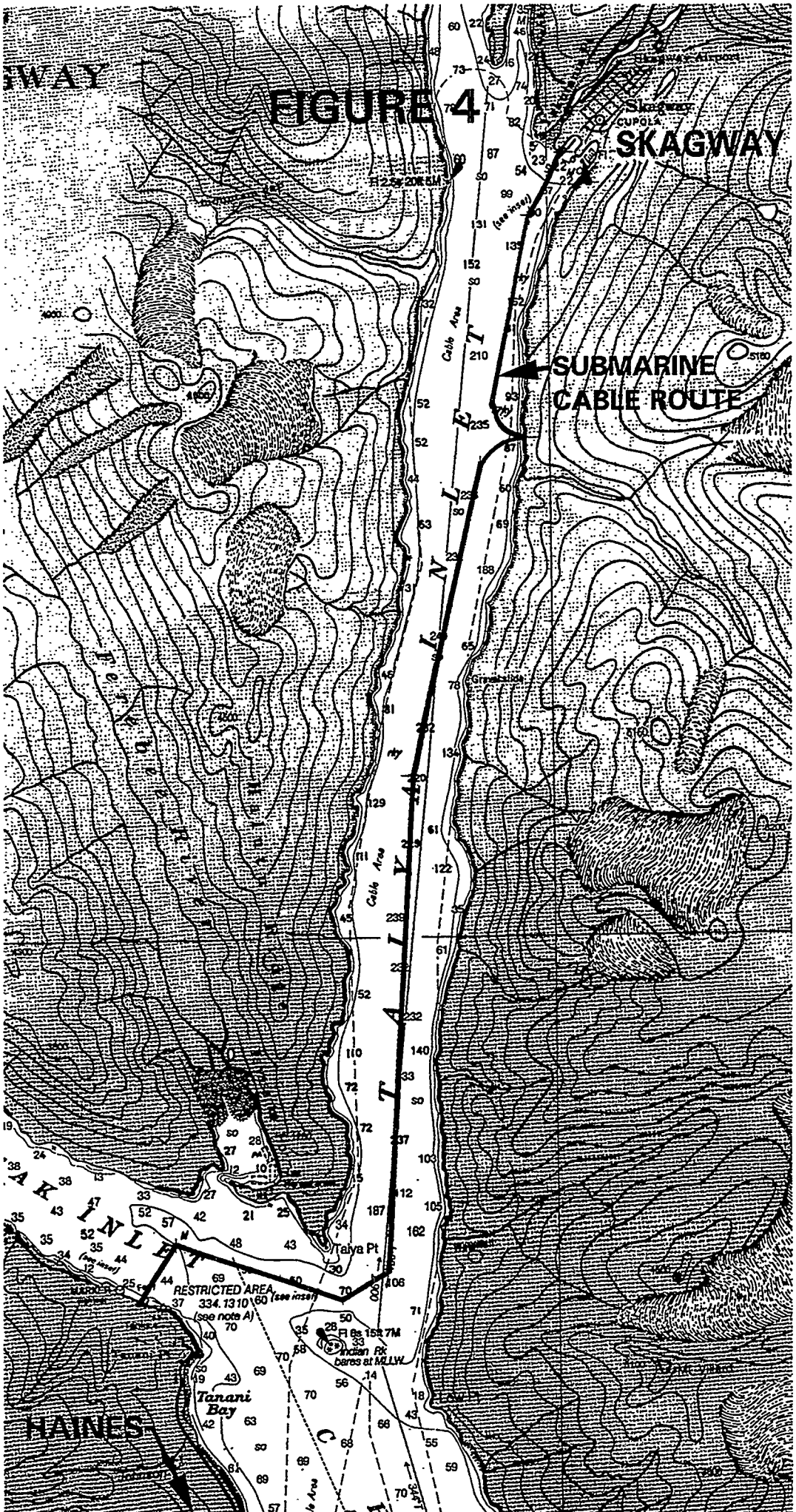


FIGURE 4
SKAGWAY
SUBMARINE CABLE ROUTE
HAINES
Taiya Pt
Tanani Bay
RESTRICTED AREA
334.1310
(see note A)
Fl 6s 158.7M
Indian Rk bares at MLLW
Law Pt
Cable Area
Skagway Airport
CUPOLA

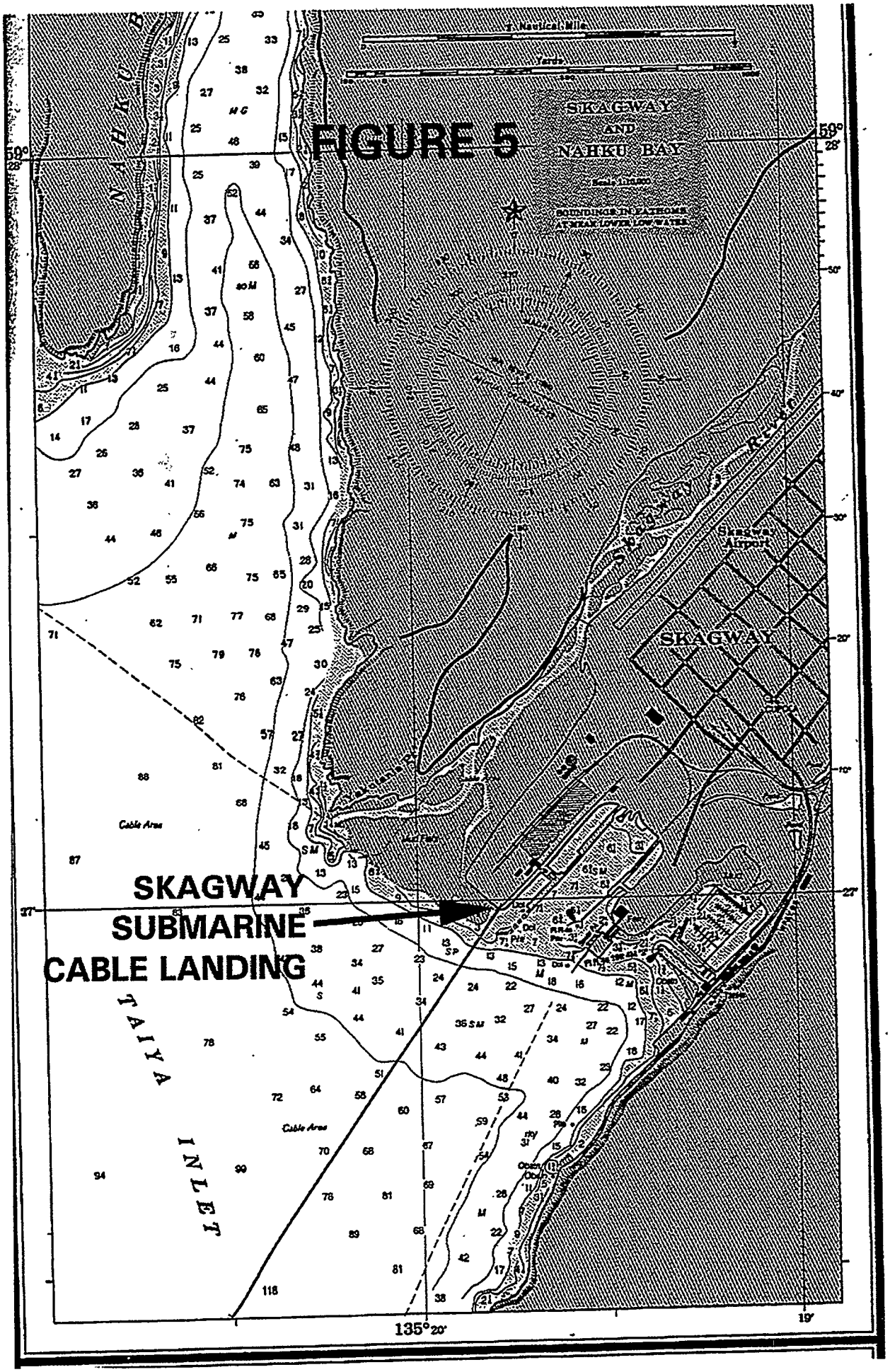


FIGURE 5
SKAGWAY AND NAHKU BAY
SOUNDINGS IN FATHOMS AT MEAN LOWER LOW WATER
SKAGWAY
SKAGWAY SUBMARINE CABLE LANDING
TAIYA INLET
N A H K U B
Skagway Airport
Cable Area
135° 20'

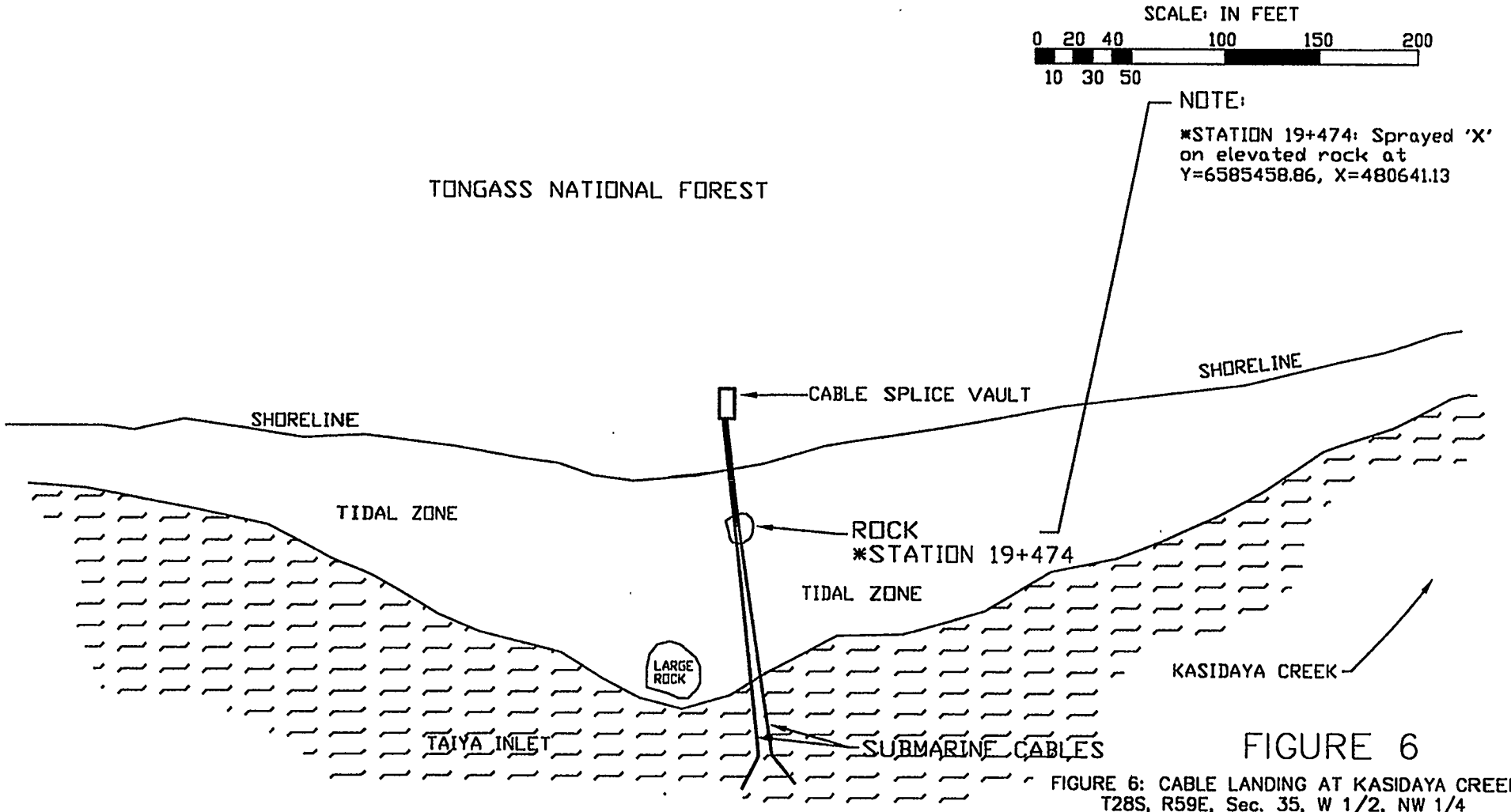


FIGURE 6

FIGURE 6: CABLE LANDING AT KASIDAYA CREEK
T28S, R59E, Sec. 35, W 1/2, NW 1/4

CERTIFICATION:
THIS DRAWING IS PART OF THE APPLICATION FOR LICENSE MADE BY THE UNDERSIGNED THIS DAY OF 19
ALASKA POWER & TELEPHONE COMPANY

REV	DESCRIPTION	AUTH	REV BY	DATE
0	ORIGINAL DRAW	VJH		08/18/97

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ALASKA POWER & TELEPHONE COMPANY

DRAWN BY	VJH
DESIGNED BY	GM
CHECKED BY	
RECORDED BY	08/18/97
SCALE	AS NOTED

DESCRIPTION: FIGURE 5
CABLE LANDING AT KASIDAYA CREEK
PROJECT: SUBMARINE CABLE PROJECT

JOB DWG. NO.: FIGURES
SHEET NO.: 01 OF 00
FILE NO.:

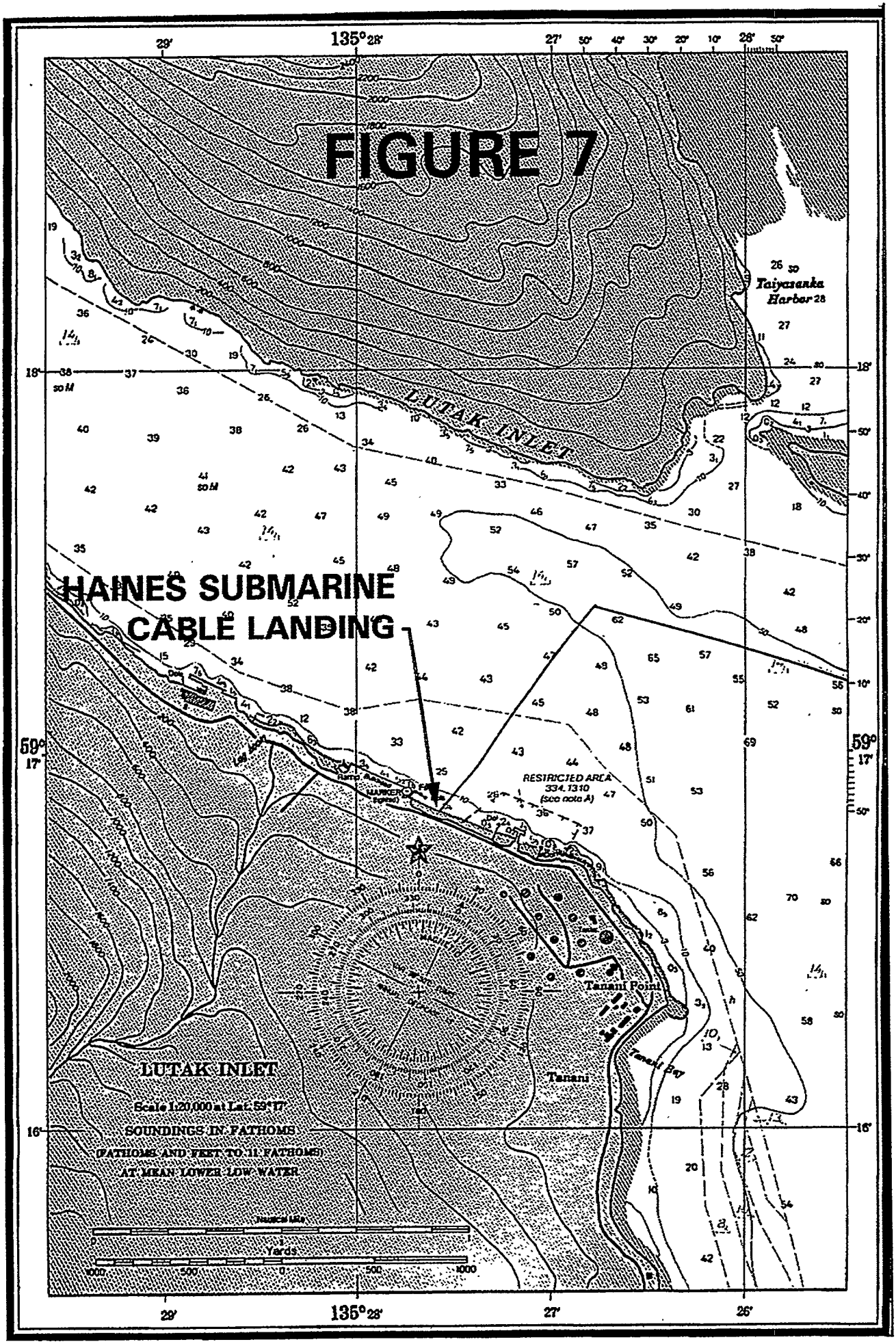
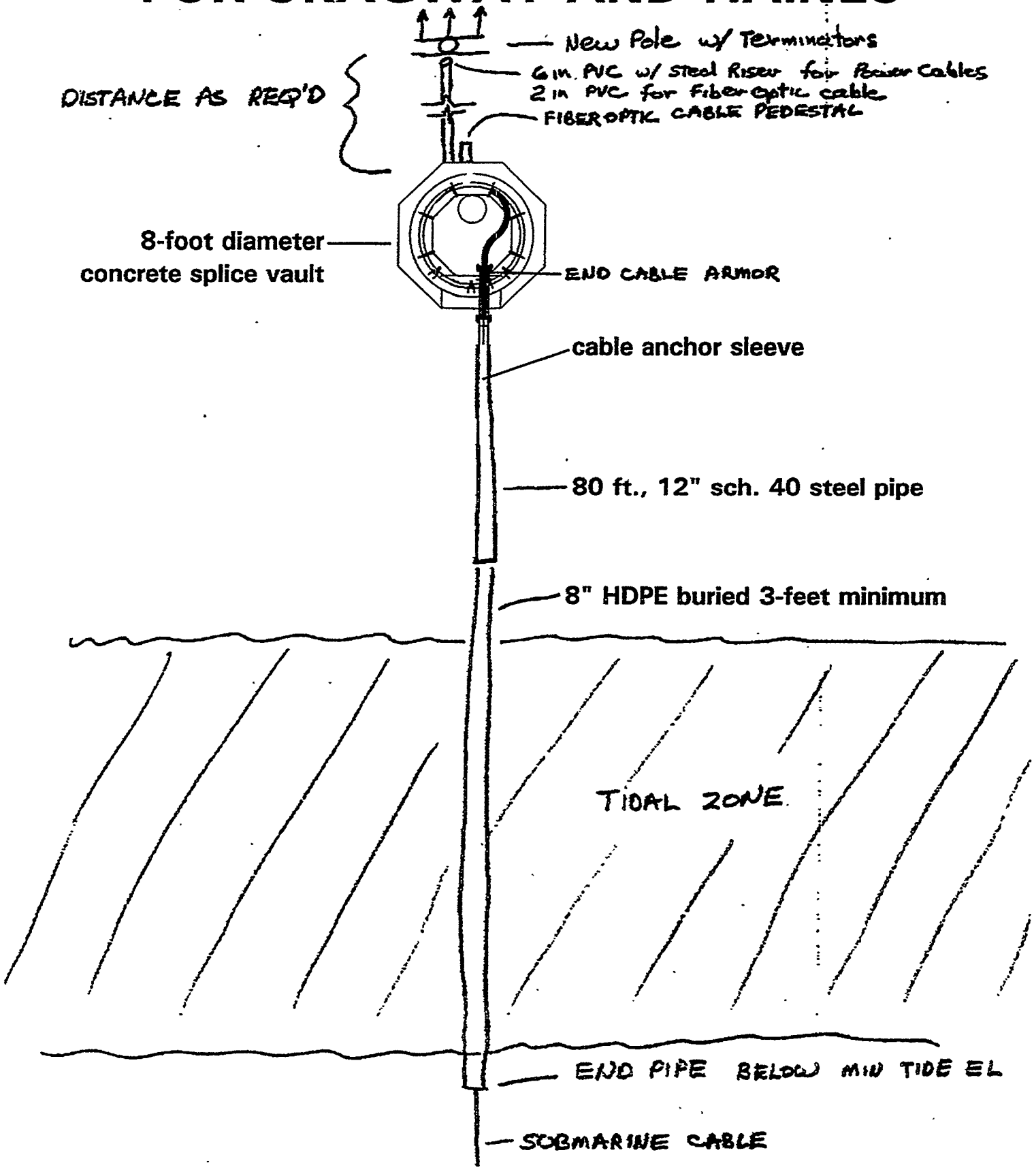
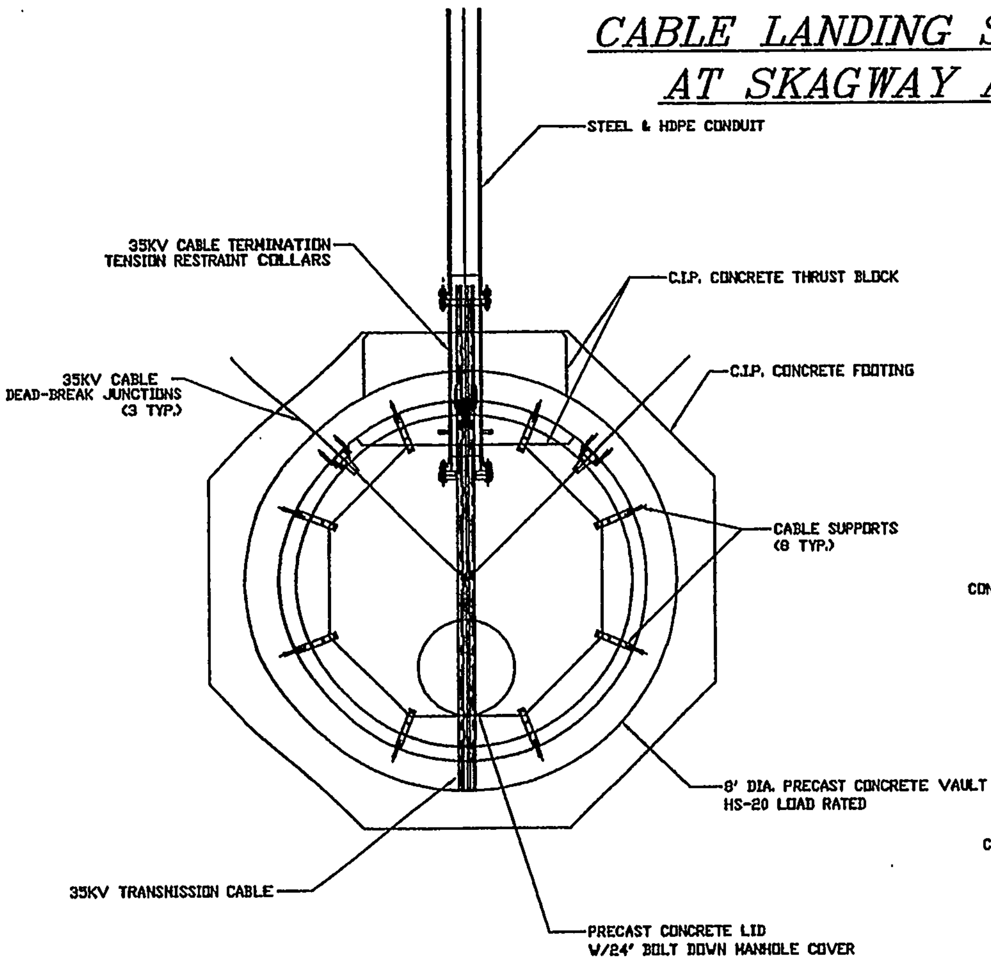


FIGURE 7
HAINES SUBMARINE CABLE LANDING
LUTAK INLET
Taiyasanka Harbor
RESTRICTED AREA
334.1310
(see note A)
Tanani Point
Tanani
Tanani Bay
LUTAK INLET
Scale 1:20,000 at Lat. 59°17'
SOUNDINGS IN FATHOMS
(FATHOMS AND FEET TO 11 FATHOMS)
AT MEAN LOWER LOW WATER
Nautical Miles
Yards
135°28'
59° 17'
16'
18'

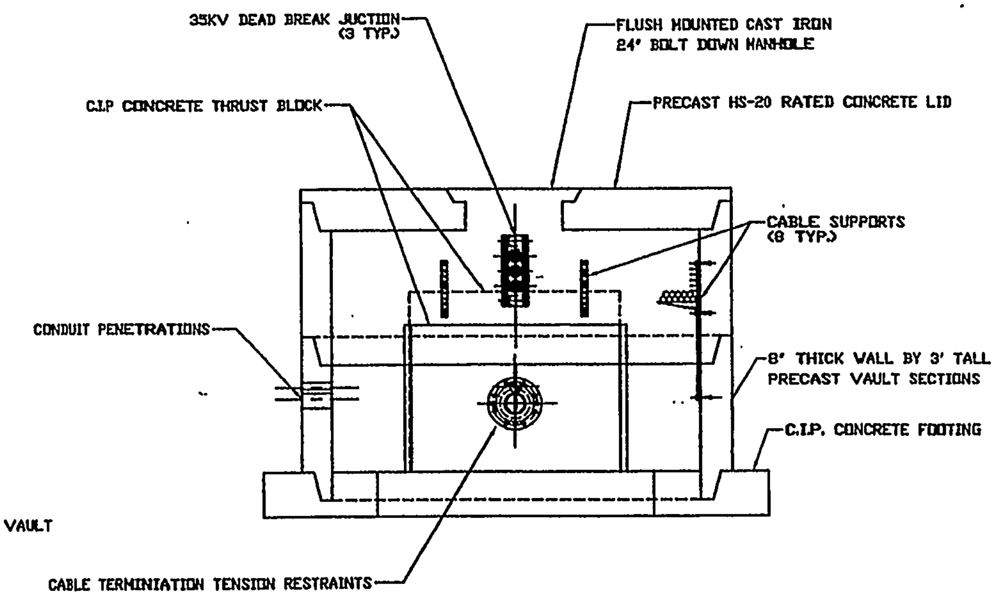
FIGURE 8
PROPOSED CABLE LANDING DESIGN FOR SKAGWAY AND HAINES



CABLE LANDING SPLICE VAULTS AT SKAGWAY AND HAINES



CABLE VAULT PLAN VIEW



CABLE VAULT SECTION VIEW

FIGURE 9: CABLE SPLICE VAULTS

REV	DESCRIPTION	AUTH	REV BY	DATE
A	DOT PERMIT APPLICATION	MER		30Apr98

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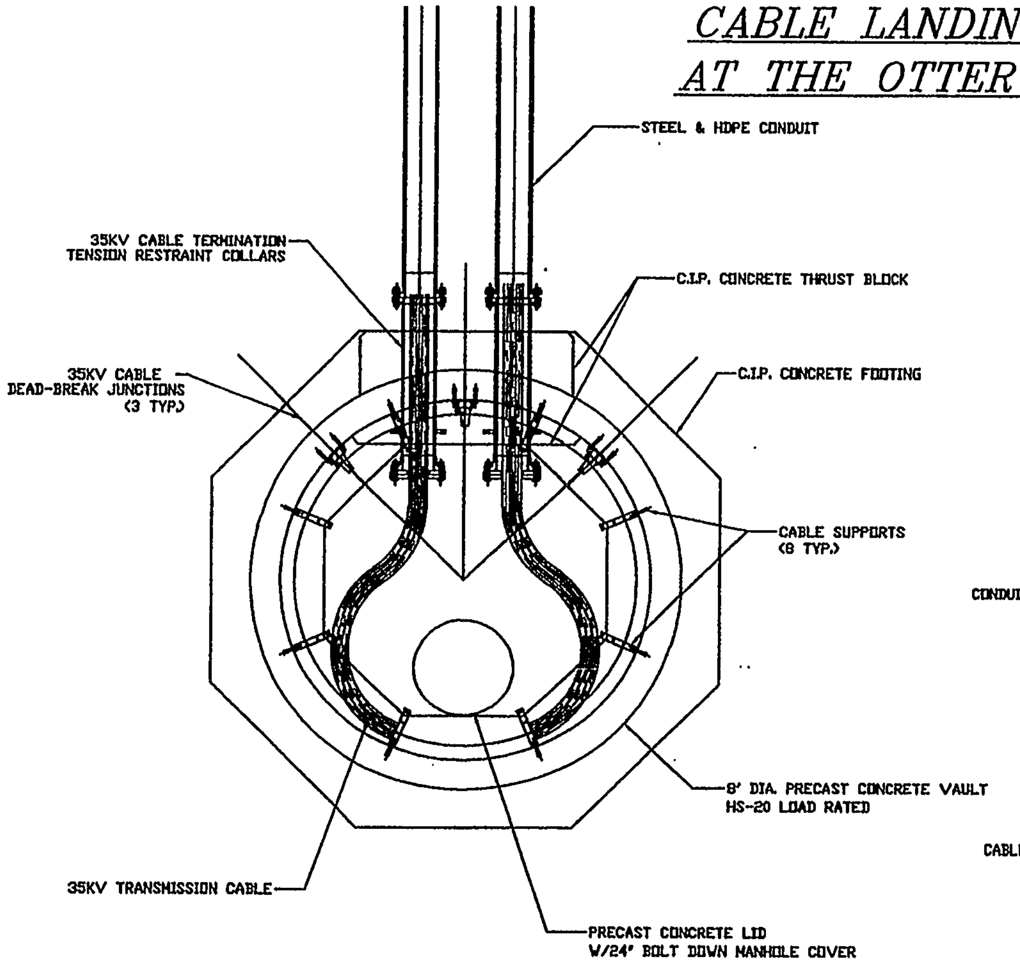
DIMENSIONING AND TOLERANCING ACCORDING TO ANSI Y14.5 ELECTRICAL AND ELECTRONIC SYMBOLS PER ANSI/IEEE ...

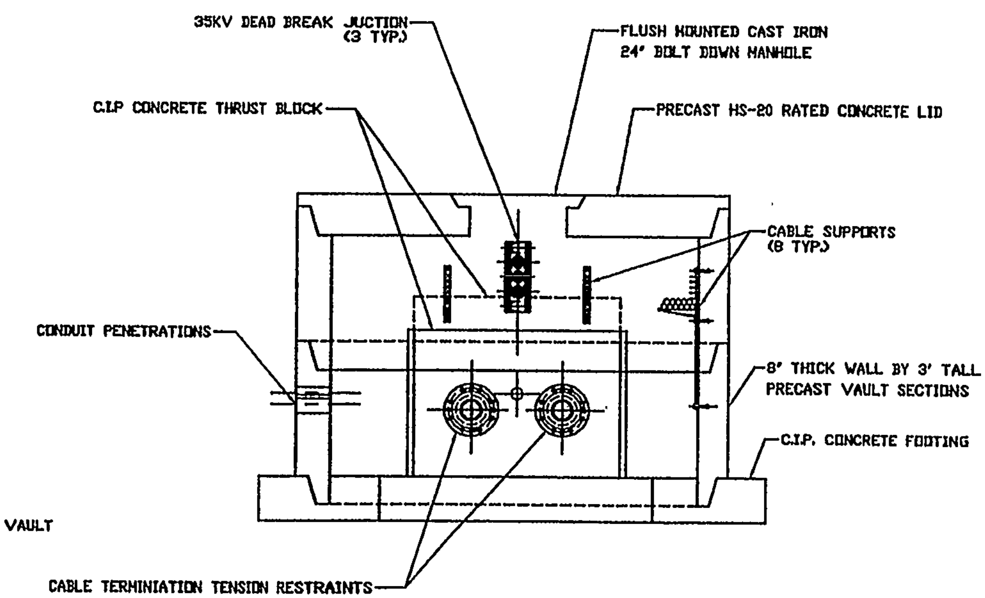
AP&T ALASKA POWER & TELEPHONE COMPANY

ENGINEER	M. RONDA	DESCRIPTION	OUTLINE DIAGRAM GENERAL LANDFALL CABLE VAULT INSTALLATION PLAN
DRAWN	MER	JOB DWG. NO.	SB709P1
CHECKED		PROJECT	HAINES – SKAGWAY SUBMARINE CABLE PROJECT
RECORDED	30Apr98		SH1/2
SCALE	NTS	FILE NO.	

CABLE LANDING SPLICE VAULT AT THE OTTER CREEK PROJECT



CABLE VAULT PLAN VIEW



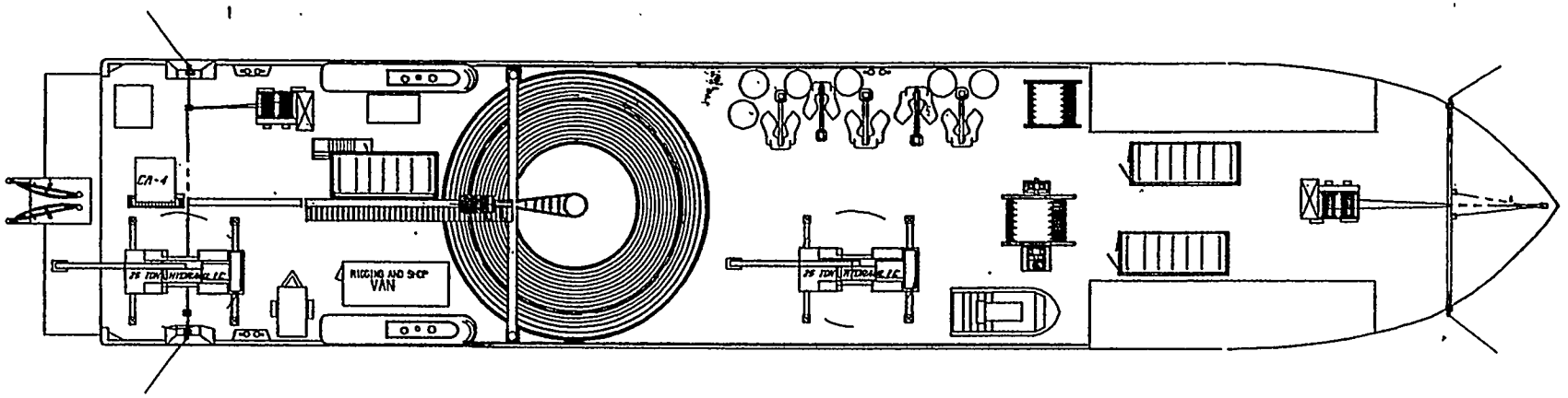
CABLE VAULT SECTION VIEW

FIGURE 10: CABLE SPLICE VAULT

A	DOT PERMIT APPLICATION	MER	30Apr98
REV	DESCRIPTION	APPD BY / REV BY	DATE

ALASKA POWER & TELEPHONE COMPANY

ENGINEER	M. RONDA	DESCRIPTION: OUTLINE DIAGRAM GENERAL HAINES LANDFALL CABLE VAULT INSTALLATION PLAN	JOB DWG. NO. SB709P1
DRAWN	MER		
CHECKED		PROJECT: HNS/SKG T-LINE PROJECT	SH1/2
RECORDED	30Apr98		
SCALE	NTS		



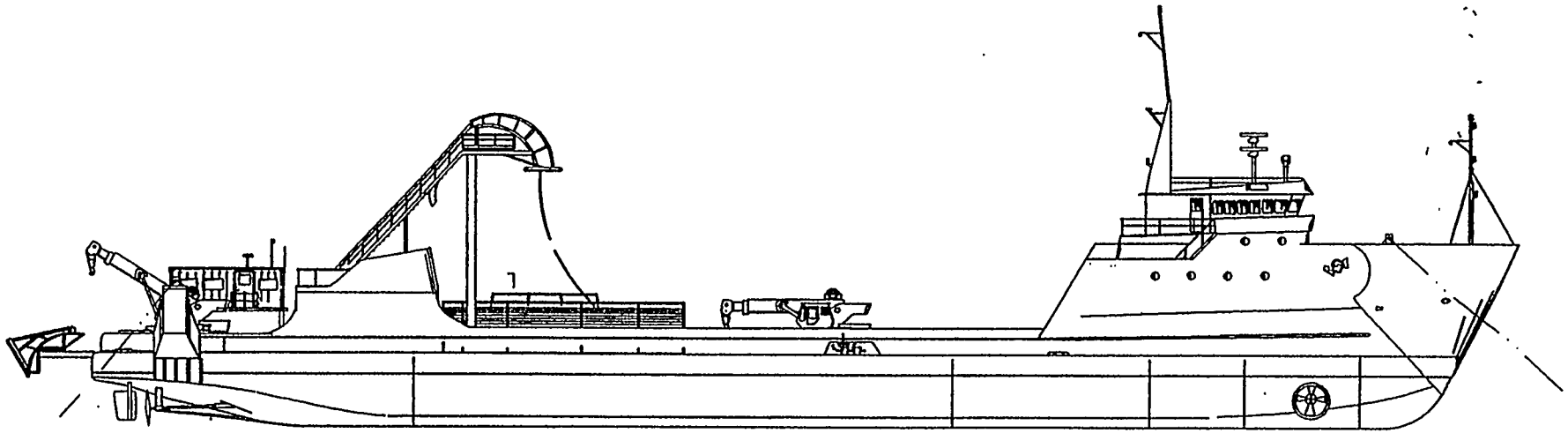


FIGURE 11

VESSEL CHARACTERISTICS

- Power cable 580 mt in 49'od x 20'id x 11'high
- 4 point mooring system (remotely controlled)
- On deck cable laying equipment @ approx. 250mt

PIRELLI
JACOBSON, INC

OFFSHORE CABLE LAYING VESSEL
267 x 51 x 16'

Date	Scale	Checked	Drawn by
8/27/97			NJB

SEABCH4.GCD

HAINES - SKAGWAY

SUBMARINE CABLE INSTALLATION

TECHNICAL REPORT

APPENDIX B

SELECT PROJECT DRAWINGS

(DRAWINGS SHOWING AS-BUILT INFORMATION)

SKAGWAY TO KASIDAY/

;Horizontal Datum: UTM, NAD83
;Horizontal Zone: 08
;Horizontal Units: Meters

;Horizontal Datum:

X	Y	LATITUDE
481315.20	6590220.90	59 27 00.42340
481249.36	6590128.13	59 26 57.41405
481195.63	6589997.95	59 26 53.19701
481017.12	6589659.23	59 26 42.21813
480939.53	6589536.34	59 26 38.23275
480888.06	6589448.56	59 26 35.38662
480843.09	6589360.45	59 26 32.53087
480786.94	6589220.79	59 26 28.00677
480769.40	6589157.87	59 26 25.96984
480685.31	6588788.41	59 26 14.01222
480045.13	6585960.21	59 24 42.47566
480092.91	6585655.75	59 24 32.64133
480177.21	6585594.97	59 24 30.69078
480284.79	6585516.00	59 24 28.15606
480328.54	6585487.68	59 24 27.24791
480373.41	6585465.11	59 24 26.52582
480421.62	6585448.06	59 24 25.98272
480465.53	6585426.98	59 24 25.30859
480502.42	6585411.05	59 24 24.79977
480536.15	6585405.48	59 24 24.62533
480562.57	6585399.93	59 24 24.45031
480570.30	6585397.67	59 24 24.37853
480667.64	6585424.43	59 24 25.25976

REVISION:		
REVISION:		
CHECKED BY: .	SCALE:	
DRAWN BY: JRH	DATE: 8/20/98	SHEET 1 OF 6

CREEK ROUTE COORDINATES

;Horizontal Datum: UTM, NAD83
;Horizontal Zone: 08
Geographic, NAD83 ;Horizontal Units: U.S. Survey Feet

LONGITUDE	X	Y
35 19 46.32520	1579115.0	21621416.4
35 19 50.47608	1578898.9	21621112
35 19 53.84613	1578722.7	21620684.9
35 20 05.07090	1578137.0	21619573.7
35 20 09.95696	1577882.4	21619170.5
35 20 13.19598	1577713.6	21618882.5
35 20 16.02216	1577566.0	21618593.4
35 20 19.54118	1577381.8	21618135.2
35 20 20.63415	1577324.3	21617928.8
35 20 25.85152	1577048.4	21616716.6
35 21 05.53298	1574948.1	21607437.8
35 21 02.40112	1575104.8	21606438.9
35 20 57.03516	1575381.4	21606239.5
35 20 50.18714	1575734.3	21605980.4
35 20 47.40356	1575877.9	21605887.5
35 20 44.55090	1576025.1	21605813.4
35 20 41.48830	1576183.3	21605757.5
35 20 38.69706	1576327.3	21605688.4
35 20 36.35267	1576448.4	21605636.1
35 20 34.21206	1576559.2	1605617.8
35 20 32.53498	1576645.7	21605599.6
35 20 32.04409	1576671.1	21605592.2
35 20 25.88053	1576990.4	21605680

EXHIBIT 1
SKAGWAY TO KASIDAYA CREEK
ROUTE COORDINATES

RELLI COBSON, INC. 9th Ave. N.W. Seattle, WA 98107 (206)782-1618	AS-LAID AND POWER CABLE FROM SKAGWAY TO KASIDAYA CREEK For ALASKA POWER & TELEPHONE CO. ALASKA	ALASKA POWER & TELEPHONE COMPANY	DESCRIPTION SKAGWAY TO KASIDAYA CREEK ROUTE COORDINATES	JOB DWG. NO. SUB
			PROJECT SKAGWAY TO HAINES SUBMARINE CABLE PROJECT	SH 00
				FILE NO.

KASIDAYA CREEK TO HAI

;Horizontal Datum: UTM, NAD83
;Horizontal Zone: 08
;Horizontal Units: Meters

;Horizontal Datum: (

X	Y	LATITUDE
480667.64	6585424.43	59 24 25.25976
480570.29	6585397.61	59 24 24.37659
480516.76	6585392.63	59 24 24.20669
480473.95	6585382.65	59 24 23.87691
480427.37	6585371.11	59 24 23.49606
480356.59	6585371.44	59 24 23.49486
480271.80	6585359.78	59 24 23.10364
480162.24	6585328.83	59 24 22.08455
480038.64	6585277.25	59 24 20.39605
479931.65	6585232.95	59 24 18.94562
479877.34	6585213.80	59 24 18.31720
479829.50	6585183.98	59 24 17.34495
479771.69	6585056.46	59 24 13.21253
479771.15	6584997.69	59 24 11.31254
479772.74	6584912.51	59 24 08.55915
479777.10	6584844.05	59 24 06.34675
479780.53	6584797.16	59 24 04.83149
479737.45	6584604.61	59 23 58.59934
478670.00	6579890.00	59 21 25.99682
478210.00	6571900.00	59 17 07.61149
477380.00	6571290.00	59 16 47.73442
474508.66	6572092.24	59 17 13.08122
474200.00	6571600.00	59 16 57.10074
474115.22	6571488.65	59 16 53.48238
474031.78	6571405.06	59 16 50.76167
474017.73	6571373.88	59 16 49.75058
473990.19	6571301.62	59 16 47.40848
473992.19	6571296.59	59 16 47.24631
474001.47	6571292.13	59 16 47.10418

REVISION:		
REVISION:		
CHECKED BY: .	SCALE:	
DRAWN BY: JRH	DATE: 6/20/96	SHEET 2 OF 6

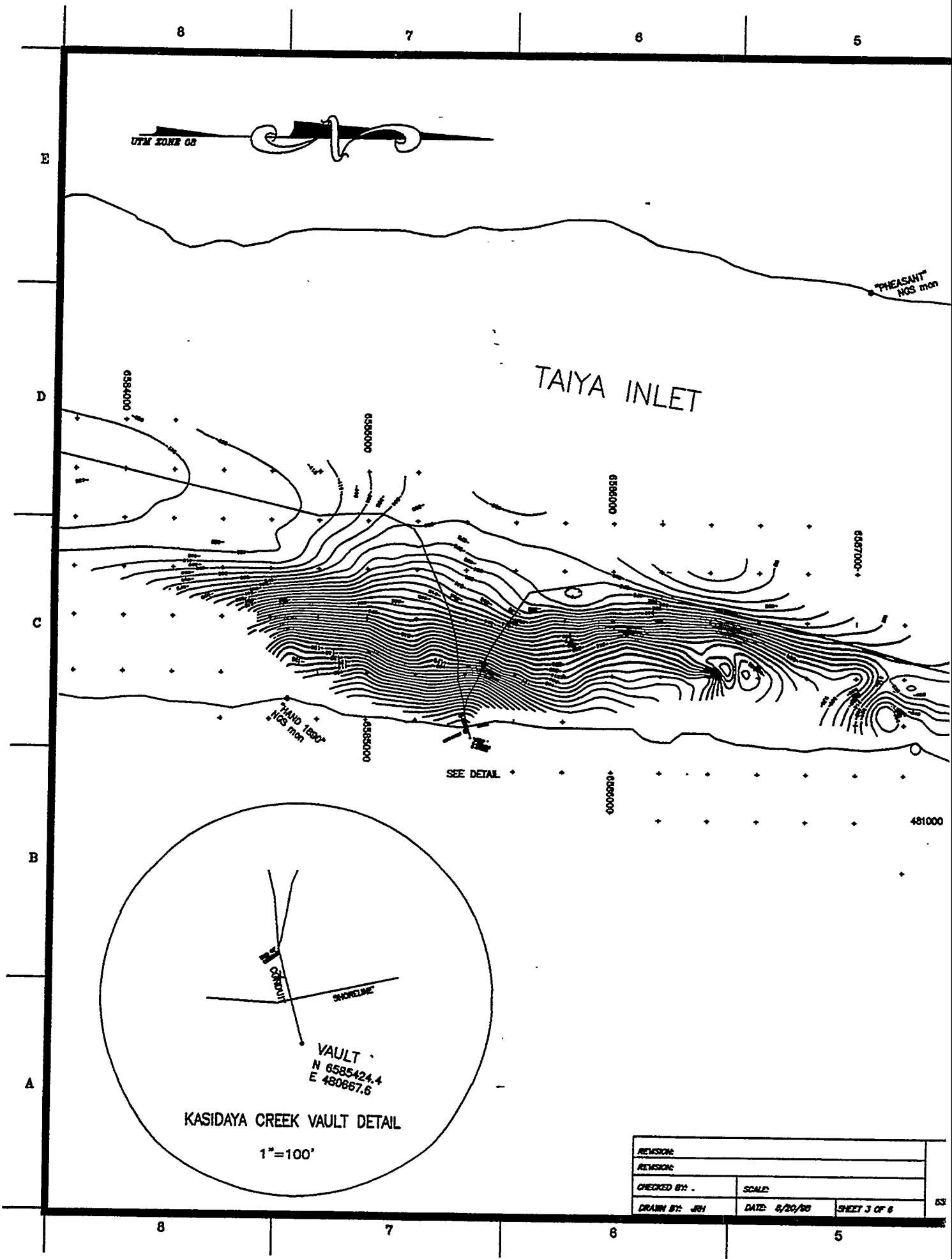
NES ROUTE COORDINATES

;Horizontal Datum: UTM,. NAD83
;Horizontal Zone: 08
eographic, NAD83 ;Horizontal Units: U.S. Survey Feet

LONGITUDE	X	Y
35 20 25.88053	1576990.4	21605680
35 20 32.04470	1576671.0	21605592
35 20 35.43736	1576495.4	21605575.7
35 20 38.14863	1576355.0	21605542.9
35 20 41.09842	1576202.1	21605505.1
35 20 45.58658	1575969.9	21605506.1
35 20 50.95913	1575691.7	21605467.9
35 20 57.89585	1575332.3	21605366.3
35 21 05.71577	1574926.8	21605197.1
35 21 12.48476	1574575.8	21605051.8
35 21 15.92188	1574397.6	21604988.9
35 21 18.94513	1574240.6	21604891.1
35 21 22.56731	1574051.0	21604472.7
5 21 22.58160	1574049.2	21604279.9
35 21 22.45189	1574054.4	21604000.5
35 21 22.15224	1574068.7	21603775.9
35 21 21.91887	1574080.0	21603622
35 21 24.58465	1573938.6	21602990.3
35 22 30.57199	1570436.5	21587522.4
5 22 56.79326	1568927.3	1561308.6
35 23 49.00552	1566204.2	21559307.3
5 26 50.73497	1556783.8	21561939.3
5 27 10.02642	1555771.2	21560324.3
35 27 15.33461	1555493.0	21559959
5 27 20.56984	1555219.3	21559684.8
35 27 21.44395	1555173.2	21559582.5
35 27 23.15248	1555082.8	21559345.4
5 27 23.02396	1555089.4	21559328.9
5 27 22.43580	1555119.8	21559314.3

EXHIBIT 2
KASIDAYA CREEK TO HAINES
ROUTE COORDINATES

RELLI COBSON. INC.	AS-LAID AND POWER CABLE FROM SKAGWAY TO KASIDAYA CREEK For ALASKA POWER & TELEPHONE CO. ALASKA	ALASKA POWER & TELEPHONE COMPANY	DESCRIPTION KASIDAYA CREEK TO HAINES ROUTE COORDINATES	JOB DWG. NO. SUB1
			PROJECT SKAGWAY TO HAINES SUBMARINE CABLE PROJECT	SH 00
				FILE NO.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481000
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SHORELINE
VAULT
N 6585424.4
E 480867.6
KASIDAYA CREEK VAULT DETAIL
1"=100'
REVISION:
REVISION:
CHECKED BY:
SCALE:
DRAWN BY: JRH
DATE: 6/20/98
SHEET 3 OF 6

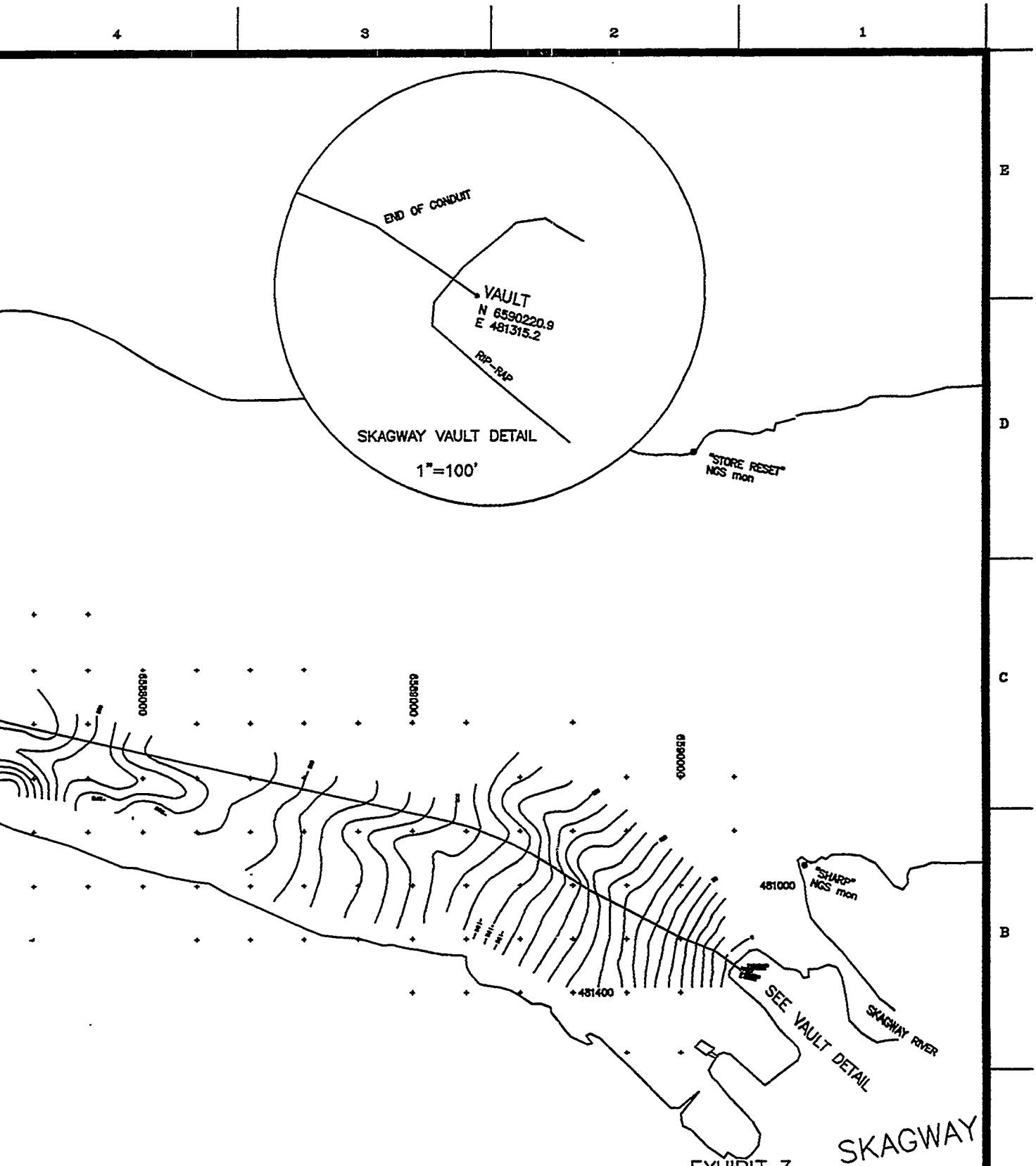
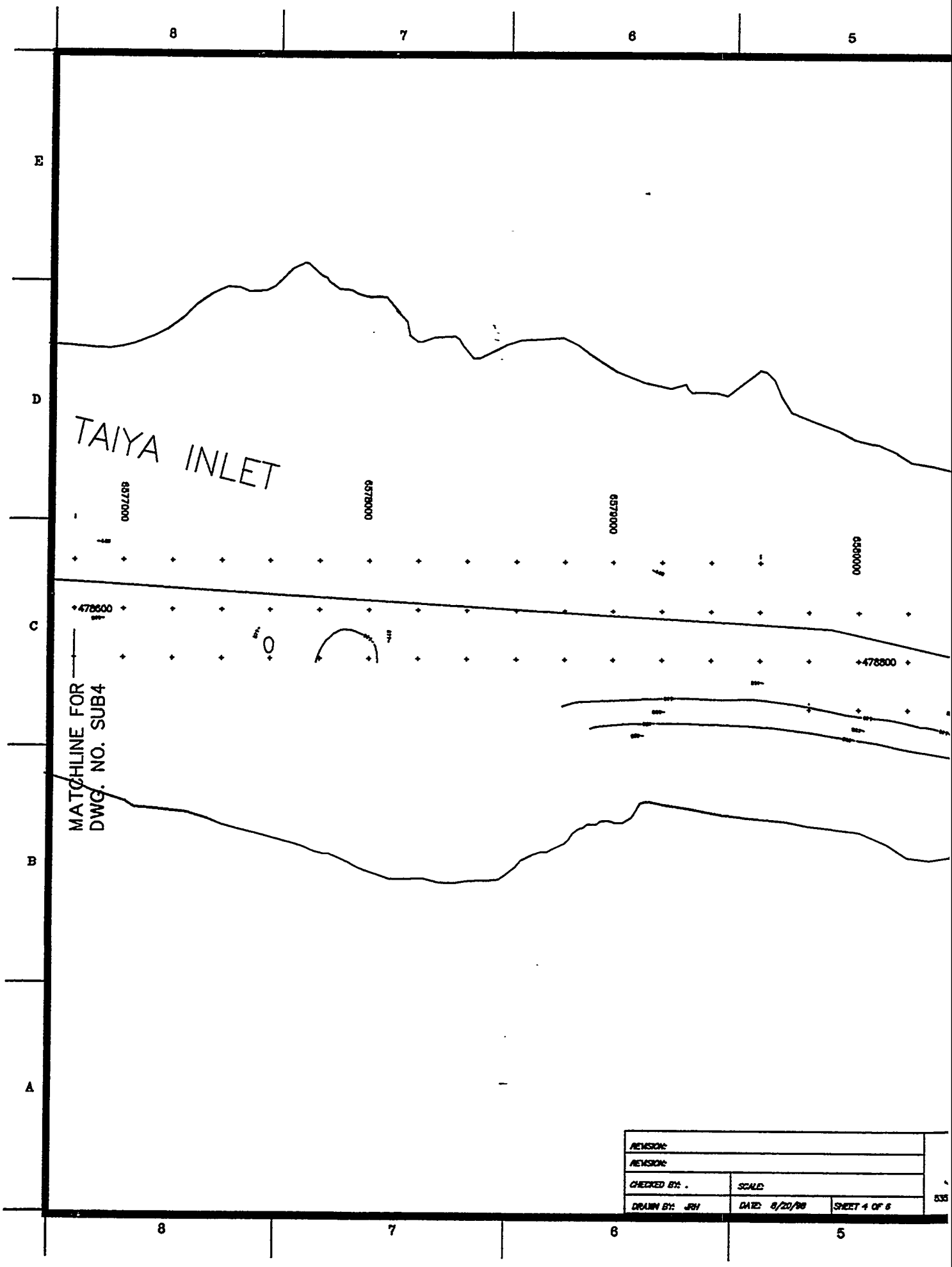


EXHIBIT 3
AS-LAID POWER CABLE FROM
SKAGWAY TO KASIDAYA CREEK

RELLI COBSON, INC. 8th Ave. N.W. Seattle, WA 98107 (206)782-1615	AS-LAID AND POWER CABLE FROM SKAGWAY TO KASIDAYA CREEK For ALASKA POWER & TELEPHONE CO. ALASKA	ALASKA POWER & TELEPHONE COMPANY	DESCRIPTION: AS-LAID POWER CABLE FROM SKAGWAY TO KASIDAYA CREEK	JOB DWG. NO. SUB2
			PROJECT: SKAGWAY TO HAINES SUBMARINE CABLE PROJECT	SH 00
				FILE NO.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MATCHLINE FOR
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REVISION:
REVISION:
CHECKED BY: .
SCALE:
DRAWN BY: JRH
DATE: 8/20/98
SHEET 4 OF 6

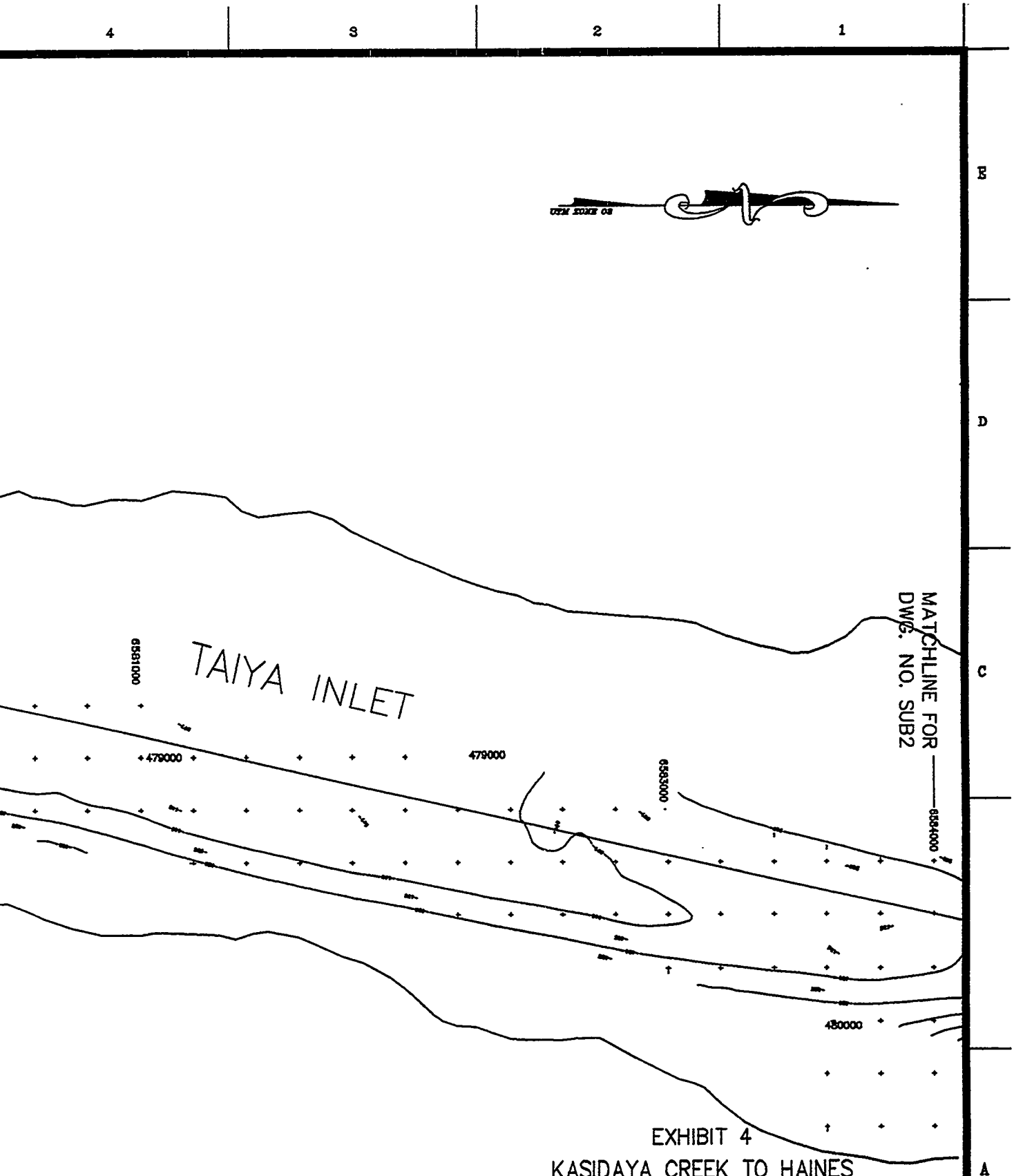
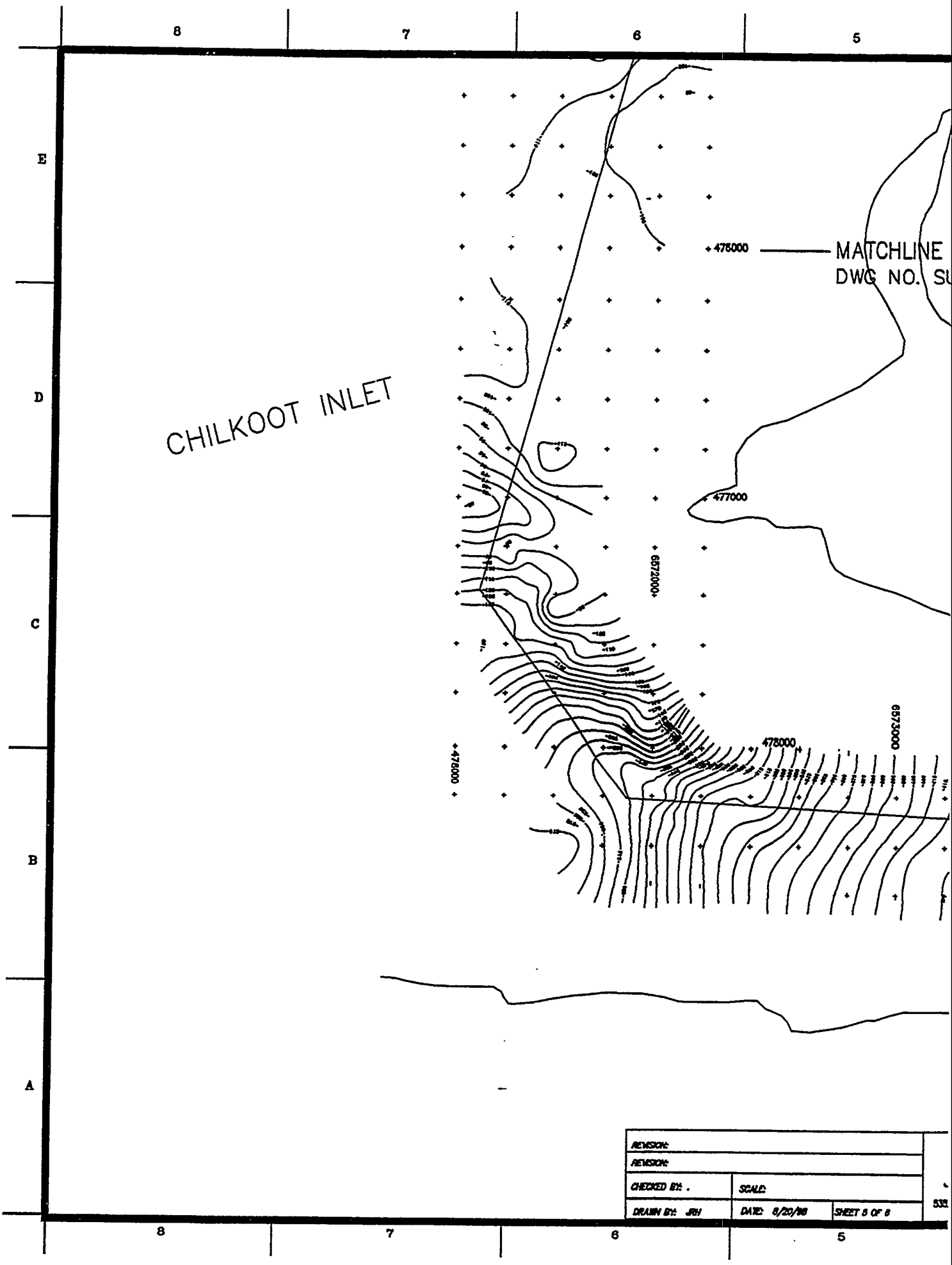


EXHIBIT 4
KASIDAYA CREEK TO HAINES
ROUTE COORDINATES

RELLI COBSON, INC. 4th Ave. N.W. Seattle, WA 98107 (206)782-1618	AS-LAID AND POWER CABLE FROM SKAGWAY TO KASIDAYA CREEK For ALASKA POWER & TELEPHONE CO. ALASKA	ALASKA POWER & TELEPHONE COMPANY	DESCRIPTION: KASIDAYA CREEK TO HAINES ROUTE COORDINATES PROJECT: SKAGWAY TO HAINES SUBMARINE CABLE PROJECT	JOB DWG. NO. SUB3 SH 00 FILE NO.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REVISION:
REVISION:
CHECKED BY: .
SCALE:
DRAWN BY: JRH
DATE: 6/20/08
SHEET 5 OF 6

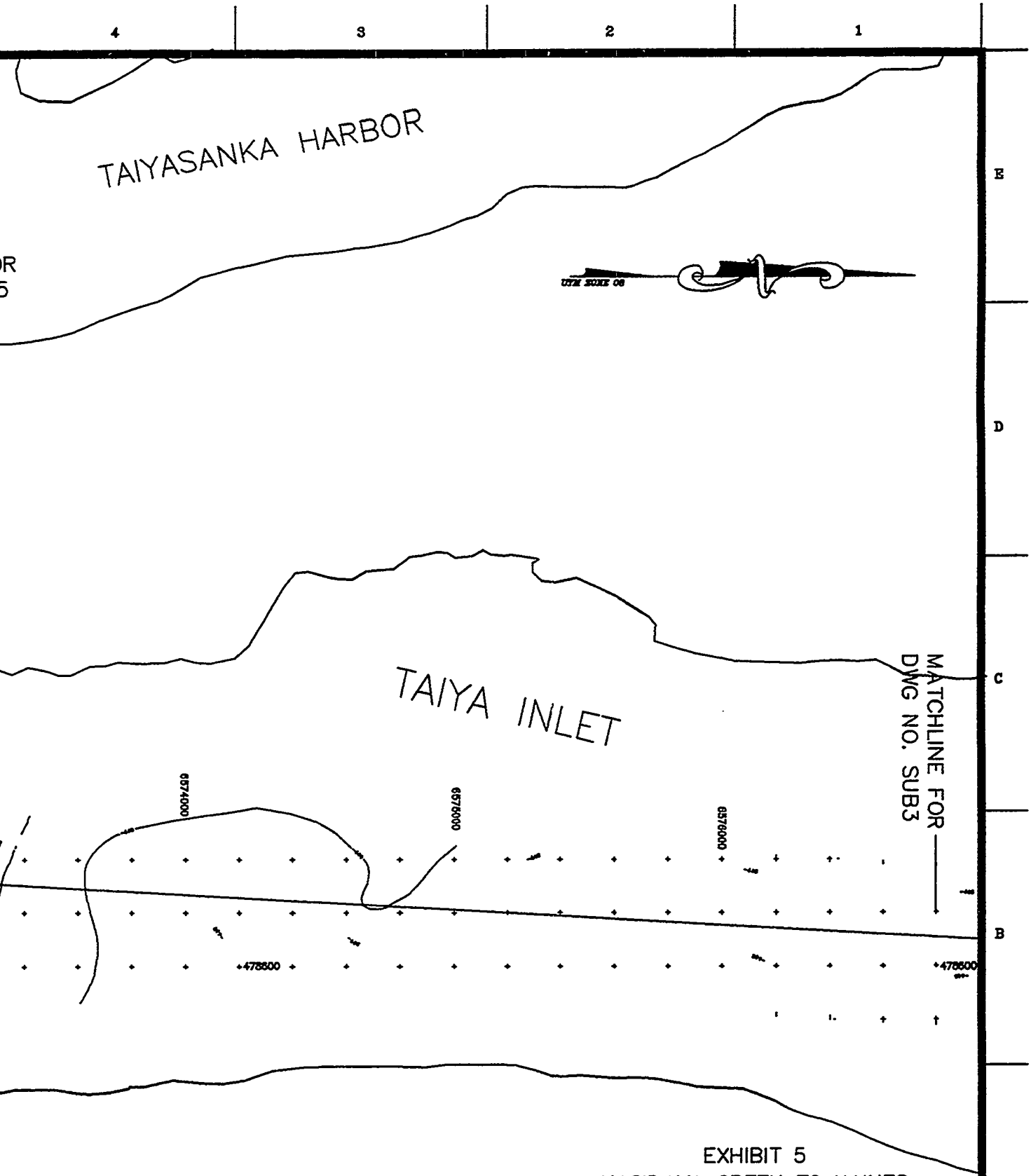
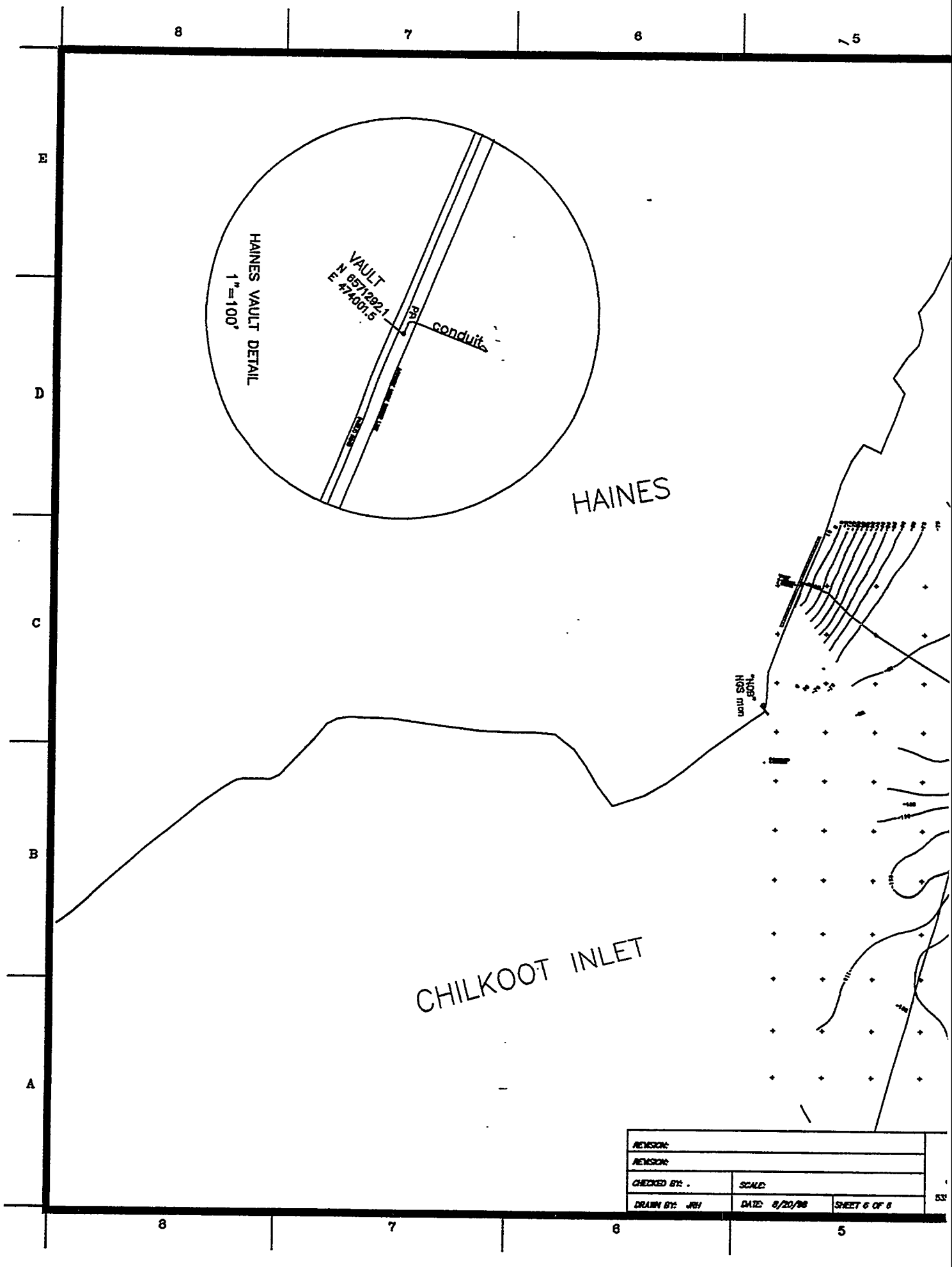


EXHIBIT 5
KASIDAYA CREEK TO HAINES
ROUTE COORDINATES

RELLI COBSON, INC.	AS-LAID AND POWER CABLE FROM SKAGWAY TO KASIDAYA CREEK For ALASKA POWER & TELEPHONE CO. ALASKA	ALASKA POWER & TELEPHONE COMPANY	DESCRIPTION: KASIDAYA CREEK TO HAINES ROUTE COORDINATES	JOB DWG. NO. SUB4
			PROJECT: SKAGWAY TO HAINES SUBMARINE CABLE PROJECT	SH 00
				FILE NO.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HAINES VAULT DETAIL
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VAULT
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conduit
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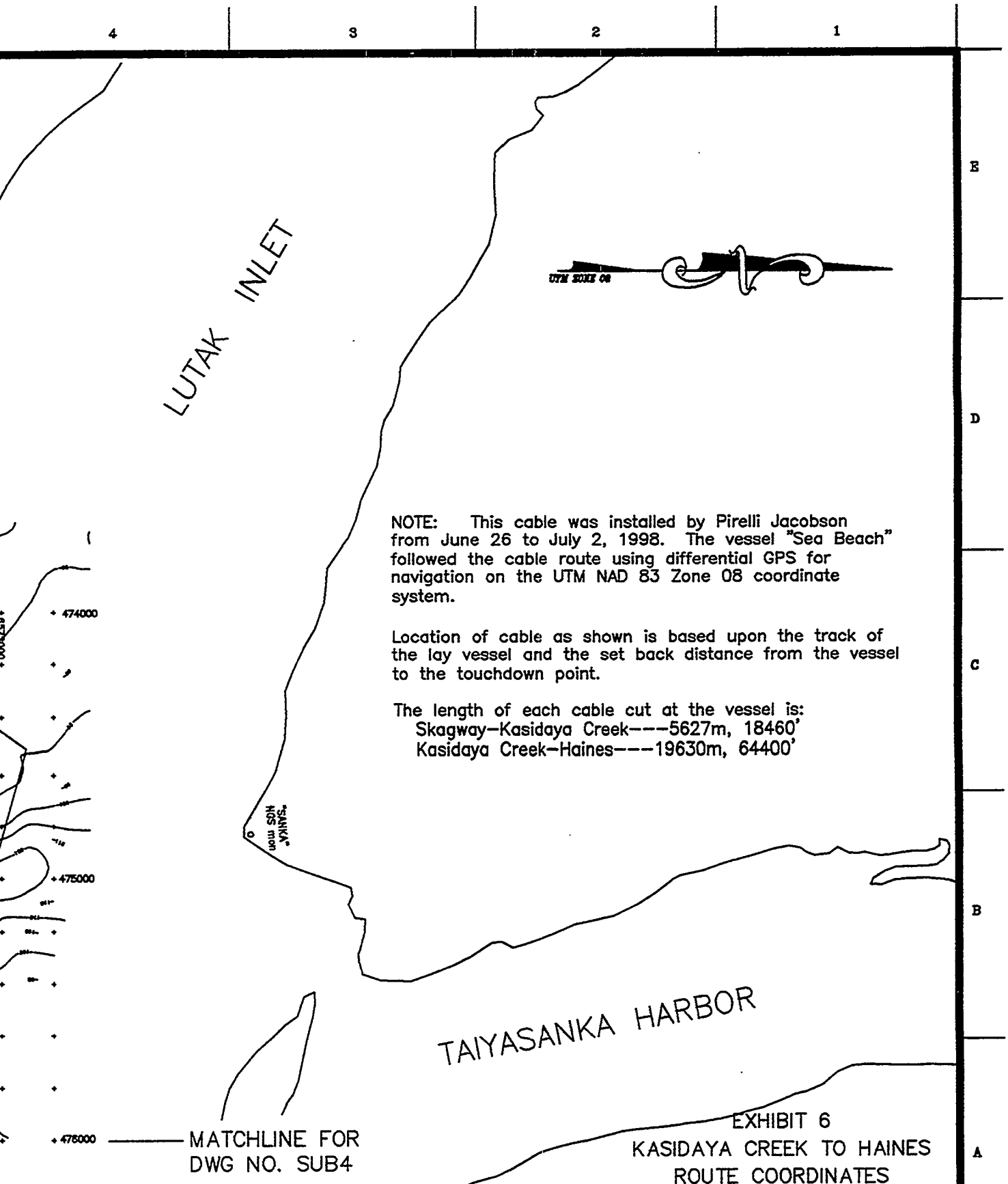
CHILKOOT INLET
REVISION:
REVISION:
CHECKED BY: .
SCALE:
DRAWN BY: JRH
DATE: 8/20/98
SHEET 6 OF 6



NOTE: This cable was installed by Pirelli Jacobson from June 26 to July 2, 1998. The vessel "Sea Beach" followed the cable route using differential GPS for navigation on the UTM NAD 83 Zone 08 coordinate system.

Location of cable as shown is based upon the track of the lay vessel and the set back distance from the vessel to the touchdown point.

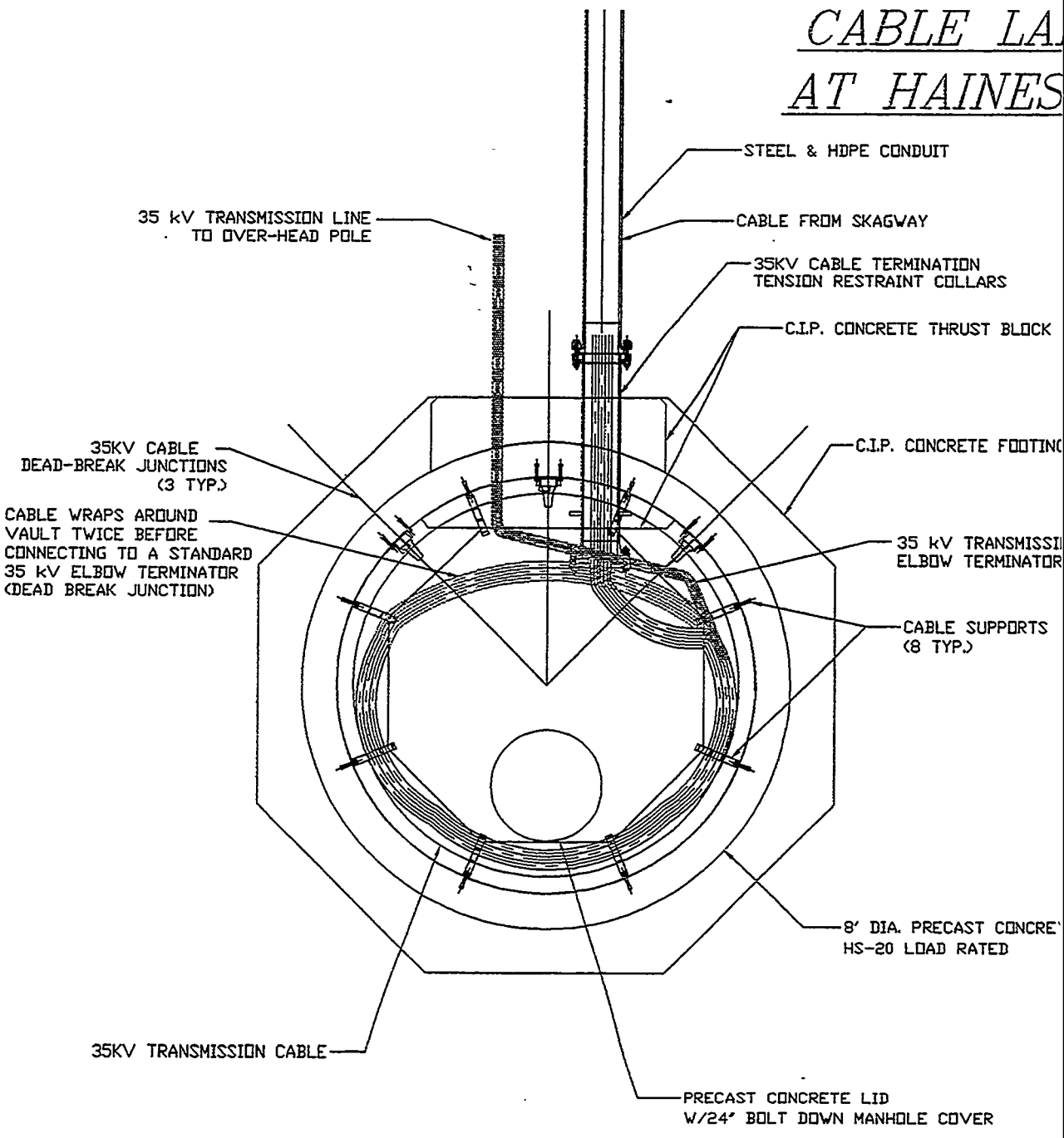
The length of each cable cut at the vessel is:
Skagway–Kasidaya Creek---5627m, 18460'
Kasidaya Creek–Haines---19630m, 64400'

MATCHLINE FOR DWG NO. SUB4

EXHIBIT 6
KASIDAYA CREEK TO HAINES
ROUTE COORDINATES

PIRELLI COBSON, INC.	AS-LAID AND POWER CABLE FROM SKAGWAY TO KASIDAYA CREEK For ALASKA POWER & TELEPHONE CO. ALASKA	ALASKA POWER & TELEPHONE COMPANY	DESCRIPTION: KASIDAYA CREEK TO HAINES ROUTE COORDINATES	JOB DWG. NO.: SUB5
			PROJECT: SKAGWAY TO HAINES SUBMARINE CABLE PROJECT	SH 00
				FILE NO.

CABLE LA
AT HAINES



CABLE VAULT PLAN VIEW

REV	DESCRIPTION	AUTH	REV BY	DATE
A	DOT PERMIT APPLICATION	MER		30Apr98

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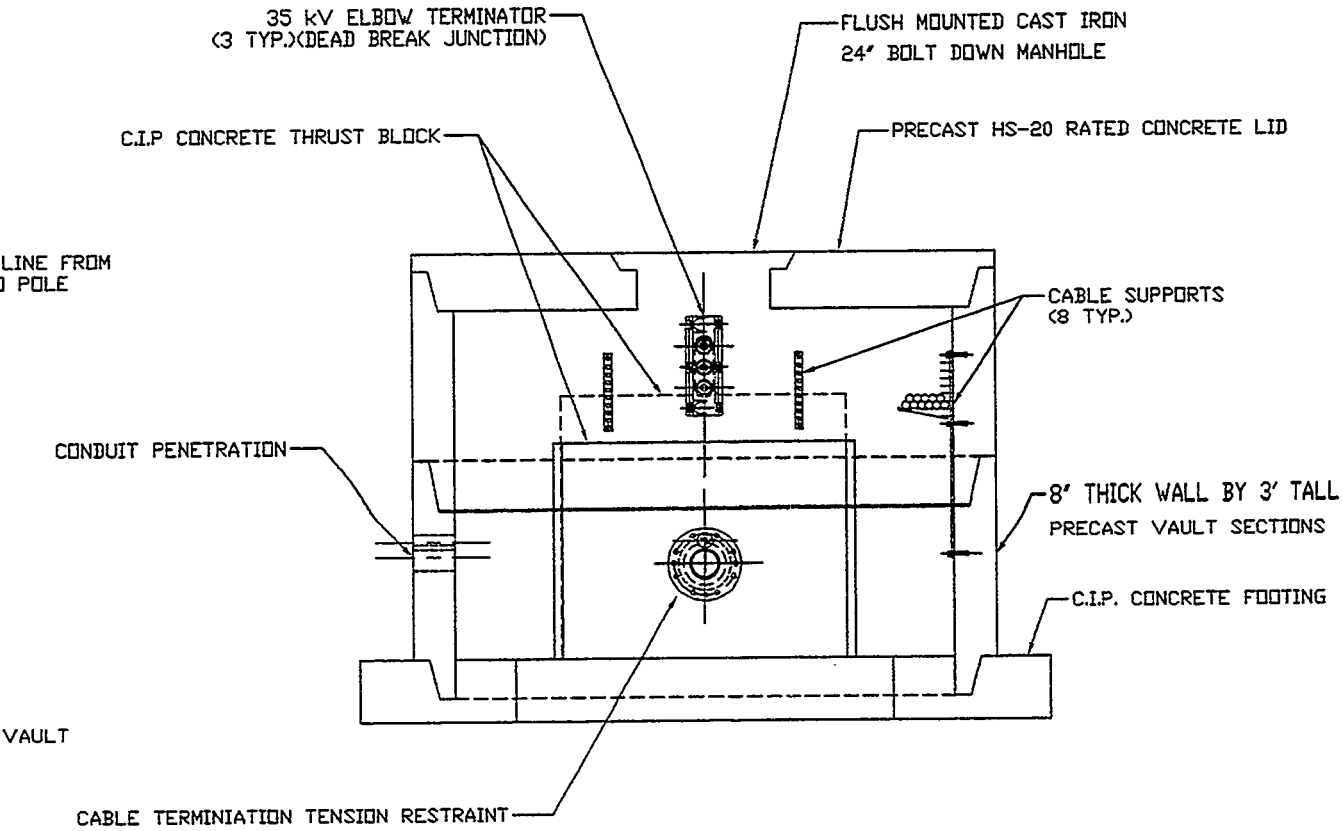
DING SPLICE VAULT
AND SKAGWAY



CABLE VAULT SECTION VIEW

EXHIBIT 7: CABLE SPLICE VAULT

ALASKA POWER & TELEPHONE COMPANY	ENGINEER: M. RONDA	DESCRIPTION: OUTLINE DIAGRAM GENERAL HAINES LANDFALL CABLE VAULT INSTALLATION PLAN	JOB DWG. NO.: SB709P1
	DRAWN: MER		
	CHECKED:	PROJECT: HNS/SKG T-LINE PROJECT	SH1/2
	RECORDED: 30Apr98		FILE C:\ACAD\HNS-SKG1 NO.
	SCALE: NTS		

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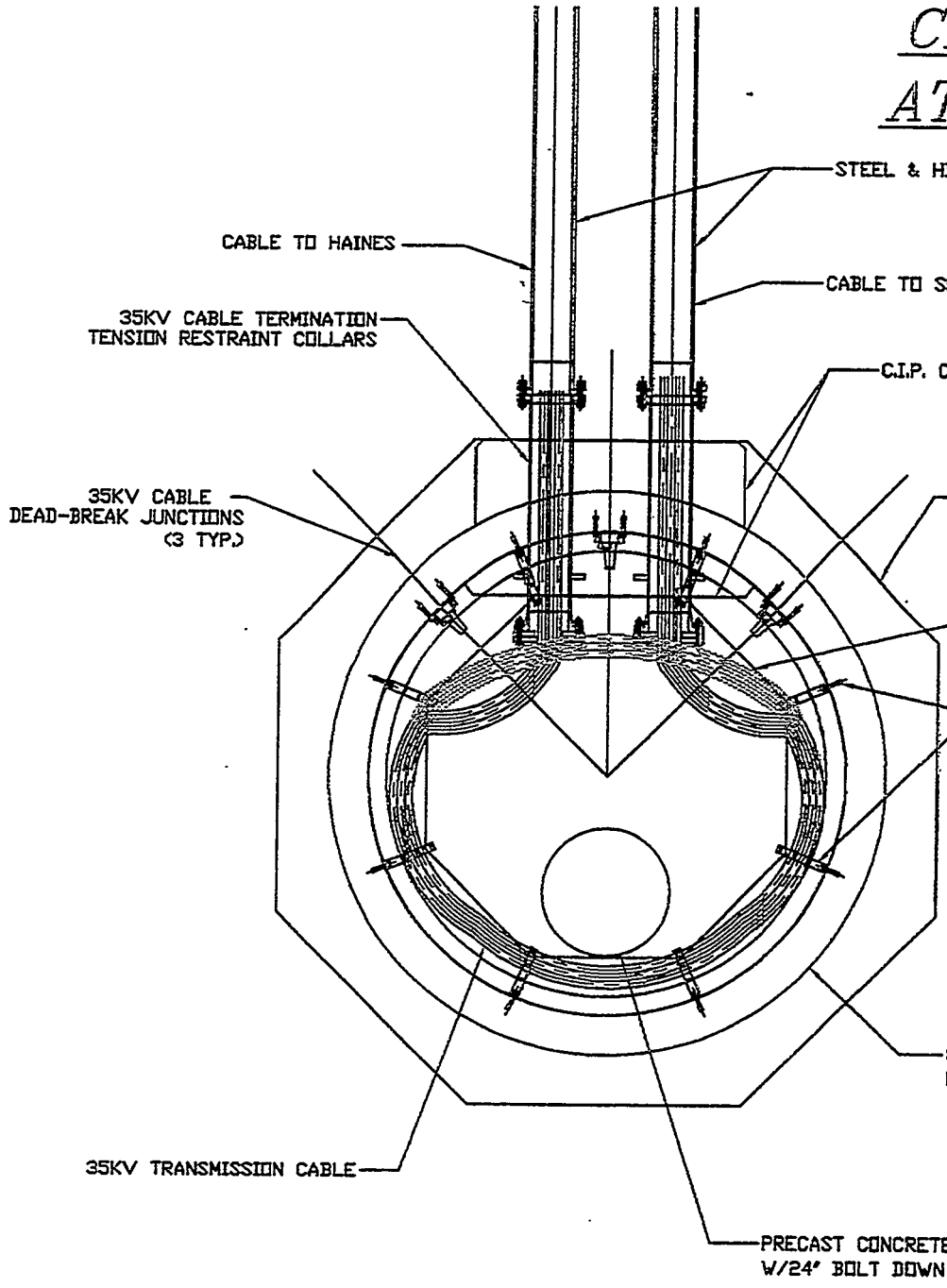

CABLE VAULT PLAN VIEW

REV	DESCRIPTION	AUTH	REV BY	DATE
A	DOT PERMIT APPLICATION	HER		30Apr98

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secret information owned by A
Company, Port Townsend, Wash
Alaska Power Company. All R

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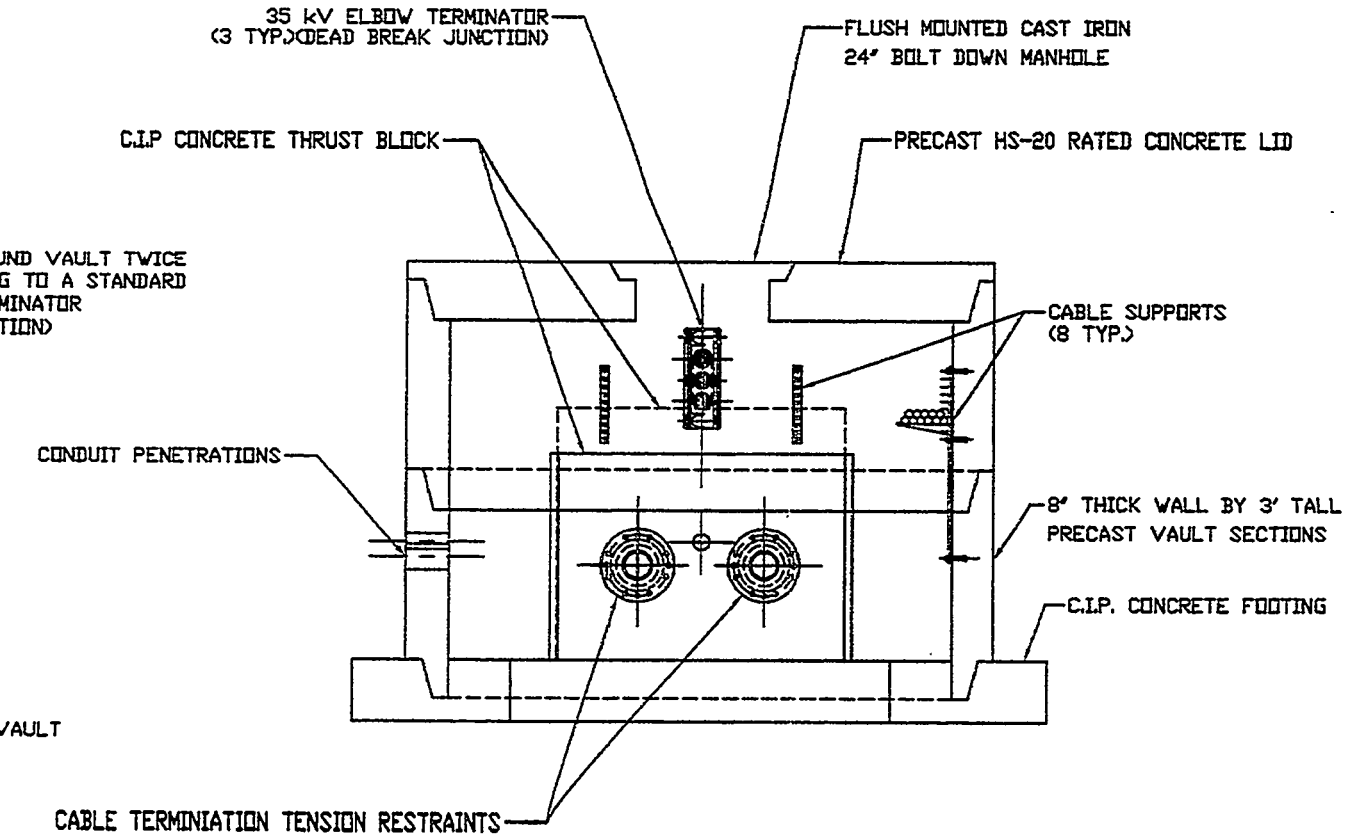
C37.2 - 1979

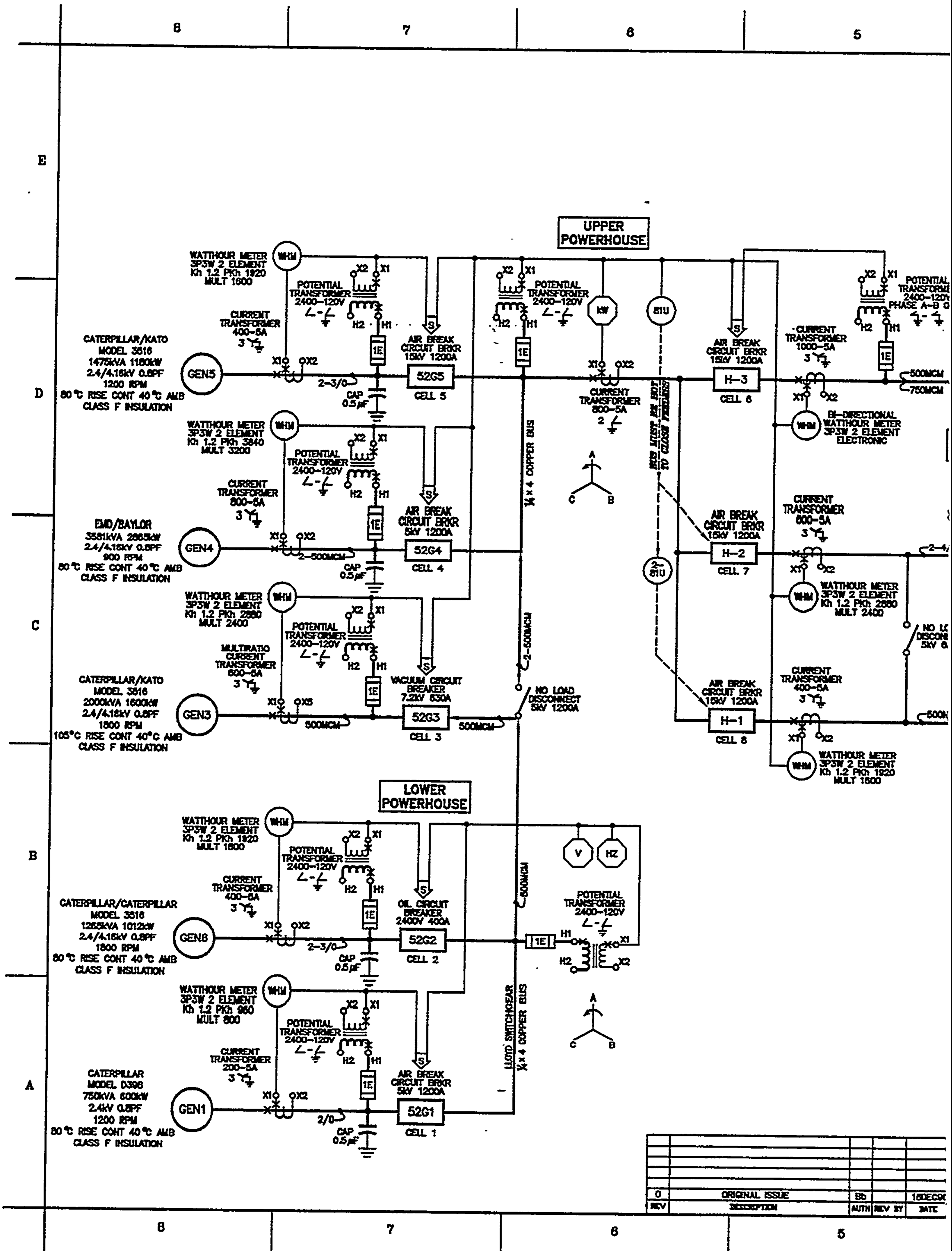
DING SPLICE VAULT
TER CREEK PROJECT



CABLE VAULT SECTION VIEW

EXHIBIT 8: CABLE SPLICE VAULT

ALASKA POWER & TELEPHONE COMPANY	ENGINEER: M. RONDA	DESCRIPTION: OUTLINE DIAGRAM GENERAL HAINES LANDFALL CABLE VAULT INSTALLATION PLAN	JOB DWG. NO. SB709P1
	DRAWN: NER		
	CHECKED:	PROJECT: HNS/SKG T-LINE PROJECT	SH1/2
	RECORDED: 30Apr98		FILE NO. G:\ACAD\HNS-SKG1
	SCALE: NTS		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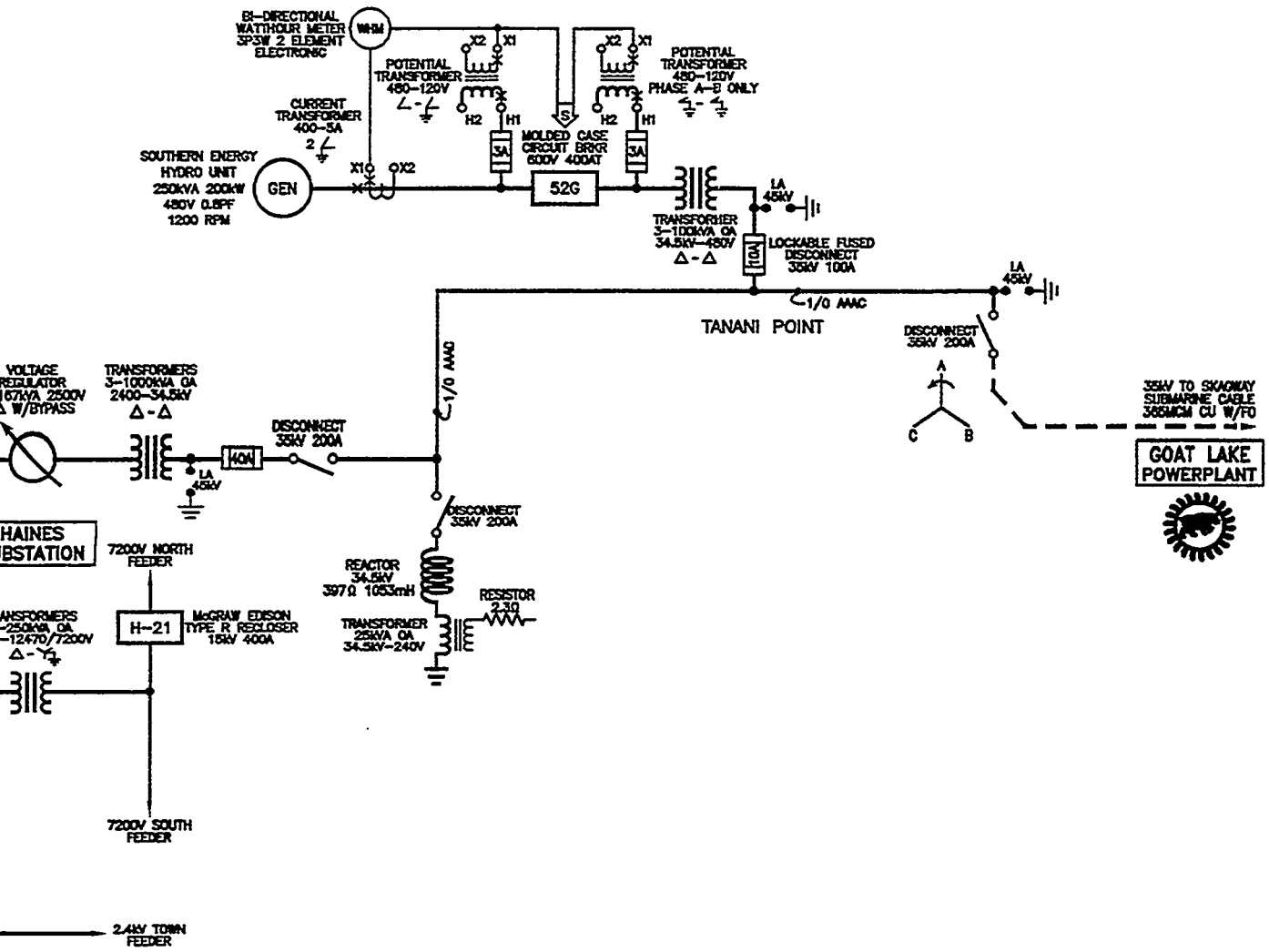
UPPER POWERHOUSE
LOWER POWERHOUSE
WATTHOUR METER 3P3W 2 ELEMENT Kh 1.2 PKh 1920 MULT 1600
POTENTIAL TRANSFORMER 2400-120V
CURRENT TRANSFORMER 400-5A
CATERPILLAR/KATO MODEL 3516 1475kVA 1180kW 2.4/4.16kV 0.8PF 1200 RPM 80°C RISE CONT 40°C AMB CLASS F INSULATION
GEN5
2-3/0
CAP 0.5μF
AIR BREAK CIRCUIT BRKR 15kV 1200A
52G5
CELL 5
KW
81U
CURRENT TRANSFORMER 800-5A
AIR BREAK CIRCUIT BRKR 15kV 1200A
H-3
CELL 6
POTENTIAL TRANSFORMER 2400-120V PHASE A-B
CURRENT TRANSFORMER 1000-5A
500MCM
750MCM
BI-DIRECTIONAL WATTHOUR METER 3P3W 2 ELEMENT ELECTRONIC
WATTHOUR METER 3P3W 2 ELEMENT Kh 1.2 PKh 3840 MULT 3200
CURRENT TRANSFORMER 800-5A
EMD/BAYLOR 3581kVA 2865kW 2.4/4.16kV 0.8PF 900 RPM 80°C RISE CONT 40°C AMB CLASS F INSULATION
GEN4
2-500MCM
AIR BREAK CIRCUIT BRKR 5kV 1200A
52G4
CELL 4
¼ x 4 COPPER BUS
BUS MUST BE DEAD TO CLOSE BREAKER
2-81U
AIR BREAK CIRCUIT BRKR 15kV 1200A
H-2
CELL 7
CURRENT TRANSFORMER 800-5A
WATTHOUR METER 3P3W 2 ELEMENT Kh 1.2 PKh 2880 MULT 2400
WATTHOUR METER 3P3W 2 ELEMENT Kh 1.2 PKh 2880 MULT 2400
MULTIRATIO CURRENT TRANSFORMER 600-5A
CATERPILLAR/KATO MODEL 3516 2000kVA 1600kW 2.4/4.16kV 0.8PF 1800 RPM 105°C RISE CONT 40°C AMB CLASS F INSULATION
GEN3
500MCM
VACUUM CIRCUIT BREAKER 7.2kV 630A
52G3
CELL 3
NO LOAD DISCONNECT 5kV 1200A
AIR BREAK CIRCUIT BRKR 15kV 1200A
H-1
CELL 8
CURRENT TRANSFORMER 400-5A
WATTHOUR METER 3P3W 2 ELEMENT Kh 1.2 PKh 1920 MULT 1600
WATTHOUR METER 3P3W 2 ELEMENT Kh 1.2 PKh 1920 MULT 1600
CURRENT TRANSFORMER 400-5A
CATERPILLAR/CATERPILLAR MODEL 3516 1265kVA 1012kW 2.4/4.16kV 0.8PF 1800 RPM 80°C RISE CONT 40°C AMB CLASS F INSULATION
GEN6
OIL CIRCUIT BREAKER 2400V 400A
52G2
CELL 2
V
HZ
POTENTIAL TRANSFORMER 2400-120V
LLOYD SWITCHGEAR ¼ x 4 COPPER BUS
WATTHOUR METER 3P3W 2 ELEMENT Kh 1.2 PKh 960 MULT 800
CURRENT TRANSFORMER 200-5A
CATERPILLAR MODEL D398 750kVA 600kW 2.4kV 0.8PF 1200 RPM 80°C RISE CONT 40°C AMB CLASS F INSULATION
GEN1
2/0
AIR BREAK CIRCUIT BRKR 5kV 1200A
52G1
CELL 1
0 ORIGINAL ISSUE Bb 18DEC9
REV DESCRIPTION AUTH REV BY DATE



WHM REVENUE QUALITY WATTHOUR METERING

kW CONTINUOUSLY RECORDED QUANTITY

S SYNCHRONIZING CAPABILITY

EXHIBIT 9:
HAINES–GL TRANSMISSION

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DIMENSIONING AND TOLERANCES ACCORDING TO ANSI Y14.5
ELECTRICAL AND ELECTRONIC SYMBOLS PER ANSI/IEEE C37.2 – 1979

ALASKA POWER & TELEPHONE COMPANY

ENGINEER	Barreth
DRAWN	Bb
CHECKED	
RECORDED	16DEC96
SCALE	NONE

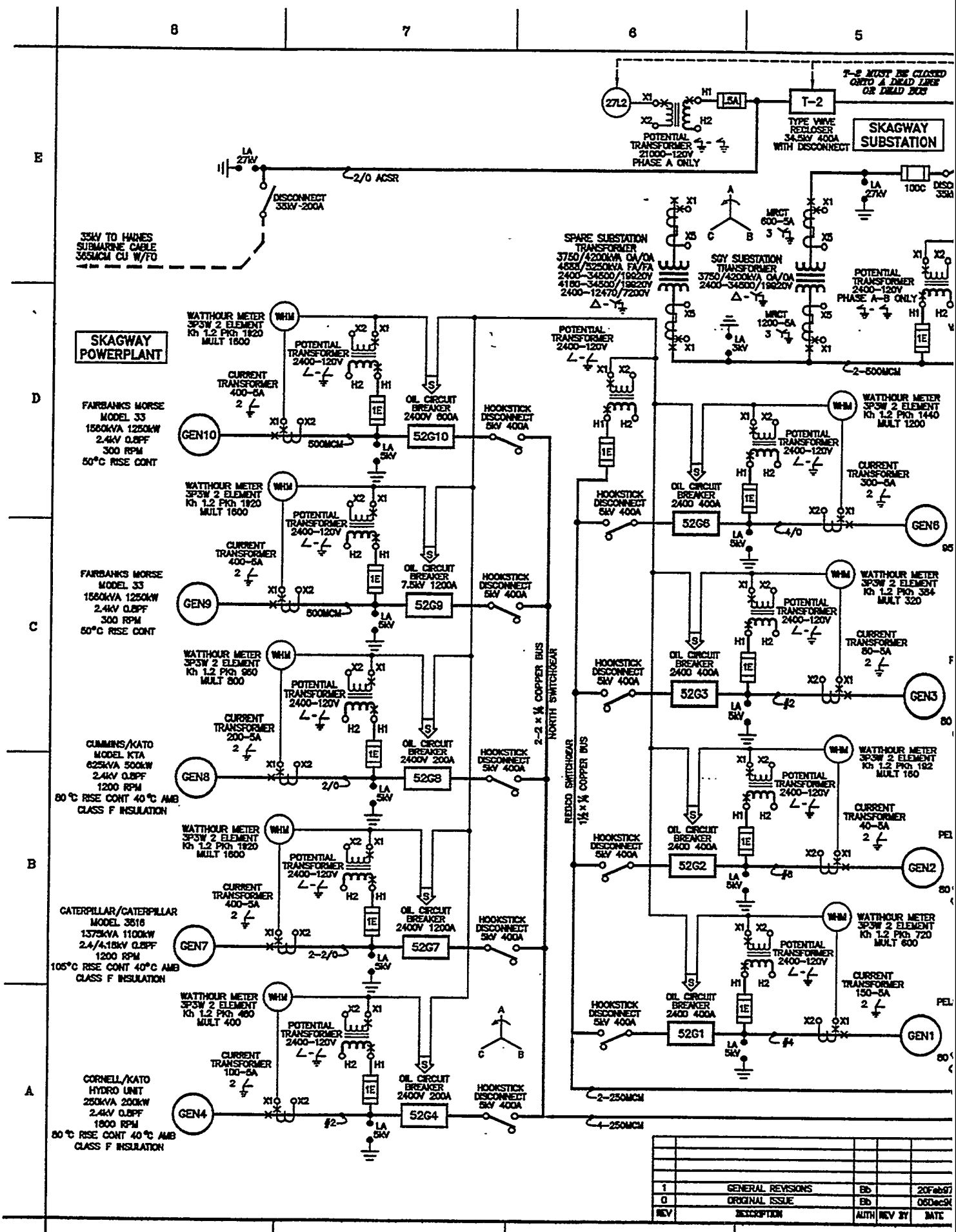
DESCRIPTION: HAINES–GL TRANSMISSION

PROJECT: SINGLE LINE METERING/DISTRIBUTION

JOB DWG. NO.: HNSTLINE

SH 1

FILE NO. HNSTLINE.DWG


T-2 MUST BE CLOSED ONTO A DEAD LINE OR DEAD BUS
27L2
T-2
TYPE VWE RECLOSER 34.5kV 400A WITH DISCONNECT
SKAGWAY SUBSTATION
POTENTIAL TRANSFORMER 21000-120V PHASE A ONLY
LA 27kV
2/0 ACSR
DISCONNECT 35kV-200A
35kV TO HAINES SUBMARINE CABLE 365MCM CU W/FO
SPARE SUBSTATION TRANSFORMER 3750/4200kVA OA/OA 4688/5250kVA FA/FA 2400-34500/19920V 4160-34500/19920V 2400-12470/7200V
SGY SUBSTATION TRANSFORMER 3750/4200kVA OA/OA 2400-34500/19920V
MRCT 600-5A
MRCT 1200-5A
POTENTIAL TRANSFORMER 2400-120V PHASE A-B ONLY
2-500MCM
SKAGWAY POWERPLANT
WATTHOUR METER 3P3W 2 ELEMENT Kh 1.2 PKh 1920 MULT 1600
POTENTIAL TRANSFORMER 2400-120V
CURRENT TRANSFORMER 400-5A
OIL CIRCUIT BREAKER 2400V 600A
HOOKSTICK DISCONNECT 5kV 400A
FAIRBANKS MORSE MODEL 33 1560kVA 1250kW 2.4kV 0.8PF 300 RPM 50°C RISE CONT
GEN10
500MCM
52G10
LA 5kV
WATTHOUR METER 3P3W 2 ELEMENT Kh 1.2 PKh 1920 MULT 1600
CURRENT TRANSFORMER 400-5A
OIL CIRCUIT BREAKER 7.5kV 1200A
FAIRBANKS MORSE MODEL 33 1560kVA 1250kW 2.4kV 0.8PF 300 RPM 50°C RISE CONT
GEN9
500MCM
52G9
WATTHOUR METER 3P3W 2 ELEMENT Kh 1.2 PKh 950 MULT 800
CURRENT TRANSFORMER 200-5A
OIL CIRCUIT BREAKER 2400V 200A
CUMMINS/KATO MODEL KTA 625kVA 500kW 2.4kV 0.8PF 1200 RPM 80°C RISE CONT 40°C AMB CLASS F INSULATION
GEN8
2/0
52G8
WATTHOUR METER 3P3W 2 ELEMENT Kh 1.2 PKh 1920 MULT 1600
CURRENT TRANSFORMER 400-5A
OIL CIRCUIT BREAKER 2400V 1200A
CATERPILLAR/CATERPILLAR MODEL 3516 1375kVA 1100kW 2.4/4.16kV 0.8PF 1200 RPM 105°C RISE CONT 40°C AMB CLASS F INSULATION
GEN7
2-2/0
52G7
WATTHOUR METER 3P3W 2 ELEMENT Kh 1.2 PKh 460 MULT 400
CURRENT TRANSFORMER 100-5A
OIL CIRCUIT BREAKER 2400V 200A
CORNELL/KATO HYDRO UNIT 250kVA 250kW 2.4kV 0.8PF 1800 RPM 80°C RISE CONT 40°C AMB CLASS F INSULATION
GEN4
#2
52G4
2-2 x 1/4 COPPER BUS NORTH SWITCHGEAR
1 1/2 x 1/4 COPPER BUS
4-250MCM
2-250MCM
WATTHOUR METER 3P3W 2 ELEMENT Kh 1.2 PKh 1440 MULT 1200
CURRENT TRANSFORMER 300-5A
OIL CIRCUIT BREAKER 2400 400A
52G6
4/0
GEN6
WATTHOUR METER 3P3W 2 ELEMENT Kh 1.2 PKh 384 MULT 320
CURRENT TRANSFORMER 80-5A
52G3
#2
GEN3
WATTHOUR METER 3P3W 2 ELEMENT Kh 1.2 PKh 192 MULT 160
CURRENT TRANSFORMER 40-5A
52G2
#6
GEN2
WATTHOUR METER 3P3W 2 ELEMENT Kh 1.2 PKh 720 MULT 600
CURRENT TRANSFORMER 150-5A
52G1
#4
GEN1
1 GENERAL REVISIONS Bb 20Feb97
0 ORIGINAL ISSUE Bb 06Dec96
REV DESCRIPTION AUTH REV BY DATE

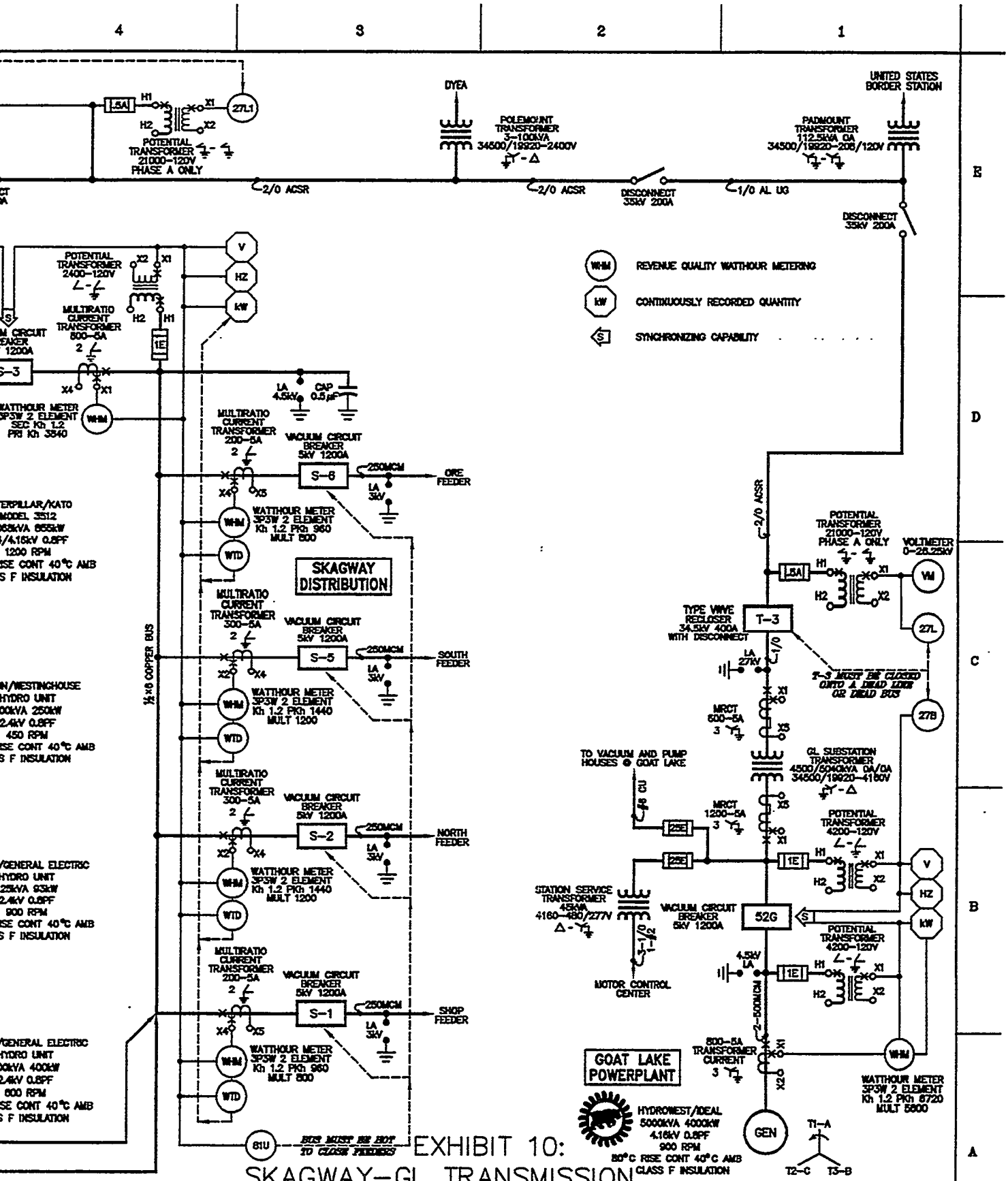


EXHIBIT 10:

SKAGWAY–GL TRANSMISSION

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DIMENSIONING AND TOLERANCES ACCORDING TO ANSI Y14.5 ELECTRICAL AND ELECTRONIC SYMBOLS PER ANSI/IEEE C37.2 – 1979

ALASKA POWER & TELEPHONE COMPANY

ENGINEER	Barrett
DRAWN	Bb
CHECKED	
RECORDED	05Dec96
SCALE	NONE

DESCRIPTION: SKAGWAY–GL TRANSMISSION

PROJECT: SINGLE LINE METERING/DISTRIBUTION

JOB DWG. NO.: SGYTLINE

SH 1

FILE G:\ACAD\SKAGWAY\ NO. SGYTLINE.DWG

HAINES - SKAGWAY

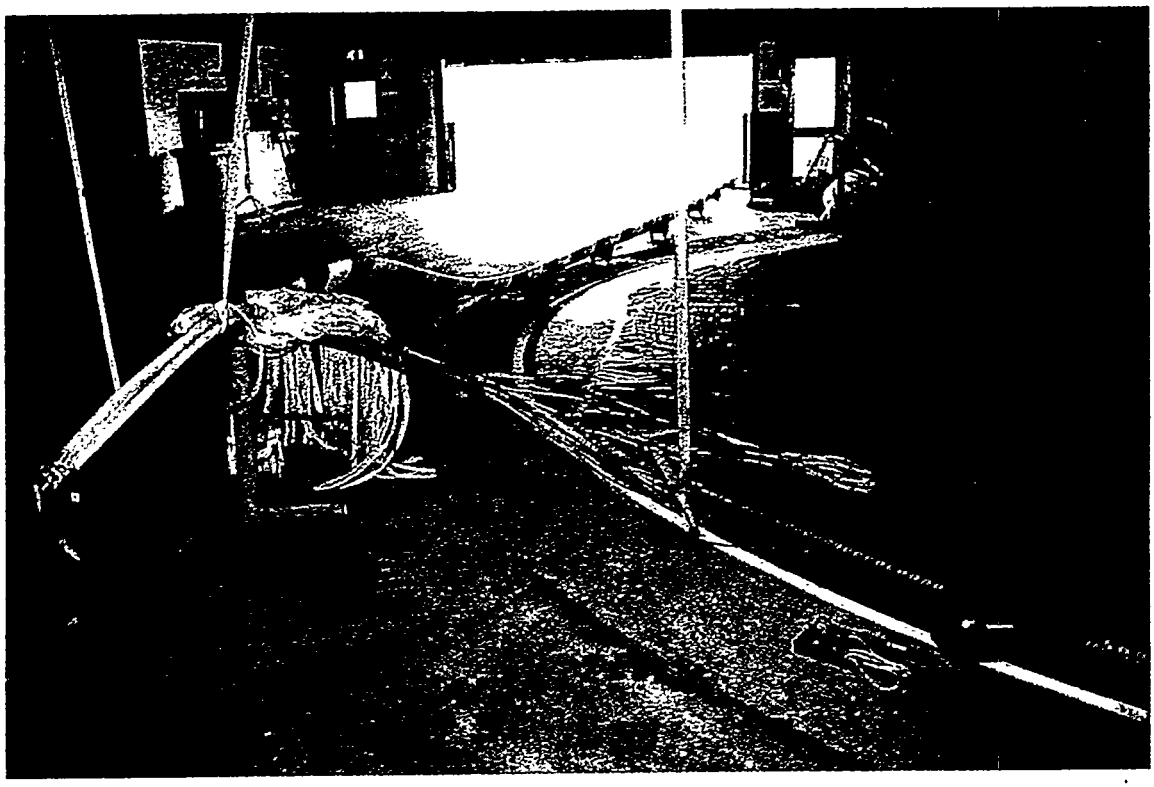
SUBMARINE CABLE INSTALLATION

TECHNICAL REPORT

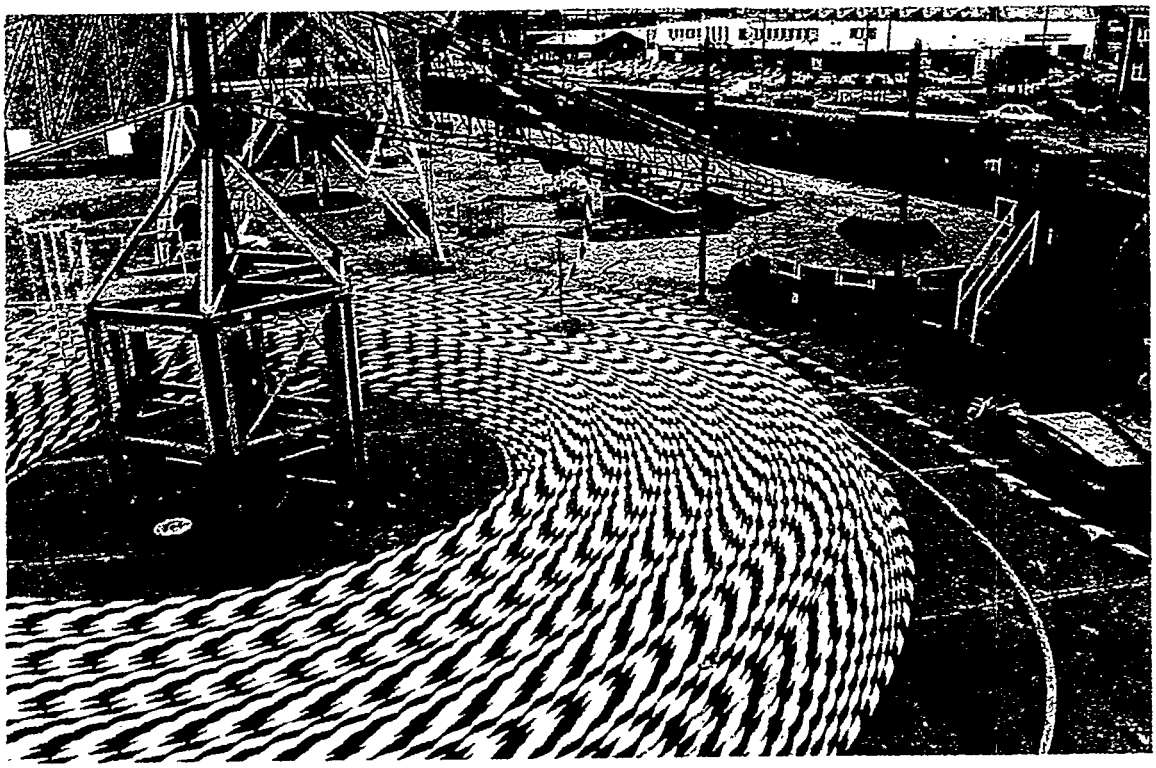
APPENDIX C

PROJECT PHOTOGRAPHS

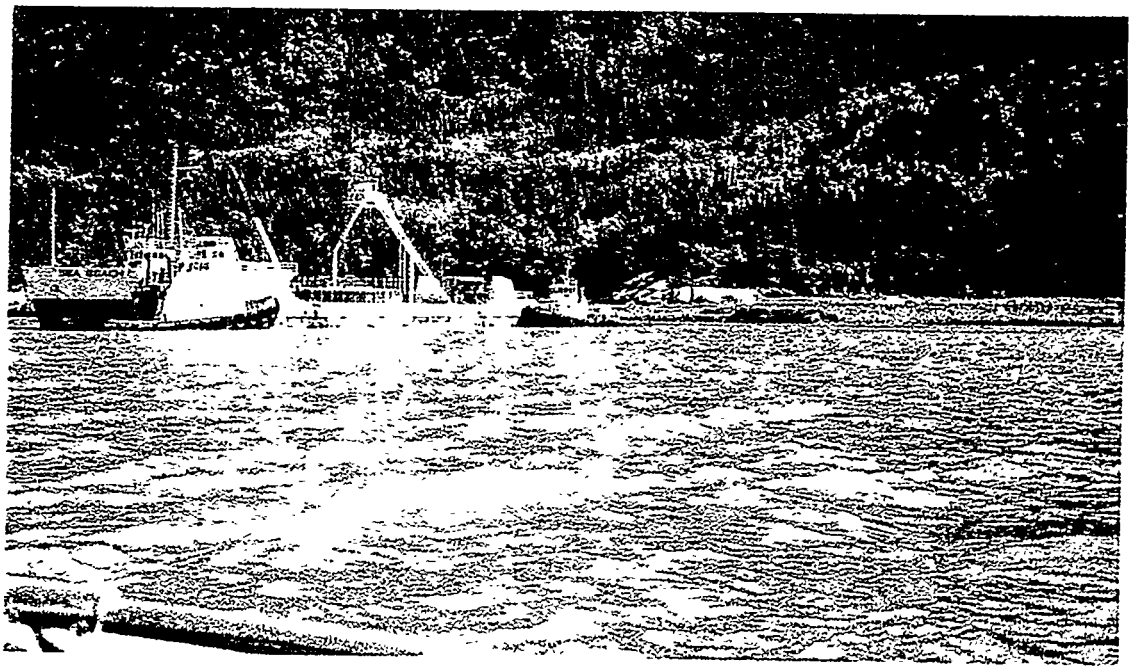
(PHOTOGRAPHS SHOWING ALL PHASES OF PROJECT)



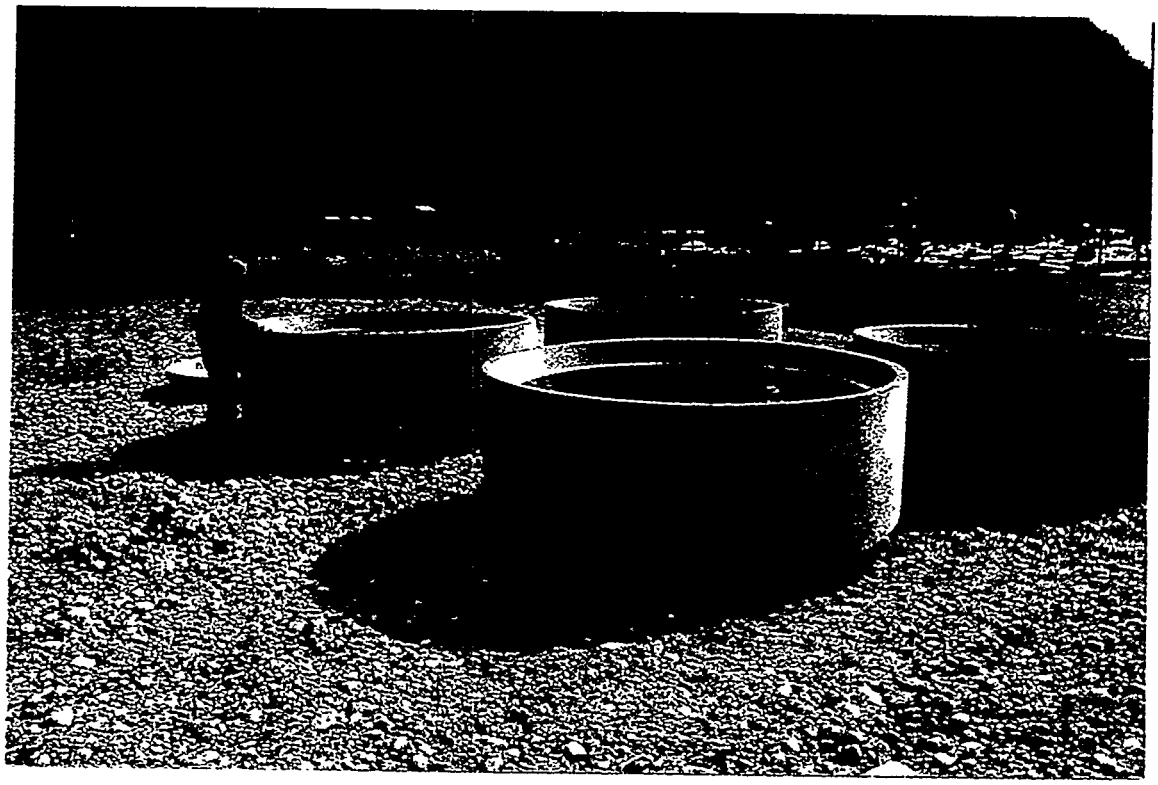
TESTING CABLE IN ENGLAND.



CABLE BEING PREPARED TO STORE IN ENGLAND
UNTIL READY TO LOAD ONTO SHIP.

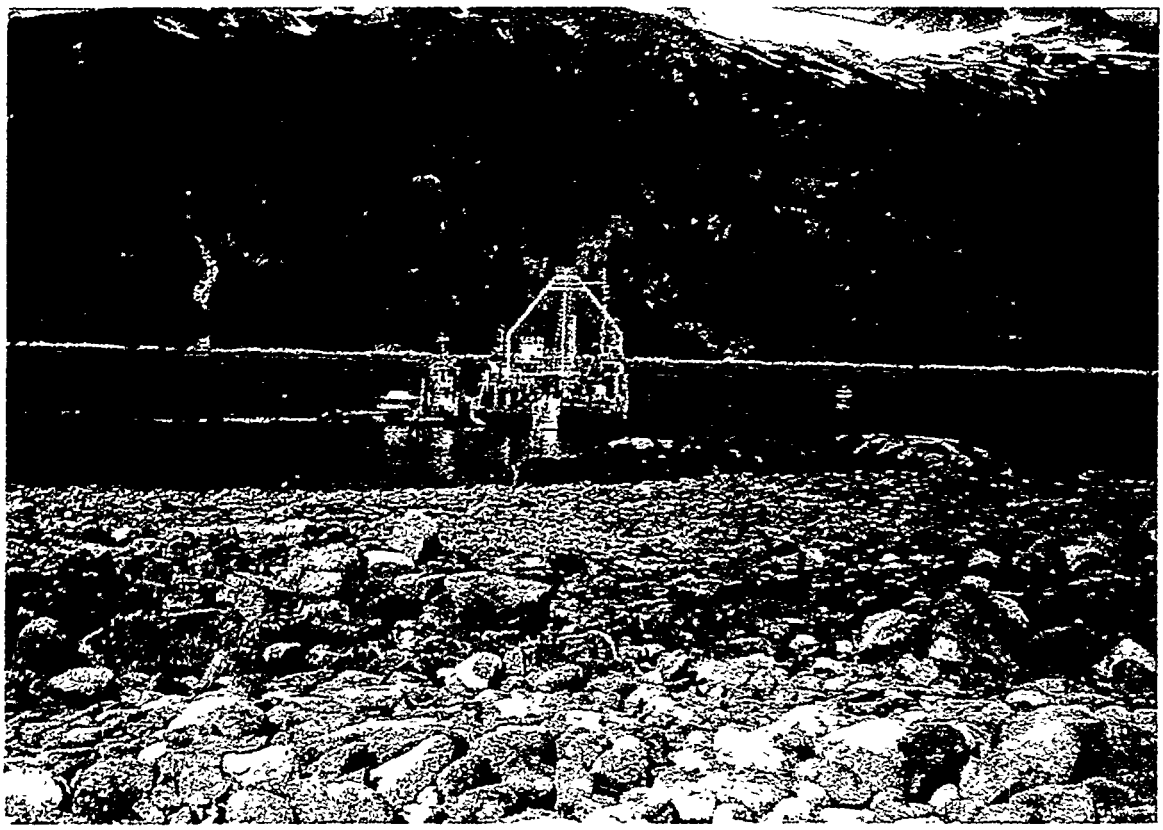


JUNE 27, 1998: CABLE LAYING SHIP "SEA BEACH" AT THE OTTER CREEK PROJECT SITE PREPARING TO LAY CABLE.



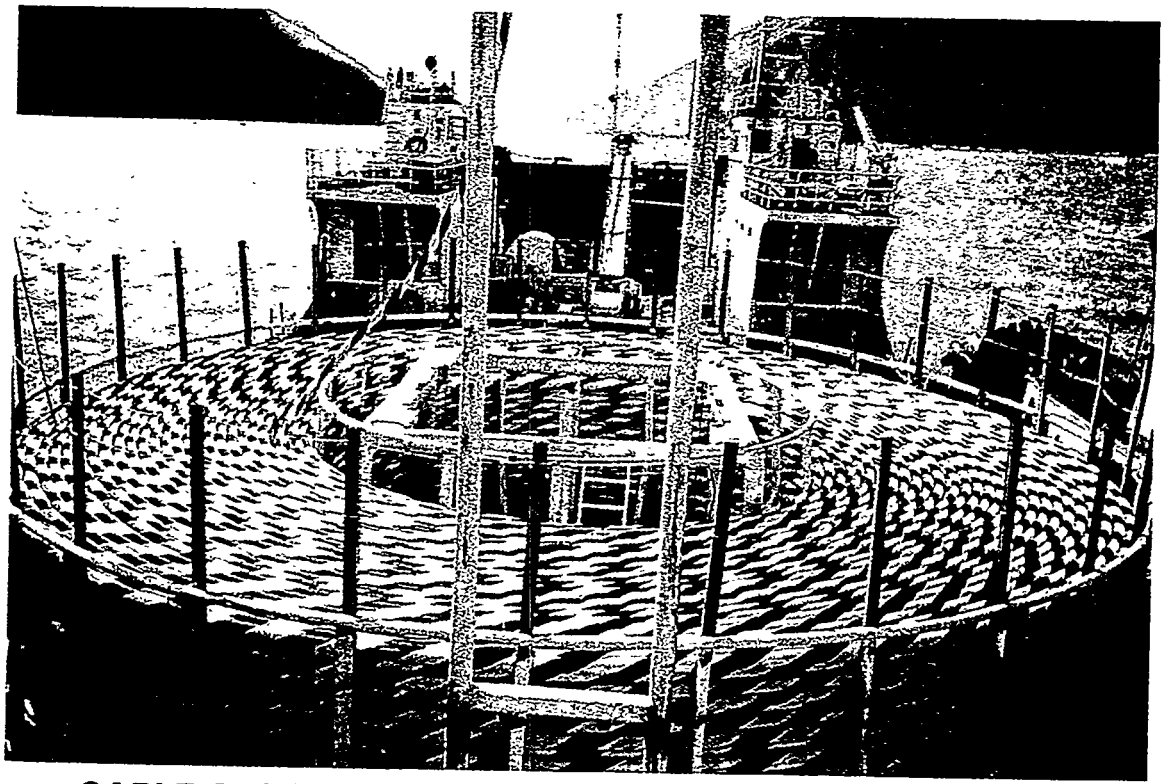
SPLICE VAULTS PRIOR TO TRANSPORTING TO THE VARIOUS CABLE LANDING SITES. TWO OF THE CONCRETE STRUCTURES WERE REQUIRED FOR EACH VAULT.

CABLE LAYING SHIP AT THE OTTER CREEK PROJECT SITE PREPARING TO LAY CABLE. SPLICE VAULT IS IN FOREGROUND. NOTE CABLE COMING OUT OF VAULT.

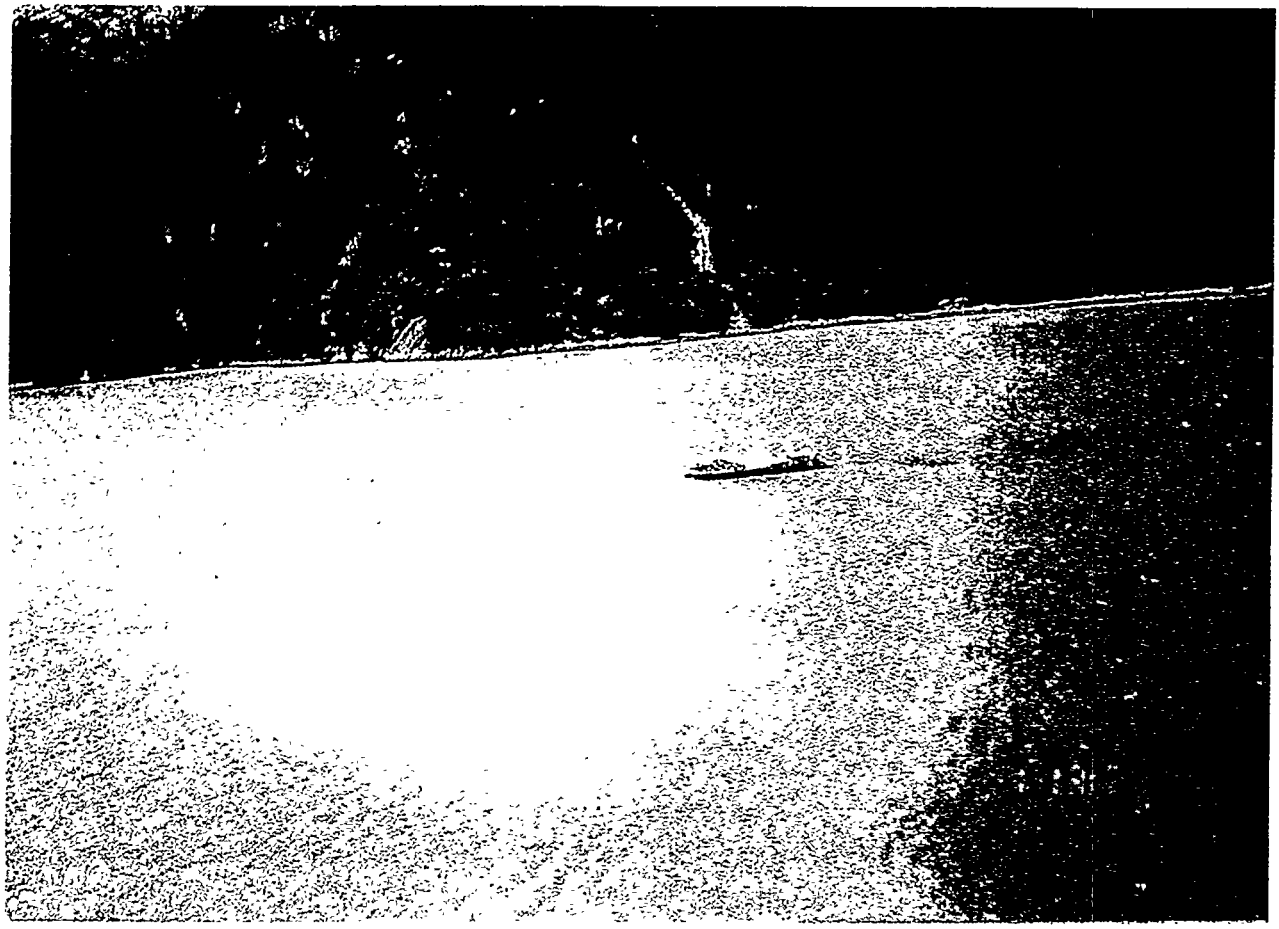


CABLE LAYING SHIP AT THE OTTER CREEK PROJECT SITE ON THE TAIYA INLET.

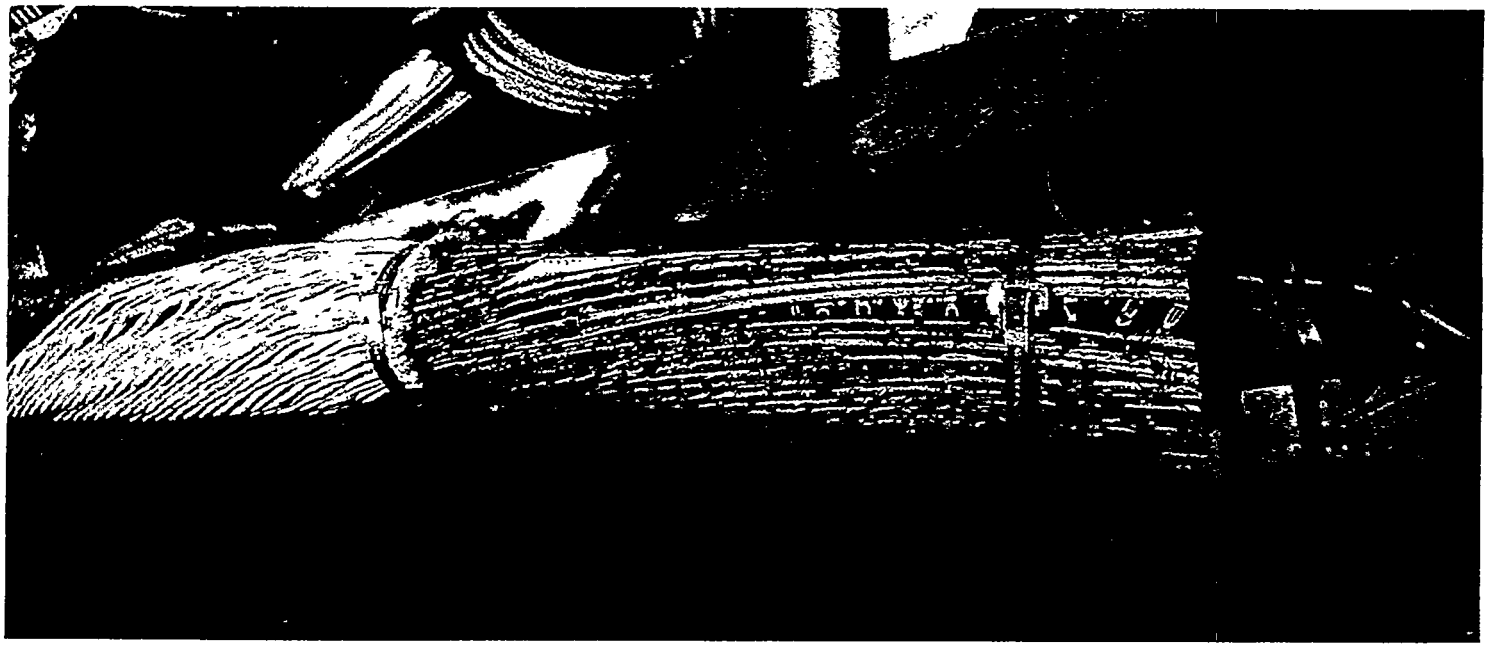
AN EXAMPLE OF THE SIZE OF THE CABLE.



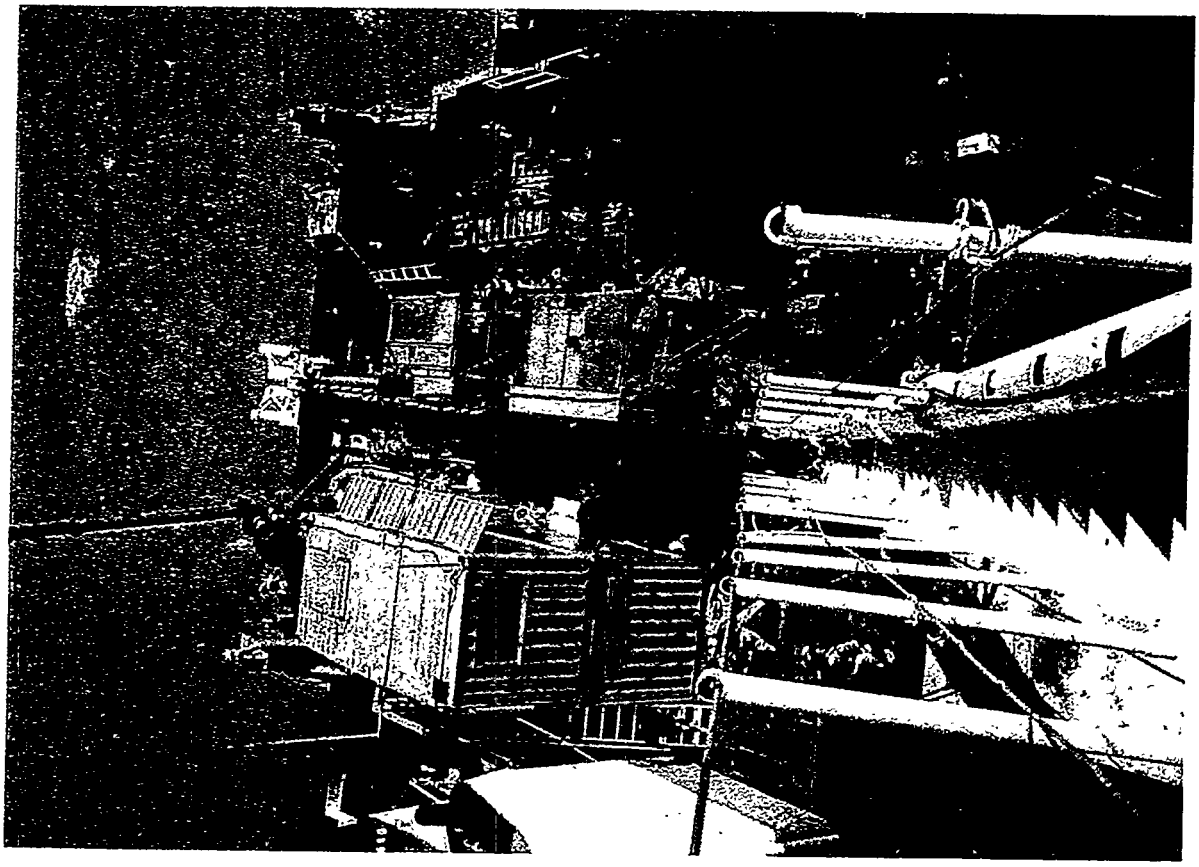
CABLE SPOOLED ON THE SHIP AS IT LAYS THE CABLE ALONG TAIYA INLET.



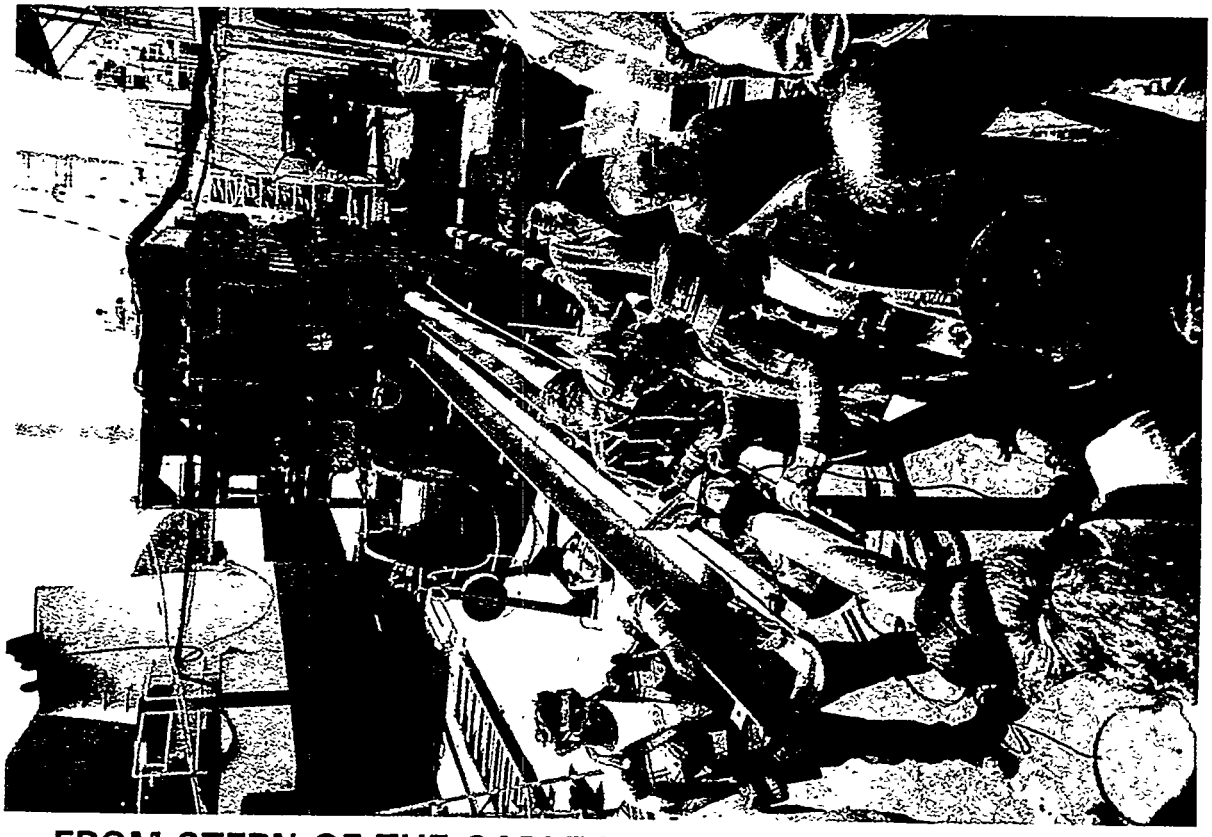
THE CABLE LAYING SHIP "SEA BEACH" HEADING TO HAINES AS IT LAYS THE CABLE IN TAIYA INLET.



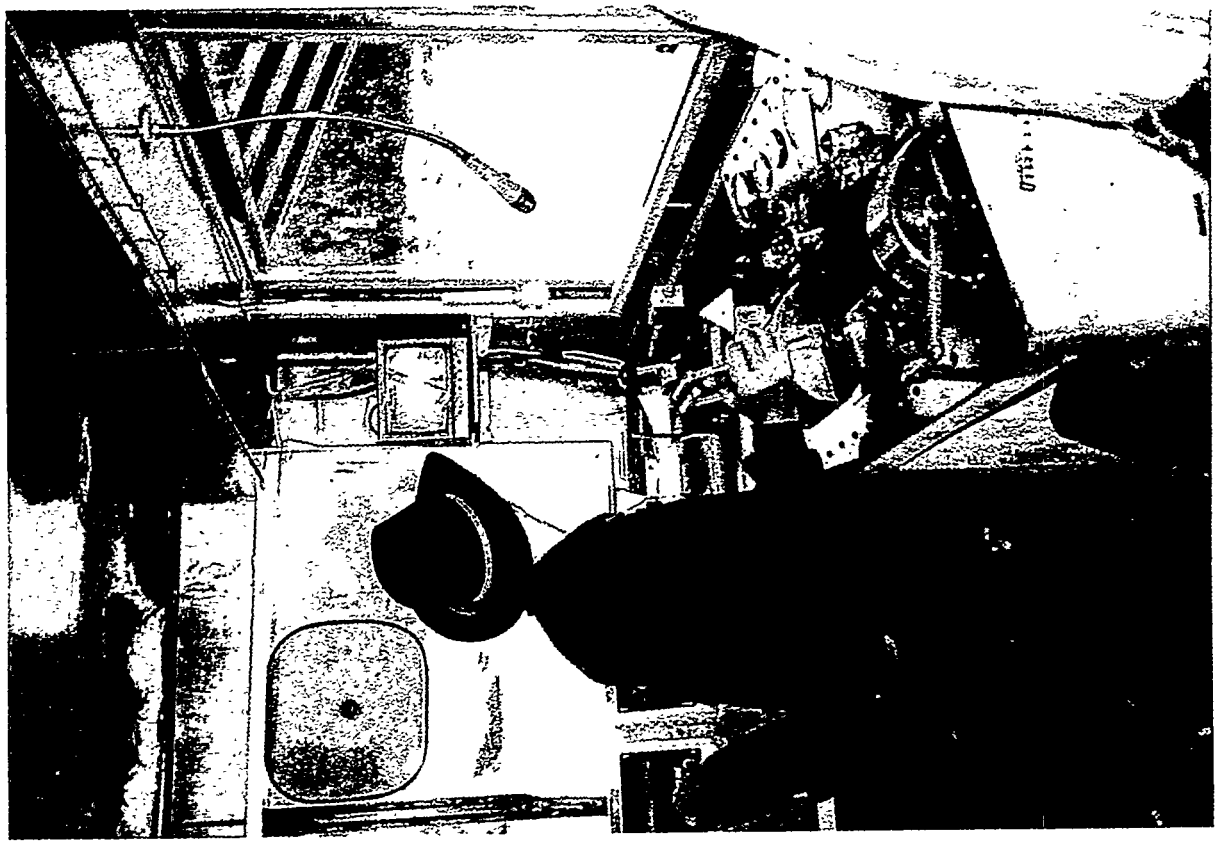
A CLOSEUP OF THE SUBMARINE CABLE.



STERN VIEW OF CABLE LAYING SHIP WITH THE COMMAND STATION FOR MONITORING THE EQUIPMENT AND THE CABLE LOCATION AS IT IS LAID.

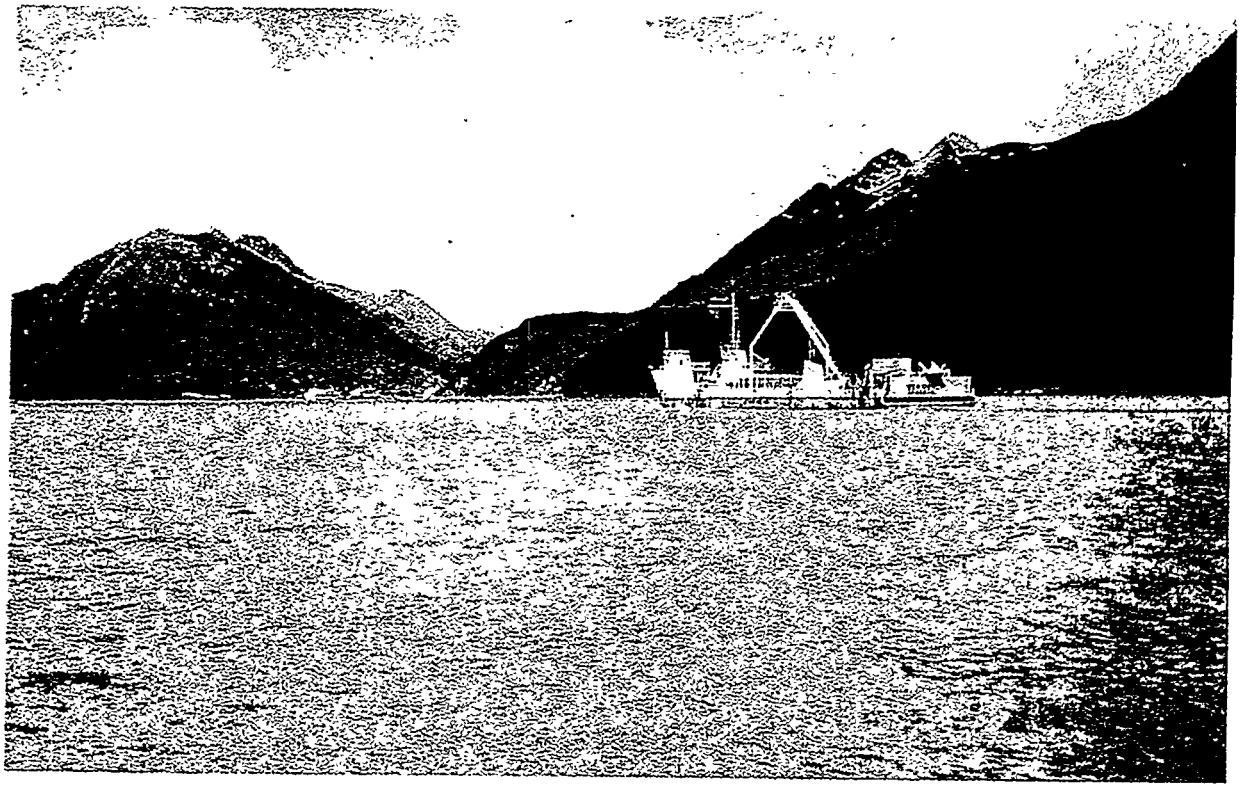


FROM STERN OF THE CABLE LAYING SHIP, PERSONNEL EXAMINE THE CABLE.

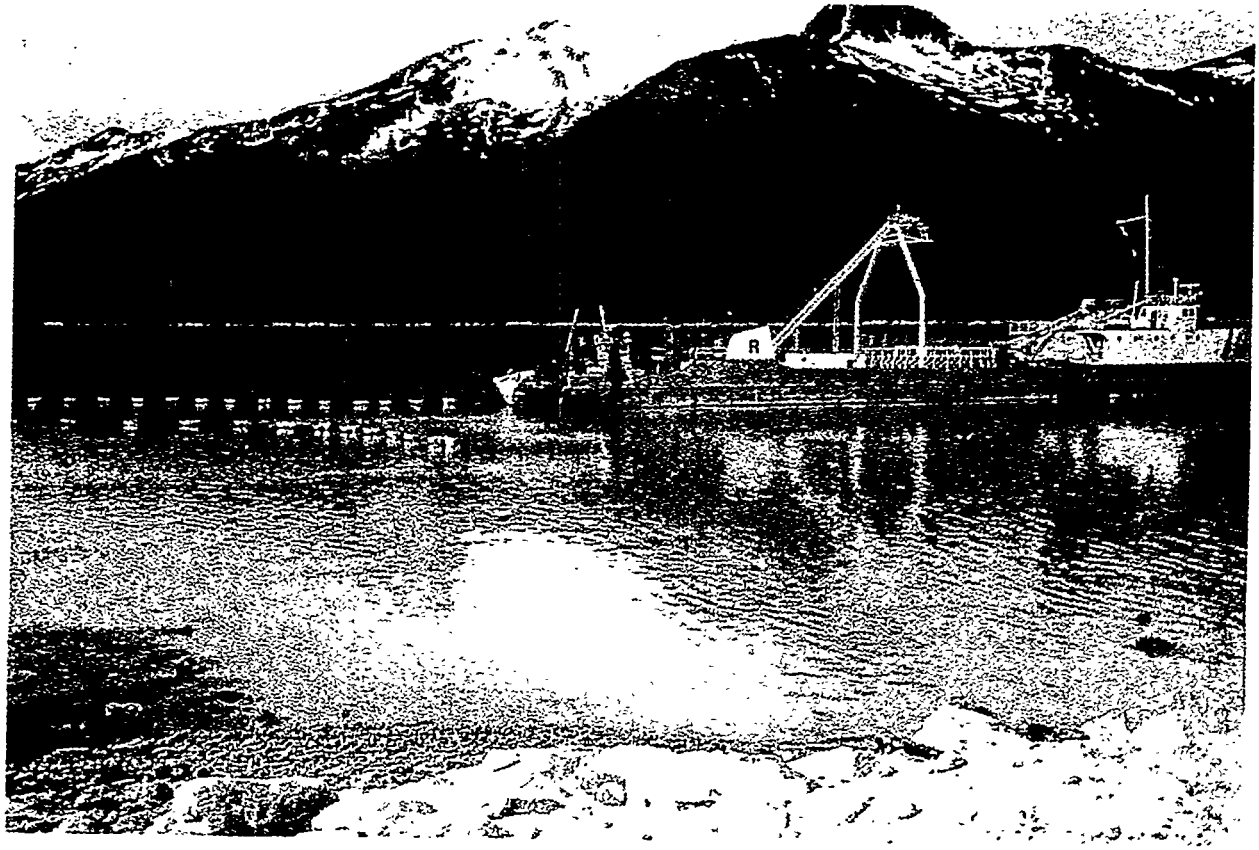


COMMAND STATION FOR CONTROL OF THE CABLE LAYING OPERATION.

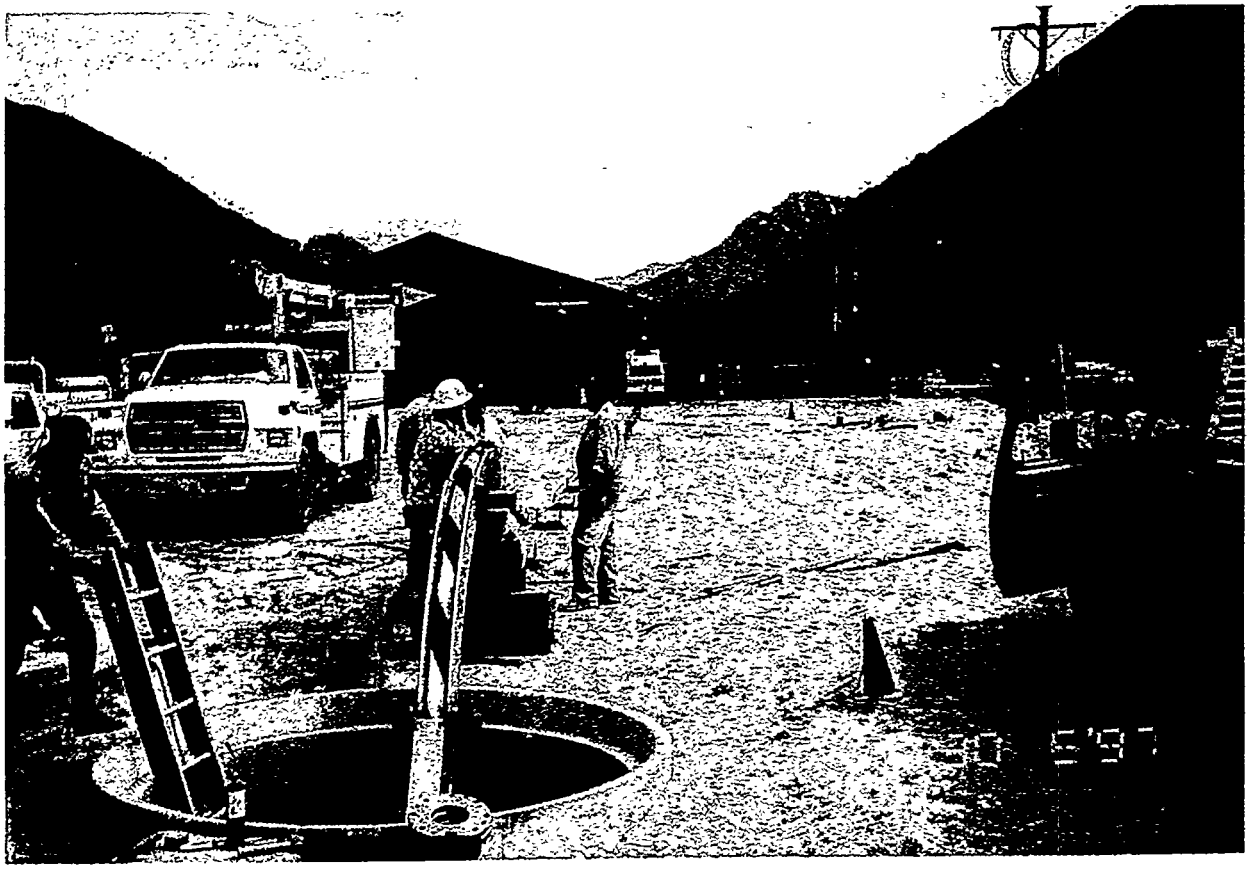
REMOTE SUBMERSIBLE ON BACK OF BOAT USED TO MONITOR THE LOCATION AND CONDITION OF THE CABLE AS IT IS LAID.



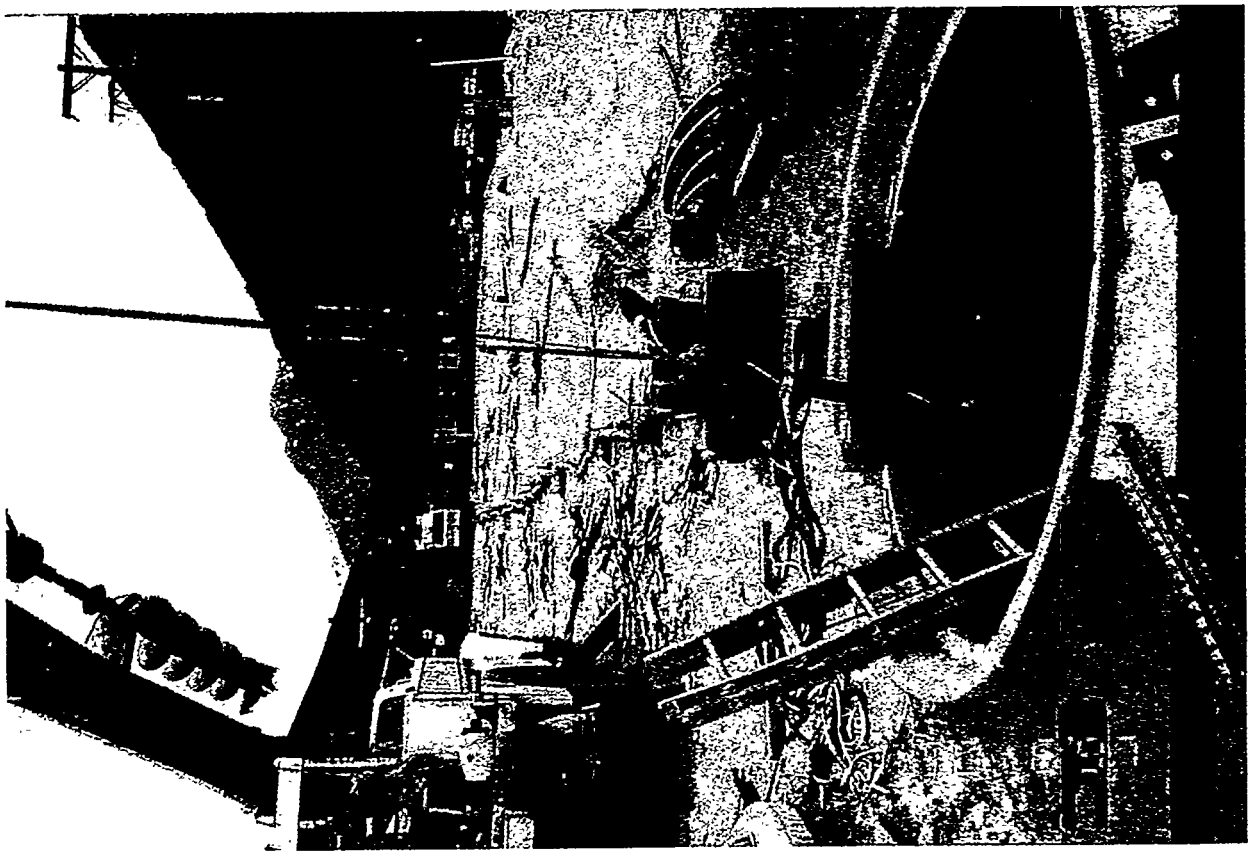
THE CABLE LAYING SHIP "SEA BEACH" HEADING TOWARDS SKAGWAY IN THE DISTANCE AS IT LAYS THE CABLE FROM THE OTTER CREEK PROJECT SITE.



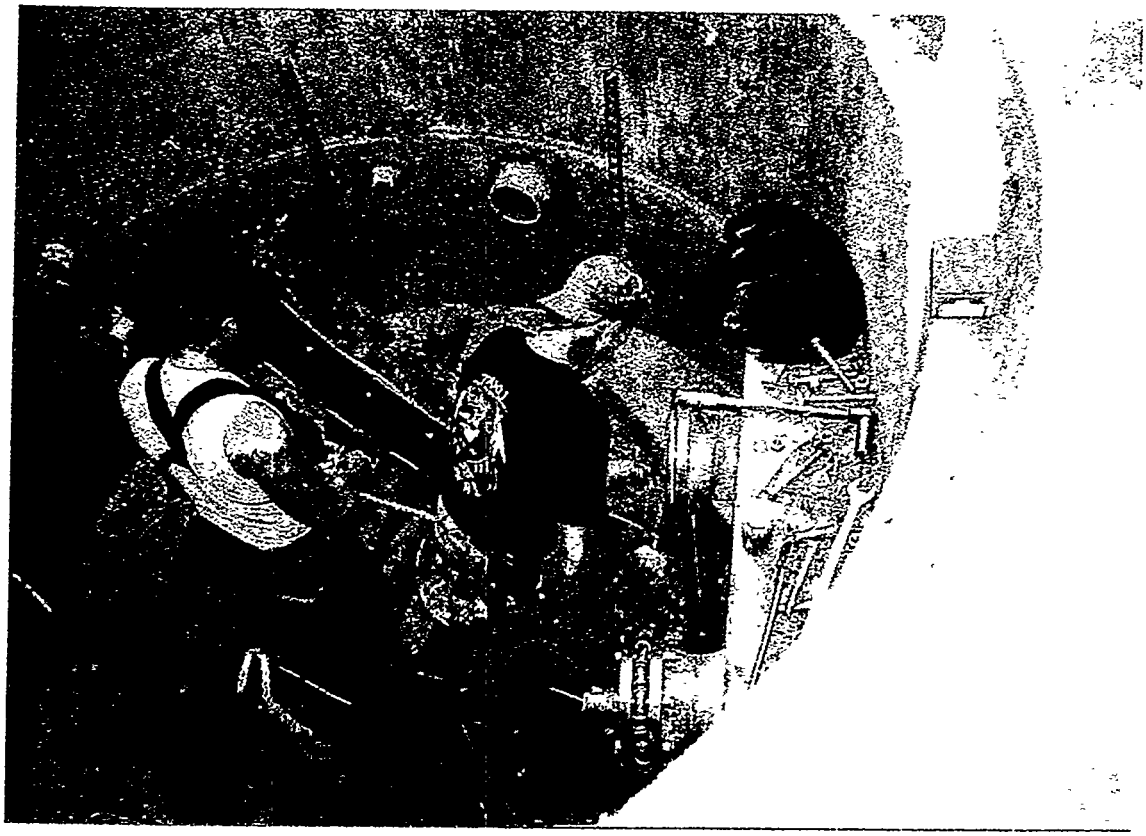
THE CABLE LAYING SHIP "SEA BEACH" AT THE SKAGWAY CABLE LANDING SITE, JUNE 30, 1998.



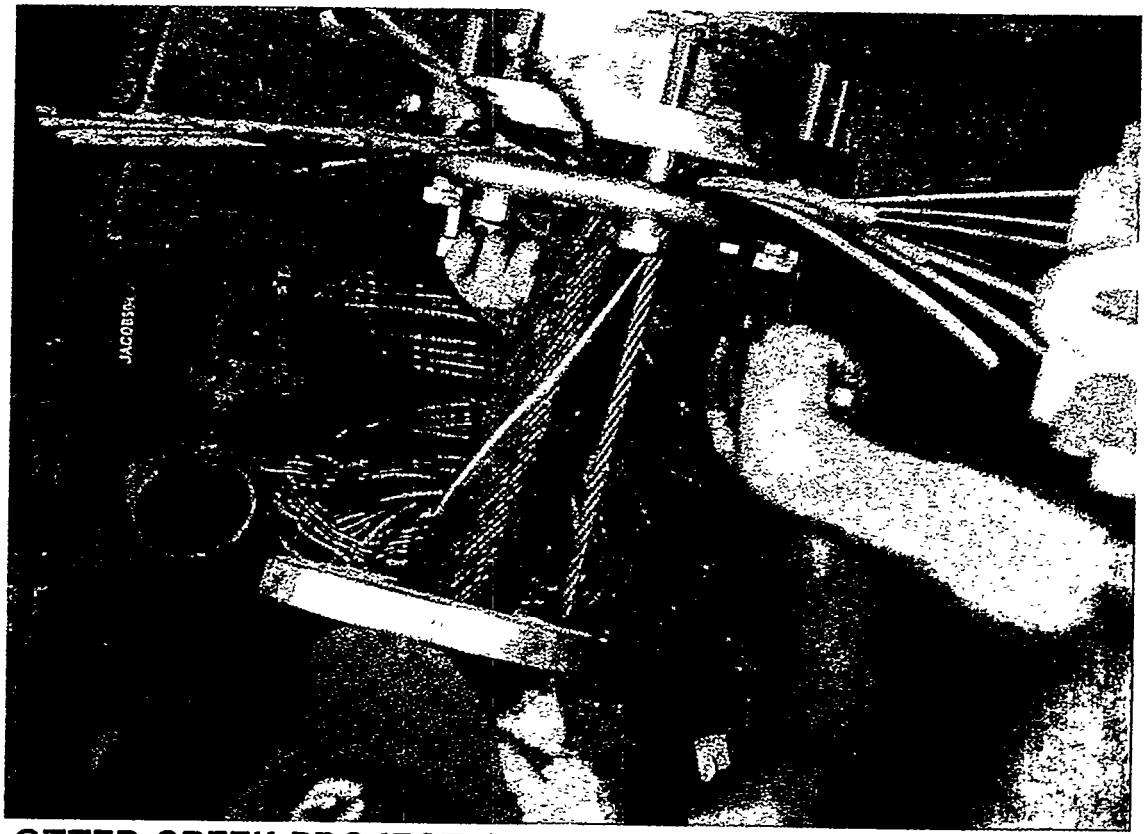
SKAGWAY CABLE LANDING; CABLE SHOWN PULLED THROUGH TO CONNECT WITH TRANSMISSION LINE.



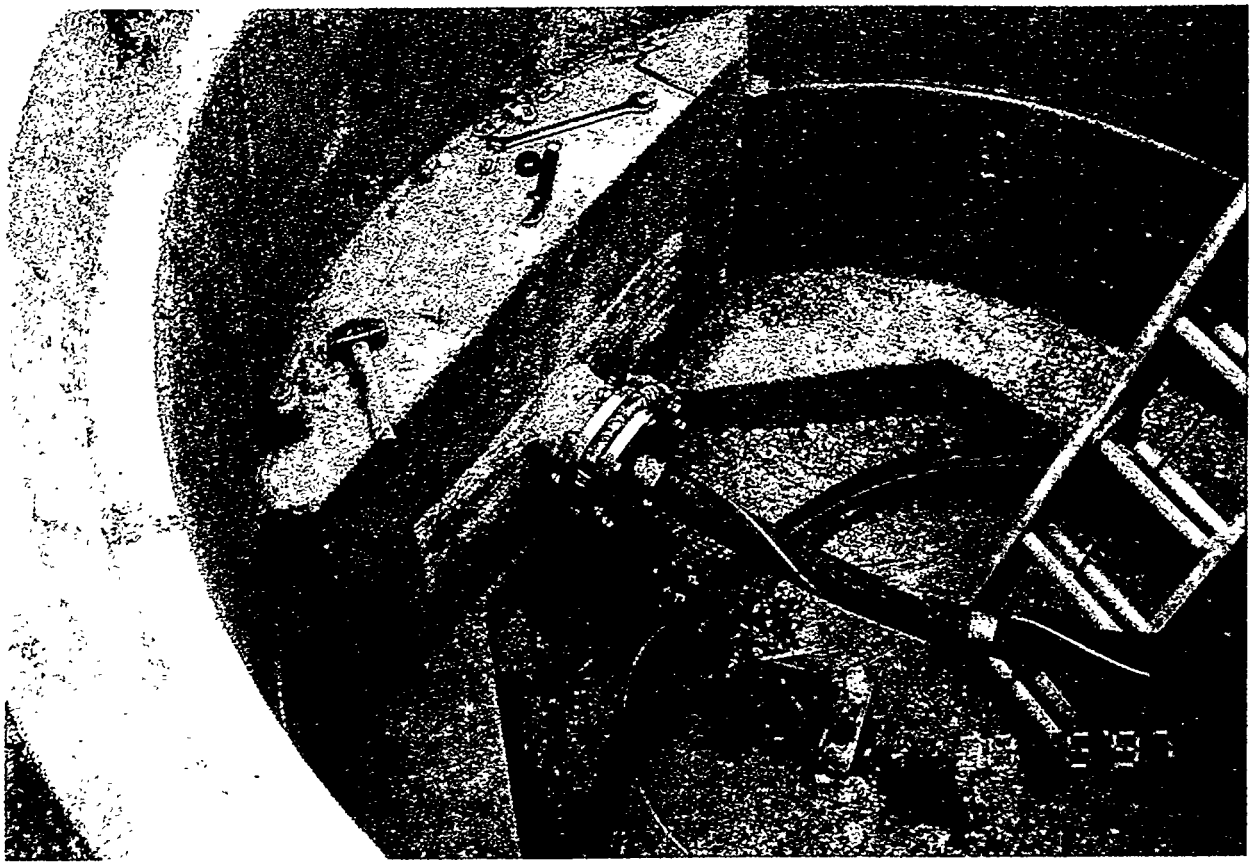
SKAGWAY CABLE LANDING; CABLE SHOWN STRIPPED OF ITS OUTER ARMOUR.



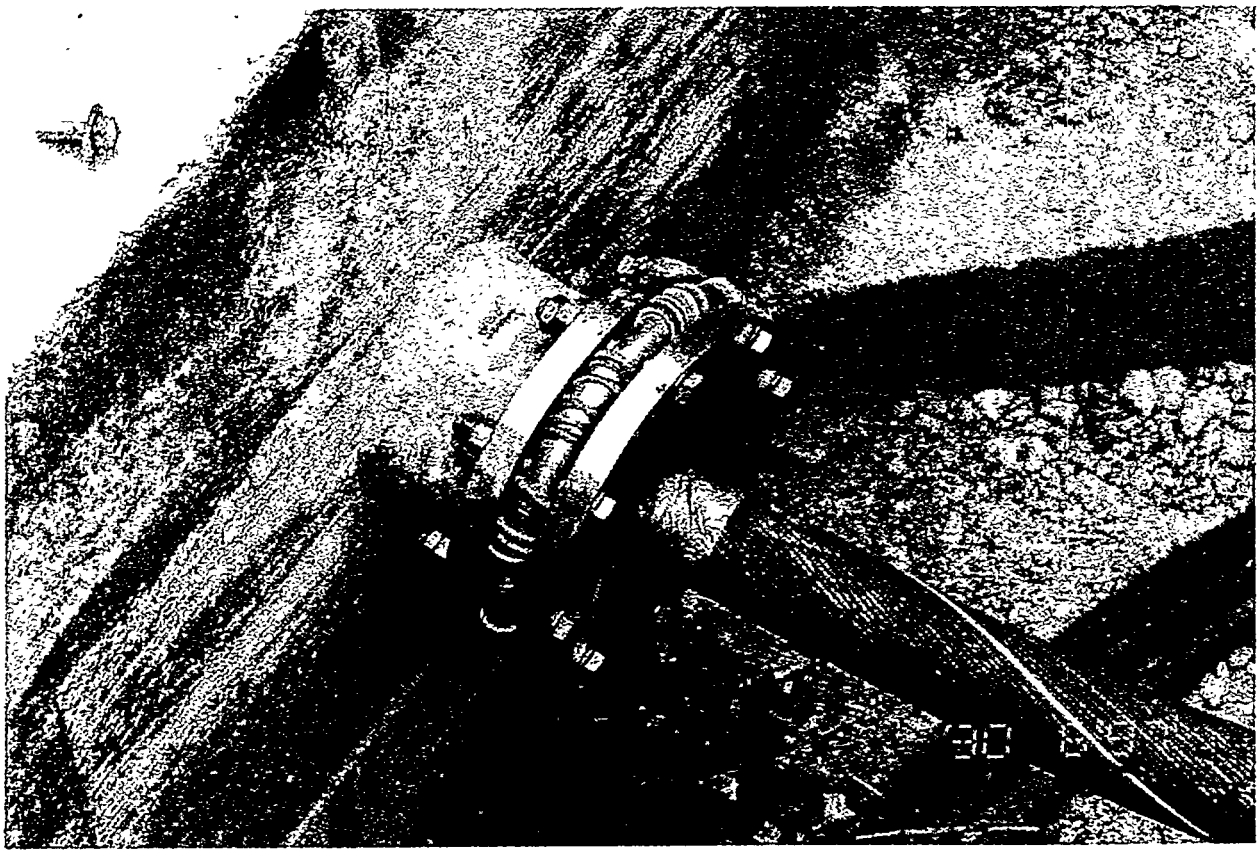
OTTER CREEK PROJECT CABLE LANDING; CABLE IS BEING ANCHORED TO REINFORCED VAULT.



OTTER CREEK PROJECT CABLE LANDING; CABLE IS BEING ANCHORED TO REINFORCED VAULT.



TYPICAL CABLE SPLICE VAULT AT HAINES AND SKAGWAY LANDINGS.



DETAIL OF CABLE SPLICE VAULT ANCHORING.