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FINAL TECHNICAL AND ECONOMIC COST REPORT

Prepared for:
Iliamna-Newhalen-Nondalton Electric Cooperative

August 1998

Prepared by:

HDR ALASKA, INC.
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TAZIMINA HYDROELECTRIC PROJECT
ILIAMNA, ALASKA
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1.0 INTRODUCTION

The Iliamna-Newhalen-Nondalton Electric Cooperative (INNEC) provides electrical power to three communities of the same names. These communities are located near the north shore of Iliamna Lake in south-central Alaska approximately 175 miles southwest of Anchorage. These communities have a combined population of approximately 600 residents. There is no direct road connection from these villages to larger population centers. Transportation to the area is by scheduled air carriers from Anchorage, by barge from Naknek via the Kvichak River or by a combination of barge from Homer, truck over a World War II mountain road and barge across Lake Iliamna from Pile Bay to Iliamna.

Electric power has been generated by INNEC since 1983 using diesel generators located in the community of Newhalen. Fuel for these generators was transported up the Kvichak River, an important salmon river, and across Iliamna Lake. In dry years the river is low and fuel is flown into Iliamna and then trucked five miles into Newhalen. The cost, difficult logistics and potential spill hazard of this fuel was a primary reason for development of hydroelectric power in this area.

A hydroelectric project was constructed for these communities, starting in the spring of 1996 and ending in the spring of 1998. The project site is on the Tazimina River about 12 miles northeast of Iliamna Lake. The Tazimina River flows west from the Aleutian Range. The project site is at Tazimina Falls about 9 miles upstream of the confluence of the Tazimina River and the Newhalen River. The project has an installed capacity of 824 kilowatts (kW) and is expandable to 1.5 megawatts (MW). The project is run-of-the-river (no storage) and uses the approximately 100 feet of natural head provided by the falls. The project features include a channel control sill, intake structure, penstock, underground powerhouse, tailrace, surface control building, buried transmission line and communication cable, and access road.

The intake is located approximately 250 feet upstream of the falls. The channel control sill is located immediately adjacent to the intake. From the intake, flow to the turbines is directed through a 60-inch-diameter penstock. The penstock runs 300 feet to the underground powerhouse. The powerhouse is 120 feet below ground adjacent to the river and is connected to the surface via an elevator in a 26-foot-diameter shaft. The powerhouse contains two turbines, generators, and auxiliary equipment. Water is discharged into the Tazimina River at the base of the falls through an 8-foot-high horseshoe shaped tailrace tunnel. A control building is located at the top of the shaft and contains all communications, controls and HVAC equipment. The intake, penstock, powerhouse cavern and tailrace are designed and configured to accommodate doubling the capacity to 1.5 MW in the future.

An access road, 6.7 miles long, leads from the existing Newhalen-Nondalton Road around the northern end of Alexcy Lake to the project site. A transmission line and a communications cable are buried along the road edge. The transmission line is tied into the existing transmission line that runs between Newhalen and Nondalton.

2.0 PROJECT HISTORY

The idea of developing hydropower in the Tazimina River area dates back to as early as 1909, when a U.S. Geological Survey Report concluded that many of the surrounding streams "could be used for water power whenever the development of the region creates a demand for it."

Over the past 18 years, more extensive investigations and environmental studies have analyzed potential hydropower alternatives on the Tazimina River. Federal and state agencies investigated the project in the 1970s and early 1980s. In 1988, INNEC began pursuing the Tazimina hydroelectric development as an alternative to diesel fuel. The following narrative presents some of the more significant steps in the development of the Tazimina project.

- 1979 The U.S. Department of Energy completed "Bristol Bay Energy and Electric Power Potential," (BBRPP) which explored numerous energy sources for the region, including geothermal, hydropower, coal, wind, and solar energy. Power schemes explored included diesel, gas turbine, steam turbine, wind-electric, and hydroelectric generating units. The report found hydroelectric power to be the most viable source of energy to supplement or replace diesel in the Bristol Bay region. The study identified a variety of potential small-scale subregional hydroelectric projects to serve the area's many villages and a regional dam project at Tazimina Lake on the Tazimina River.
- 1980 The Alaska Power Authority (APA) completed a reconnaissance study to further investigate some of the recommended projects, including the one at Tazimina Lake. The report strongly recommended the immediate development of the Tazimina Lake project, to be joined with the Naknek/King Salmon and Dillingham utilities.
- 1982 The APA completed the "Bristol Bay Regional Power Plan Interim Feasibility Assessment", which assessed the technical, economic, and environmental aspects of various hydroelectric alternatives for the region. Based on economic feasibility considerations, this study ultimately recommended construction of a 16 MW dam project on the Newhalen River. It ranked a regional Tazimina dam project second and a subregional run-of-the-river Tazimina project at Tazimina Falls for Iliamna, Newhalen, and Nondalton fifth out of 21 power plan scenarios. In a 1983 economic update to this report, the Newhalen dam continued to rank first, but the subregional Tazimina run-of-the-river project rose to second.

An environmental impact evaluation in the BBRPP ranked the subregional Tazimina run-of-the-river project first. Resource agency comments on the BBRPP, as well as policies in regional planning documents, discouraged projects involving dams on anadromous fish streams due to impacts to fisheries. Fish studies for the Newhalen project were undertaken from 1982 to 1985.

- 1985 The APA conducted an updated economic evaluation of several promising alternatives identified in the BBRPP. The APA determined that the Newhalen project and other large regional projects were no longer economical due to declining oil prices, large capital costs, and low electrical loads in the region. This evaluation indicated that the subregional Tazimina project was feasible, a conclusion that was further substantiated in the APA's "Findings and Recommendations" dated February 1986.
- 1987 The APA completed a feasibility report for a variety of run-of-the-river development alternatives projects at Tazimina Falls (Stone and Webster Engineering Corporation). Concludes 700 kW project with underground powerhouse would have a capital cost of \$8 million and would have a present worth cost compared to diesel power of \$1.06.
- 1991 Economic analysis updated by HDR Engineering. Estimates 700 kW project with underground powerhouse would have a capital cost of \$9.4 million and would have a present worth cost compared to diesel power of \$1.32.
- 1992 Initial Consultation Document filed with the Federal Energy Regulatory Commission for application for a license for the project.
- 1994 Engineering Review and Constructibility Study of the Tazimina Hydroelectric Project. The purpose of this work was to review the project configuration previously developed for the project and develop alternative layouts for the project. Estimates 700 kW project with underground powerhouse would have a capital cost of \$10.4 million.
- 1996 Final design of project by HDR Alaska.
- 1996 Construction Awarded to Wilder Construction Company.
- 1997 Start of limited commercial operation
- 1998 Construction of project completed.

3.0 PROJECT DESCRIPTION

3.1 General

Main features of the proposed project include an access road, stream channel control sill, intake structure, buried steel penstock, underground powerhouse, control building and underground transmission line. Plan and section drawings of these features are shown in Appendix B.

3.2 Access Road

Access to the project site is via a 6.7-mile gravel road. The access road extends from the Newhalen-Nondalton Road, around the north end of Alexcy Lake and on to the project site along the left bank of the Tazimina River looking downstream. The road is a limited access road of single lane construction, 16' wide.

3.3 Stream Channel Control Sill

A linear concrete sill is constructed across the right side of the river, opposite the intake structure. The purpose of the sill is to prevent degradation of the streambed, and to help divert streamflow to the intake during periods of low flow. The sill is 144 feet in length and is constructed of pre-cast concrete blocks. The blocks are trapezoidal in section to provide stability against flowing water. Block dimensions are 2.5 feet high by 8 feet long, with a 2-foot top width and 5-foot bottom width. The blocks are fastened to the rock streambed with steel rock bolts. The top of the sill is visible above the water at low flows, but it is totally submerged during spring and summer at higher flow periods.

3.4 Intake Structure

Because there is no dam, the problem of diverting 110 cfs (ultimately 220 cfs in the future) to the intake presents a design challenge, and the 170-foot-wide river channel makes it difficult to attract a large percentage of the streamflow to the intake during low flow periods. Compounding the problem is the potential of ice blocking the intake during the low flow period.

The intake structure is located on the left bank approximately 250 feet upstream of the top of the falls. The function of the intake is to withdraw 110 cfs from the river, the hydraulic capacity of the units, during the low flow period between January and April. The location, dimensions, and elevations of the intake were designed based on a physical scale model constructed in a hydraulics laboratory. This modeling optimized location of the intake to attract a large percentage of the stream flow from the 170-foot-wide river channel to the intake during low flow periods.

The concrete intake structure is constructed in the bedrock bank of the river. There is a 4-foot-deep sump in front of the trashrack to trap bedload. The trashrack is designed for a maximum of 1.5 feet per second approach velocity. If the capacity of the power plant is eventually doubled in size, the increased flow will result in an approach velocity of 3 fps without increasing the trashrack size. This is the recommended maximum velocity for manual cleaning. The trashrack is set 2 feet below minimum water surface elevation to minimize entrainment of floating material. The trashrack is constructed of HDPE to prevent the adhesion of frazil ice. Sensors are installed to detect differential pressures across the trashrack in order to determine if there is trashrack blockage. Stoplog slots and concrete stoplogs are provided to allow dewatering of the intake box. The intake box expands the flow area reducing the water velocities to less than 1-foot per second allowing coarse sediment to drop out of suspension. This sediment is collected in a trap at the bottom of the intake and is pumped out of the intake with a sluice pump. The walls of the intake box are provided with heat trace to prevent freezing of the intake box if the project is shut down during winter.

The intake vault houses the controls, penstock shutoff valve, and miscellaneous equipment. The shutoff valve is a 60-inch-diameter electrically operated butterfly valve.

3.5 Penstock

From the intake, flow to the turbines is conveyed via a 60-inch buried welded steel penstock. The penstock diameter is sized to convey 220 cfs, or double the initial hydraulic capacity of the power plant. Overall penstock length is 300 feet. The penstock is buried in a trench cut in the native rock for 140 feet and is grouted in place within a tunnel for 40 feet. The remainder of the penstock is vertical and is within the powerhouse access shaft. Vent pipes are located immediately downstream of the valve and at the top of the vertical section to provide air release and vacuum and surge protection.

3.6 Powerhouse and Powerhouse Access Shaft

The powerhouse is an underground structure excavated into the native rock to the left of the base of the falls. The powerhouse is 32 by 58 feet in plan view and 16 feet high. The generator floor is set at elevation 483 feet, about 13 feet above the streambed at the base of the falls. This design accommodates a tailwater for the draft tubes and prevents backwater during winter icing conditions. The powerhouse is connected to the surface by a 26-foot-diameter vertical shaft. Within the vertical shaft are the penstock, fresh-air ducts, communications and power cables and an elevator. The walls and ceiling of the powerhouse and the walls of the shaft are reinforced with patterned rockbolts and shotcrete. Drainage fabric is placed between the rock and the shotcrete to intercept ground water.

The powerhouse contains two horizontal Francis turbines, generators, and auxiliary equipment. The turbines are rated at 412-kW at a design flow and head on each unit of 55 cfs and 96 feet, respectively. An 8-foot-wide draft tube pit serving both units is excavated below the cavern floor. Tailwater level is controlled by a control sill constructed within the tailrace. A concrete

floor is constructed within the cavern and over the draft tube pit and tailrace channel. A primary sump pump is located within the cavern and discharges to the tailrace. A backup sump pump discharges to the surface. In conjunction with the turbine generating units, the powerhouse also accommodates a 540 kW load bank, which is used for supplemental load to keep the turbines at or near peak efficiency throughout system load swings.

The powerhouse is sized and configured to accommodate doubling the plant capacity to approximately 1500 kW in the future. New turbines and generators would replace the units initially installed.

3.7 Control Building

A 36-foot by 46-foot control building is constructed on top of the vertical shaft. The building houses the controls, elevator, batteries, standby diesel generator, HVAC system and an office. It also provides access to the shaft for equipment removal and installation. The building is steel frame construction, with insulated steel panels for the roof and walls.

3.8 Transmission Line

The transmission line is 6.7 miles long and operates at 7200/12470 volts. The line is buried and follows the new access road alignment. The new transmission line is buried 25 kV 260 mil EPR insulated cable with concentric neutral and matches the cable used throughout the INNEC system. A transformer at the powerhouse end steps up the 480V generation voltage to 7200/12470V. A tap changer is provided to allow some adjustment in transmission voltage to best match the system at the tie-in point. A 25-pair communications cable is installed along with the transmission line to provide voice and control circuits for the plant, as well as manual-remote control of the main circuit switch.

TABLE 3-1
SUMMARY OF PROJECT FEATURES

PROJECT FEATURE	DESCRIPTION
Name of Project	Tazimina River Hydroelectric Project. FERC Number 11316
Project Location	Section 24, Range 32 West, Township 3 South, Seward Meridian. 12 miles northeast of the community of Iliamna in South-central Alaska. Approximate latitude 59°54' and longitude 154°42'.
Intake	Run-of-the-river shoreline intake 250 feet upstream of the falls at elevation 570 feet msl.
Reservoir	None. Run-of-the-river project.
Penstock	Total Length: 300 feet Diameter: 60 inches Material: Lined and coated steel Components: All buried pipe to the powerhouse
Tailrace	8 foot horseshoe tunnel to base of Tazimina Falls
Powerhouse	Size: 32 feet by 58 feet Number of Units: 2 Type of Turbines: Horizontal Francis Turbine Rating: Flow: 55 cfs each unit; 110 cfs total Gross Head: 92 feet Generator Rating: 412 kW each unit, 824 total, expandable to 1500 kW Load Bank: 540 kW Max.
Transmission Line	Voltage: 7.2/12.47 kV Length: 6.7 miles Type: Underground
Average Annual Energy Production	Initial Load: 6,030,000 kWh per year (Energy Production at Capacity)

4.0 PERMITS AND LICENSES

Land issues posed an initial hurdle for the Tazimina Hydroelectric Project. The project site surface estate was owned by Iliamna Natives Limited (INL), a Native village corporation holding land in trust for local Alaska Natives. The subsurface lands (gravel) are owned by a Native regional corporation. The land also lies in an in-holding within Lake Clark National Preserve, where National Park Service (NPS) jurisdiction normally applies. Submerged lands in Alaska, such as the bed of the Tazimina River, are typically owned by the state, although in this case both the state and INL claimed ownership of the river bed. Because of the complicated jurisdiction, a considerable amount of time was spent gaining approval for the different components of the project. This approval process lasted well into the project development stage. Representatives from Native groups, local organizations, and local, state, and federal government worked together to resolve these complex land and water issues.

Another hurdle appeared during the project's inception in the early 1980s: licensing by the Federal Energy Regulatory Commission (FERC). FERC jurisdiction had originally not been exerted and then was later imposed based on the potential for impacts to salmon. Later, a section of the Energy Policy Act of 1992 exempted the Tazimina Hydroelectric Project from certain FERC licensing requirements. After further discussions between regulators, INNEC, and HDR, FERC staff ruled that the project still required compliance with the National Environmental Policy Act (NEPA). An environmental assessment would be necessary. Regulatory agencies raised additional environmental concerns, such as: 1) Would the project intake entrain resident fish, thereby serving to permanently "fish" the river reach above the falls? 2) How would gas supersaturation at the tailrace affect fish? 3) How would sensitive plants and endangered peregrine falcons that might live in the region be protected from project impacts? 4) Would an access road in this relatively roadless part of Alaska result in increased vehicle traffic in and around a national park?

Seeking to answer these questions, INNEC hired HDR Alaska to conduct environmental studies. Field reconnaissance and research produced these findings:

1. The project's intake would not adversely affect fish. Summer and winter fish surveys above the falls confirmed that the 914-m (3,000-ft) stretch of river above the falls was marginal fish habitat. Approximately 80 fish (Dolly Varden and sculpin) were found during the rigorous yearlong sampling program. A scale model was constructed that demonstrated that sweeping velocities in front of the intake would limit the potential for fish entrainment.
2. Tazimina Falls already produced natural, substantial but very temporary gas supersaturation at the foot of the falls, and salmon spawning occurred no closer than 2.4 km (1.5 mi) downstream of the falls.
3. Field surveys of the rock cliffs in the canyon downstream of the falls found no threatened or endangered species.

4. The corporation holding title to the land agreed to limit access on the road. The route of the access road would avoid any creek crossings or wetland areas.

FERC issued the environmental assessment for the project on July 28, 1995.

Despite these findings, another snag occurred: FERC decided not to issue an exemption for the project until receiving a determination that it was consistent with the State of Alaska's coastal management program regulations. The state's Division of Governmental Coordination (DGC), the agency capable of making that determination, wanted to see the project's final design plans before making this ruling. Release of funds for final design was contingent on the grant of the exemption.

Fortunately, HDR staff brought to light an obscure legality that appeared to allow DGC to review the project in phases. When INNEC and HDR secured a phase one review from DGC, FERC responded by issuing an exemption order for the Tazimina project in September 1995.

5.0 PROJECT MANAGEMENT

5.1 Organization

This section identifies the key construction management personnel and chain of command used during the administration of the project, as well as quality control and inspection responsibilities. The attached organization chart shows the key project team members involved with project quality control and engineering design and the related chain of command. A description of each member's role and responsibilities follows in this section. The scale and location of this project is such that it did not require, or warrant, full-time, on-site representation from all members of the project team. Only one or two of the members (field engineers) of the team were required to work full-time on-site to oversee project construction and to perform the required field material tests. On an as-needed basis, the full-time field engineers were supplemented by the other members of the team as the construction and the schedule dictated.

Tazimina Hydroelectric Project

Organization Chart

Key Personnel for Quality Control of the Tazimina Hydroelectric Project

Brent Petrie, General Manager, INNEC As the owner's representative, Mr. Petrie had overall responsibility for the project, particularly the engagement of project personnel in quality control activities associated with the Tazimina project. Mr. Petrie had primary responsibility for project contract issues. Mr. Petrie was in daily contact with key project staff to ensure that project personnel are adequately coordinated and directed. Mr. Petrie worked directly with the affected parties on land issues, particularly issues dealing with access to and use of private and public lands for the completion of the project.

Duane Hippe, P.E., Project Manager Mr. Hippe managed the Tazimina Hydroelectric project construction and reviewed the work and decisions of the design engineer and the field engineer. He was responsible for coordination of construction and design items with the project owner, INNEC, and communication with the contractor. Mr. Hippe scheduled and coordinated field inspections and off-site materials testing. Mr. Hippe also made routine site visits to the project site. Mr. Hippe worked with Mark Dalton on oversight of project contract issues with the project owner.

Paul Berkshire, P.E., Design Engineer Mr. Berkshire had primary responsibility for development of the civil drawings.

Mike Haynes, M.E., Design Engineer Mr. Haynes had primary responsibility for development of the mechanical drawings, review of mechanical shop drawings and coordination of the turbine, generator and controls procurement and installation.

Ernie Swanson, E.E., Design Engineer Mr. Swanson had primary responsibility for development of the electrical drawings, review of electrical submittals and field assistance inspection of turbine, generator and controls installation.

Bob Butera, P.E., Design Engineer Mr. Butera was responsible for hydrologic and road design and review of shop drawings and test results to ensure that the project was being constructed according to the design specifications and intent. Mr. Butera communicated regularly with the field engineer to monitor progress and to provide technical support in resolving engineering issues.

Joe Wagner, Field Inspector Mr. Wagner was the on-site field inspector for the duration of the project. Mr. Wagner was supported in the field by an assistant field engineer(s) during periods of extensive construction activity and rock work. During the rock tunneling work, a blasting supervisor was retained on-site to oversee the tunneling work, especially blasting work. As field engineer, Mr. Wagner was responsible for ensuring that all aspects of the construction documents are being fulfilled.

Mark Dalton, Environmental Coordinator Mr. Dalton was responsible for reviewing and monitoring project construction to ensure compliance with all the FERC license compliance articles and project permit stipulations. He specifically documented compliance with the terms and conditions presented in the Project's erosion and sedimentation control plan and monitor construction activities that could potentially impact the Tazimina River and the privately owned lands. Mr. Dalton acted as the liaison with FERC staff and local and state permitting authorities. Mr. Dalton handled overall contract issues.

Bob Tripp, Scheduling Coordinator Mr. Tripp was responsible for schedule control and compliance. Mr. Tripp tracked project progress. Mr. Tripp's Company also assisted with review and settlement of potential claims.

Steve Wells, Project Accounting Mr. Wells had overall responsibility for tracking project costs and preparing accounting reports for the state and federal grants.

6.0 PROJECT COST

An estimate of probable construction cost was prepared for the project. The estimated direct construction cost of the project was \$6,887,000. Total project development cost, including engineering services, owner costs, contingencies and escalation was estimated to be \$10,359,000 in 1994. In February 1997 the formal estimate to complete was \$11,904,000.

Bids for the turbine, generator and controls were received from three vendors. The winning bid was received from Burke Electric for \$1,425,334. Change orders for \$77,027 were processed for a total cost of \$1,502,361.

Bids for the general construction were received from three contractors. The winning bid was received from Wilder construction for \$7,248,700. Deductive alternates for a lessor quality road totaled [\$673,520]. Total contract cost was \$6,331,154 excluding engineer directed items. Change orders totaling \$16,400 were processed. The final cost for the general construction was \$6,347,554.

Costs for FERC licensing, NEPA, geotechnical investigations, topographic surveying, hydraulic modeling, engineering design, permitting and construction management and administration totaled approximately \$3,650,000. Land Acquisition and interest during construction totaled approximately \$210,000.

Total cost of the project was \$11,714,500.

Funding for the project came from the following sources:

State of Alaska Grant through DCRA	\$5,000,000
Federal Grant – Administered by USDOE	\$3,380,000
Financing	\$3,334,500

7.0 PROJECT ENERGY PRODUCTION

The rated generator nameplate capacity of the units is 824 kW. This equates to a theoretical full load capability of approximately 800 kW at maximum net head. (Note: Unit performance testing indicated a maximum demonstrated output of 804 kW, as measured on the generator low-side bus.) Current peak load in the INNEC system is about 575 kW in summer and 720 kW in winter. About 110 cubic feet per second of water is required to produce full turbine output. There are 5-1/2 years of daily flow records on the Tazimina River at the falls. During this period, the lowest recorded river flow was 140 cfs. Although it is likely that flows may occasionally drop below 140 cfs, it is reasonable to assume that 110 cfs is available at most times for diversion except during short periods in the late winter months. If this is the case, full load output should be available at most times from the units, if necessary. In reality, the units are operated to follow the INNEC system load. It appears that at least in the near term, sufficient energy is generated by the hydro facility to carry 100% of the INNEC load, except during very low river flow periods or during hydro plant outages.

An estimate of the maximum theoretical energy generation from the project was made. The daily flows at the diversion site for the five years of record, and project information (such as pipe length, diameter, headwater and tailwater elevation, turbine and generator efficiency curves, and other system losses) were input into a model to calculate energy production for each day of the period of record.

The model was run for two cases; a) using the constructed project arrangement with two units with a total diversion of 110 cfs, and; b) the same arrangement using two approximately 750 kW units and a total diverted flow of 220 cfs (future case). Results show that the maximum theoretical generation from the proposed arrangement is about 6,030,000 kWh per year. In the future, increasing diversion to 220 cfs and replacing the turbines with two 750 kW units could provide up to 10,800,000 kWh per year. Current INNEC system load is approximately 2,200,000 kWh per year.

APPENDIX A

PROJECT CONSTRUCTION PHOTOS

Tazimina River, August 1996.

Project site, August 1996.

Intake excavation, August 1996.

Intake construction, August 1996.

Penstock placement,
September 1996.

Intake construction, September 1996.

Face of intake,
October 1996.

Completed intake with sill in river,
May 1997.

Shaft collar, July 1996.

Shaft pattern rock bolting, August 1996.

Space frame in shaft, January 1997.

Underground powerhouse construction, November 1996.

Control building,
May 1997.

Arrival of turbine and bifurcation, September 1996.

Placement of diversion sill, March 1997.

Completed diversion sill, April 1997.

Tailrace tunnel, December 1996.

Tailrace, May 1997.

APPENDIX B

SELECTED PROJECT DRAWINGS

TAZIMINA HYDROELECTRIC ILIAMNA, GENERAL CONTRACTOR CONTRACT NO.

LOCATION
N.T.

INDEX OF

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E-060	ELECTRICAL LEGEND AND ABBREVIATIONS	C-211	INTAKE ELEVATION, SECTION AND DETAILS
C-080	GENERAL SITE PLAN	C-212	INTAKE SECTION AND DETAILS
ACCESS ROAD AND TRANSMISSION LINE		C-213	INTAKE SECTIONS AND DETAILS
C-101	SURVEY CONTROL DRAWING	C-221	INTAKE REINFORCEMENT PLAN
C-102	ROAD ALIGNMENT LAYOUT	C-222	INTAKE REINFORCEMENT SECTIONS
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C-112	ROAD PLAN AND PROFILE STA. 36+00 TO 62+00	C-242	INTAKE MISCELLANEOUS DETAILS SHEET 2
C-113	ROAD PLAN AND PROFILE STA. 62+00 TO 88+00	E-261	INTAKE AREA POWER AND LIGHTING PLAN
C-114	ROAD PLAN AND PROFILE STA. 88+00 TO 114+00	E-262	INTAKE AREA STRUCTURE HEATING
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C-116	ROAD PLAN AND PROFILE STA. 140+00 TO 166+00	C-281	TEMPORARY DIVERSION DURING CONSTRUCTION
C-117	ROAD PLAN AND PROFILE STA. 166+00 TO 192+00	C-291	INTAKE ACCESS ROAD PROFILE AND SECTION
C-118	ROAD PLAN AND PROFILE STA. 192+00 TO 218+00	PENSTOCK	
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C-152	MISCELLANEOUS DETAILS		

				SCALE: NONE		
				DESIGNED E.E. CLEAVER		
				DRAWN: E.E. CLEAVER		
				CHECKED P. BERKSHIRE		
1	05/08/98	AS CONSTRUCTED				
0	06/05/96	ISSUED FOR CONSTRUCTION				
ISSUE NO	DATE	DESCRIPTION	BY	CHK	APPR

ILIAMNA-NEWHALEN-NONDALTON
ELECTRIC COOPERATIVE

ELECTRIC PROJECT ALASKA

INSTRUCTION

07250-03

AP

AWINGS

CONTROL BUILDING

- 402 CONTROL BUILDING PLAN
- 403 CONTROL BUILDING INTERIOR ELEVATIONS
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- 412 CONTROL BUILDING SECTIONS AND DETAILS
- 415 CONTROL BUILDING FLOOR STEEL FRAMING PLAN
- 421 CONTROL BUILDING FOUNDATION REINFORCEMENT
- 451 DRAINFIELD PROFILE AND SECTION
- 461 CONTROL BUILDING ELECTRICAL POWER PLAN
- 462 CONTROL BUILDING ELECTRICAL LIGHTING PLAN

HVAC AND ELECTRICAL

- M-601 POWERHOUSE HVAC SCHEMATIC
- E-612 ELECTRICAL SITE AND GROUNDING PLAN
- E-613 ELECTRICAL ONE LINE DIAGRAM
- E-614 ELECTRICAL ONE LINE DIAGRAM
- E-615 ELECTRICAL ONE LINE DIAGRAM
- E-650 COMMUNICATION SYSTEM SUPPORT DETAILS
- E-660 INSTRUMENTATION FLOW DIAGRAM
- E-670 ELECTRICAL DETAILS
- E-671 ELECTRICAL DETAILS
- E-672 ELECTRICAL DETAILS
- E-673 ELECTRICAL PANELBOARD SCHEDULES
- E-674 ELECTRICAL CONDUIT SCHEDULES
- E-675 ELECTRICAL PANELBOARD AND LIGHTING FIXTURE SCHEDULE
- E-676 CONTROL DIAGRAMS

POWERHOUSE, SHAFT AND TAILRACE

- 501 SHAFT AND POWERHOUSE EXCAVATION SECTIONS & DETAILS
- 502 POWERHOUSE CAVERN EXCAVATION PLAN AND SECTIONS
- 521 POWERHOUSE GENERAL ARRANGEMENT
- 531 POWERHOUSE CONCRETE PLAN AND SECTIONS
- 535 POWERHOUSE REINFORCEMENT PLAN & SECTIONS
- 541 POWERHOUSE SPACEFRAME ISOMETRIC VIEW
- 542 POWERHOUSE SPACEFRAME SECTION AND PLANS
- 543 POWERHOUSE SPACEFRAME SECTIONS AND DETAILS
- 551 POWERHOUSE MECHANICAL PLAN
- 561 POWERHOUSE ELECTRICAL POWER PLAN AND SECTION
- 562 POWERHOUSE ELECTRICAL LIGHTING PLAN AND SECTIONS
- 581 TAILRACE TUNNEL PROFILE, PLAN AND SECTIONS

MISCELLANEOUS

- C-901 POWERHOUSE AREA EROSION AND SEDIMENTATION CONTROL PLAN
- C-902 EROSION AND SEDIMENTATION CONTROL DETAILS
- C-951 MISCELLANEOUS CONCRETE DETAILS
- C-952 MISCELLANEOUS STEEL DETAILS

NOTICE

These revised drawings have been prepared in accordance with the original drawings dated 6/1/78 for design and construction.

RECORD DRAWING

These record drawings have been prepared based on the drawings previously prepared. The Engineer has not verified the accuracy of such information and shall not be responsible for any errors or omissions which may be encountered when in use.

DR
ENGINEERING INC.

TAZIMINA
HYDROELECTRIC PROJECT

PROJECT MAP
AND DRAWING INDEX

PROJECT NUMBER
07250-03

DWG. TITLE
G-001

1

							SCALE	1"=30'-0"
							DESIGNED	P. BERKSHIRE
							DRAWN	E.E. CLEAVER
							CHECKED	D. HIPPE
1	05/08/98	AS CONSTRUCTED						
0	06/05/98	ISSUED FOR CONSTRUCTION						
ISSUE NO.	DATE	DESCRIPTION		BY	CHK	APPR		

REF: 1B-1240 DWG FALLTOP DWG INT-7250 DWG PHS-7250 DWG

ILLIAMNA-NEWHALEN-NONDALTON
ELECTRIC COOPERATIVE

1. THE TAILRACE TUNNEL IS TO BE CONSTRUCTED IN THE MOUNTAIN SIDE...
 2. THE TAILRACE PORTAL IS TO BE CONSTRUCTED IN THE MOUNTAIN SIDE...
 3. THE TAILRACE PORTAL IS TO BE CONSTRUCTED IN THE MOUNTAIN SIDE...
 4. THE TAILRACE PORTAL IS TO BE CONSTRUCTED IN THE MOUNTAIN SIDE...
 5. THE TAILRACE PORTAL IS TO BE CONSTRUCTED IN THE MOUNTAIN SIDE...
 6. THE TAILRACE PORTAL IS TO BE CONSTRUCTED IN THE MOUNTAIN SIDE...
 7. THE TAILRACE PORTAL IS TO BE CONSTRUCTED IN THE MOUNTAIN SIDE...
 8. THE TAILRACE PORTAL IS TO BE CONSTRUCTED IN THE MOUNTAIN SIDE...
 9. THE TAILRACE PORTAL IS TO BE CONSTRUCTED IN THE MOUNTAIN SIDE...
 10. THE TAILRACE PORTAL IS TO BE CONSTRUCTED IN THE MOUNTAIN SIDE...

SECTION A
NTS

	COORDINATES	
	NORTH	EAST
CP-14	2,155,891.73	371,988.15
CP-15	2,156,123.29	372,225.17
BH-1	2,156,188.00	372,243.00
BH-2	2,155,897.00	372,030.00
BH-3	2,155,994.00	372,139.00
BH-4	2,155,964.00	372,125.00
BH-5	2,155,921.00	372,058.00
BH-6	2,155,908.00	372,083.00

BH=BORE HOLE
CP=CONTROL POINT

NOTICE
 These record drawings have been prepared on computer. See general submitted dated 6/5/96 for signed and sealed documents.

RECORD DRAWING
 These record drawings have been prepared based on information prepared by others. The Engineer has not verified the accuracy of such information and shall not be responsible for any errors or omissions which may be incorporated herein as a result.

HDR
ENGINEERING INC.

TAZIMINA
HYDROELECTRIC PROJECT

GENERAL
SITE PLAN

DATE	
PROJECT NUMBER	07250-03
SHEET NUMBER	C-080
ISSUE NO	1

A

B

C

D

E

NEWHALEN
RIVER

TO NONDALTON

TO ILIAMNA

ISSUE NO.	DATE	DESCRIPTION	BY	CHK	APPR
1	05/08/98	AS CONSTRUCTED			
0	06/05/96	ISSUED FOR CONSTRUCTION			

SCALE

1"=1000'

DESIGNED

T. LOPES

DRAWN

G. RADVANSKY

CHECKED

D. HIPPE

ILLIAMNA-NEWHALEN-NONDALTON
ELECTRIC COOPERATIVE

TAZIMINA RIVER

TAZIMINA RIVER

SHT C-117

180+00

190+00

SHT C-118

200+00

210+00

220+00

SHT C-119

230+00

240+00

SHT C-120

250+00

260+00

270+00

SHT C-121

280+00

290+00

SHT C-122

300+00

310+00

320+00

SHT C-123

330+00

340+00

SHT C-124

350+00

360+00

SHT C-125

370+00

375+73.1073

STA AHEAD: 340+00
STA BACK: 330+66.1708

NOTICE

These record drawings have been prepared on computer. See original submittal dated 6/3/96 for signed and sealed documents.

RECORD DRAWING

These record drawings have been prepared based on information provided by others. The Engineer has not verified the accuracy of such information and shall not be responsible for any errors or omissions which may be incorporated herein as a result.

* ROAD WAS NOT CONSTRUCTED USING DESIGN CRITERIA. THE ROAD WAS KEPT WITHIN THE 100' RIGHT OF WAY. LINE AND GRADE VARIED WIDELY.

HDR
ENGINEERING INC.

TAZIMINA
HYDROELECTRIC PROJECT
ROAD

ROAD ALIGNMENT LAYOUT

DATE

PROJECT NUMBER
07250-03

SHEET NUMBER: C-102
ISSUE NO: 1

C

D

E

1" x 6'-0" TYPE 4
ROCK BOLT OR APPROVED
ALTERNATE. ROCK BOLTS
WITH NO ANCHOR WERE
USED IN BLOCKS 1-8 DUE
TO IRREGULAR BOTTOM &
NO BEDROCK

CHANNEL CONTROL SILL BLOCK DETAILS

NOTE: SILL BLOCKS 16 & 17 WERE SET ON GRAVEL BOTTOM AND ANCHOR DRIVEN TO REFUSAL. REBAR NOT GROUTED. INTENT IS BLOCKS TO STAY IN PLACE AND ARMOR BOTTOM.

					SCALE	AS SHOWN
					DESIGNED	P. BERKSHIRE
					DRAWN	E.E. CLEAVER
					CHECKED	
1	05/08/98	AS CONSTRUCTED				
0	06/05/96	ISSUED FOR CONSTRUCTION				
ISSUE NO	DATE	DESCRIPTION	BY	CHK	APPR	

REF: TB-7246.DWG

ILIAMNA-NEWHALEN-NONDALTON
ELECTRIC COOPERATIVE

SECTION
-0"

NOTES:

1. PLACE BLOCKS AS CLOSE TOGETHER AS POSSIBLE.
2. NOT USED
3. NOT USED
4. NOT USED
5. FURNISH 24 SILL BLOCKS. STORE UNUSED BLOCKS AT INTAKE PARKING AREA, SEE DWG C-080. 17 INSTALLED IN RIVER.
6. INSTALL 15,000 LB. CAPACITY LIFTING EYE IN THREADED SOCKET. AFTER PLACEMENT, REMOVE EYE AND REPLACE WITH SS CAR BOLT.
7. SCALE BED OF STREAM PRIOR TO INSTALLATION OF SILL BLOCKS SO THAT MAXIMUM VARIATION IN BED IS LESS THAN 6" OR AS DIRECTED.

NOTE: ALL REINFORCEMENT SHALL BE #5012
EW, EF, UNO.

SECTION B
1/2" = 1'-0"

NOTICE

These record drawings have been prepared on a computer. See original submittal dated 6/3/96 for signed and sealed documents.

RECORD DRAWING

These record drawings have been prepared based on information provided by others. The Engineer has not verified the accuracy of such information and shall not be responsible for any errors or omissions which may be incorporated herein as a result.

HDR
ENGINEERING INC.

**TAZIMINA
HYDROELECTRIC PROJECT
CHANNEL CONTROL SILL
ELEVATION, PLAN
AND SECTIONS**

DATE	
PROJECT NUMBER	07250-003
SHEET NUMBER	C-201
ISSUE NO	1

NOTES

1. SLOPE VALVE PIT FLOOR TO DRAIN TO SUMP
2. BALCO TYPE J HATCH 3'-0" x 3'-0", STEEL FRAME, GALV CYLINDER LOCK WITH PLUG SS HARDWARE, DRAIN CUTTER TO DAYLIGHT DESIGN HATCH OVER INTAKE FOR H-20 LOADING

PIER BLOCKS

—INTAKE ACCESS
ROAD DRAINAGE

NOTICE

These record drawings have been prepared on computer. See original submitted dated 6/5/96 for signed and sealed documents.

RECORD DRAWING

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HDR
ENGINEERING INC.

TAZIMINA
HYDROELECTRIC PROJECT
INTAKE PLAN

DATE

PROJECT NUMBER
07250-03

SHEET NUMBER: C-210
ISSUE: 1

A

B

C

D

E

ELEV. $\frac{1}{4}" = 1'-0"$ A C-210

ELEVATION

SECTION A

RECESSED HAND HOLD DETAIL

1 1/2" = 1'-0"

SECTION E

 $\frac{1}{4}" = 1'-0"$

ILIAMNA-NEUHALEN-NONDALTO
ELECTRIC COOPERATIVE

1	05/08/98	AS CONSTRUCTED	BY	CHK	APPR	SCALE: AS SHOWN
0	06/05/96	ISSUED FOR CONSTRUCTION				DESIGNED: P. BERKSHIRE
						DRAWN: E.E. CLEAVER
						CHECKED: J. PETERSON
DATE	DESCRIPTION	BY	CHK	APPR

5

6

7

8

595

APPROX. EXISTING
GROUND SURFACE

585

LARGE PIPES (2)
UP TO DRAIN
PIT
4-2311'-6"
(TYP)

575

MANHOLE, FOR
DETAILS SEE
DWG C-9522" THICK INSULATION
BOARD (TYP)1/4" THICK NEOPRENE RUBBER
PAD UNDER PIPE

555

FLANGE
EL 592.00
180° ELBOW W/
INSECT SCREEN
12" STL PIPE
HANDRAILEL VARIES
583.88 TO 584.0

EL VARIES

EL 583.0

GRATING PLATFORM EL 570.5,
SEE DWG C-242LADDER, SEE DWG C-241
PROVIDE BILCO LU-2 AT TOP
(LADDER-UP SAFETY POST)
OR APPROVED ALTERNATE

CLASS C BACKFILL, TYP

1'-6" DEEP x
2'-0" WIDE x
3'-6" LONG
SUMP

EL 562.5

1'-0" 4'-0" 7'-0" 1'-0"

SECTION D
1/2" = 1'-0" C-210

NOTICE

These record drawings have been prepared
on computer. See original submitted dated
6/3/98 for signed and sealed documents.

RECORD DRAWING

These record drawings have been prepared
based on information provided by others. The
Engineer has not verified the accuracy of
such information and shall not be responsible
for any errors or omissions which may be
incorporated herein as a result.1
FOOT
1 1/2" = 1'-0"4 8 FEET
1/2" = 1'-0"HDR
ENGINEERING INC. TAZIMINA
HYDROELECTRIC PROJECT
INTAKE
ELEVATION, SECTION
AND DETAILS

DATE

PROJECT NUMBER
07250-03SHEET NUMBER
C-211 1

SECTION B
1/4" = 1'-0" C-210

NOTES:

1. HOLD DOWN BOLTS SHALL BE SS, SUPPLY WITH 1/4"x3/4" SS FLAT WASHER. SHOP DRILL 3/4" HOLE INTO 2x3x1/4" RETAINER BARS LOCATED 1'-0" FROM EACH END (TYP 4 PLACES EACH COVER). FIELD DRILL AND TAP INTO 1/4"x3/4" CONTINUOUS BAR.
2. PLACE PVC WATERSTOP IN ALL CONSTRUCTION JOINTS IN THIS WALL.

DETAIL 2
1 1/2" = 1'-0"

630

620

610

600

590

580

570

560

550

540

•SEE MECHANICAL AS BUILTS FOR PENSTOCK INFO

ORIGINAL GROUND SURFACE

ROAD SURFACE
EL. 583.5BEGIN PENSTOCK
STA 10+00
EL. 566.5

60" I.D. STEEL PENSTOCK

C

10 0 10 20 FEET
1" = 10'PROF
1" = 1'ORIGINAL GROUND
SURFACE

VARIES

10'-0"

SEE NOTE 1

PIPE BEDDING

60" DIA. STEEL PIPE

4'-0" 4'-0"

SEE NOTE 1

CLASS C
BACKFILLFILTER FABRIC PLACED
1" ABOVE PIPE • PIPE
BEDDING/ROCK
INTERFACE

6" MIN.

TYPICAL OPEN EXCAVATION SECTION

SCALE: 1/4" = 1'-0"

NOTES:

1. CONTRACTOR SHALL DETERMINE TEMPORARY EXCAVATION A COMBINED USE OF SHORING, ROCK BOLTING AND LAYING BACK OF SIDE SLOPES OF EXCAVATION MAY BE REQUIRED TO MEET MINIMUM SAFE REQUIREMENTS OF SECTION 05.160 OF STATE OF ALASKA CONSTRUCTION CODE (EXCAVATION STANDARDS) AND THE LATEST FEDERAL OSHA EXCAVATING AND TRENCH STANDARDS.

2. CONTRACTOR TO SUBMIT PLAN SHOWING THE EXTENTS OF TUNNELING; TUNNEL SHAPE; PENSTOCK PLACEMENT CONCRETING, AND GROUTING PROCEDURES PRIOR TO STARTING THIS WORK.

3. MAX TUNNEL WIDTH OR HEIGHT = 10'

4. INSTALLATION OF OWNER FURNISHED BIFURCATION REQUIRES FULL PENETRATION BUTT-WELDING OF 1-60" DIA AND 3-42" DIA PIPE JOINTS AND REPAIR OF COATINGS AND LININGS

5. FABRICATE BRACKET TO MOUNT VENT PIPE TO FINISHED SHAFT WALL.

NOTICE

These record drawings have been prepared on a computer. See original submitted dated 8/5/96 for signed and sealed documents.

RECORD DRAWING

These record drawings have been prepared based on information provided by others. The Engineer has not verified the accuracy of such information and shall not be responsible for any errors or omissions which may be incorporated herein as a result.

SEE NOTE 2

						SCALE	AS SHOWN
						DESIGNED	P. BERKSHIRE
						DRAWN	E.E. CLEAVER
						CHECKED	J. PETERSON
1	05/08/98	AS CONSTRUCTED					
0	06/05/96	ISSUED FOR CONSTRUCTION					
ISSUE NO	DATE	DESCRIPTION	BY	CHK	APPR

ILIAMNA-NEWHALEN-NONDALTON
ELECTRIC COOPERATIVE

H
EN

5 6 7 8

FORMATION

SHED GRADE
599.5±

DR
ENGINEERING INC.

TAZIMINA
HYDROELECTRIC PROJECT

PENSTOCK
PROFILE AND SECTIONS

DATE	
PROJECT NUMBER 07250-03	
SHEET NUMBER C-301	ISSUE NO 1

ISSUE NO	DATE	DESCRIPTION	BY	CHK	APPR	CHECKED
1	05/08/98	AS CONSTRUCTED				
0	06/05/96	ISSUED FOR CONSTRUCTION				
SCALE	$\frac{1}{4}'' = 1' - 0''$					
DESIGNED	P. BERKSHIRE					
DRAWN	E.E. CLEAVER					
CHECKED	M. HAYNES

ILIAMNA-NEWHALEN-NONDALTON
ELECTRIC COOPERATIVE

NO. QTY.

EQUIPMENT SPECIFICATION

- 1 1 EYE WASH STATION
- 2 2 TRICLASS FIRE EXTINGUISHER
- 3 1 WALL EXHAUST FAN W/ BACKDRAFT DAMPER, 1800 CFM, 950 RPM
1/6 HP, 115 VOLT, SINGLE PHASE, COOK FAN COMPANY MODEL
16SP100 OR APPROVED EQUAL
- 4 2 WALL ADJUSTABLE LOUVER, AUTOMATIC OPERATION, ELECTRICALLY OPERATED,
120 VAC, DRAINABLE EXTRUDED ALUMINUM CONSTRUCTION
- 5 1 OIL/WATER SEPARATOR, 100 GALLON CAPACITY, 1/4-INCH GALVANIZED
DIAMOND PLATE STEEL COVER, ACID RESISTING COATING, SLUDGE RETAINER
WEIR, REMOVABLE FLOW DIFFUSING BAFFLES, UTILITY VAULT COMPANY
MODEL 25-SA OR APPROVED EQUAL
- 6 2 ELECTRIC UNIT HEATER, 10 KW, 480 VAC, 34,100 BTU, 3 PHASE
CHROMALOX MODEL MUH-10-4, OR APPROVED EQUAL,
HORIZONTAL THROW, WALL MOUNTED
- 7 1 ELECTRIC BASEBOARD HEATER WITH INTEGRAL THERMOSTAT, 5,120 BTUH, 6 FEET
LONG, MARLEY-QMARK MODEL QMKC-2516 OR APPROVED EQUAL
- 8 1 CUMMINGS TANK-MOUNTED, DIESEL-FUELED, ENGINE GENERATOR, MODEL 50 DGCA,
60 HZ, PROVIDED BY OTHERS, INSTALLED BY CONTRACTOR. CONTRACTOR IS
RESPONSIBLE FOR THE COMPLETE INSTALLATION INCLUDING MOUNTING AND ANCHORAGE,
EXHAUST AND MUFFLER ASSEMBLY, AND WIRING, ACCORDING TO THE MANUFACTURERS
RECOMMENDATIONS.
- 9 1 FLOOR DRAIN, 9-IN TOP, FLUSH MOUNTED
- 10 1 THROUGH-WALL EXHAUST FAN, MC MASTERS-CAR NO. 2089K5
OR APPROVED EQUAL, 10 3/4" SQ, 12 VOLT AC, 60 HZ
SIZED FOR WALL THICKNESS AS REQD.
- 11 1 8'-0"x10'-0" ACCESS HATCH, BILCO MODEL JD-AL, WITH SAFETY CHAINS
- 12 NOT USED
- 13 NOT USED
- 14 1 BILCO TYPE J HATCH, 3'-0"x3'-0" ALUMINUM COVER
- 15 1 LOUVER, MCMASTERS-CARR NO. 2038K81, 12x12, OR EQUAL
- 16 1 FIELD FABRICATED RETURN AIR LOUVER

NOTES:

1. DIESEL GENERATOR, DIESEL FUEL TANK; CONTROL, SWITCHGEAR AND
STATION SERVICE PANELS PROVIDED BY OTHERS
2. PROVIDE TRAP AND VENT LINES. VENT LINES TO EXIT
ROOF NEAR NORTH WALL OF BUILDING
3. LOCATE ELEVATOR ACCESS DOOR TO MATCH ELEVATOR
ENCLOSURE OPENING.

DESIGN SUMMARY

DESCRIPTION: PRE-ENGINEERED METAL BUILDING, STRUCTURAL STEEL
RIGID FRAME CONSTRUCTION, SHEET METAL WALL AND
ROOF PANELS, REINFORCED CONCRETE FOUNDATION
OVERALL BUILDING AREA: 1,656 S.F.

USAGE: POWERHOUSE

LOCATION: TAZIMINA RIVER, ALASKA

1991 UBC CODE SYNOPSIS

702: OCCUPANCY B-4: POWER PLANT
1901: CONSTRUCTION TYPE II-N WALLS AND PERMANENT
PARTITIONS NON-COMBUSTIBLE

TABLE 5-A: FIRE RESISTANCE OF EXTERIOR WALLS ONE HOUR IF
LESS THAN 5 FEET FROM PROPERTY LINE.

TABLE 5-C: B-4: II-N 18,000 S.F. ALLOWED

TABLE 33-A: MINIMUM EGRESS REQUIREMENTS: 100 S.F./OCCUPANT
ONE EXIT: MAXIMUM OCCUPANCY = 16

NOTICE

These record drawings have been prepared
on computer. See original submitted dated
6/5/95 for signed and sealed documents.

RECORD DRAWING

These record drawings have been prepared
based on information provided by others. The
Engineer has not verified the accuracy of
such information and shall not be responsible
for any errors or omissions which may be
incorporated herein as a result.

TAZIMINA
HYDROELECTRIC PROJECT

CONTROL BUILDING
PLAN

DATE	
PROJECT NUMBER	07250-03
SHEET NUMBER	C-402
ISSUE NO.	1

NORTH ELEVATION

WEST ELEVATION

NOTICE

These record drawings have been prepared on a computer. See original submitted 6/5/96 for signed and sealed drawings.

RECORD DRAWING

These record drawings have been prepared based on information provided by the Engineer. The Engineer has not verified the accuracy of such information and shall not be responsible for any errors or omissions which may be incorporated herein as a result.

1	05/08/98	AS CONSTRUCTED					SCALE	1/4"=1'-0"
0	06/05/96	ISSUED FOR CONSTRUCTION					DESIGNED	P. BERKSHIRE
							DRAWN	E.E. CLEAVER
							CHECKED	J. PETERSON
ISSUE NO.	DATE	DESCRIPTION	BY	CHK	APPR			

XREF IR-25C DWG.

**ILIAMNA-NEWHALEN-NONDALTON
ELECTRIC COOPERATIVE**

				SCALE	AS SHOWN
				DESIGNED	P. BERKSHIRE
				DRAWN	E.E. CLEAVER
				CHECKED	J. PETERSON
1	05/08/98	AS CONSTRUCTED			
0	06/05/98	ISSUED FOR CONSTRUCTION			
ISSUE NO	DATE	DESCRIPTION	BY	CHK	APPR

IILIAMNA-NEUHALEN-NONDALTON
ELECTRIC COOPERATIVE

PLAN

					SCALE	1/4"=1'-0"
					DESIGNED	P. BERKSHIRE
					DRAWN	E.E. CLEAVER
					CHECKED	J. PETERSON
1	05/08/98	AS CONSTRUCTED				
0	06/05/96	ISSUED FOR CONSTRUCTION				
ISSUE NO	DATE	DESCRIPTION	BY	CHK	APPR

ILIAMNA-NEWHALEN-NONDALTON
ELECTRIC COOPERATIVE

NOTES:

1. SYMBOL SHOWN INDICATES MANDATORY EXCAVATION SEQUENCE OF POWERHOUSE.
2. ALL ROCK BOLTS AND SHOTCRETE SHALL BE INSTALLED BEFORE ADVANCING TO NEXT EXCAVATION SEQUENCE.
3. EXCAVATE AS REQUIRED FOR MINIMUM CONCRETE COVER.
4. SLOPE SUMP PIT FLOOR TO DRAIN TO PUMP.

NOTICE

These record drawings have been prepared on computer. See original submitted dated 6/5/96 for signed and sealed documents.

RECORD DRAWING

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DR
ENGINEERING INC.

**TAZIMINA
HYDROELECTRIC PROJECT
POWERHOUSE CAVERN
EXCAVATION
PLAN AND SECTIONS**

DATE	
PROJECT NUMBER 07250-03	
SHEET NUMBER C-502	ISSUE NO. 1

A

B

C

D

E

SECTION A
1/4"=1'-0"

							SCALE:	1/4"=1'-0"
							DESIGNED	P. BERKSHIRE
							DRAWN	E.E. CLEAVER
1	05/08/98	AS CONSTRUCTED					CHECKED	D. HIPPE
0	06/05/96	ISSUED FOR CONSTRUCTION						
ISSUE NO	DATE	DESCRIPTION		BY	CHK	APPR		

WFF 16-1250 DWG. 16-1250 DWG.

ILIAMNA-NEWHALEN-NONDALTON
ELECTRIC COOPERATIVE

NOTES:

1. BILCO TYPE J HATCH, 3'-0"x3'-0", STEEL FRAME, GALVANIZED, STAINLESS STEEL HARDWARE. DRAIN GUTTER TO TAILRACE.

2. LOCATE PRIMARY LIFTING EYE BOLTS OVER THE TOP OF LIFTING LUGS ON THE GENERATOR, TURBINE SCROLL CASE, DRAFT TUBE AND TURBINE SHUT-OFF VALVE FOR EACH UNIT. LOCATE ADDITIONAL LIFTING EYE BOLTS 4'-0" TO EACH SIDE OF THE PRIMARY LIFTING EYE BOLTS.

SECTION C

NOTICE

These record drawings have been prepared based on information provided by owners. The Engineer has not verified the accuracy of such information and shall not be responsible for any errors or omissions which may be incorporated herein as a result.

RECORD DRAWING

These record drawings have been prepared based on information provided by owners. The Engineer has not verified the accuracy of such information and shall not be responsible for any errors or omissions which may be incorporated herein as a result.

HDR
ENGINEERING INC.

TAZUMA
HYDROELECTRIC PROJECT
POWERHOUSE
GENERAL ARRANGEMENT

6-011

1

2

3

4

A

B

C

D

E

						SCALE	NTS
						DESIGNED	P. BERKSHIRE
						DRAWN	T.A. MAUS
						CHECKED	J. PETERSON
1	05/08/98	AS CONSTRUCTED					
0	08/08/98	ISSUED FOR CONSTRUCTION					
ISSUE NO	DATE	DESCRIPTION	BY	CHK	APPR

ILLIAMNA-NEWHALEN-NONDALTON
ELECTRIC COOPERATIVE

NOTICE

These record drawings have been prepared on computer. See original submitted dated 6/3/96 for signed and sealed documents.

RECORD DRAWING

These record drawings have been prepared based on information provided by others. The Engineer has not verified the accuracy of such information and shall not be responsible for any errors or omissions which may be incorporated herein as a result.

HDR
ENGINEERING INC.

TAZIMINA
HYDROELECTRIC PROJECT
POWERHOUSE
SPACE FRAME
ISOMETRIC VIEW

DATE

PROJECT NUMBER

07250-03

SHEET NUMBER

C-541

ISSUE NO

1

A
B
C
D
E

PROFILE
1"=10'-0"

PORTAL PLAN
1"=10'-0"

•SEE ENVIRONMENTAL PLAN
FOR SPOIL PILE LIMITS

1	105/08/98	AS CONSTRUCTED	BY	CHK	APPR
0	106/05/98	ISSUED FOR CONSTRUCTION			
ISSUE NO.	DATE	DESCRIPTION	BY	CHK	APPR

SCALE: 1" = 10'
DESIGNED: P. BERKSHIRE
DRAWN: E.E. CLEAVER
CHECKED: J. PETERSON

ILIAMNA-NEWHALEN-NONDALTON
ELECTRIC COOPERATIVE

STA 12+5
1/4"=1'-0"

4+25 TO STA 14+45
3/4"=1'-0"

NOTES

1. PROVIDE 1/2" THICK RUBBER PORTAL CURTAIN AT STA. 14+60.
FASTEN CURTAIN TO LINER PLATES WITH 3/8" GALV. BOLTS
AND 2" GALV. WASHERS.

SECTION A
3/4"=1'-0"

NOTICE

These record drawings have been prepared
based on information provided by others. The
Engineer has not verified the accuracy of
such information and shall not be responsible
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RECORD DRAWING

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DR
NEERING INC.

HYDROELECTRIC PROJECT
PALEMBANG
PROFESSIONAL ENGINEER