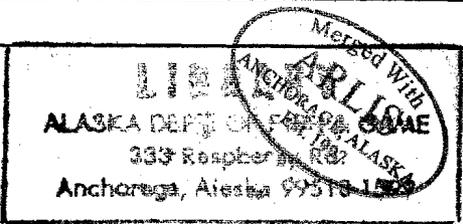


1777

**SUSITNA
HYDROELECTRIC PROJECT**

FEDERAL ENERGY REGULATORY COMMISSION
PROJECT No. 7114



**ALASKA POWER AUTHORITY
COMMENTS
ON THE
FEDERAL ENERGY REGULATORY COMMISSION
DRAFT ENVIRONMENTAL IMPACT STATEMENT
OF MAY 1984**

**VOLUME 6
APPENDIX IV-
TEMPERATURE SIMULATIONS,
WATANA AND DEVIL CANYON
RESERVOIRS**

**AUGUST 1984
DOCUMENT No. 1777**

ALASKA POWER AUTHORITY

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NO. 1777

FEDERAL ENERGY REGULATORY COMMISSION
SUSITNA HYDROELECTRIC PROJECT
PROJECT NO. 7114

ALASKA POWER AUTHORITY
COMMENTS
ON THE
FEDERAL ENERGY REGULATORY COMMISSION
DRAFT ENVIRONMENTAL IMPACT STATEMENT
OF MAY 1984

Volume 6

Appendix IV - Temperature Simulations, Watana
and Devil Canyon Reservoirs

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Alaska Resources
Library & Information Services
Anchorage, Alaska

August 1984

APPENDIX IV

This Appendix contains results of Watana and Devil Canyon reservoir temperature simulations using the Dynamic Reservoir Simulation Model (Harza-Ebasco 1984). Reservoir outflow temperatures, ice thicknesses, and temperature profiles are included. Simulations were made in response to the Federal Energy Regulatory Commission's (FERC) Request for Supplemental Information of April, 1983 (copy of response attached as Exhibit A) and are referenced in the Alaska Power Authority's Technical Comments on the FERC's Draft Environmental Impact Statement (DEIS) numbers AQR003, AQR032, AQR033, AQR038, AQR043, AQR046, AQR066, AQR071, AQR098, AQR099 and AQR109. Simulations were made for various hydrological and meteorological conditions, for four levels of project energy demands and for the three years required to fill Watana Reservoir. Case C minimum target flows, as defined in the License Application (p. E-2-57) were used. Low level, mid-level and multi-level intakes and the spillway were operated in accordance with policies set out in the License Application, Exhibit E, Chapter 2. The policy for operating the multi-level intake to the powerhouse was to discharge water having temperatures as close to natural river temperatures as possible. (License Application p. E-2-119).

The reservoir temperature simulations in this Appendix provided the upstream boundary conditions for river temperature and river ice simulations.

Temperature simulations for Devil Canyon Reservoir in this Appendix are significantly different than the temperature simulations for Devil Canyon presented in the License Application. A review of the License Application Dynamic Reservoir Simulation Model (DYRESM) input indicated that the reservoir volume employed in the License Application simulations was too high by a factor of 6. This caused simulated outflow temperatures from Devil Canyon to be lower in the summer and higher in the winter by 1°C to 2°C than for simulations for similar energy demands and weather using the correct reservoir volume. The river temperature simulations presented in

the License Application for Devil Canyon operation would reflect this error in the area near the dam. Further downstream, the effects of this error would be smaller.

The reservoir temperature simulations in this Appendix were made with the correct elevation-area-volume relationship. The resulting outflow temperatures from Devil Canyon reservoir are much more similar to outflow temperatures from Watana Reservoir. Devil Canyon Reservoir tends to smooth out some of the peaks and valleys in Watana reservoir outflow temperatures.

The meteorologic and hydrologic data utilized for simulating Watana and Devil Canyon Reservoir temperatures are summarized on plots. Meteorologic data collected by R & M Consultants, Inc. (R & M) at weather stations at Devil Canyon and Watana (R&M 1982a, 1982b, 1982c, 1982d, 1984a, 1984b) were utilized for reservoir simulations for the period 1980-1983. Data collected at the National Oceanic and Atmospheric Administration (NOAA) weather stations at Summit were used for simulations for the period 1970-1977. These data were supplemented by data collected by NOAA at Talkeetna and Anchorage and by R & M at other locations in the Susitna Basin.

As indicated in Exhibit A, the years 1974-1975, 1982-1983 and 1981-1982 were selected to represent dry, average and wet hydrologic conditions, respectively, as requested by FERC. Simulations were made for 1971-1972 and 1976-1977 to provide cold and average winter outflow conditions for use in simulation of river ice.

Each temperature simulation in this Appendix was initiated in November, six months preceding the period of interest for assessment of impacts. This was done because the Watana reservoir is generally isothermal in November. For analyses of biological effects, temperatures should not be used for the initial six month periods between November and May. The exceptions to this rule are the first year of filling simulations. These simulations were carried out to verify that the reservoir would become isothermal by November of the first winter of filling, so that simulations of the second and third

years of filling could begin with isothermal conditions in November of the first winter. Additionally, simulations for the period November 1980 to May 1983 were run continuously and only the period November 1980 to April 1981 should not be used.

The temperature simulation for the third summer of filling assumed all flow would be through the mid-level outlet works. The License Application (Fig C.1), however, indicates that units 1 and 2 would be operational on April 1 and July 1, 1993, respectively. Thus, some flow would be passed through the multi-level intake during the third summer of filling. This would tend to cause temperatures to be slightly warmer than indicated in this Appendix for the third summer of filling.

REFERENCES

1. Harza-Ebasco Susitna Joint Venture, 1984, "Eklutna Lake Temperature and Ice Study - with Six Months Simulation for Watana Reservoir", Susitna Hydroelectric Project Report.
2. R&M Consultants, Inc., 1982a, "Processed Climatic Data, Vol. 5, 0650 Watana Station October 1981 - September 1982", Susitna Hydroelectric Project Report.
3. R&M Consultants, Inc., 1982b, "Processed Climatic Data, Vol. 6, 0660, Devil Canyon Station October 1981 - September 1982", Susitna Hydroelectric Project Report.
4. R&M consultants, Inc., 1982c, "Processed Climatic Data, Vol. 5, Watana Station, April 1980 - September 1981", Susitna Hydroelectric Project Report.
5. R&M Consultants, Inc., 1982d, "Processed Climatic Data, Vol. 6, Devil Canyon Station, July 1980 - September 1981", Susitna Hydroelectric Project Report.
6. R&M Consultants, Inc., 1984a, "Processed Climatic Data, Vol. 5, Devil Canyon Station, October 1982 - September 1983", Susitna Hydroelectric Project Report.
7. R&M Consultants, Inc., 1984b, "Processed Climatic Data., Vol 4, Watana Station, October 1982 - September 1983", Susitna Hydroelectric Project Report.

LIST OF EXHIBITS

<u>Exhibit</u>	<u>Title</u>
A	The Alaska Power Authority's Response to the Federal Energy Regulatory Commission's Request for Supplemental Information of April 12, 1983 - Schedule B, Exhibit E. No. 2.28.
B	Watana Reservoir Weather Data, November 1980 - April 1983.
C	Devil Canyon Reservoir Weather Data, November 1980 - April 1983.
D	Watana and Devil Canyon Reservoir Weather Data, November 1970 - April 1972, November 1973 - April 1975, November 1975 - April 1977.
E	Watana Reservoir Inflow and Outflow - November 1970 - April 1972.
F	Devil Canyon Reservoir Inflow and Outflow - November 1970 - April 1972.
G	Watana Reservoir Inflow and Outflow - November 1973 - April 1975.
H	Devil Canyon Reservoir Inflow and Outflow - November 1973 - April 1975.
I	Watana Reservoir Inflow and Outflow - November 1975 - April 1977
J	Devil Canyon Reservoir Inflow and Outflow, November 1975 - April 1977
K	Watana Reservoir Inflow and Outflow - November 1980 - April 1983
L	Devil Canyon Reservoir Inflow and Outflow, November 1980-April 1983.

LIST OF EXHIBITS

<u>Exhibit</u>	<u>Reservoir(s) Operating</u>	<u>Reservoir Temperature Simulation</u>	<u>Energy Demand Year</u>	<u>Meteorologic and Hydrologic Data Period¹</u>
M	Watana	Watana	First year of filling ²	5/81 - 4/82
N	Watana	Watana	First year of filling ²	5/82 - 4/83
O	Watana	Watana	Second year of filling ²	5/81 - 4/82
P	Watana	Watana	Third year of filling ²	5/82 - 4/83
Q	Watana	Watana	1996	5/71 - 4/72
R	Watana	Watana	1996	5/74 - 4/75
S	Watana	Watana	1996	5/76 - 4/77
T	Watana	Watana	1996	5/81 - 4/82
U	Watana	Watana	1996	5/82 - 4/83
V	Watana	Watana	2001	5/71 - 4/72
W	Watana	Watana	2001	5/74 - 4/75
X	Watana	Watana	2001	5/81 - 4/82
Y	Watana	Watana	2001	5/82 - 4/83
Z	Watana and Devil Canyon	Watana	2002	5/71 - 4/72
AA	Watana and Devil Canyon	Watana	2002	5/74 - 4/75
AA	Watana and Devil Canyon	Watana	2002	5/76 - 4/77
AC	Watana and Devil Canyon	Watana	2002	5/81 - 4/82
AD	Watana and Devil Canyon	Watana	2002	5/82 - 4/83
AE	Watana and Devil Canyon	Watana	2020	5/71 - 4/72
AF	Watana and Devil Canyon	Watana	2020	5/74 - 4/75

LIST OF EXHIBITS

<u>Exhibit</u>	<u>Reservoir(s) Operating</u>	<u>Reservoir Temperature Simulation</u>	<u>Energy Demand Year</u>	<u>Meteorologic and Hydrologic Data Period¹</u>
AG	Watana and Devil Canyon	Watana	2020	5/76 - 4/77
AH	Watana and Devil Canyon	Watana	2020	5/81 - 4/82
AI	Watana and Devil Canyon	Watana	2020	5/82 - 4/83
AJ	Watana and Devil Canyon	Devil Canyon	2002	5/71 - 4/72
AK	Watana and Devil Canyon	Devil Canyon	2002	5/74 - 4/75
AL	Watana and Devil Canyon	Devil Canyon	2002	5/76 - 4/77
AM	Watana and Devil Canyon	Devil Canyon	2002	5/81 - 4/82
AN	Watana and Devil Canyon	Devil Canyon	2002	5/82 - 4/83
AO	Watana and Devil Canyon	Devil Canyon	2020	5/71 - 4/72
AP	Watana and Devil Canyon	Devil Canyon	2020	5/74 - 4/75
AQ	Watana and Devil Canyon	Devil Canyon	2020	5/76 - 4/77
AR	Watana and Devil Canyon	Devil Canyon	2020	5/81 - 4/82
AS	Watana and Devil Canyon	Devil Canyon	2020	5/82 - 4/83

FOOTNOTES

¹Temperature simulations shown in the Appendix normally begin in November, six months prior to the period shown in this table. This was done because the reservoir(s) would generally be isothermal in November. Simulations made for the period November 1980 through April 1983 were run continuously.

²Two simulations were made for the first year of filling for purposes of river ice modeling and to demonstrate that the reservoir becomes isothermal in November of the first year of filling. Since data were not available for the study area for a continuous three year period the simulations for the second and third years of filling utilized data for the period November 1980 to May 1983. Having verified that the reservoir would become isothermal during November of the first winter of filling, the simulation of the second and third years of filling was begun with data from November of 1980 with an isothermal reservoir at the water temperature and level simulated for November of the first winter of filling. The simulation carried through until the completion of filling in the third winter.

EXHIBIT A

Exhibit A

**The Alaska Power Authority's Response to the Federal Energy Regulatory
Commission's Request for Supplemental Information of April 12, 1983 -
Schedule B, Exhibit E No. 2.28.**

EXHIBIT E

2. Water Use and Quality

Comment 28 (p. E-2-87, para. 1)

Provide longitudinal profiles of predicted weekly average temperatures downstream of Watana Dam and Devil Canyon/Watana using the DYRSEM and HEATSIM models. Simulations for stations with pre-project temperature data should be provided with Watana in operation and Devil Canyon/Watana in operation using data for an average water year and for conditions of minimum releases (i.e., using data for a minimum flow year) from Watana and from Devil Canyon. Listings of inputs used and assumptions made in each simulation should also be provided. Outflow temperature from each reservoir used in the HEATSIM model should include the temperatures that would have to be available at the multilevel intakes in order to match pre-dam temperatures that would have to be available at the multilevel intakes in order to match pre-dam temperatures. Meteorological conditions used as model parameters should be provided. These simulated average weekly temperatures should be compared to pre-project temperatures measured during low-flow and average flow years. Provide parameter values used in each simulation and document the source of the values used.

Response:

Daily simulations of reservoir and river temperatures had been prepared to provide the longitudinal profiles of temperatures downstream of Watana dam and Watana/Devil Canyon using the DYRESM and HEATSIM models for a wet year (1981) condition (Acres American Inc., 1983a, 1983b). Selected profiles from the daily simulations are given as Figures 8.44 to 8.56 (attached) in Acres 1983b. Figures 8.44 through 8.56 (see pages 2-28-6 to 2-28-18) correspond to Figures E.2.176 through E.2.178, E.2.180 through E.2.183, and E.2.217 through E.2.222 of Exhibit E, Chapter 2 of the license document.

To provide average weekly temperatures, for comparisons with pre-project temperatures during low-flow and average flow years, additional studies will be conducted in 1983. A work plan to carry out the studies and to provide the updated parameter values and their sources is presented as follows:

1. The parameter values of DYRESM used (in Acres 1983a) will be updated through additional calibration using Eklutna Lake data, including data collected after January 1, 1983. This calibration effort will be completed by January 1, 1984.
2. Water temperature profiles downstream from Watana will be determined by SNTMP model^{1/} (Stream Network Temperature Model). The calibration of SNTMP will be made using existing streamflow, stream temperature, and meteorological data.
3. The reservoir temperature profiles will be determined using the DYRESM model and the updated parameter values. Outflow temperatures from the reservoir temperature model will be used as inputs for the SNTMP model to provide longitudinal profiles of temperatures downstream from the reservoir. This study will be completed by June 30, 1984.

Weekly simulations will be made for comparison with pre-project temperatures measured during low-flow and average flow years for the following cases:

^{1/}AEIDC will perform river temperature studies using SNTMP model.

- (a) Filling of Watana reservoir
- (b) Watana in operation
- (c) Watana/Devil Canyon in operation

Although not specifically requested case (a), filling of Watana Reservoir is included because the cited paragraph (E-2-87, para. 1) is in the section entitled "Impoundment of Watana Reservoir".

Weekly simulations of the reservoir thermal behavior will be performed under various power operation schemes for low-flow, average-flow, and high-flow (1981) years. The resulting outflow temperatures at the multilevel intakes, will be used as inputs to the downstream temperature simulations using the SNTMP model.

The computed temperatures will be compared with the measured pre-project temperatures. Results of the 1983 Study (Acres 1983b) for wet year conditions will also be verified.

The representative years for low-flow (dry), average-flow (average), and high-flow (wet) years conditions are selected based on the available stream-flow data. From a frequency analysis of annual flow volumes at Gold Creek, water years 1974, 1982 and 1981 may be considered as dry, average, and wet years, respectively.

At the completion of the study, a summary report will be prepared. The report will include:

- (a) A listing of inputs used in the study.

- (b) The assumptions made in each simulation.
- (c) The parameter values used in each simulation and documentation of their sources.
- (d) The outflow temperatures from each reservoir.
- (e) A comparison of simulated average weekly temperatures with measured pre-project temperatures.

Outflow temperatures will include the temperatures that would have to be available at the multilevel intakes in order to match pre-dam temperatures. The study will be completed by June 30, 1984.

The parameter values used for the 1983 reservoir thermal simulations are given in the following table:

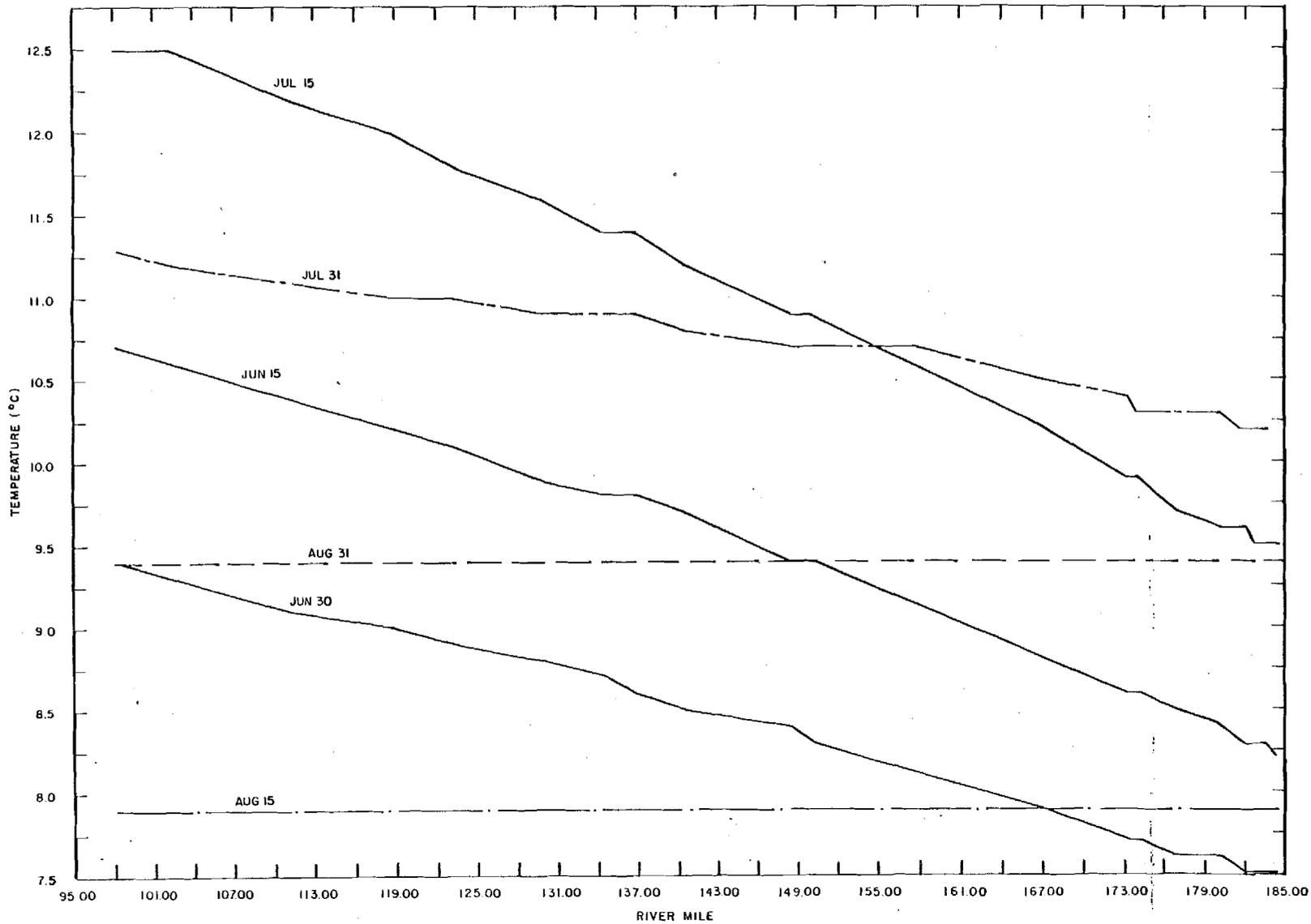
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Convective overturn, CK	0.125
Mechanical stirring, ETA	1.230
Temporal effects, CT	0.510
Shear production, CS	0.200
Diffusion constant	
W = Wedderburn number	
W > 1 (for general condition)	0.048
W ≤ 1 (for high wind condition)	0.096
Drag coefficients	0.015

These parameters values were derived from calibration of the model to Eklutna Lake (Acres 1983b).

References

Acres American Incorporated, "Susitna Hydroelectric Project, License Application, Volumes 5A, and 5B," prepared for Alaska Power Authority, 1983(a).

Acres American Incorporated, "Susitna Hydroelectric Project Feasibility Report - Supplement, Chapter 8: Reservoir and River Temperature Studies," prepared for Alaska Power Authority, 1983(b).

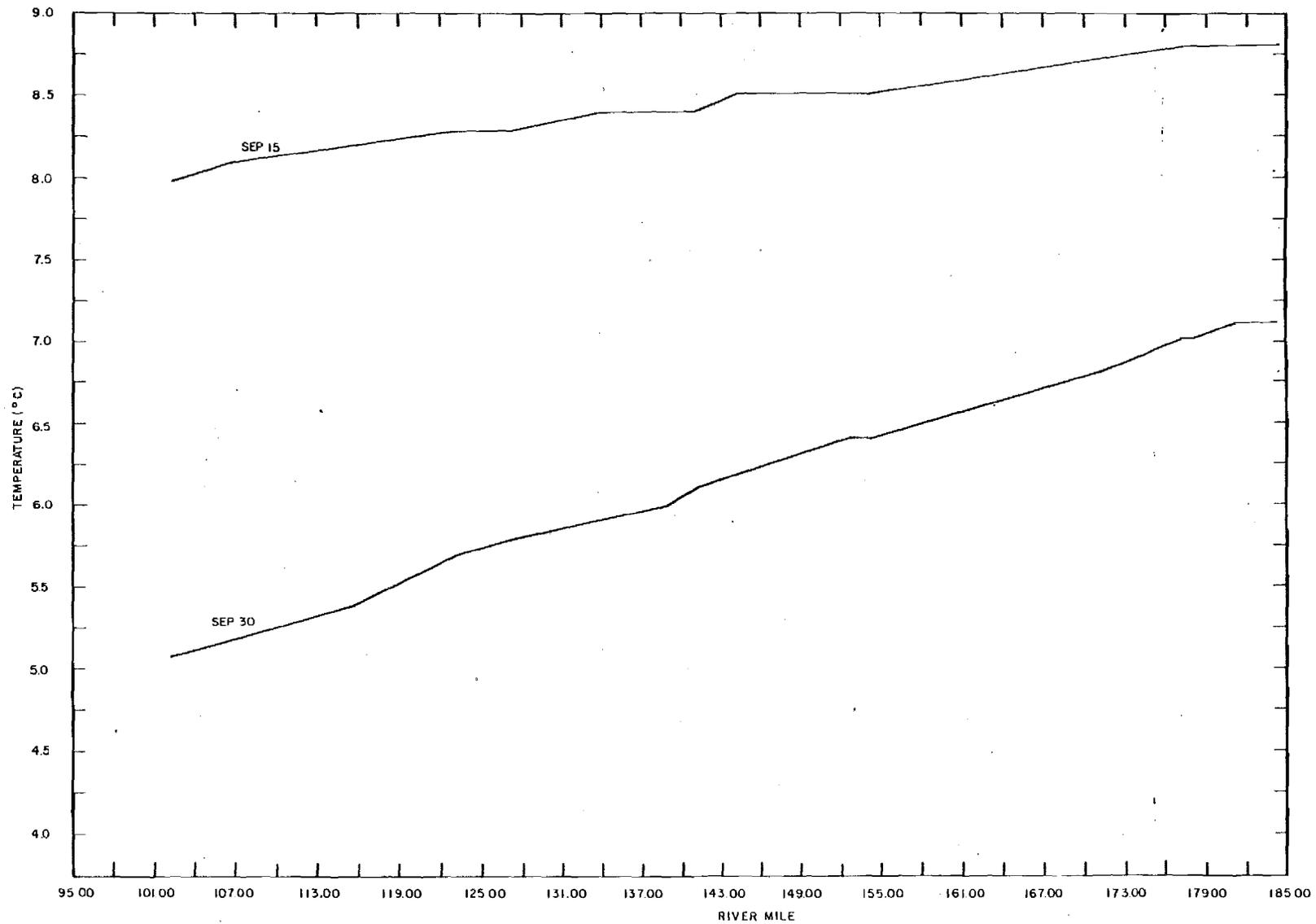


WATANA DISCHARGE (CFS):
 JUN 15 4410
 JUN 30 4210
 JUL 15 4130
 JUL 31 3970
 AUG 15 6250
 AUG 31 21000 (RELEASE)

NOTE:
 1. MODEL ASSUMES 1981 METEOROLOGICAL DATA RECORDED AT WATANA.
 2. WATANA TEMPERATURE AND DISCHARGE FROM DYRESM MODEL (RUN WA4020)

WATANA OPERATION:
 DOWNSTREAM TEMPERATURES - JUN TO AUG

2-28-6

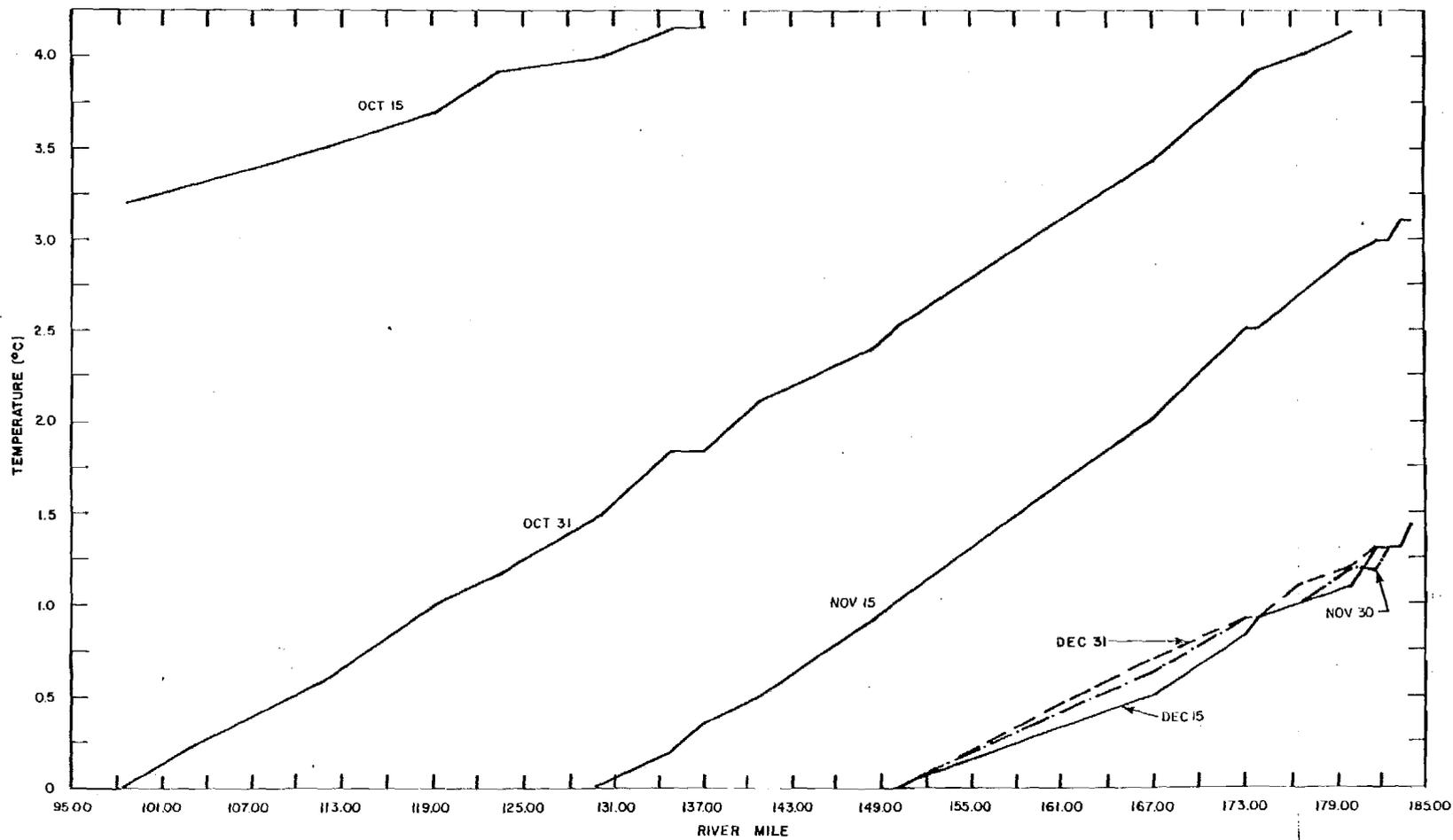


NOTE:

1. MODEL ASSUMES 1981 METEOROLOGICAL DATA RECORDED AT WATANA.
2. WATANA TEMPERATURES AND DISCHARGE FROM DYRESM MODEL. (RUN WA4020)

WATANA OPERATION
 DOWNSTREAM TEMPERATURES - SEP

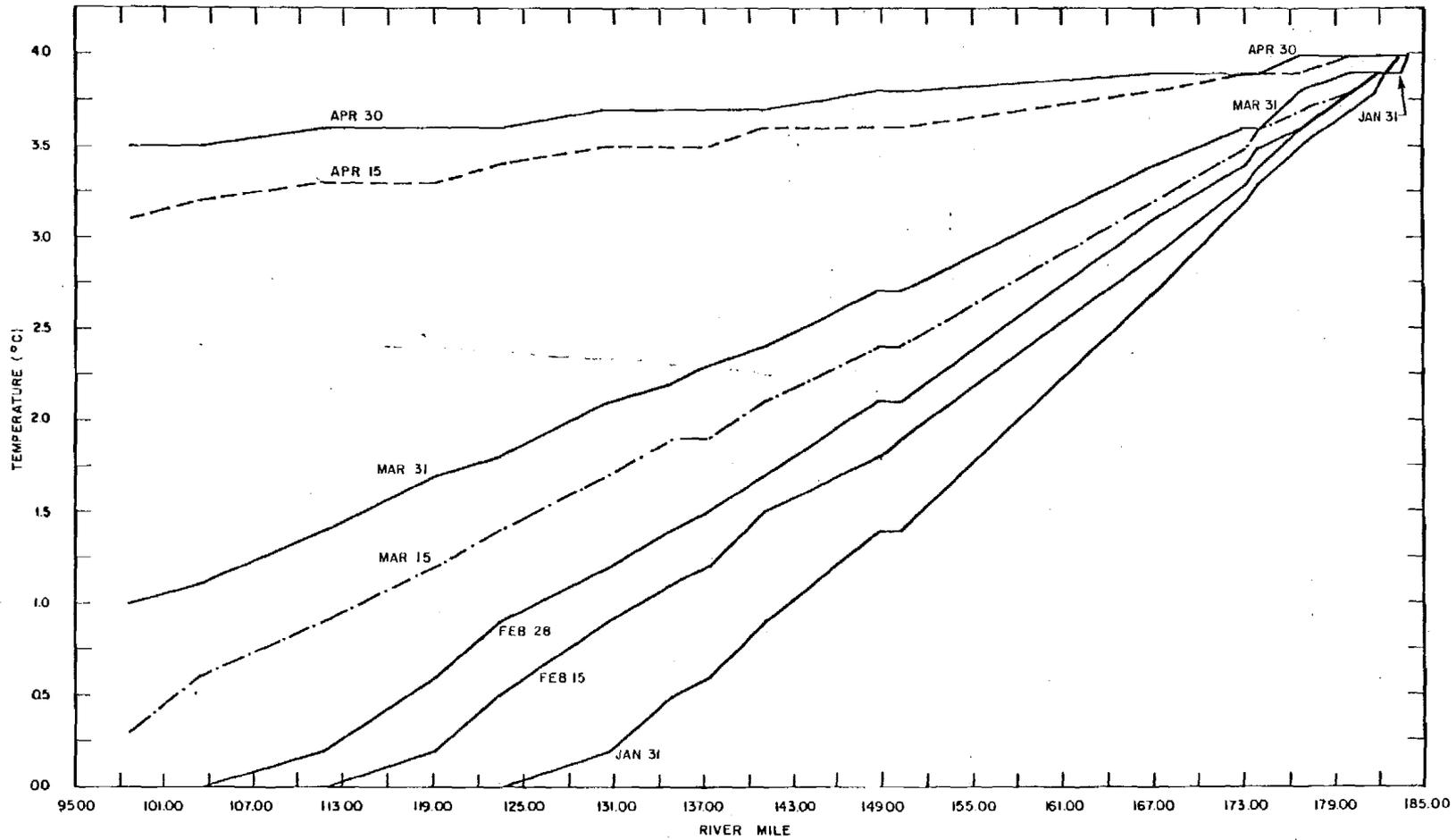
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- NOTES:
1. MODEL ASSUMES 1981 METEOROLOGICAL DATA RECORDED AT WATANA.
 2. WATANA TEMPERATURES AND DISCHARGE FROM DYRESM MODEL. (RUN WA4020)

WATANA OPERATION:
DOWNSTREAM TEMPERATURES -OCT TO DEC

2-28-8

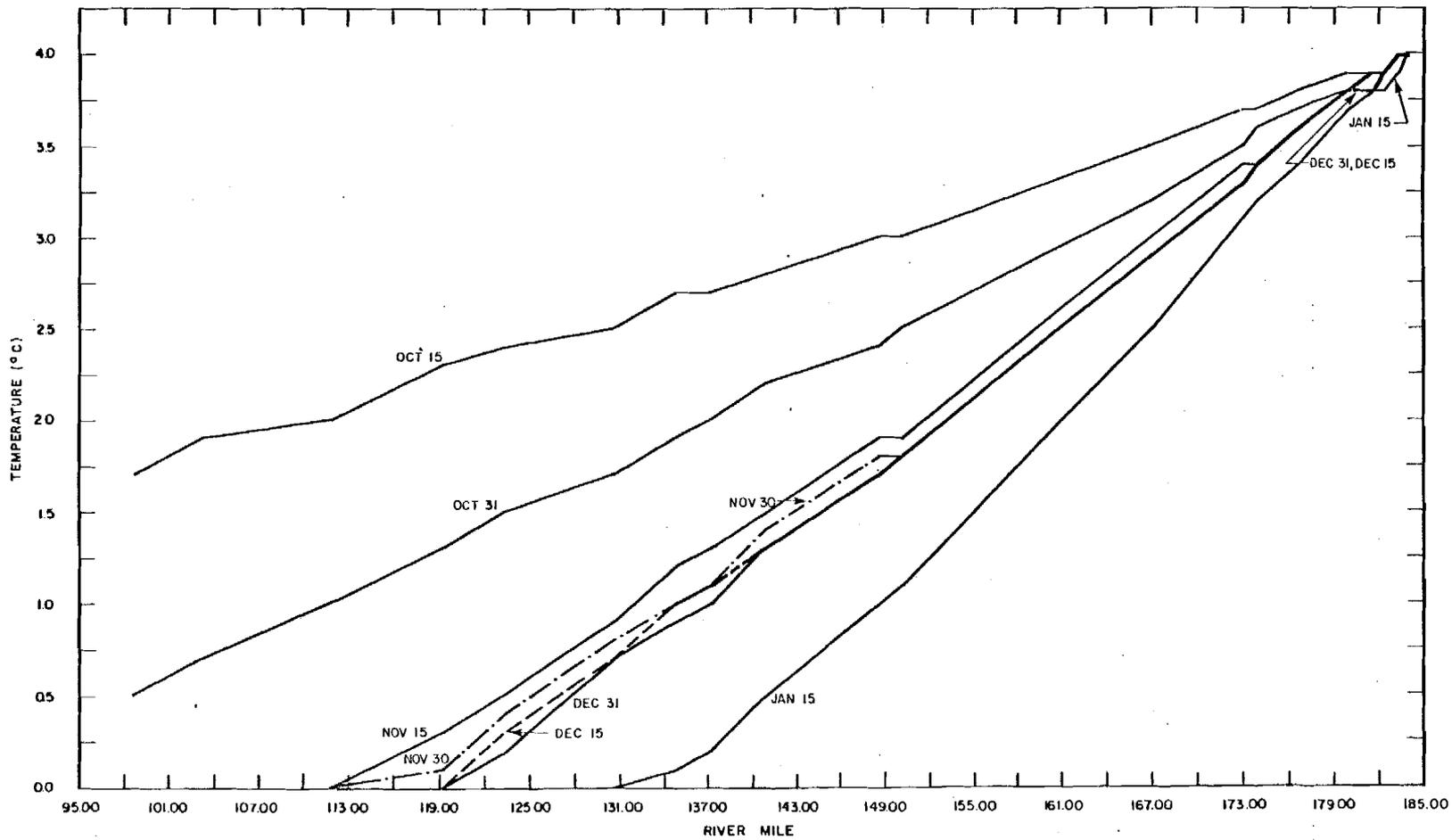


NOTE :

MODEL ASSUMES DAILY BASED LONG TERM
 AVERAGE METEOROLOGICAL DATA AND
 MEAN MONTHLY FLOWS AT WATANA.

WATANA OPERATION:
 DOWNSTREAM TEMPERATURES - JAN TO APR
 OUTFLOW TEMPERATURE 4°C

2-28-9

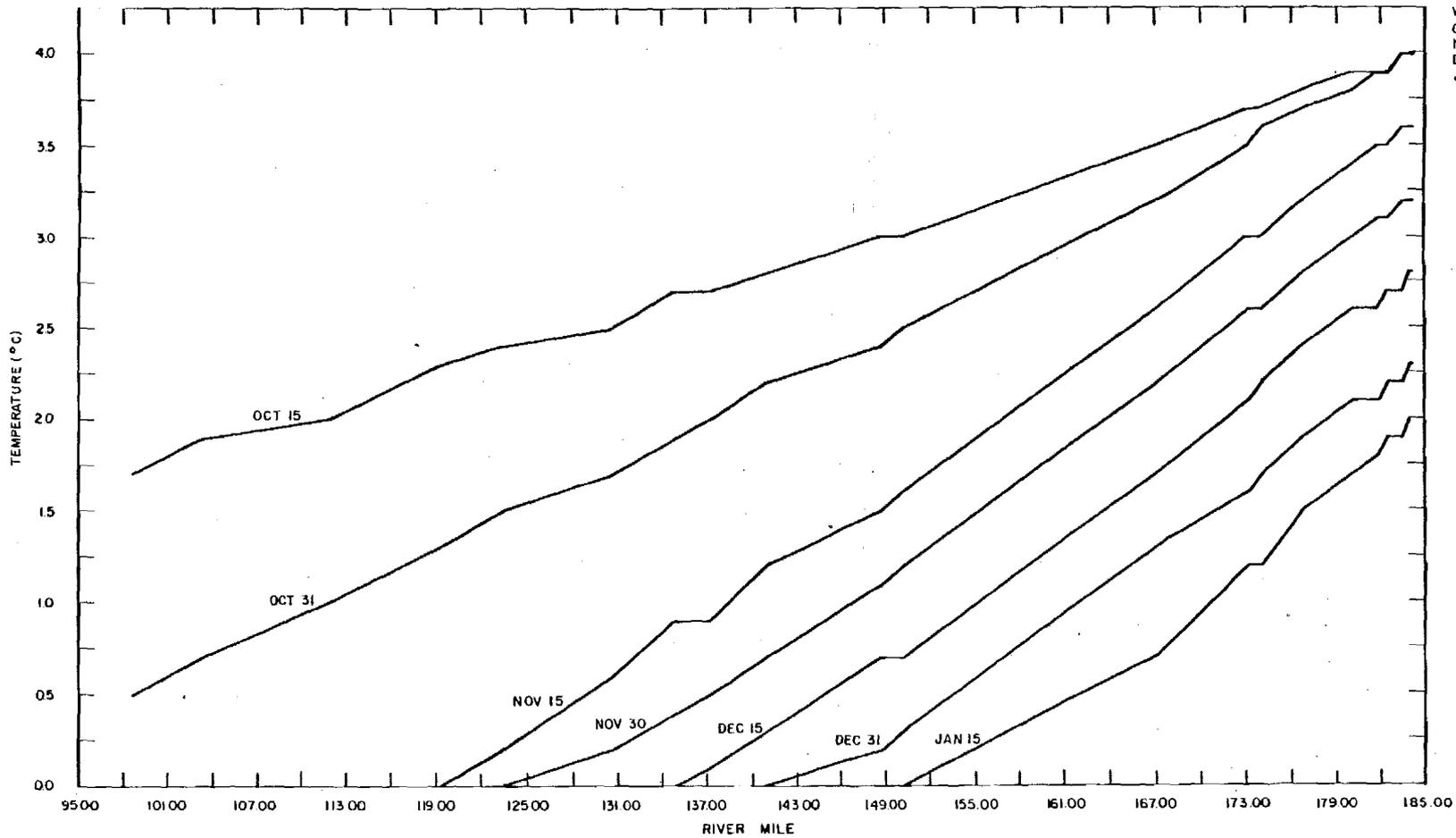


NOTE :

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WATANA OPERATION:
 DOWNSTREAM TEMPERATURES - OCT TO JAN
 OUTFLOW TEMPERATURE 4° C

2-28-10



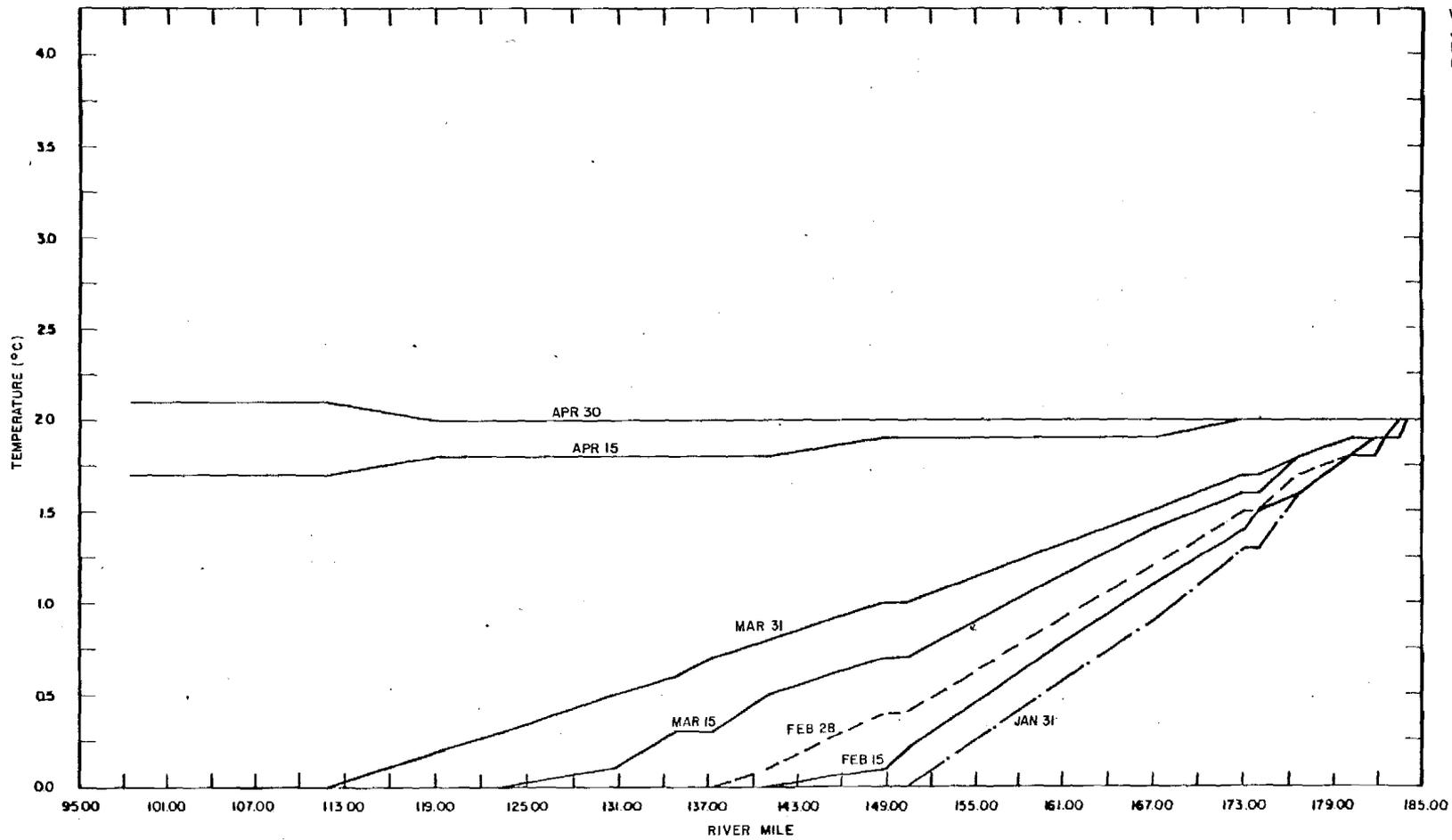
WATANA DISCHARGE (CFS):
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 NOV 8670
 DEC 10301
 JAN 9400

NOTE:

MODEL ASSUMES DAILY BASED LONG TERM
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 MEAN MONTHLY FLOWS AT WATANA.

WATANA OPERATION: DOWNSTREAM TEMPERATURES - OCT TO JAN
 OUTFLOW TEMPERATURE 4 TO 2°C

2-28-11

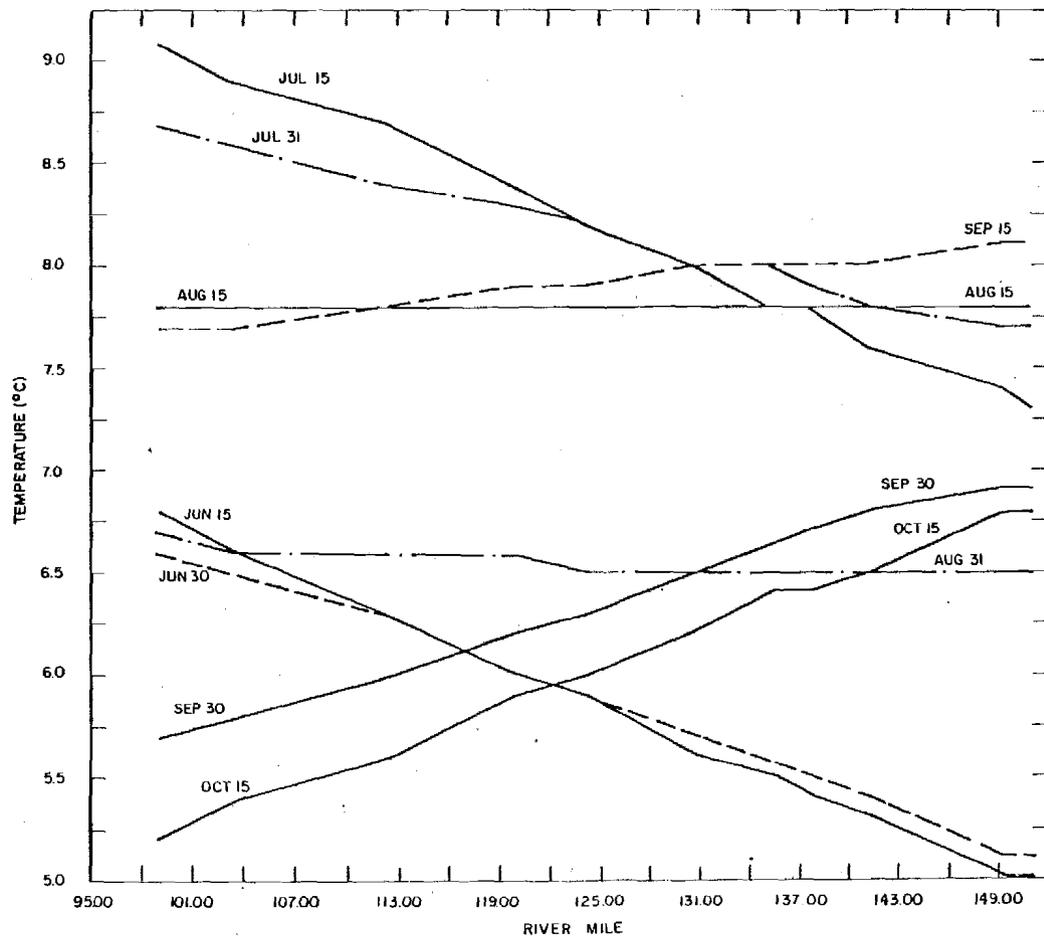


NOTE :

- I. MODEL ASSUMES DAILY BASED LONG TERM AVERAGE METEOROLOGICAL DATA AND MEAN MONTHLY FLOWS AT WATANA.

WATANA OPERATION: DOWNSTREAM TEMPERATURES - JAN TO APR
 OUTFLOW TEMPERATURE 4 TO 2°C

2-28-12



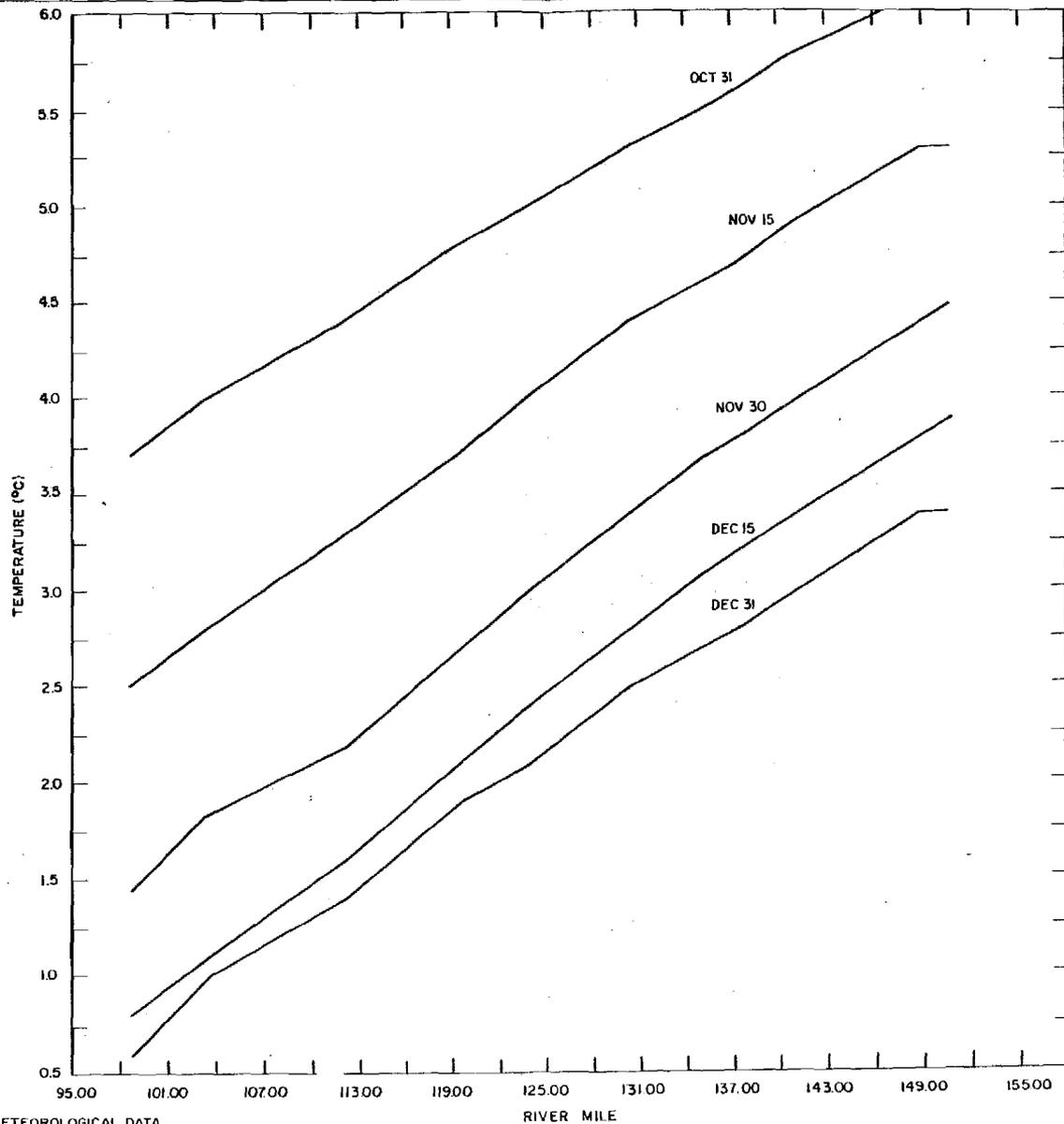
DEVIL CANYON DISCHARGE (CFS):
 JUN 15 7920
 JUN 30 5740
 JUL 15 6830
 JUL 31 6480
 AUG 15 9940
 AUG 31 24100 (RELEASE)
 SEP 15 13750
 SEP 30 10500
 OCT 15 7450

NOTE:

1. MODEL ASSUMES 1981 METEOROLOGICAL DATA RECORDED AT WATANA.
2. DEVIL CANYON TEMPERATURE AND DISCHARGE FROM DYRESM MODEL. (RUNS DC1020 AND DC1021)

WATANA / DEVIL CANYON OPERATION
 DOWNSTREAM TEMPERATURES - JUN TO OCT

2-28-13



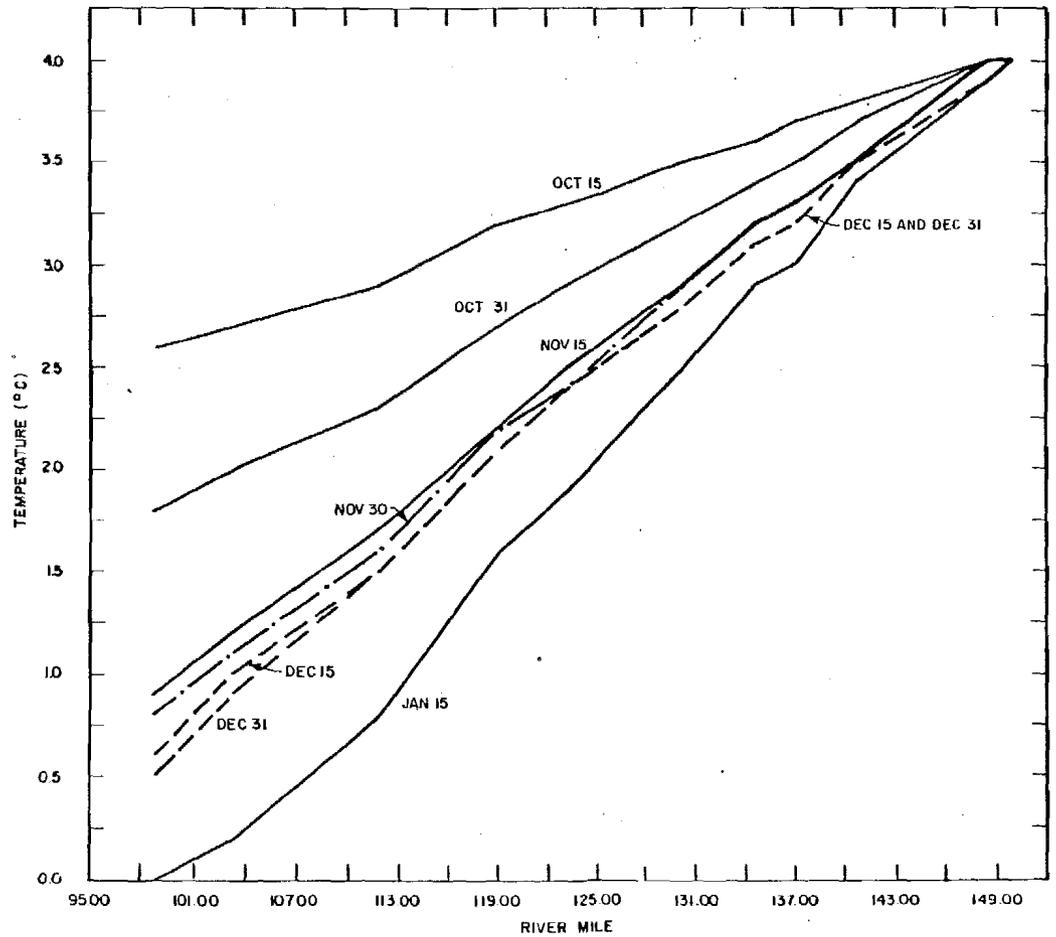
DEVIL CANYON DISCHARGE (CFS):
 OCT 31 8690
 NOV 15 10300
 NOV 30 10500
 DEC 15 10900
 DEC 31 11100

NOTE:

1. MODEL ASSUMES 1981 METEOROLOGICAL DATA RECORDED AT WATANA.
2. DEVIL CANYON TEMPERATURE AND DISCHARGE FROM DYRESM MODEL. (RUN DC1022)

WATANA / DEVIL CANYON OPERATION
 DOWNSTREAM TEMPERATURES - OCT TO DEC

7 28-14



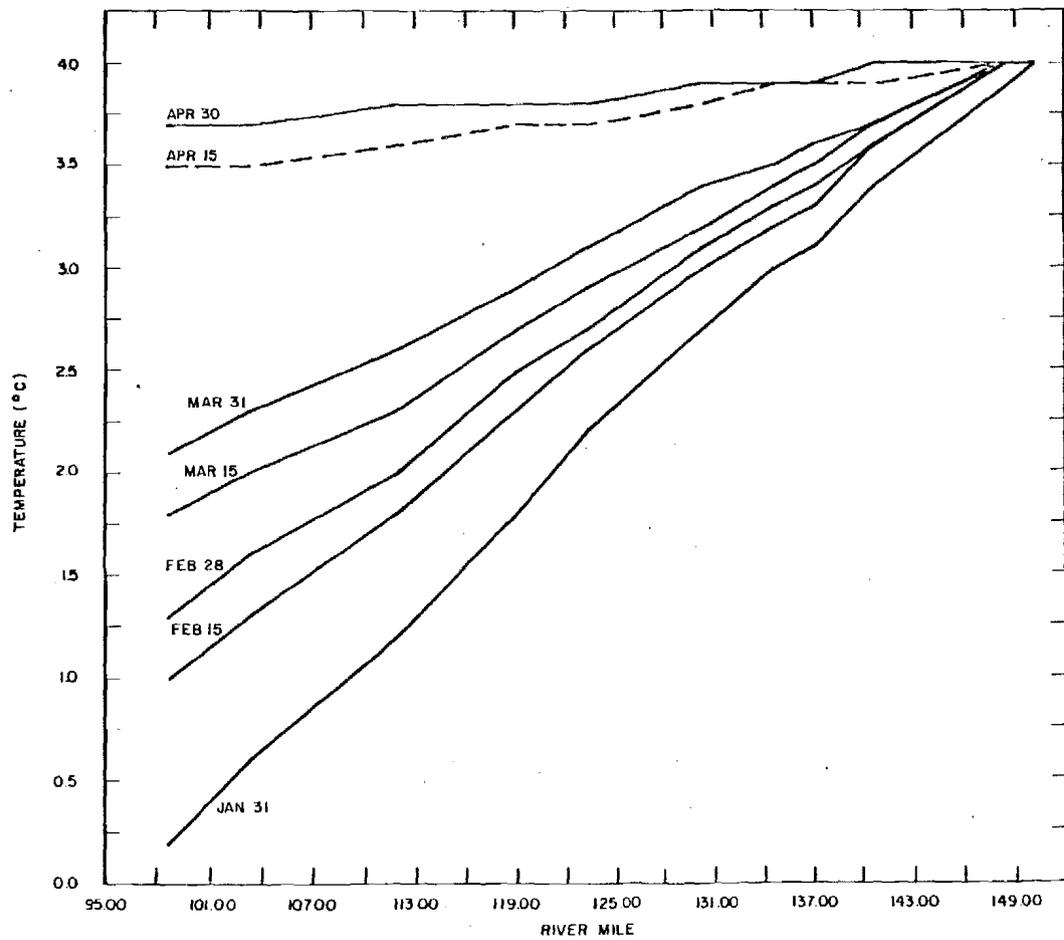
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 JAN 10,480

NOTE:

MODEL ASSUMES DAILY BASED LONG TERM
 AVERAGE METEOROLOGICAL DATA AND
 MEAN MONTHLY FLOWS AT DEVIL CANYON.

WATANA/DEVIL CANYON OPERATION DOWNSTREAM TEMPERATURES - OCT TO JAN
 OUTFLOW TEMPERATURE 4°

2-28-15

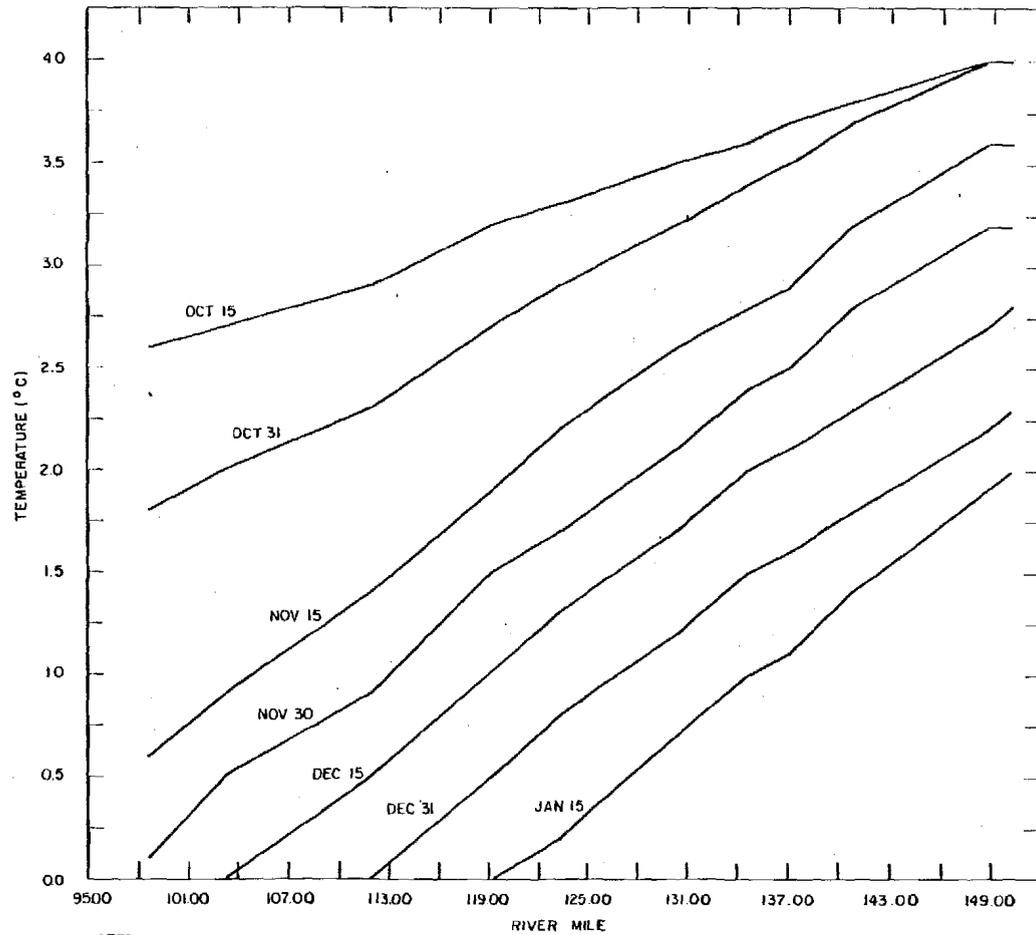


DEVIL CANYON DISCHARGE (CFS):
 JAN 10,480
 FEB 10,090
 MAR 9200
 APR 8010

NOTE:
 MODEL ASSUMES DAILY BASED LONGTERM
 AVERAGE METEOROLOGICAL DATA AND
 MEAN MONTHLY FLOWS AT DEVIL CANYON.

WATANA / DEVIL CANYON OPERATION DOWNSTREAM TEMPERATURES - JAN TO APR
 OUTFLOW TEMPERATURE 4°C

2.28.1a

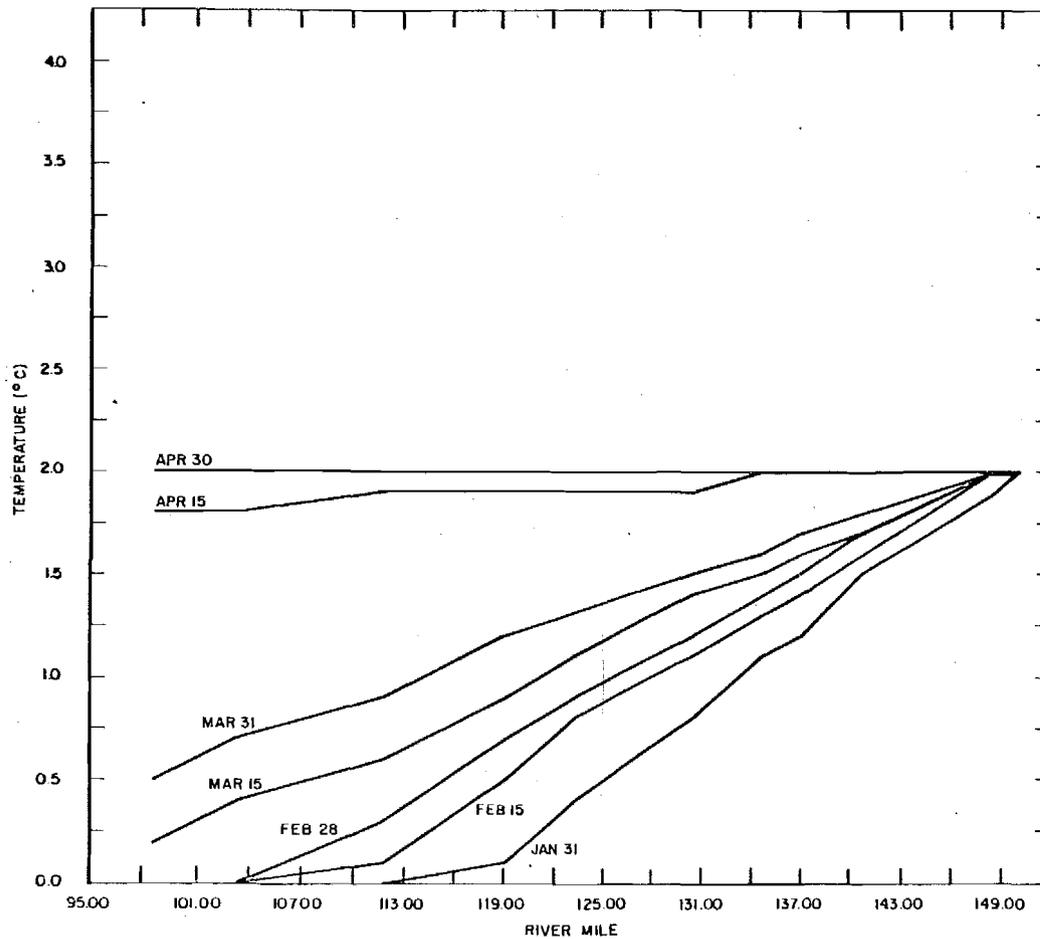


DEVIL CANYON DISCHARGE (CFS):
 OCT 7320
 NOV 9440
 DEC 11,130
 JAN 10,480

NOTE:
 MODEL ASSUMES DAILY BASED LONG TERM
 AVERAGE METEOROLOGICAL DATA AND
 MEAN MONTHLY FLOWS AT DEVIL CANYON.

WATANA/DEVIL CANYON OPERATION DOWNSTREAM TEMPERATURES - OCT TO JAN
 OUTFLOW TEMPERATURES 4 TO 2°C

2-28-17



DEVIL CANYON DISCHARGE (CFS):
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 FEB 10,090
 MAR 9200
 APR 8010

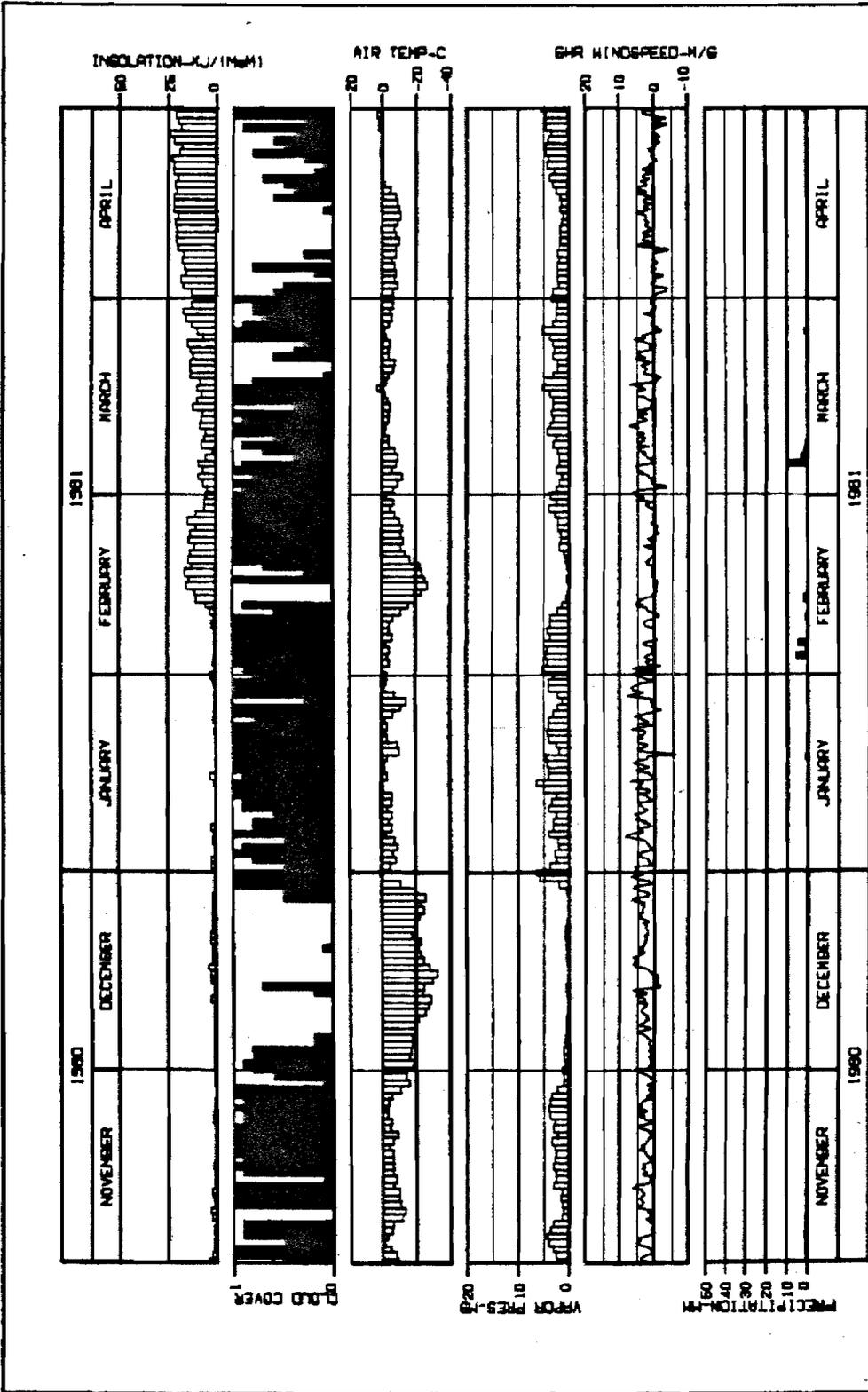
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WATANA/DEVIL CANYON OPERATION DOWNSTREAM TEMPERATURES-JAN TO APR
 OUTFLOW TEMPERATURE 4 TO 2°C

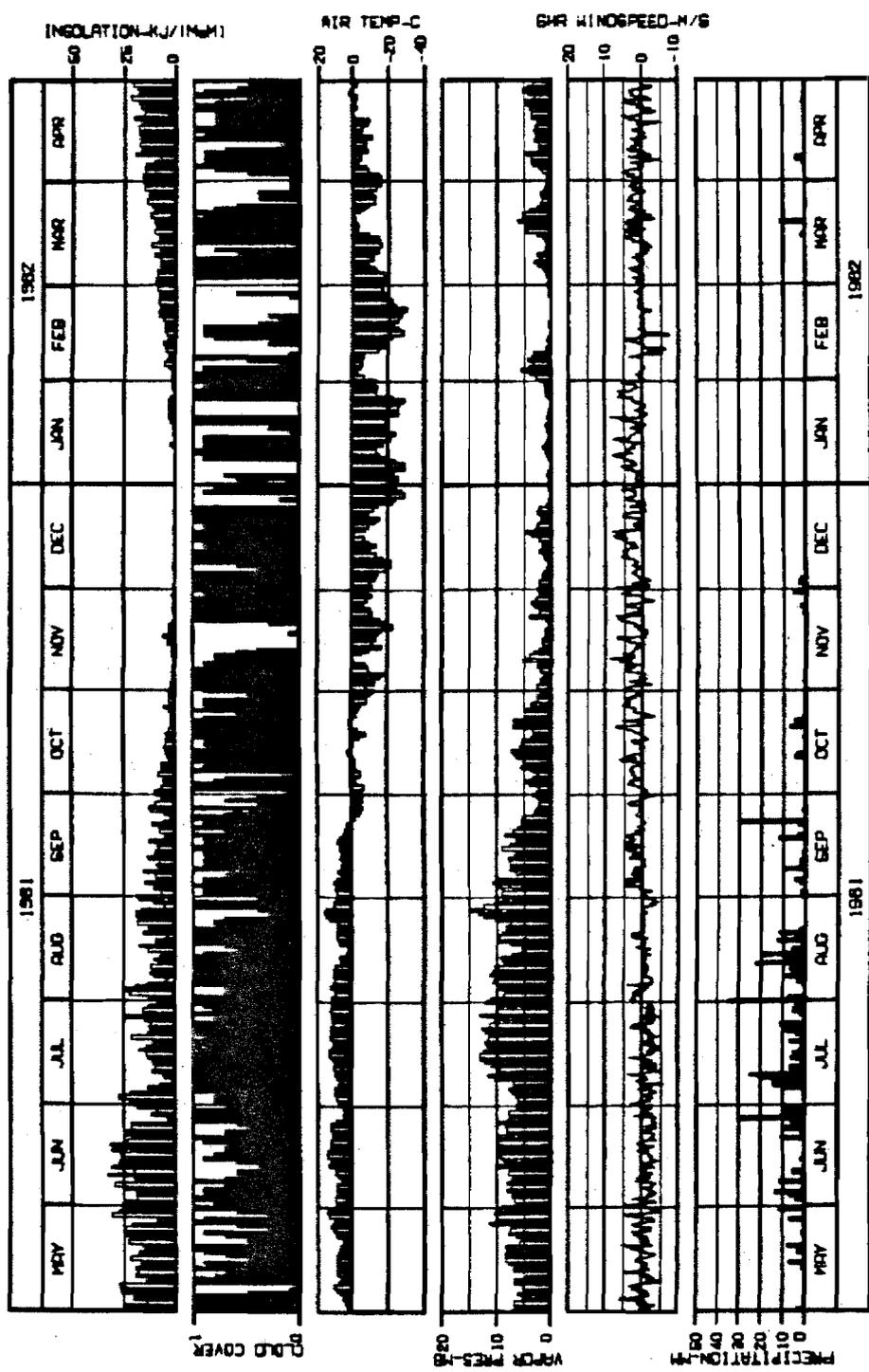
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Weather Data

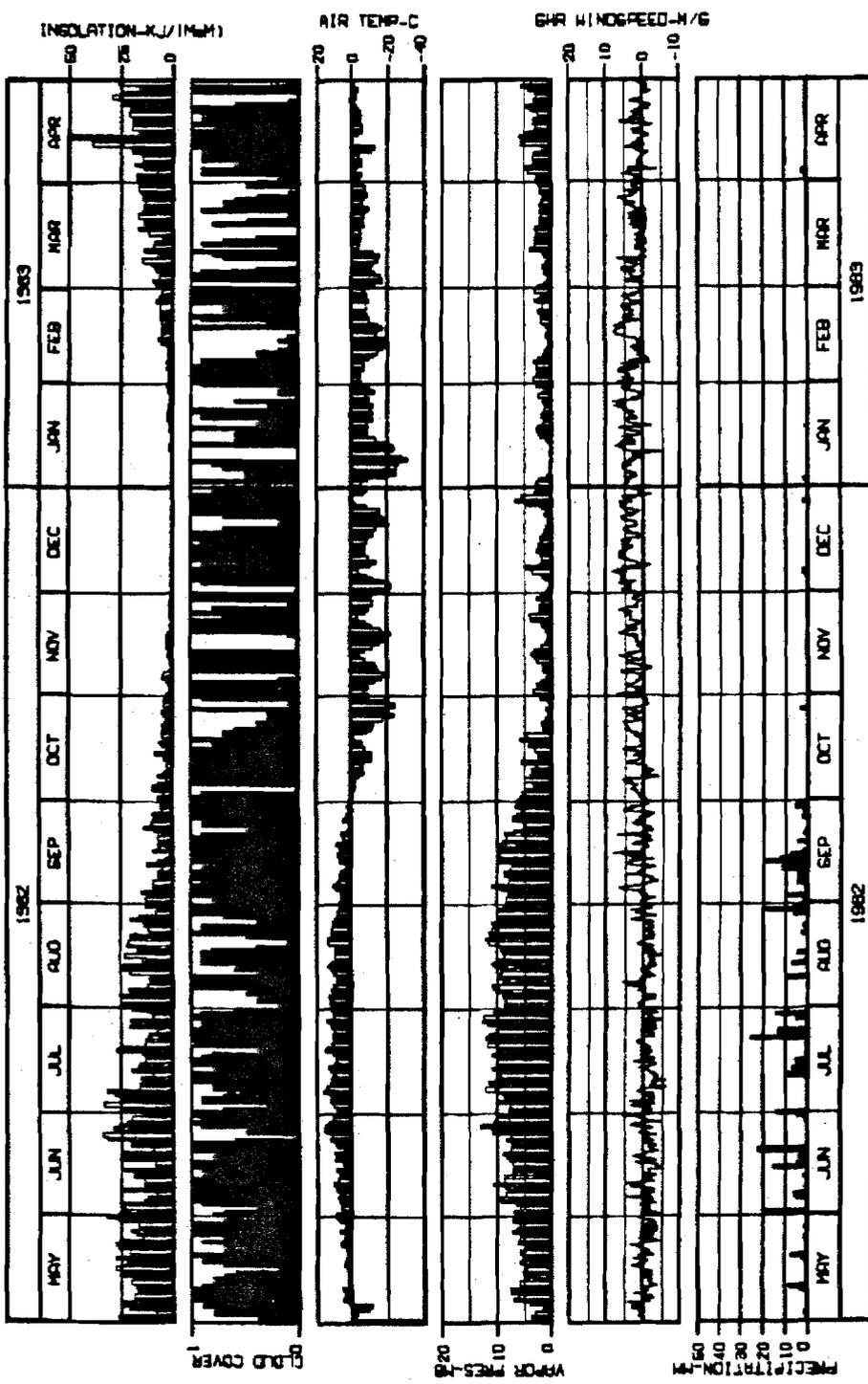
EXHIBIT B



ALASKA POWER AUTHORITY	
SUBMITTING PROJECT	OWNER MODEL
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WEATHER DATA	
HARZA-EBASCO JOINT VENTURE	
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48-110-06	

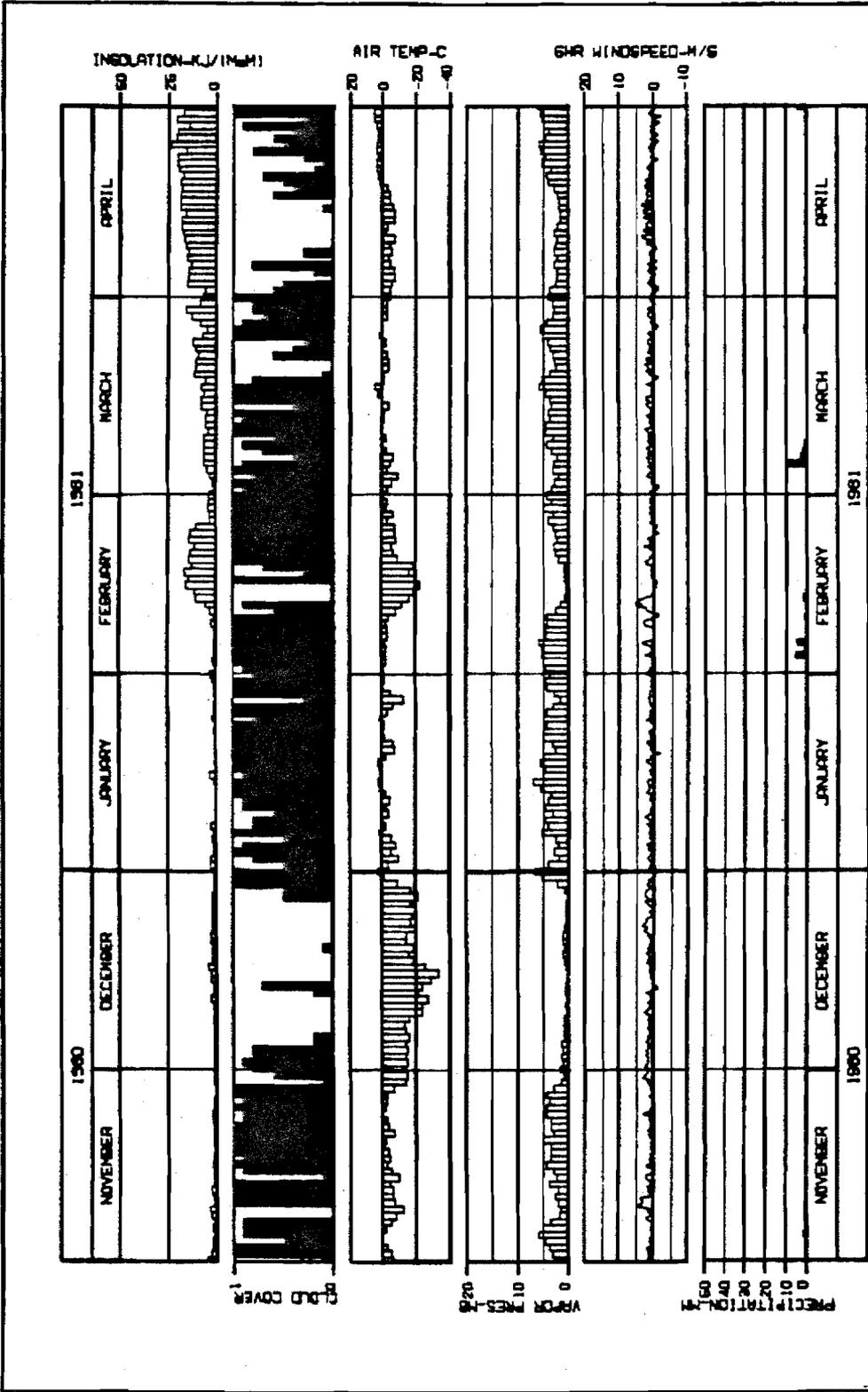


ALASKA POWER AUTHORITY
 SUBMITTING PROJECT: WATANA RESERVOIR
 DIRECTOR: HARZA-EBRSCO JOINT VENTURE
 DATE: 12 JUL 81

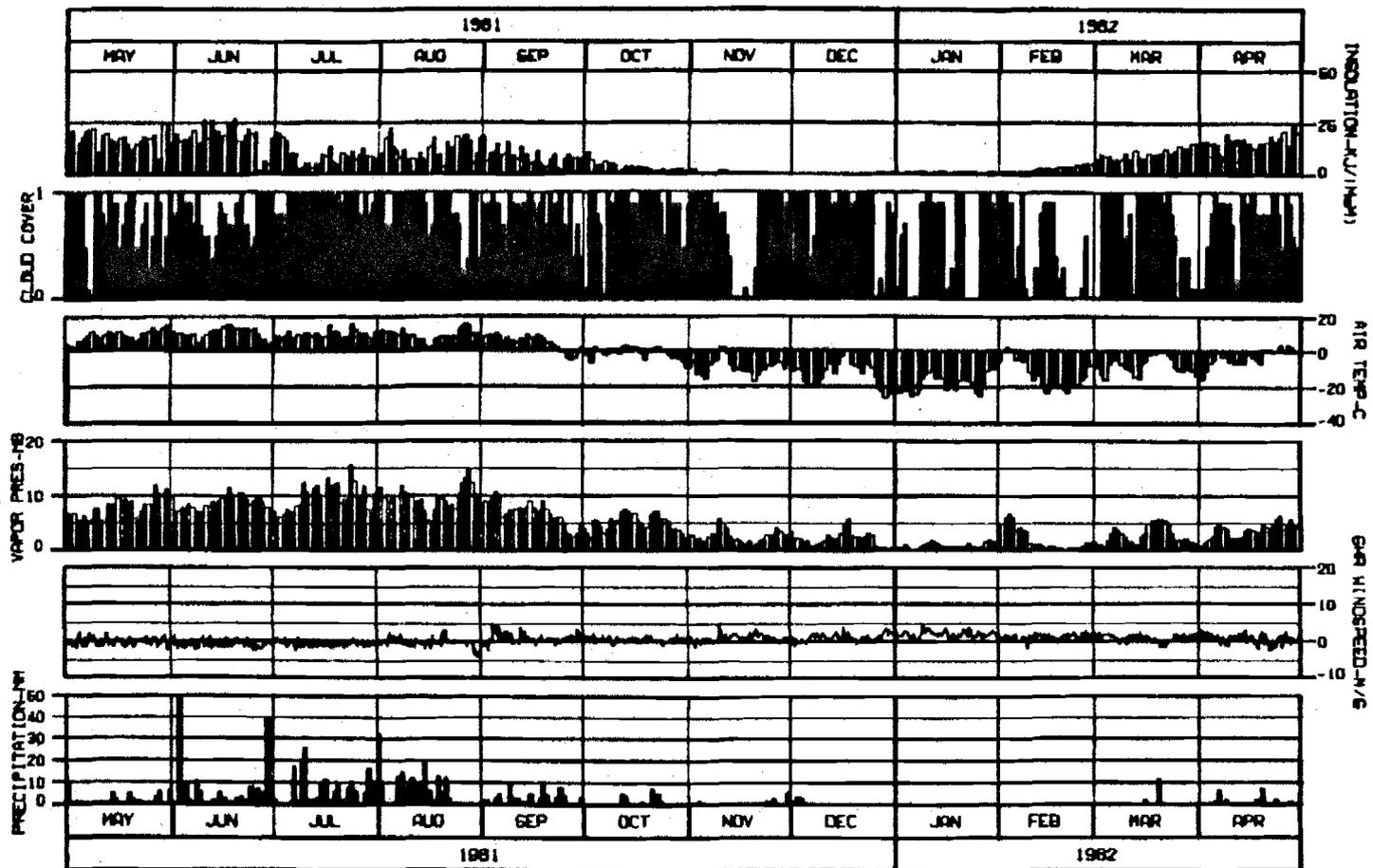


ALASKA POWER AUTHORITY
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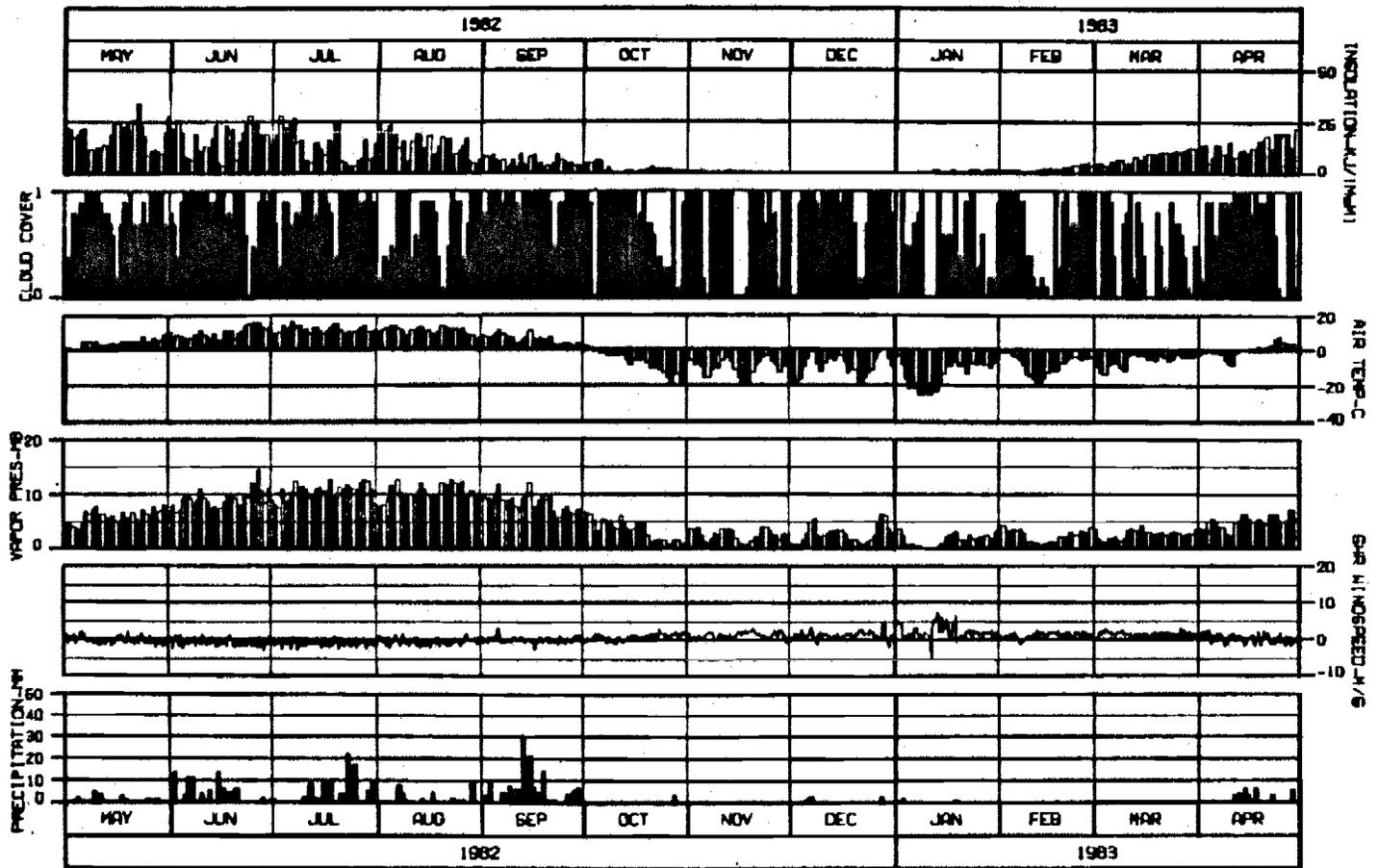
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ALASKA POWER AUTHORITY
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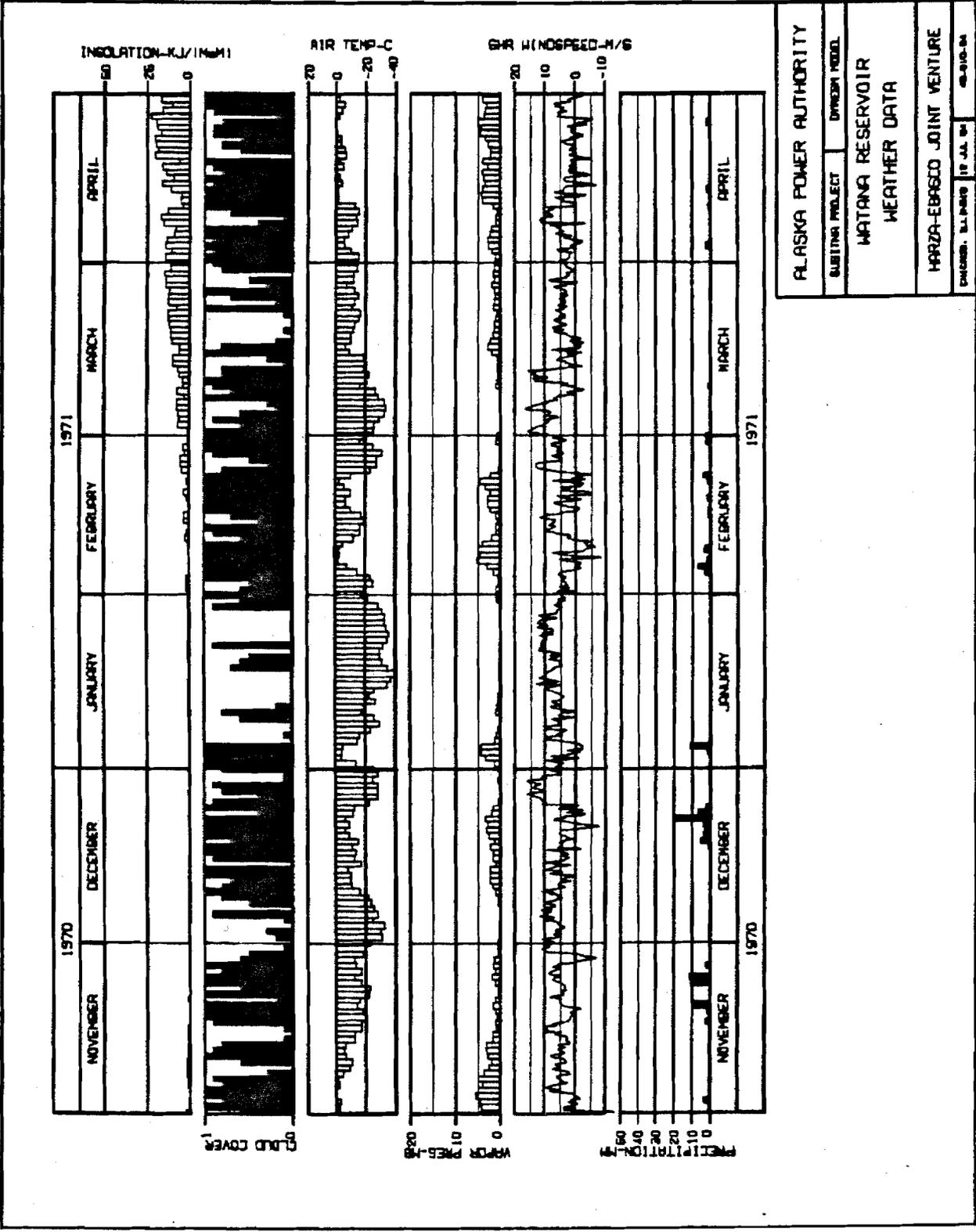


ALASKA POWER AUTHORITY	
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HARZA-EBASCO JOINT VENTURE	
CHICHO. 8.1.1982	17 JUL 82
88-010-04	

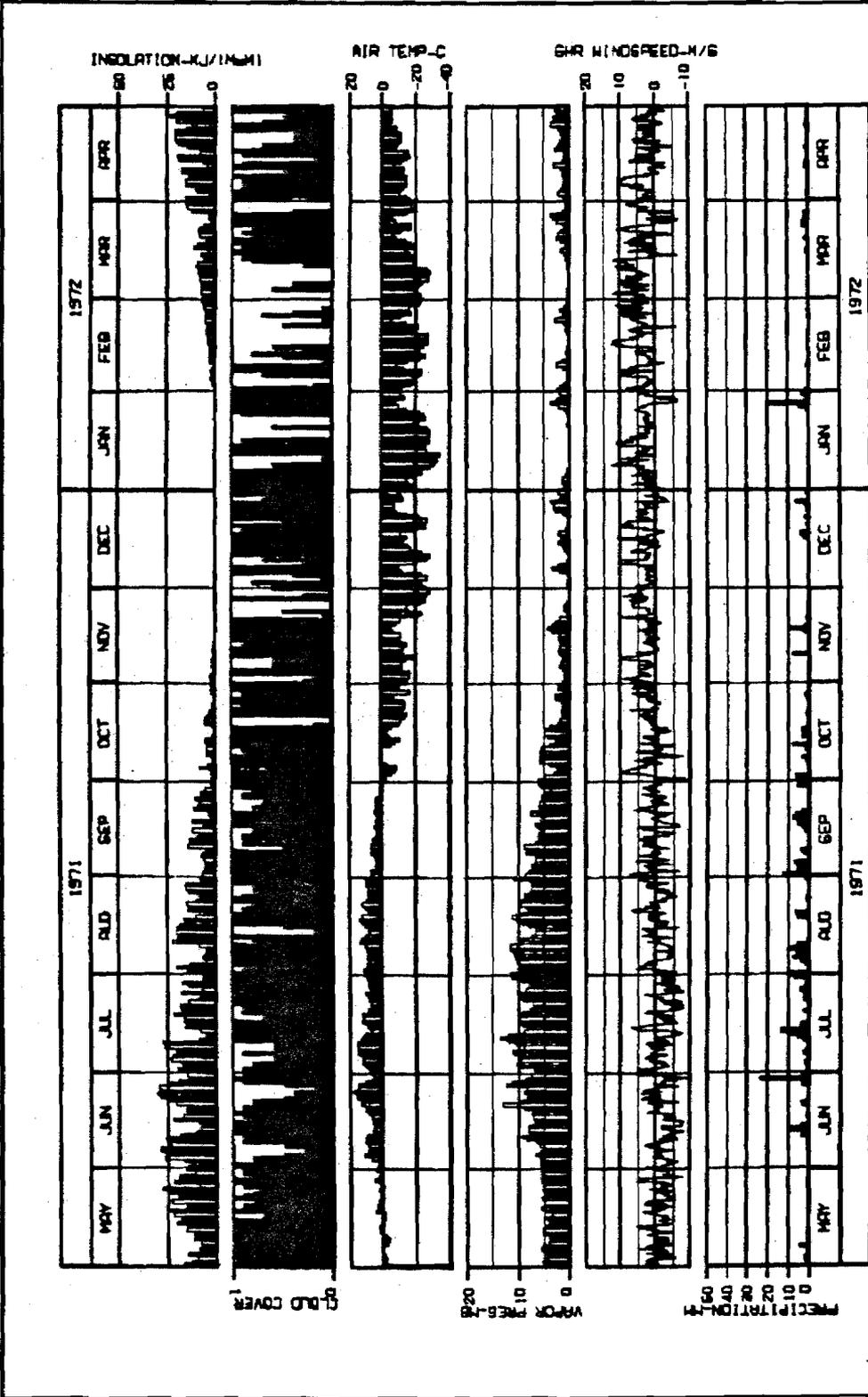


ALASKA POWER AUTHORITY		
SUBITMA PROJECT	OYAKHA MODEL	
DEVIL CANYON RESERVOIR WEATHER DATA		
HARZA-EBASCO JOINT VENTURE		
CHECKED: ALLDRED	12 JUL 84	48-910-84

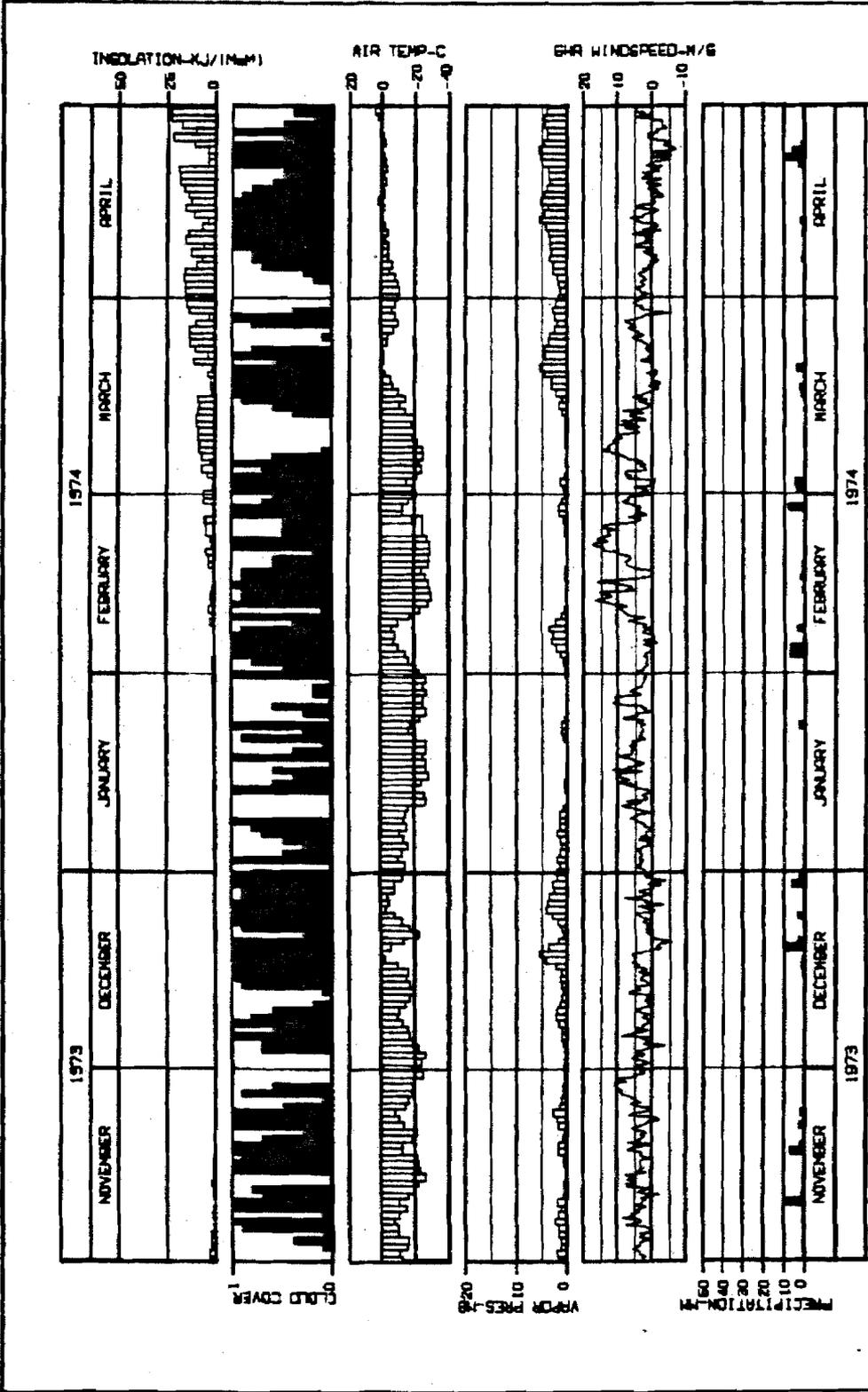
EXHIBIT D



ALASKA POWER AUTHORITY
 SUBJECT PROJECT: WATANA RESERVOIR
 DIRECTOR: [blank]
 WATANA RESERVOIR
 WEATHER DATA
 HARZA-EBASCO JOINT VENTURE
 CHARGE: [blank] 18 JUL 71
 68-910-04



ALASKA POWER AUTHORITY	
SUBMITTER PROJECT	OPERATOR MODEL
MATANA RESERVOIR	
WEATHER DATA	
HARZA-EBASCO JOINT VENTURE	
CHECKED: ALLISON	18 JUL 84
	45-810-04

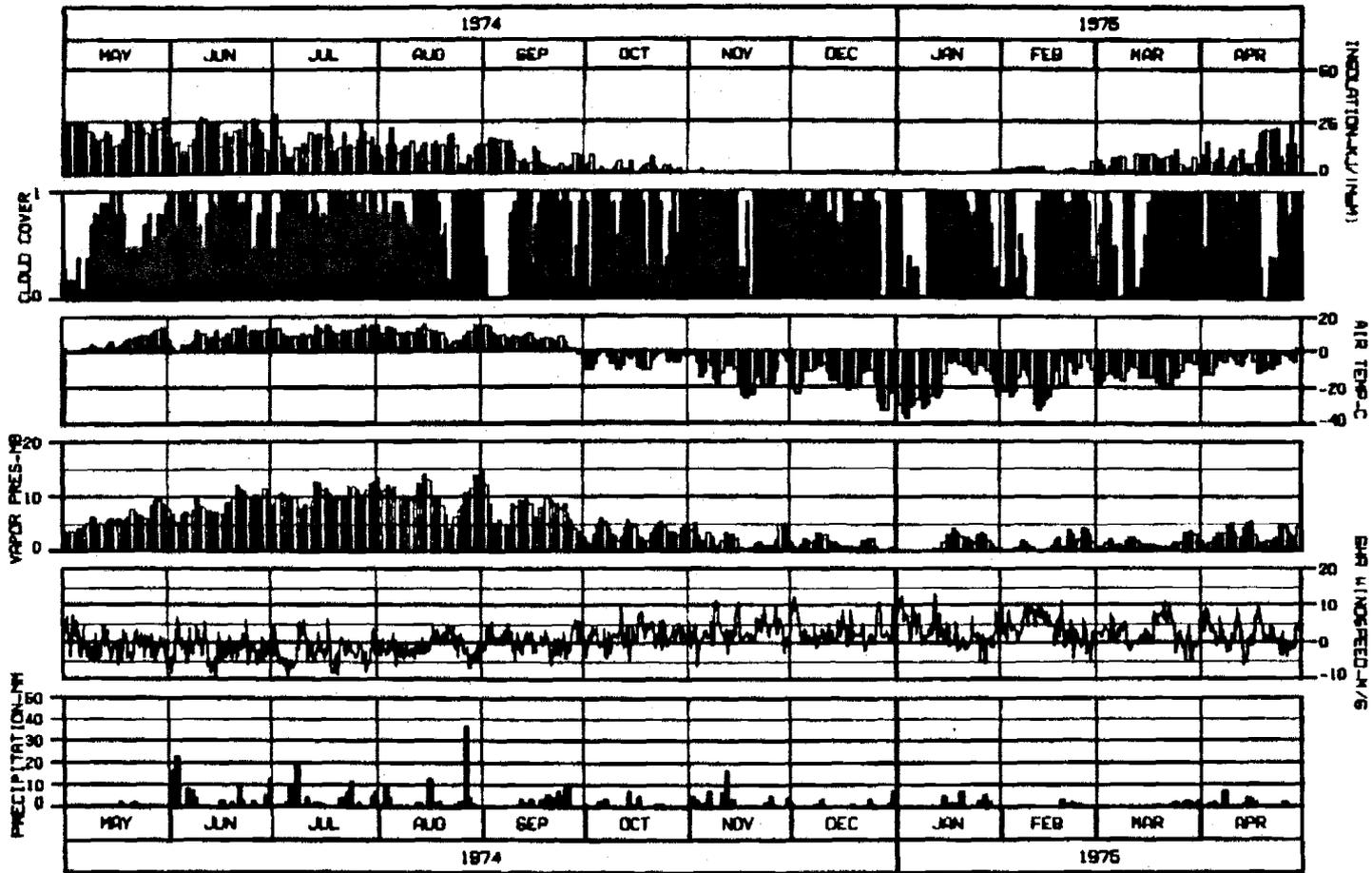


ALASKA POWER AUTHORITY

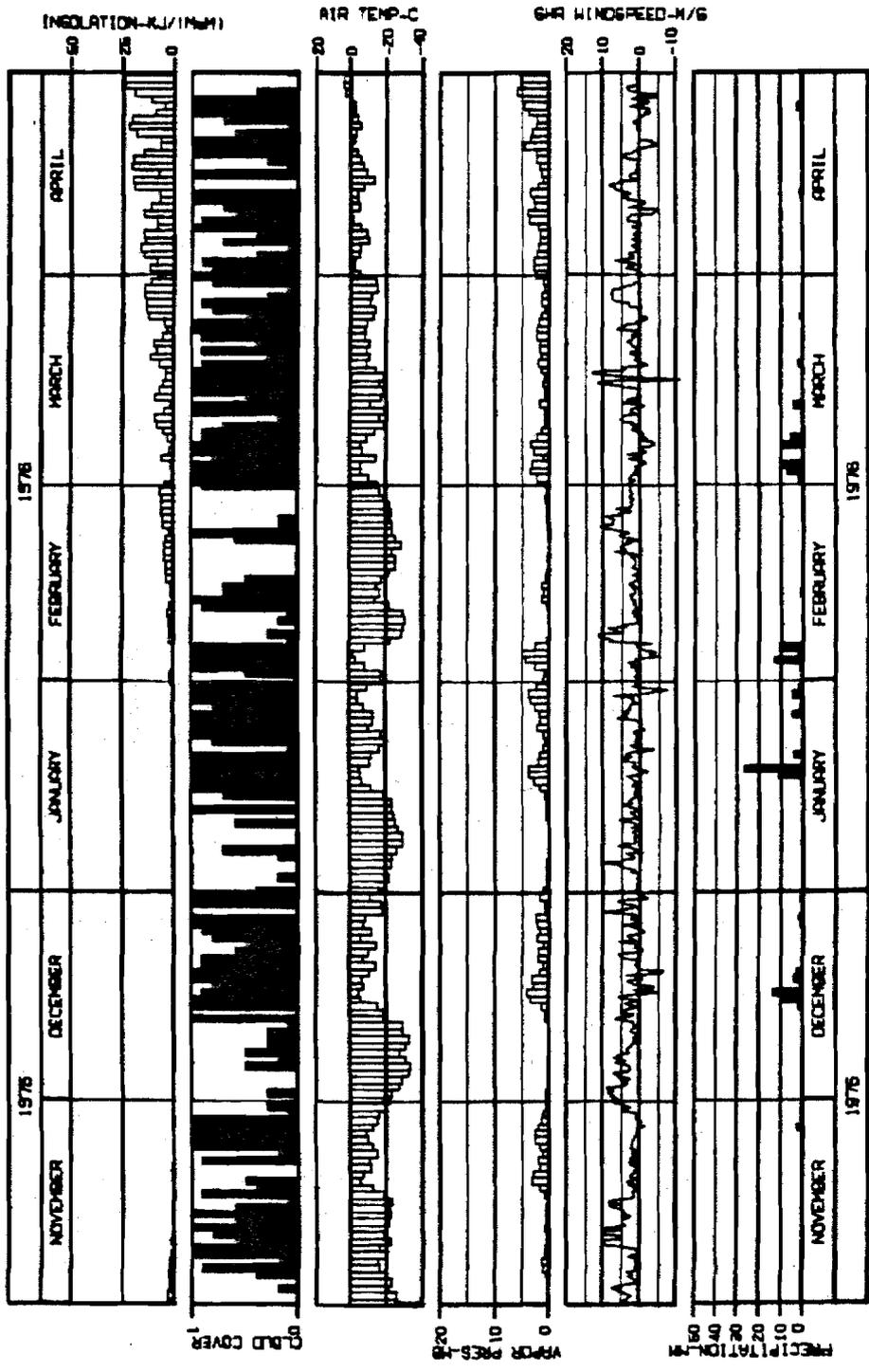
SUBMITTING PROJECT: MATANA RESERVOIR WEATHER DATA

PROJECT NUMBER: HARZA-EBASCO JOINT VENTURE

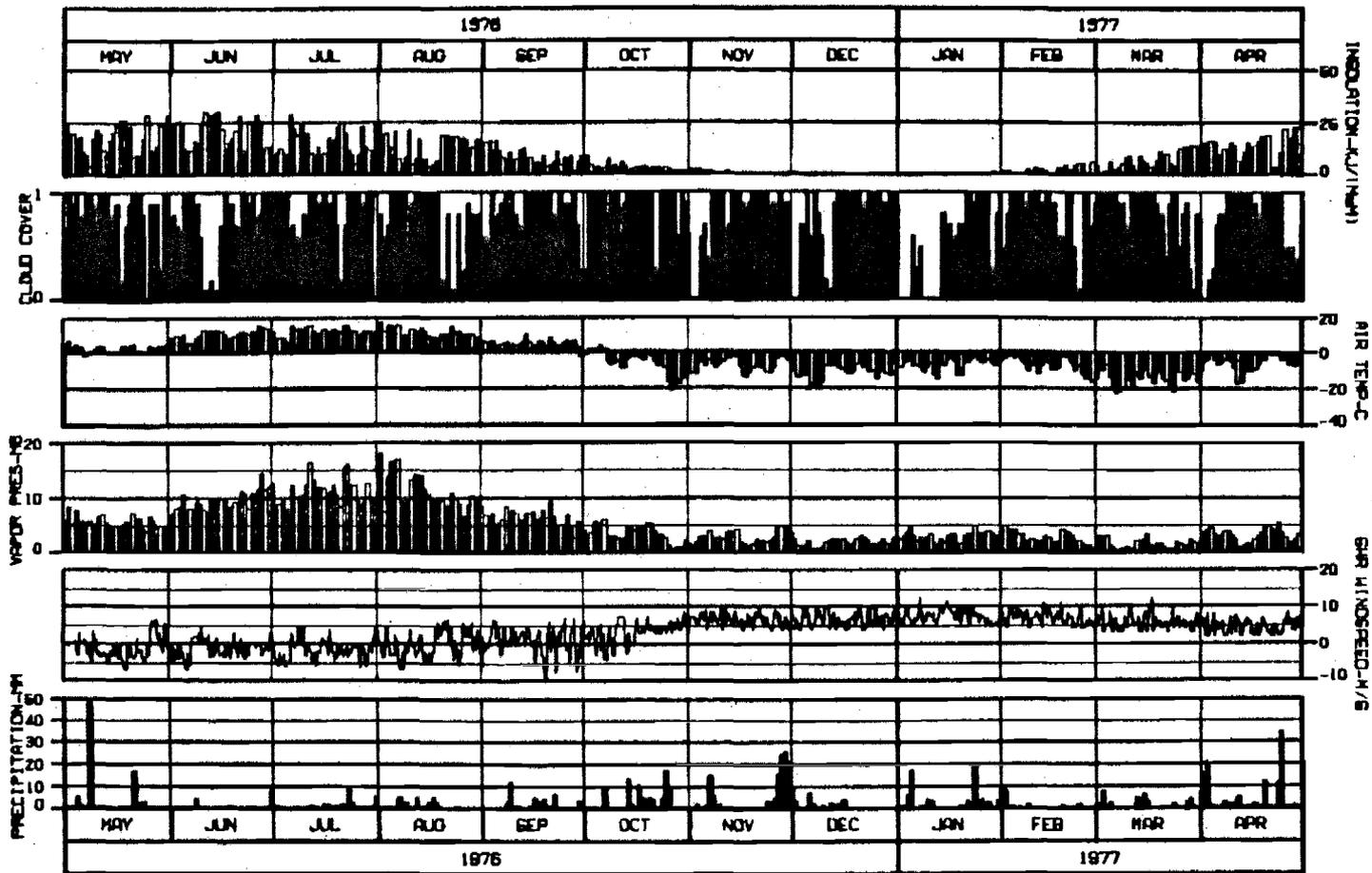
DATE: 1974



ALASKA POWER AUTHORITY		
SUBTINA PROJECT	DYWIDOP HEDD.	
WATANA RESERVOIR WEATHER DATA		
MARZA-EBASCO JOINT VENTURE		
DWG. NO. AL-1002	18 JUL 84	48-810-84



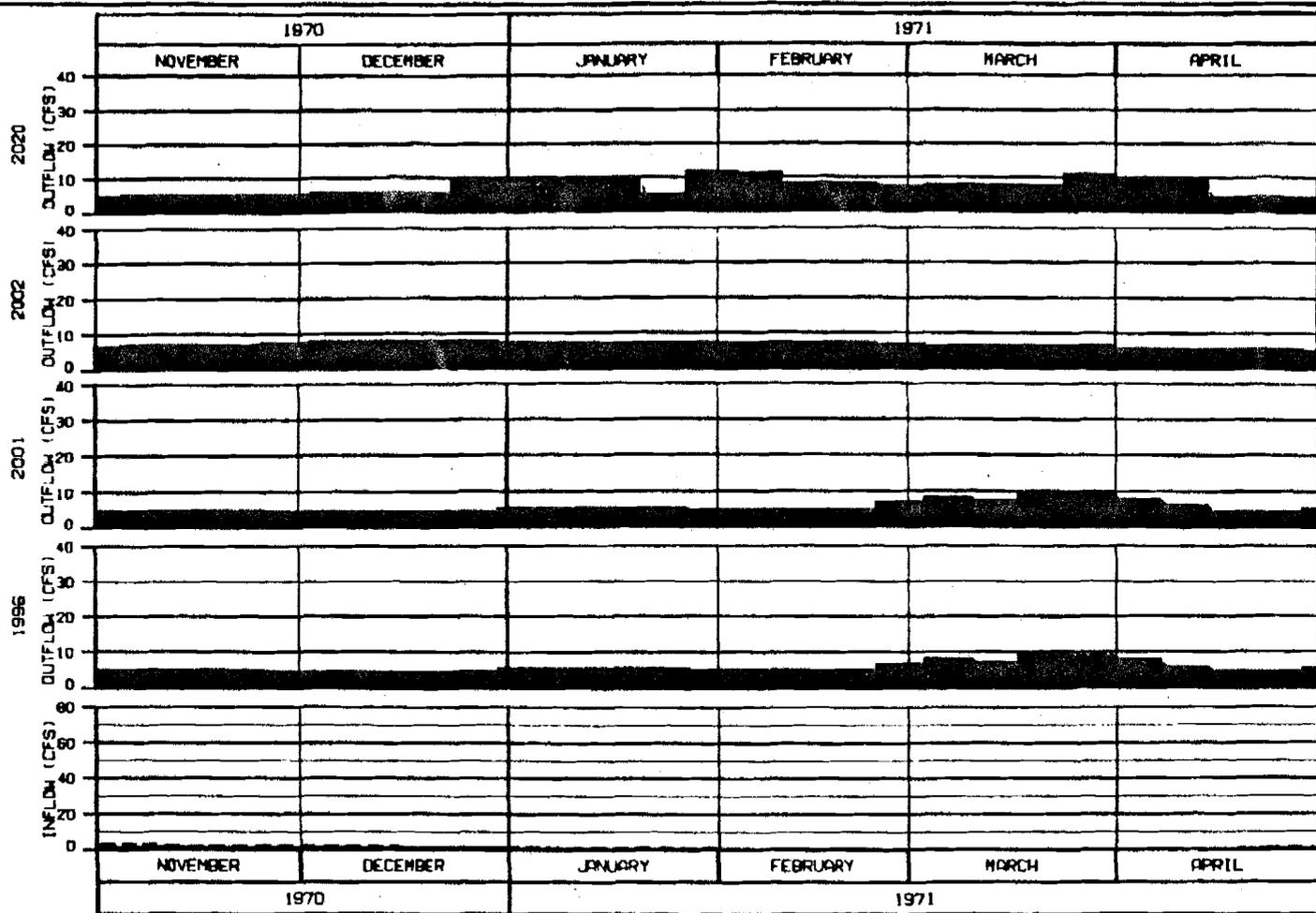
ALASKA POWER AUTHORITY
 SUBMITTING PROJECT DIVISION MODEL
 WATANA RESERVOIR
 WEATHER DATA
 HARZA-EDRSCO JOINT VENTURE
 ORDER NO. 10-11-76 48-210-04



ALASKA POWER AUTHORITY	
SUBITNA PROJECT	DYKEMA MODEL
HATANA RESERVOIR WEATHER DATA	
HARZA-EBASCO JOINT VENTURE	
CHG 0001 - 04-08-88	18 JUL 84
	48-810-84

Reservoir Inflow and Outflow Data

EXHIBIT E



LEGEND:
 INFLOW
 SUSITNA RIVER
 SUSITNA + TRIBUTARY
 OUTFLOW
 POWERHOUSE
 POWERHOUSE + CONE VALVE
 POWERHOUSE + CONE VALVE + SPILLWAY

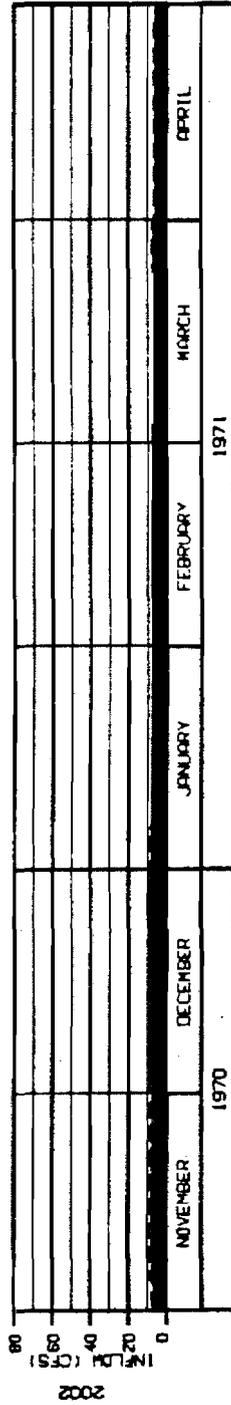
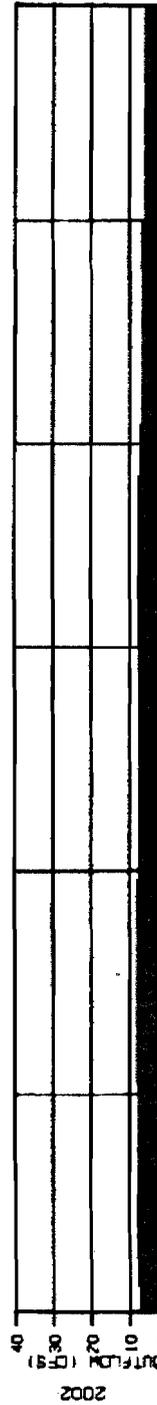
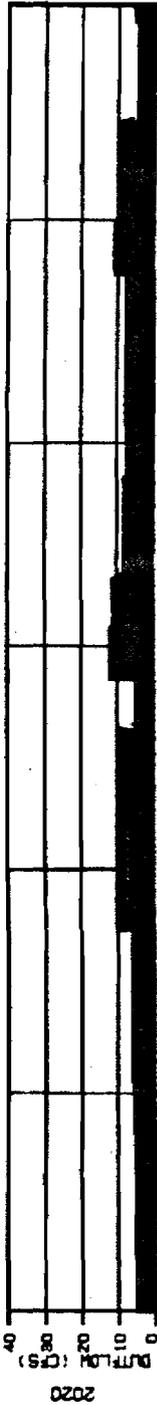
ALASKA POWER AUTHORITY
 SUSITNA PROJECT UYRESH MODEL
 WATANA RESERVOIR
 INFLOW AND OUTFLOW
 HARZA-EBASCO JOINT VENTURE
 CMC/CRD - ILL/NDTB 18 JAN 84 48-910-04



ALASKA POWER AUTHORITY
 SUBITINA PROJECT DYKESDA MODEL
 MATANA RESERVOIR
 INFLOW AND OUTFLOW
 HARZA-EBASCO JOINT VENTURE
 CHICAGO, ILL. DATE 10 JUL 84 4-1010-84

LEGEND: **SOLID LINE** INFLOW **DASHED LINE** OUTFLOW
SOLID LINE SUSITINA RIVER
DASHED LINE SUSITINA + TRIBUTARY
SOLID LINE POWERHOUSE
DASHED LINE POWERHOUSE + CONE VALVE + SPILLWAY

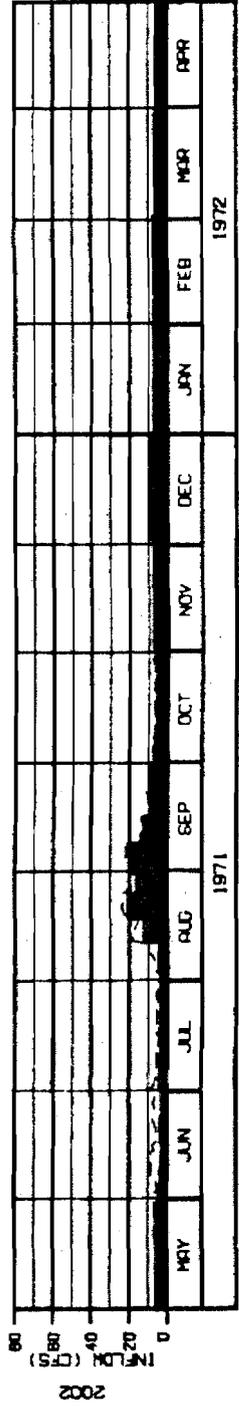
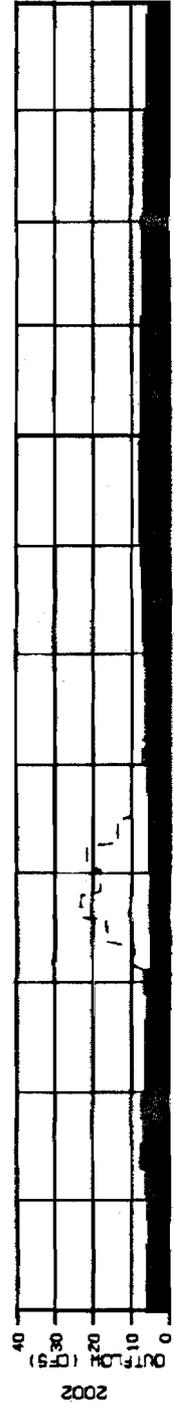
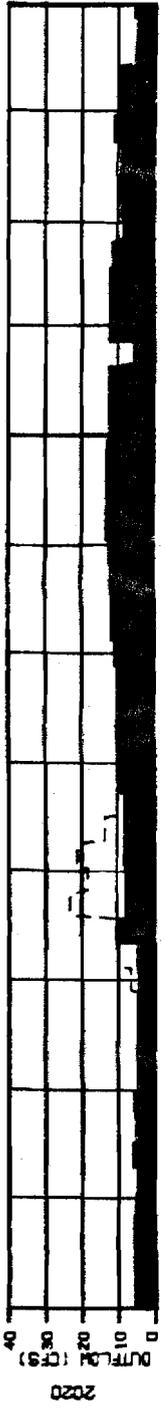
EXHIBIT F



LEGEND:

- SUBITNA RIVER (FROM MATANA)
- SUBITNA + TRIBUTARY
- POWERHOUSE
- POWERHOUSE + CONE VALVE
- POWERHOUSE + CONE VALVE + BRILLWAY

ALASKA POWER AUTHORITY
 SUSTINA PROJECT | DYNESN MODEL
 DEVIL CANYON RESERVOIR
 INFLOW AND OUTFLOW
 HARZA-EBRASCO JOINT VENTURE
 DATED: JULY 1978 10 JUL 84 48-010-04

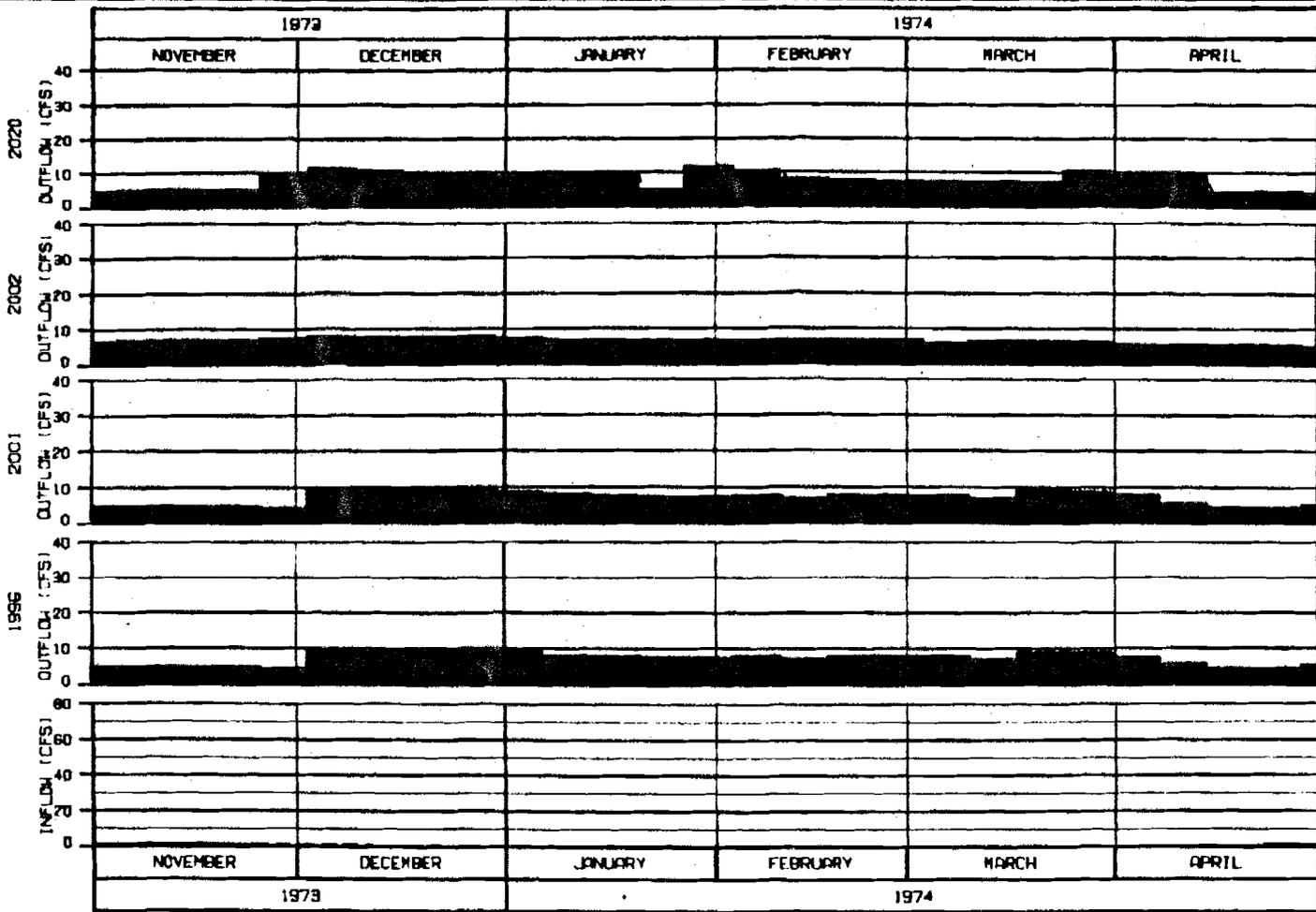


ALASKA POWER AUTHORITY
 SUBMITTING PROJECT: DEVIL CANYON RESERVOIR INFLW AND OUTFLOW
 HARZA-EBERD JOINT VENTURE
 CHICAGO, ILLINOIS 10 JUL 84 42-010-04

LEGEND: **SOLID LINE** INFLW SERIES
 - - - - - SUSITNA RIVER (FROM NATONGA)
 - - - - - SUSITNA + TRIBUTARY
 - - - - - OUTFLOW SERIES
 - - - - - POWERHOUSE
 - - - - - POWERHOUSE + CONE VALVE
 - - - - - POWERHOUSE + CONE VALVE + SPILLWAY

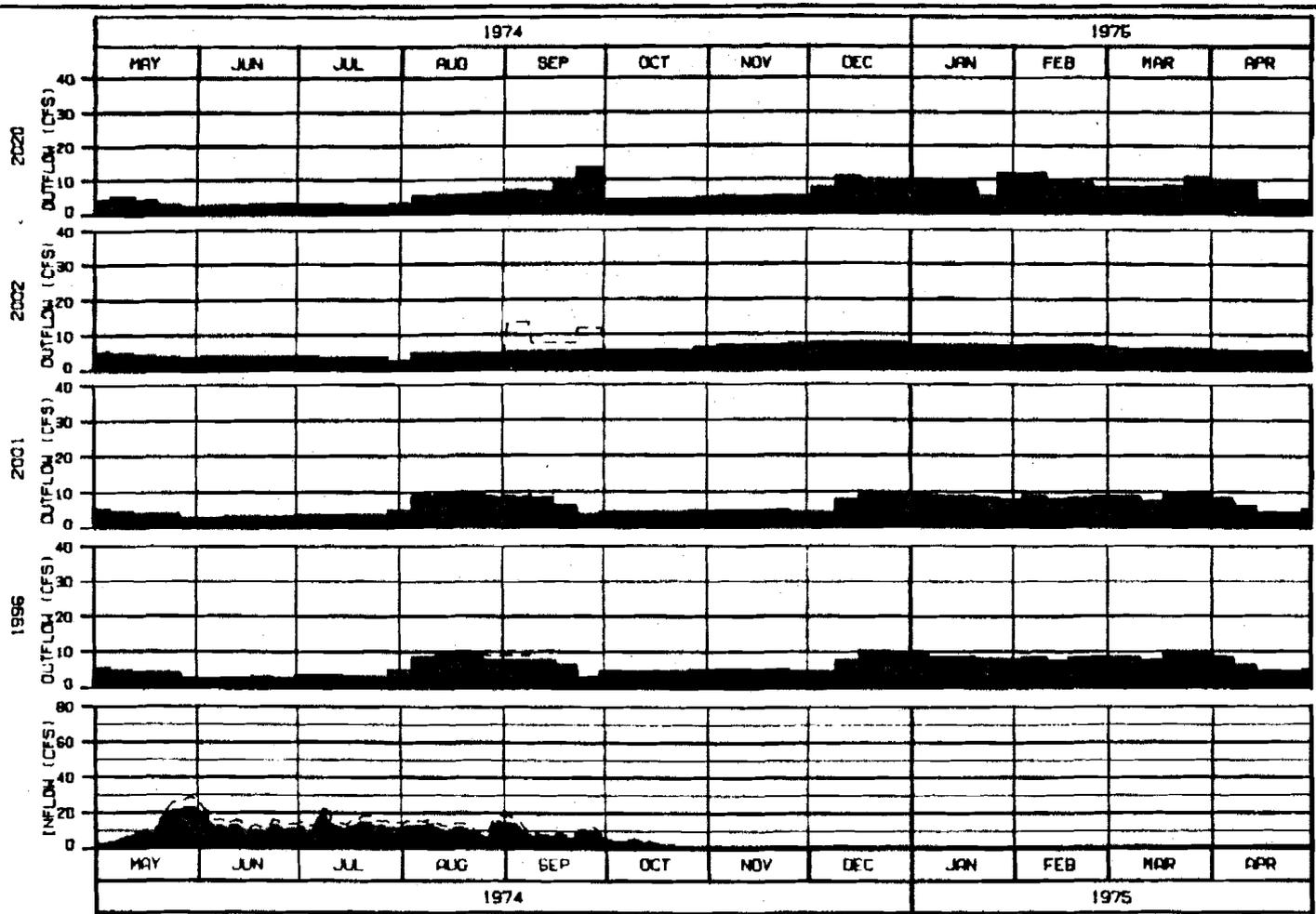
1971 1972

EXHIBIT G



LEGEND:
 ===== INFLOW =====
 ■■■■■ SUSITNA RIVER
 - - - - - SUSITNA + TRIBUTARY
 ===== OUTFLOW =====
 ■■■■■ POWERHOUSE
 - - - - - POWERHOUSE + CONE VALVE
 - - - - - POWERHOUSE + CONE VALVE + SPILLWAY

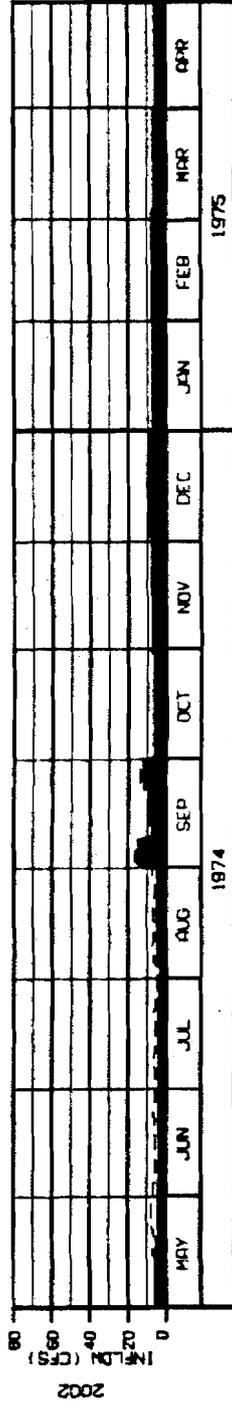
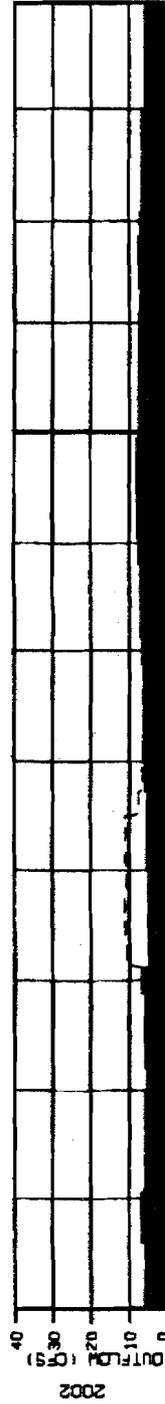
ALASKA POWER AUTHORITY	
SUSITNA PROJECT	DYRESM MODEL
WATANA RESERVOIR INFLOW AND OUTFLOW	
WARZA-EBASCO JOINT VENTURE	
CHICAGO, ILLINOIS	18 JUL 84
	48-910-04



LEGEND:
 ■■■■■ INFLOW ■■■■■
 ■■■■■ SUSITNA RIVER
 - - - - - SUSITNA + TRIBUTARY
 ■■■■■ OUTFLOW ■■■■■
 ■■■■■ POWERHOUSE
 - - - - - POWERHOUSE + CONE VALVE
 - - - - - POWERHOUSE + CONE VALVE + SPILLWAY

ALASKA POWER AUTHORITY		
SUSITNA PROJECT	DYRESH MODEL	
WATANA RESERVOIR INFLOW AND OUTFLOW		
MARZA-EBASCO JOINT VENTURE		
CHICAGO, ILL. 60618	18 JUL 84	AP-810-04

EXHIBIT H

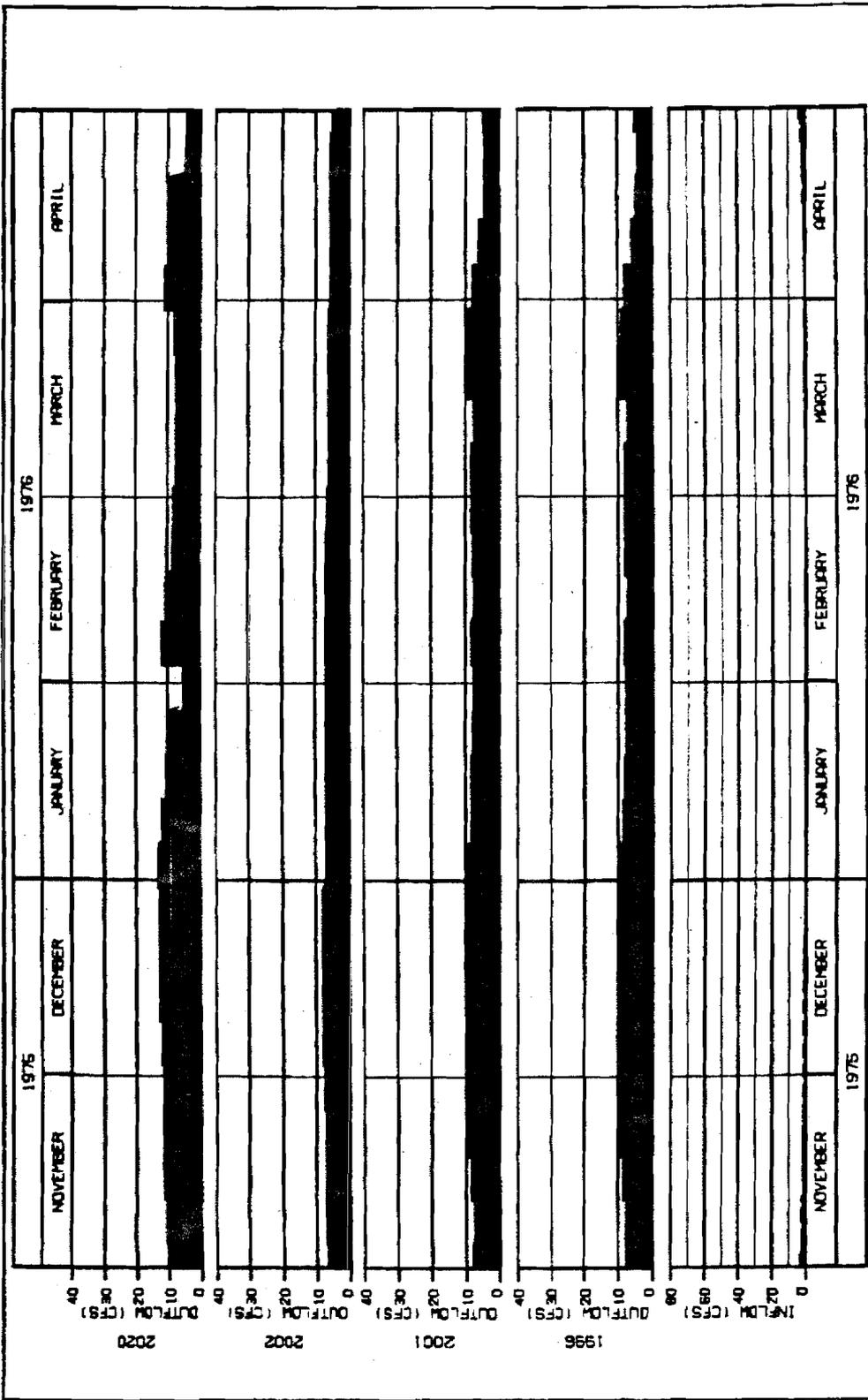


LEGEND:

- SOLID BLACK AREA: INFLOW (FROM NATONG)
- DASHED LINE: INFLOW + TRIBUTARY
- SOLID BLACK AREA: POWERHOUSE
- DASHED LINE: POWERHOUSE + CONE VALVE
- DOTTED LINE: POWERHOUSE + CONE VALVE + SPILLWAY

ALASKA POWER AUTHORITY
 SUBITINA PROJECT DYPRESA MODEL
 DEVIL CANYON RESERVOIR
 INFLOW AND OUTFLOW
 HARZA-EBASCO JOINT VENTURE
 CHICKEN, ALASKA 18 JUL 84 48-010-04

EXHIBIT I



ALASKA POWER AUTHORITY

SUBITNA PROJECT | GYPSUM MIDD.

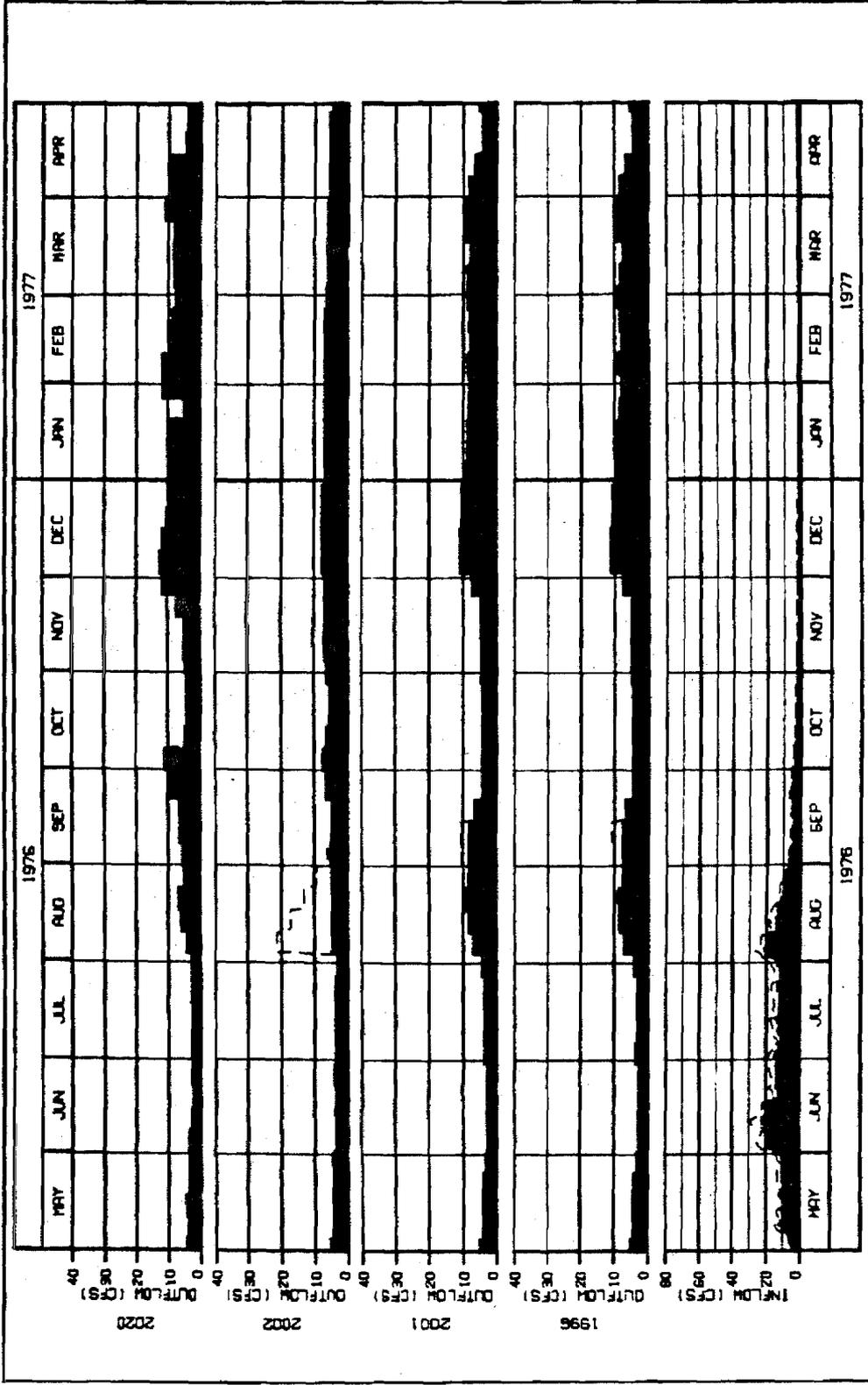
WATANA RESERVOIR
INFLOW AND OUTFLOW

HARZA-EBASCO JOINT VENTURE

CHICAGO, ILL. 60618 | 312.464.5000

LEGEND:

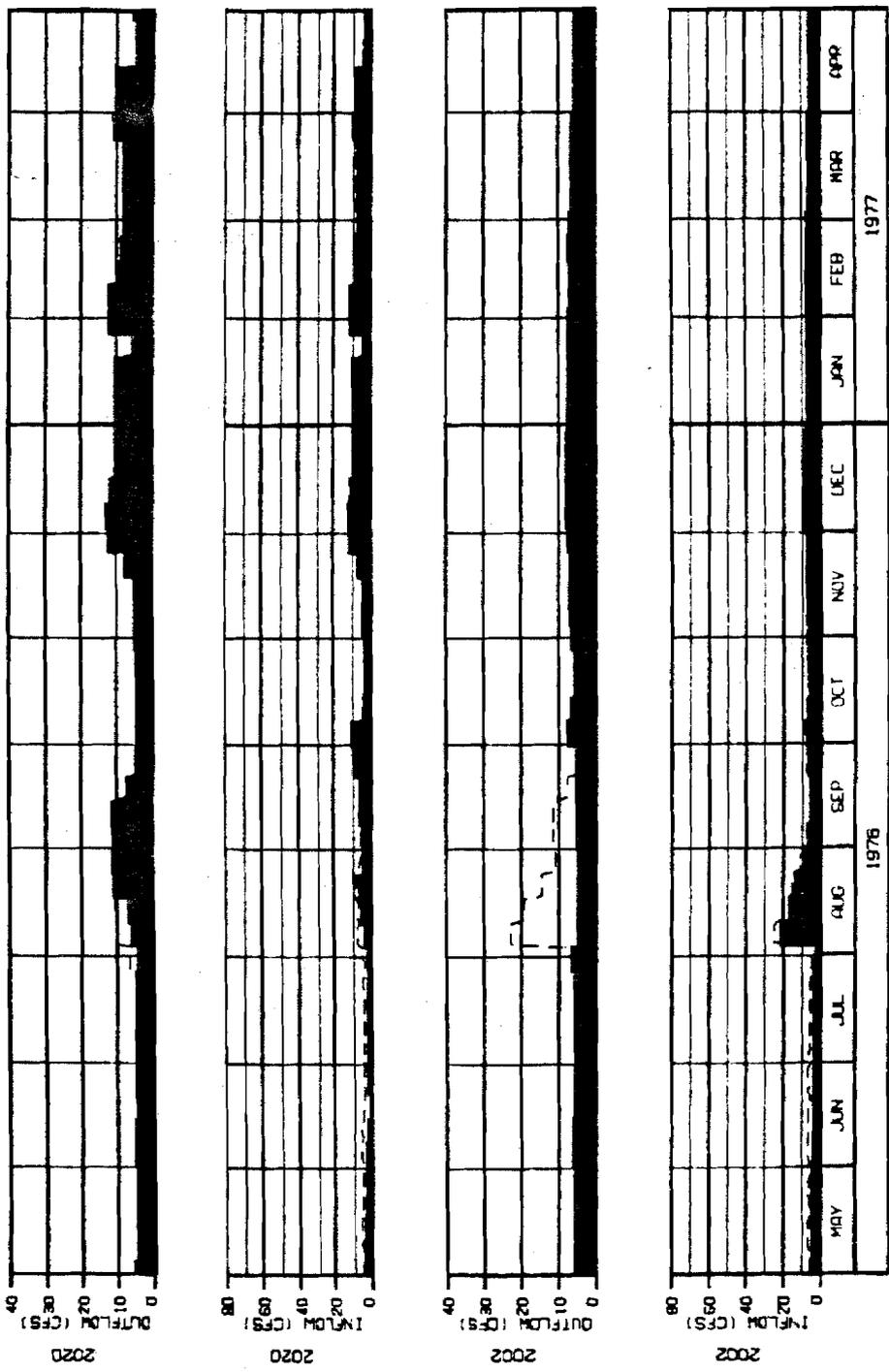
- SOLID BLACK BAR: INFLOW
- DASHED LINE: OUTFLOW
- THICK SOLID LINE: SUSITNA RIVER
- DASHED LINE WITH TRIANGLE: SUSITNA TRIBUTARY
- THICK SOLID LINE WITH TRIANGLE: POWERHOUSE CONE VALVE
- DASHED LINE WITH TRIANGLE: POWERHOUSE CONE VALVE SPILLWAY



ALASKA POWER AUTHORITY
 SUBITINA PROJECT DYPRESKI MODEL
 WATANA RESERVOIR
 INFLOW AND OUTFLOW
 HARZA-EBASCO JOINT VENTURE
 CHICAGO, ILL. 60618 18 JUL 84 48-5103-84

LEGEND:
 ■ INFLOW
 ■ SUSITNA RIVER
 --- SUSITNA + TRIBUTARY
 ■ OUTFLOW
 ■ POWERHOUSE
 --- POWERHOUSE + CONE VALVE
 --- POWERHOUSE + CONE VALVE + SPILLWAY

EXHIBIT J



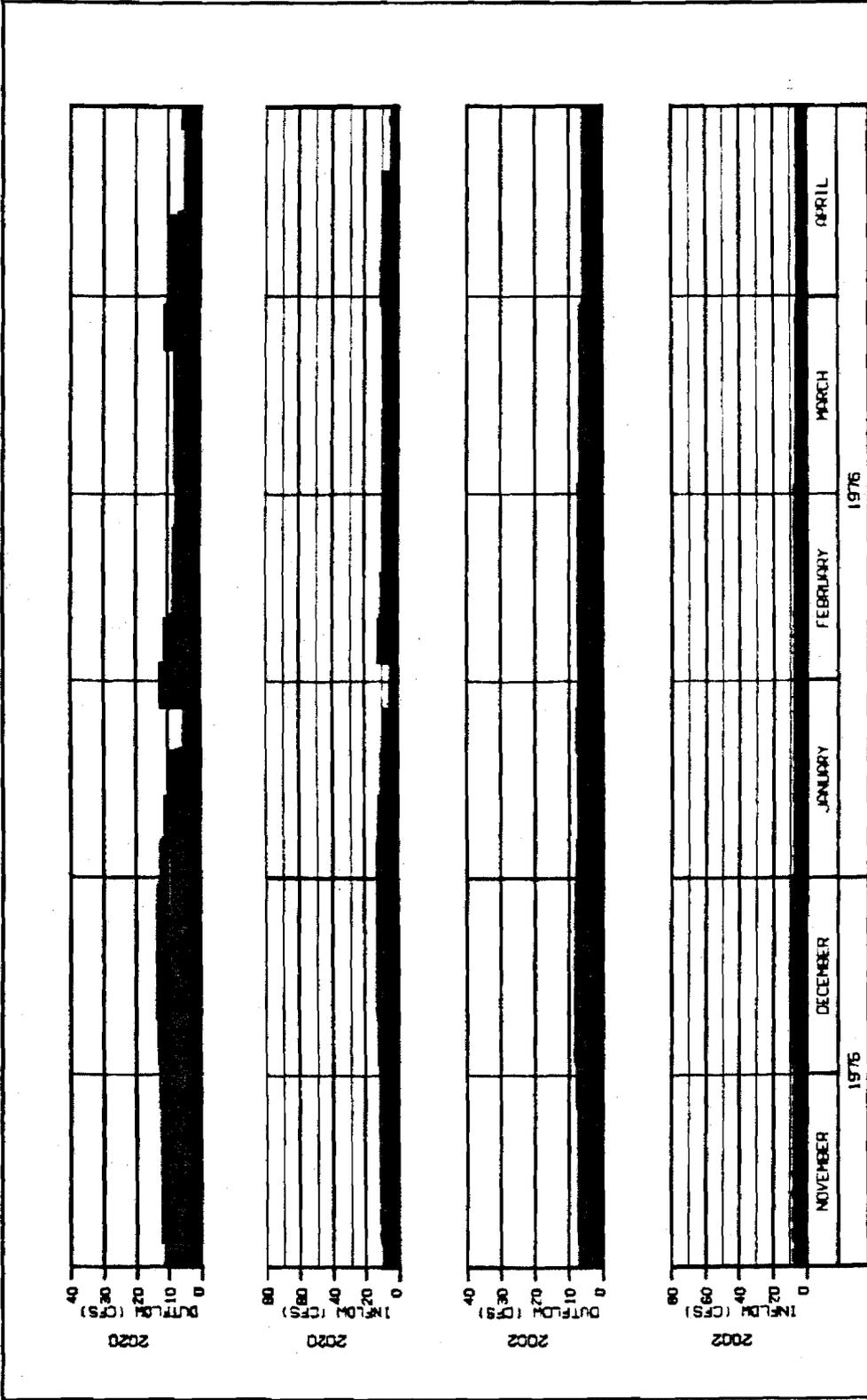
ALASKA POWER AUTHORITY
 SUBITINA PROJECT DRYCASH MODEL
 DEVIL CANYON RESERVOIR
 INFLOW AND OUTFLOW
 HARZA-EBASCO JOINT VENTURE
 CONTROL: 11-1-218 18 JUL 84 48-010-04

LEGEND: ■■■■■ INFLOW ■■■■■
 ■■■■■ SUBITINA RIVER (FROM MATANA)
 - - - SUBITINA + TRIBUTARY
 ■■■■■ OUTFLOW ■■■■■
 ■■■■■ POWERHOUSE
 - - - POWERHOUSE + CONE VALVE
 - - - POWERHOUSE + CONE VALVE + SPILLWAY

1976

1977

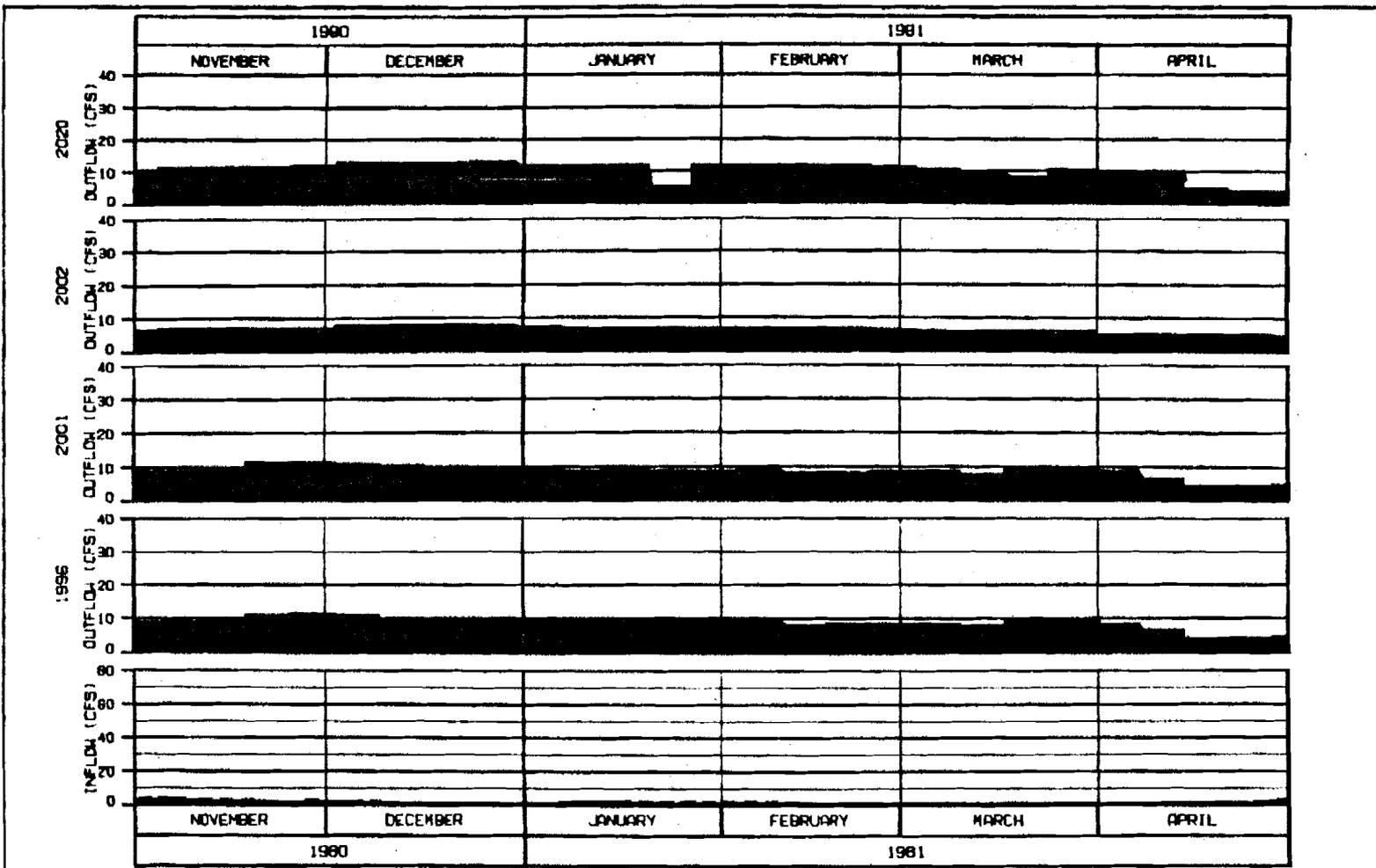
MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR APR



ALASKA POWER AUTHORITY
 SUBITINA PROJECT DYKESDA MIDDLE
 DEVIL CANYON RESERVOIR
 INFLOW AND OUTFLOW
 HARZA-EBASCO JOINT VENTURE
 ENGINEER: BILLINGBERRY 18 JUL 84 42-010-04

LEGEND: INFLW INFLW
 SUBITINA RIVER (FROM MATANGI)
 SUBITINA + TRIBUTARY
 OUTFLOW
 POWERHOUSE + CONE VALVE
 POWERHOUSE + CONE VALVE + SPILLWAY

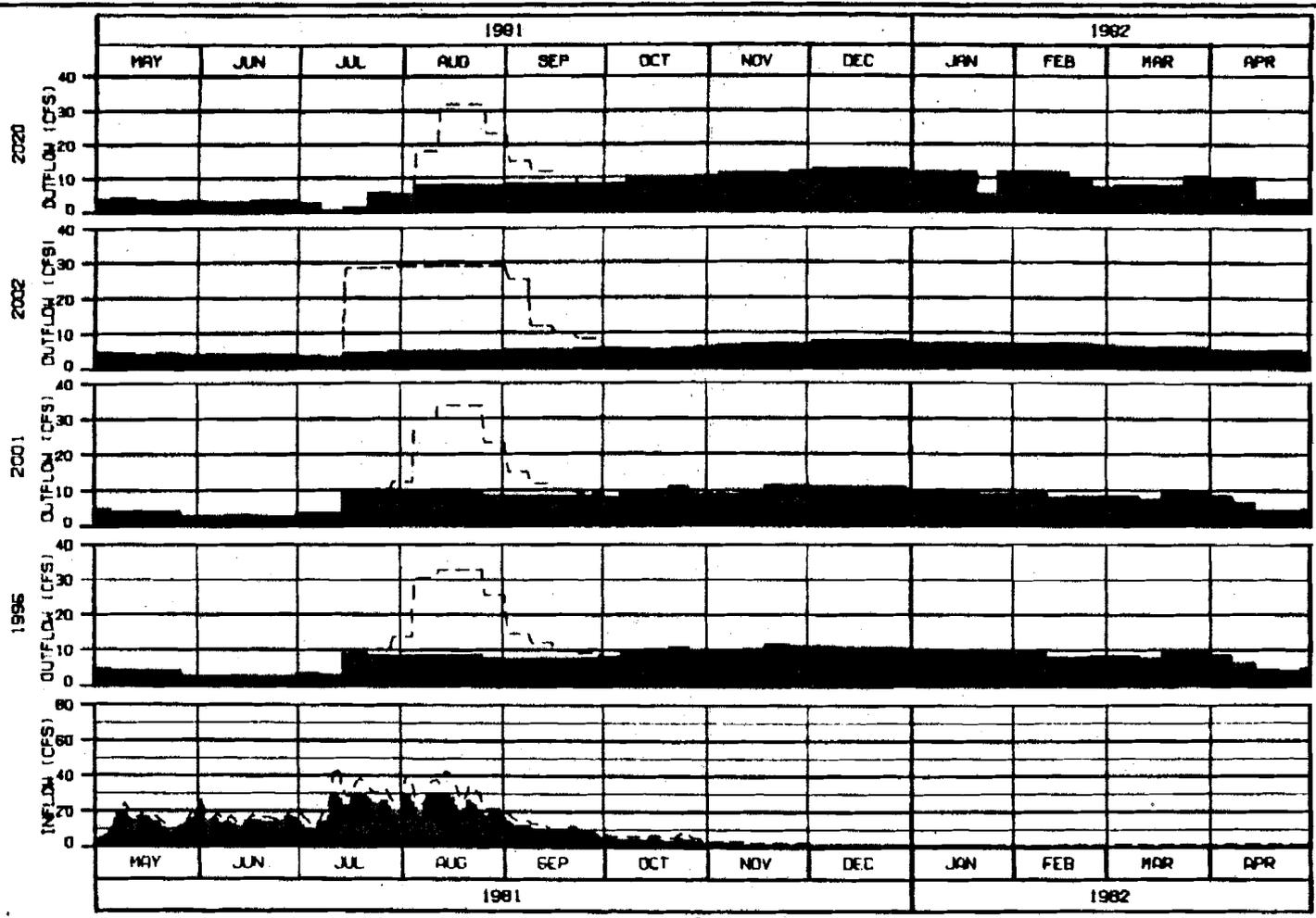
EXHIBIT K



LEGEND:

■■■■■ INFLOW ■■■■■
 ■■■■■ SUSITNA RIVER
 - - - - SUSITNA + TRIBUTARY
 ■■■■■ OUTFLOW ■■■■■
 ■■■■■ POWERHOUSE
 - - - - POWERHOUSE + CONE VALVE
 - - - - POWERHOUSE + CONE VALVE + SPILLWAY

ALASKA POWER AUTHORITY	
SUSITNA PROJECT	DYRESM MODEL
WATANA RESERVOIR INFLOW AND OUTFLOW	
HARZA-EBASCO JOINT VENTURE	
ENGINEER: ILLIOTT	28 JUL 84
48-910-04	



LEGEND: **INFLOW**

■ SUSITNA RIVER
 - - - SUSITNA + TRIBUTARY

OUTFLOW

■ POWERHOUSE
 - - - POWERHOUSE + CONE VALVE
 - · - · - POWERHOUSE + CONE VALVE + SPILLWAY

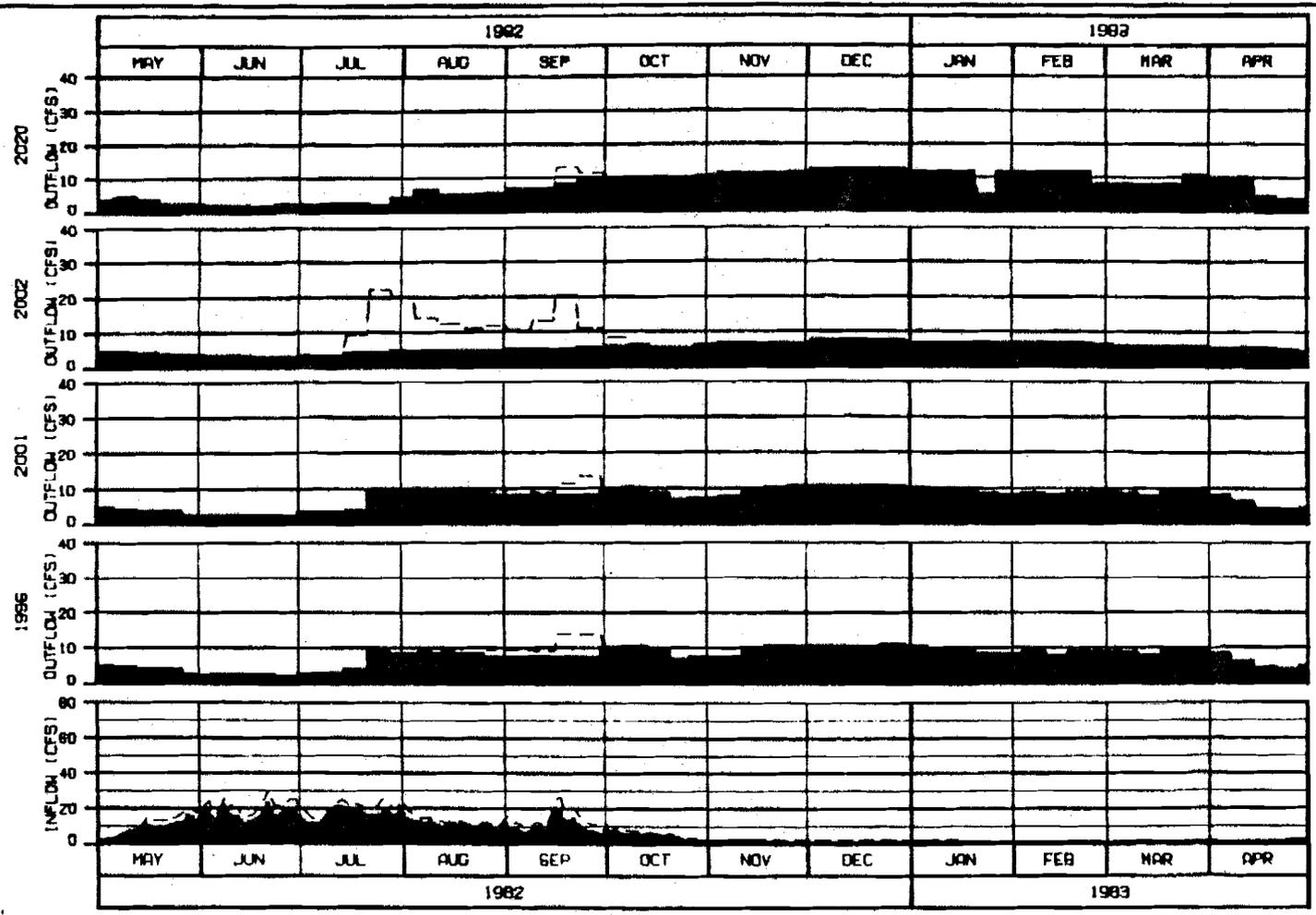
ALASKA POWER AUTHORITY

SUSITNA PROJECT | DYRESM MODEL

WATANA RESERVOIR
INFLOW AND OUTFLOW

HARZA-EBASCO JOINT VENTURE

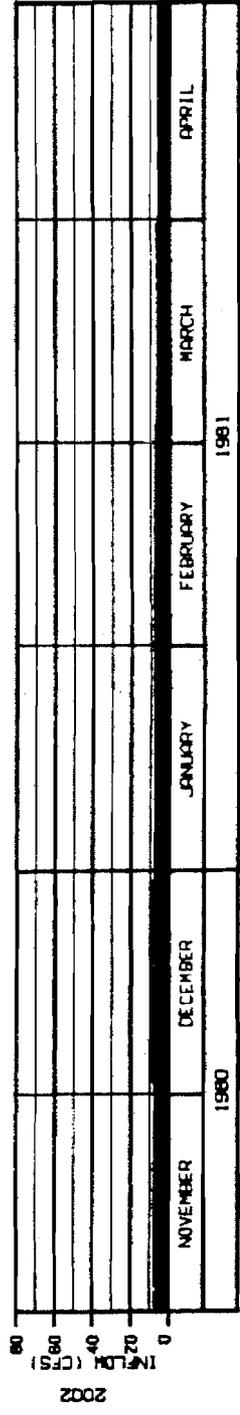
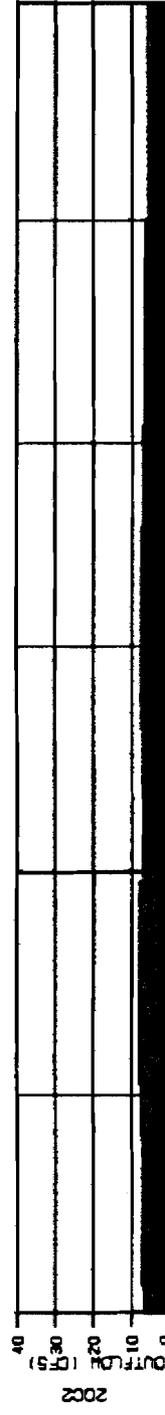
CHICAGO, ILL. 60619 | 10 JUL 91 | 47-910-04



LEGEND:
 ■■■■■ INFLOW ■■■■■
 ■■■■■ SUSITNA RIVER
 - - - - SUSITNA + TRIBUTARY
 ■■■■■ OUTFLOW ■■■■■
 ■■■■■ POWERHOUSE
 - - - - POWERHOUSE + CONE VALVE
 - - - - POWERHOUSE + CONE VALVE + SPILLWAY

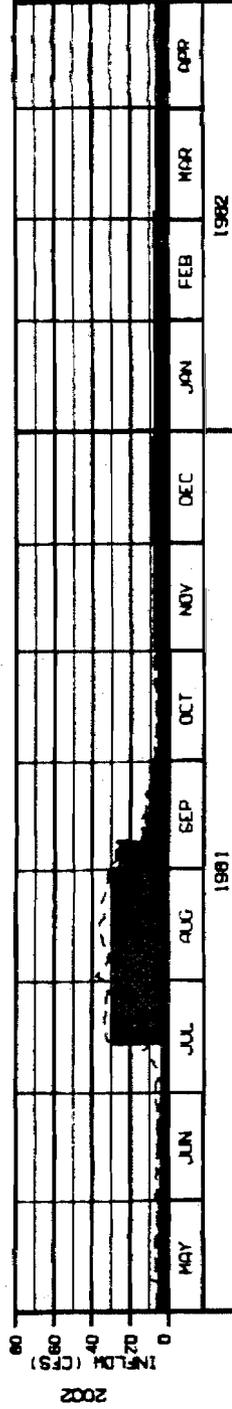
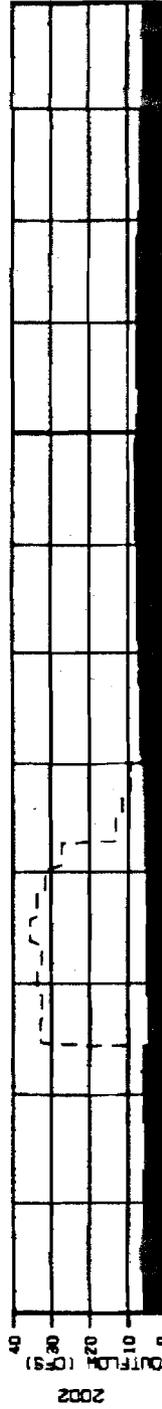
ALASKA POWER AUTHORITY	
SUSITNA PROJECT	OWYHEE MODEL
WATANA RESERVOIR INFLOW AND OUTFLOW	
MARZA-EBASCO JOINT VENTURE	
CHICAGO, ILLINOIS 18 JUL 84	42-010-04

EXHIBIT L



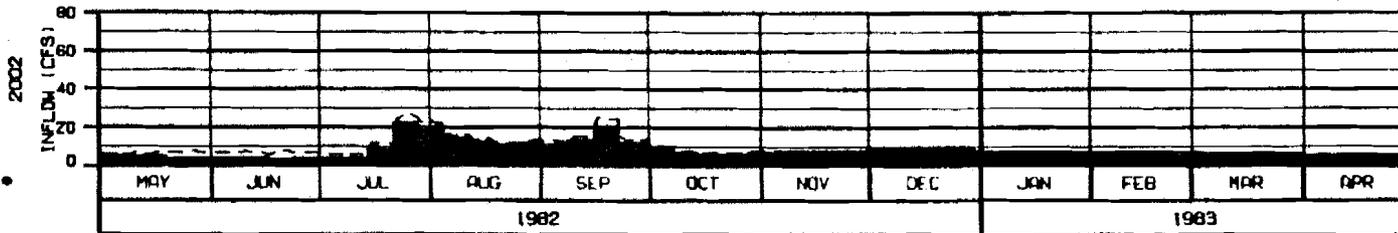
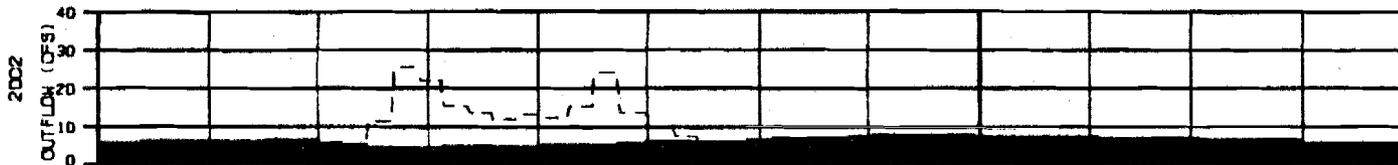
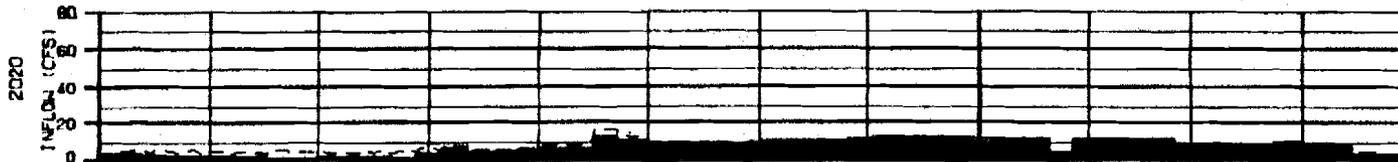
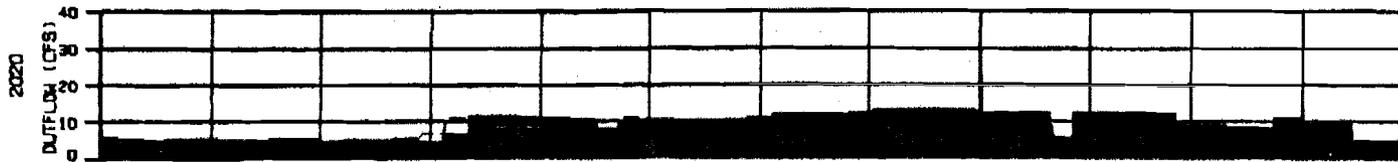
LEGEND: WINDMILL INFLOW (WINDMILL)
 SUSITNA RIVER (FROM NATANA)
 SUSITNA + TRIBUTARY
 POWERHOUSE
 POWERHOUSE + CONE VALVE
 POWERHOUSE + CONE VALVE + SPILLWAY

ALASKA POWER AUTHORITY
 SUBMITTA PROJECT: DEVIL CANYON RESERVOIR INFLOW AND OUTFLOW
 HARZA-EBASCO JOINT VENTURE
 CHICAGO, ILLINOIS 10 JUL 81 48-910-04



LEGEND:
 ■ INFLOW (CFS)
 --- OUTFLOW (CFS)
 ■ POWERHOUSE
 --- POWERHOUSE + CONE VALVE
 --- POWERHOUSE + CONE VALVE + SPILLWAY

ALASKA POWER AUTHORITY
 SUBMITTING PROJECT: DEVIL CANYON RESERVOIR INFLOW AND OUTFLOW
 HARZA-EBRASCO JOINT VENTURE
 CHICAGO, ILLINOIS 10 JUL 84
 AE-010-04



LEGEND: INFLOW

SUGITNA RIVER (FROM NATANA)

SUGITNA + TRIBUTARY

OUTFLOW

POWERHOUSE

POWERHOUSE + CONE VALVE

POWERHOUSE + CONE VALVE + SPILLWAY

ALASKA POWER AUTHORITY

SUGITNA PROJECT DYRESM MODEL

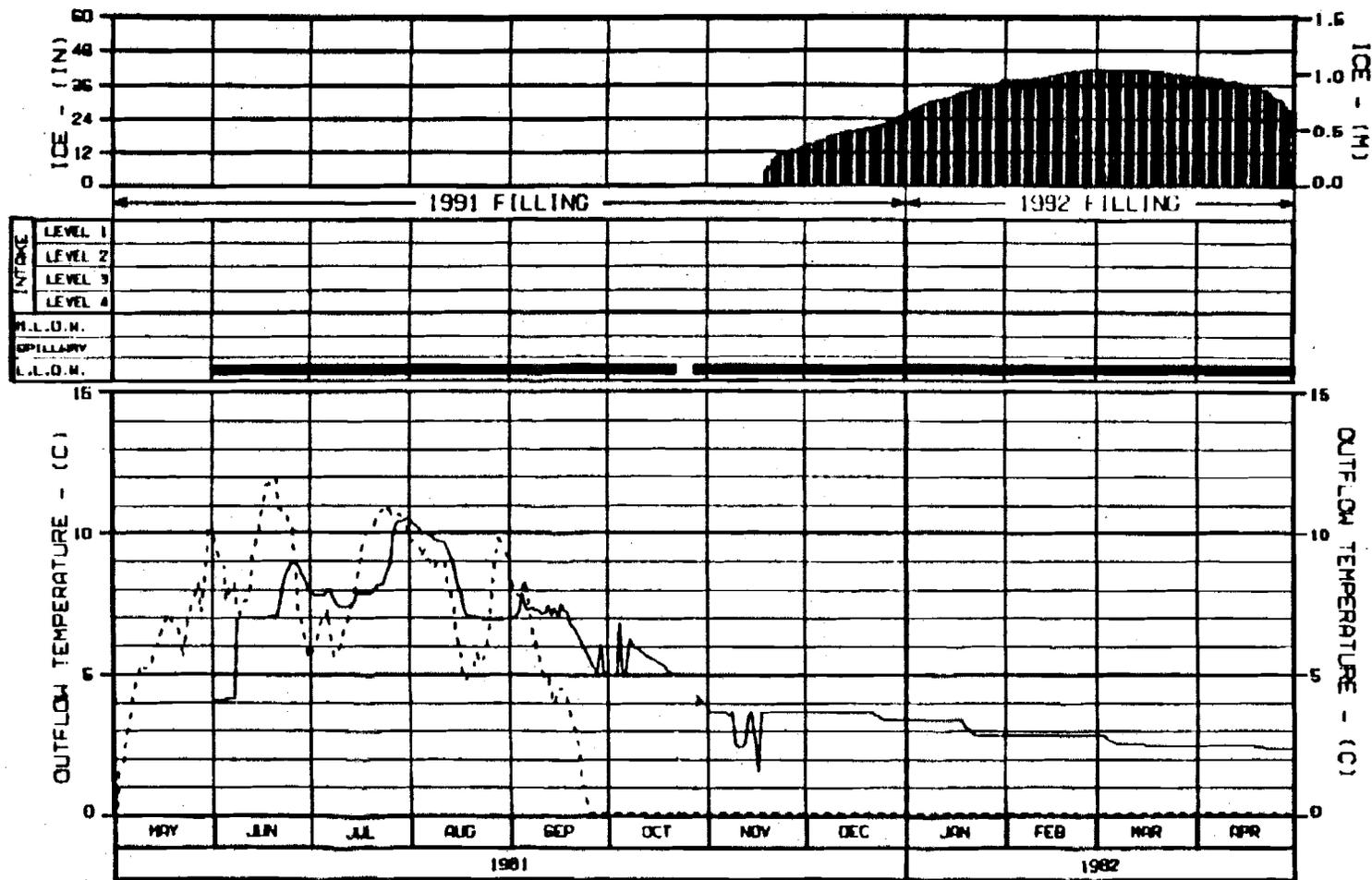
DEVIL CANYON RESERVOIR
INFLOW AND OUTFLOW

HARZA-EBASCO JOINT VENTURE

CHICAGO, ILLINOIS 18 JUL 84 48-010-04

Watana Filling

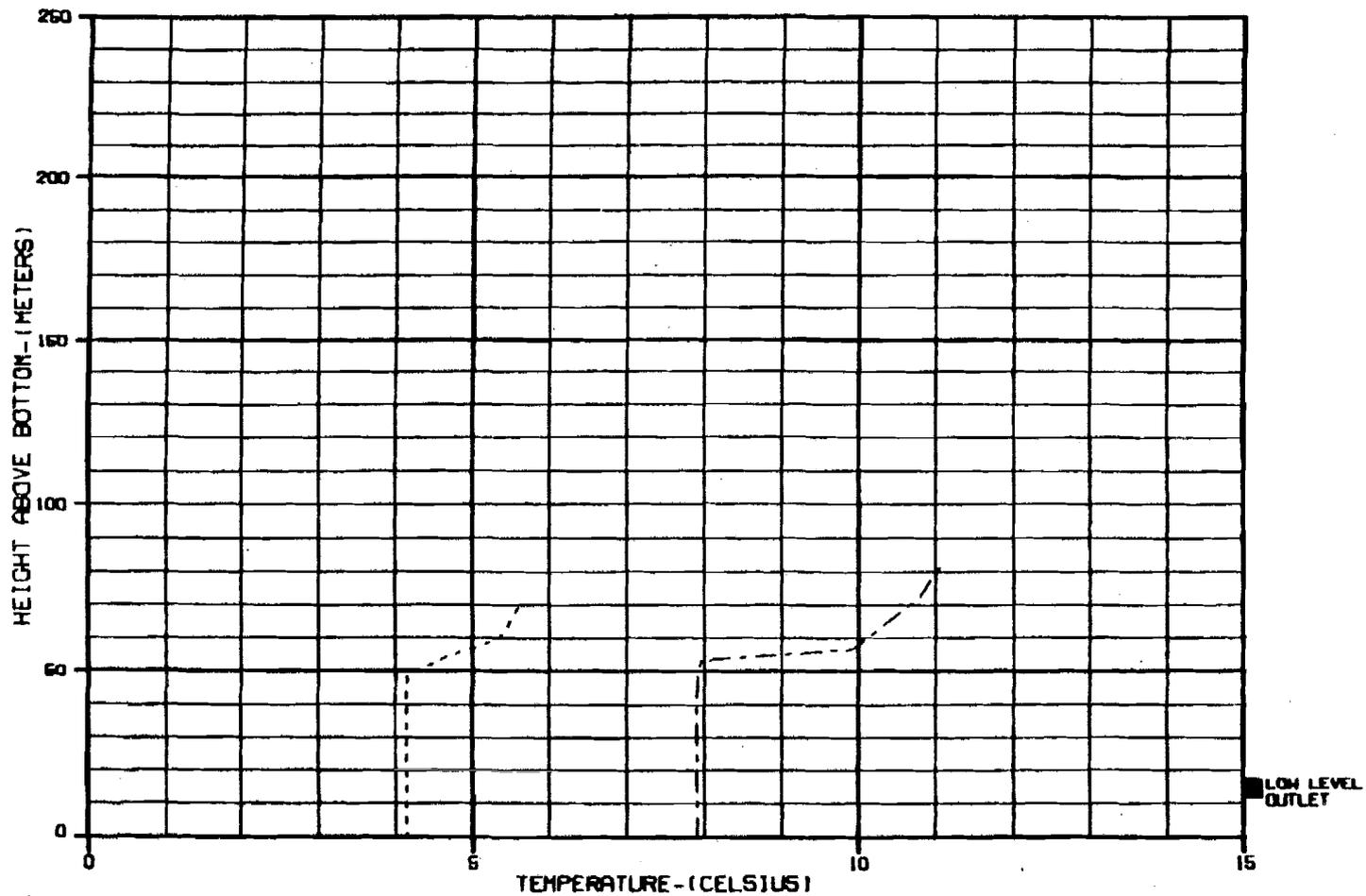
EXHIBIT M



LEGEND: CASE: WATANA RESERVOIR - WATANA FILLING OPERATION
 FIRST YEAR FILLING STARTS IN MAY 1991
 - - - - - PREDICTED OUTFLOW TEMPERATURE
 - - - - - INFLOW TEMPERATURE

- NOTES:
1. INTAKE PORT LEVEL 1 AT ELEVATION 2161 FT (656.6 M)
 2. INTAKE PORT LEVEL 2 AT ELEVATION 2114 FT (644.3 M)
 3. INTAKE PORT LEVEL 3 AT ELEVATION 2077 FT (633.1 M)
 4. INTAKE PORT LEVEL 4 AT ELEVATION 2040 FT (621.0 M)
 5. CONE VALVE (MLOW) AT ELEVATION 2040 FT (621.0 M)
 6. SPILLWAY CREST AT ELEVATION 2149 FT (654.7 M)
 7. LOW LEVEL OUTLET WORKS (LLOW) ELEV. 1609 FT (490.96 M)

ALASKA POWER AUTHORITY	
SUBMITTING PROJECT	OPERATION MODEL
WATANA RESERVOIR	
OUTFLOW TEMPERATURE	
AND ICE GROWTH	
MARZA-EBASCO JOINT VENTURE	
ENGINEER: ALAN HARRIS	DATE: 8 JUL 94
	48-810-00



CASE: ■■ WABIFILA - WATANA FILLING OPERATION ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

_____ 1 MAY 1981
 - - - - - 1 JUNE 1981
 - · - · - 1 JULY 1981

ALASKA POWER AUTHORITY

WATANA PROJECT

HYDROM MODEL

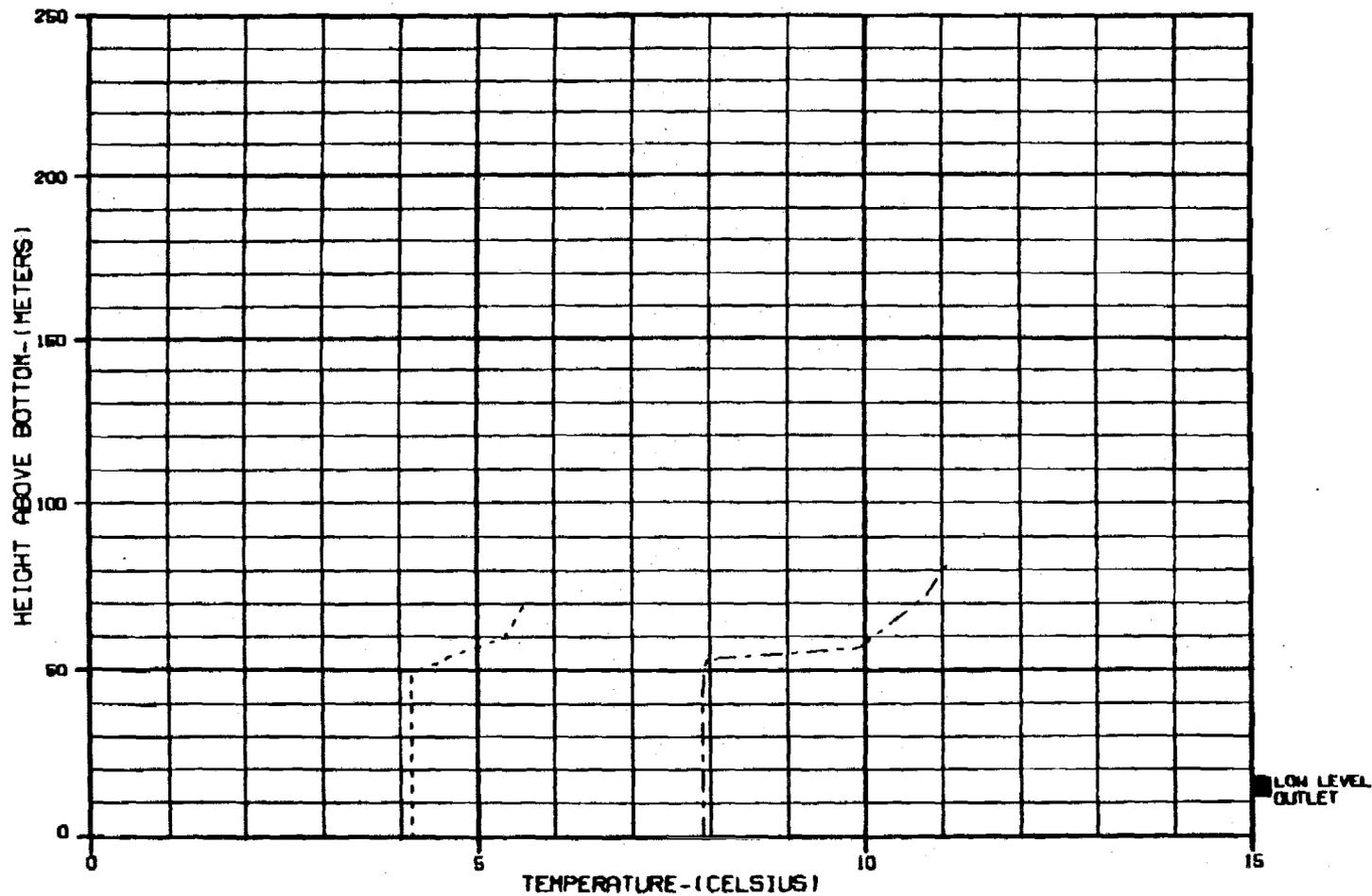
WATANA RESERVOIR
TEMPERATURE PROFILES

HARZA-EBRACO JOINT VENTURE

REVISED: 01-08-88

1 JAN 88

42-010-04



CASE: ■■ WABIFILA - WATANA FILLING OPERATION ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

_____ | MAY 1981
 - - - - - | JUNE 1981
 - · - · - | JULY 1981

ALASKA POWER AUTHORITY

WATANA PROJECT

DYADON MODEL

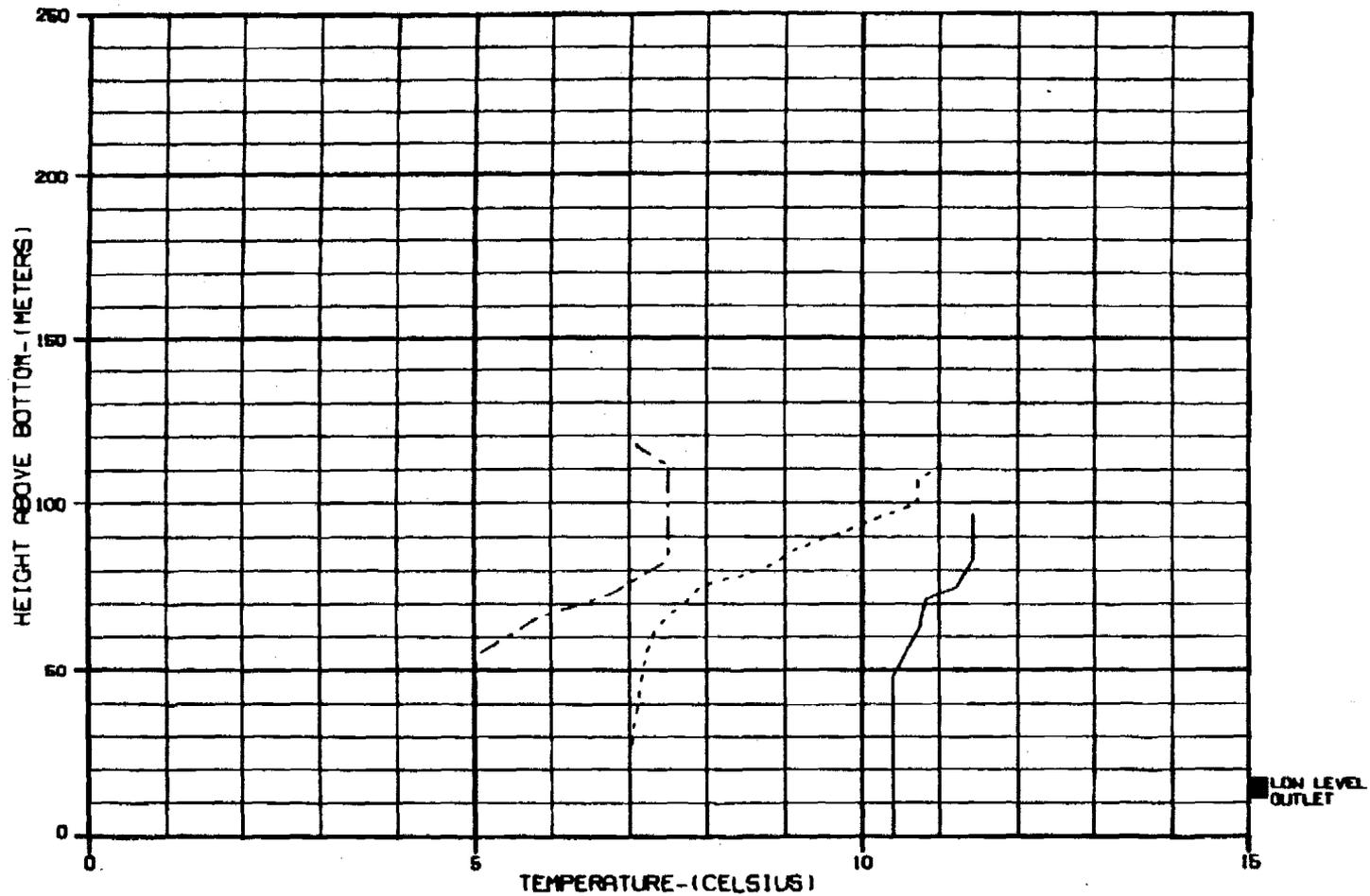
WATANA RESERVOIR
TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

UNIVERSITY OF ALASKA

1 JAN 84

42-010-04



CASE: ■■ WABIFILA - WATANA FILLING OPERATION ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

_____ | AUGUST 1981
 - - - - - | SEPTEMBER 1981
 - · - · - | OCTOBER 1981

ALASKA POWER AUTHORITY

WATANA PROJECT

DYNAMIC MODEL

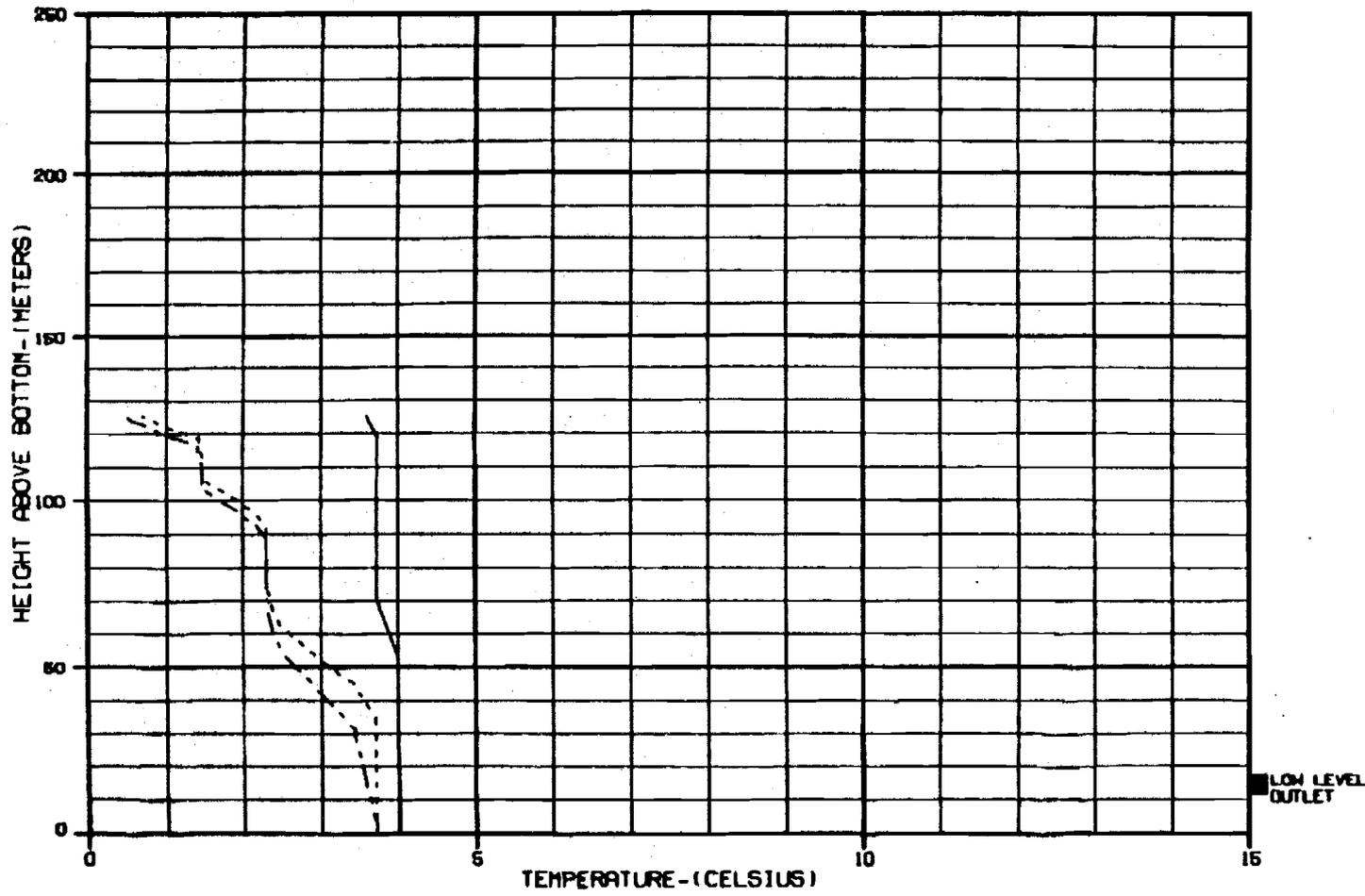
WATANA RESERVOIR
TEMPERATURE PROFILES

HARZA-EBRASCO JOINT VENTURE

DESIGN: S. L. PERRY

4 JAN 84

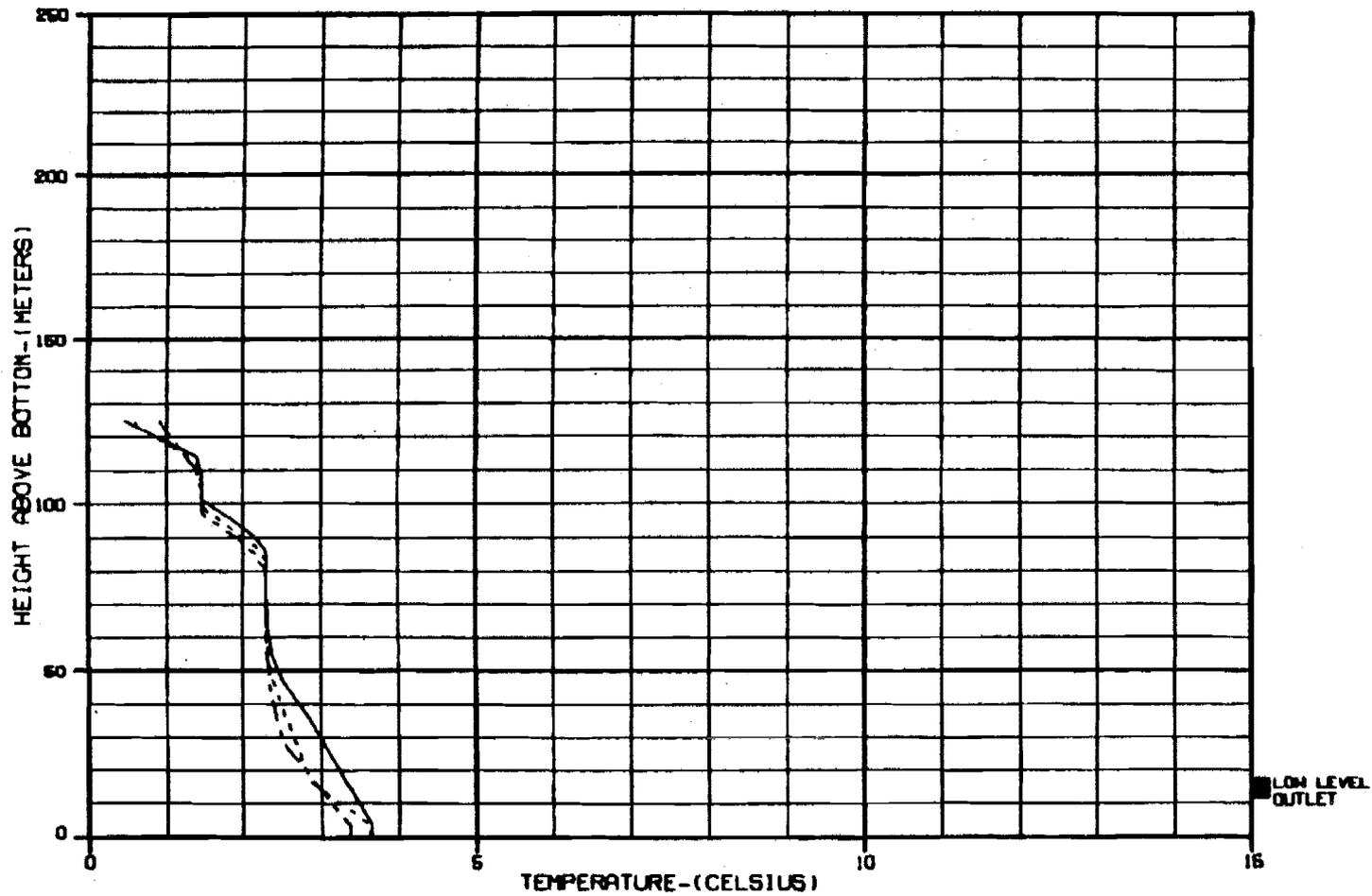
42-010-04



CASE: ■■ WADIFILA - WATANA FILLING OPERATION ■■

LEGEND: PREDICTED TEMPERATURE PROFILES:
 _____ | NOVEMBER 1981
 - - - - - | DECEMBER 1981
 - · - · - | JANUARY 1982

ALASKA POWER AUTHORITY		
SUBITNA PROJECT	DYWIDEN MODEL	
WATANA RESERVOIR TEMPERATURE PROFILES		
HARZA-EBASCO JOINT VENTURE		
OWNER: ALASKA	4 JAN 84	42-010-04



CASE: ■■ WABIFILA - WATANA FILLING OPERATION ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

———— | FEBRUARY 1982
 - - - - - | MARCH 1982
 - · - · - | APRIL 1982

ALASKA POWER AUTHORITY

SUBMITTA PROJECT

DYNEMIX MODEL

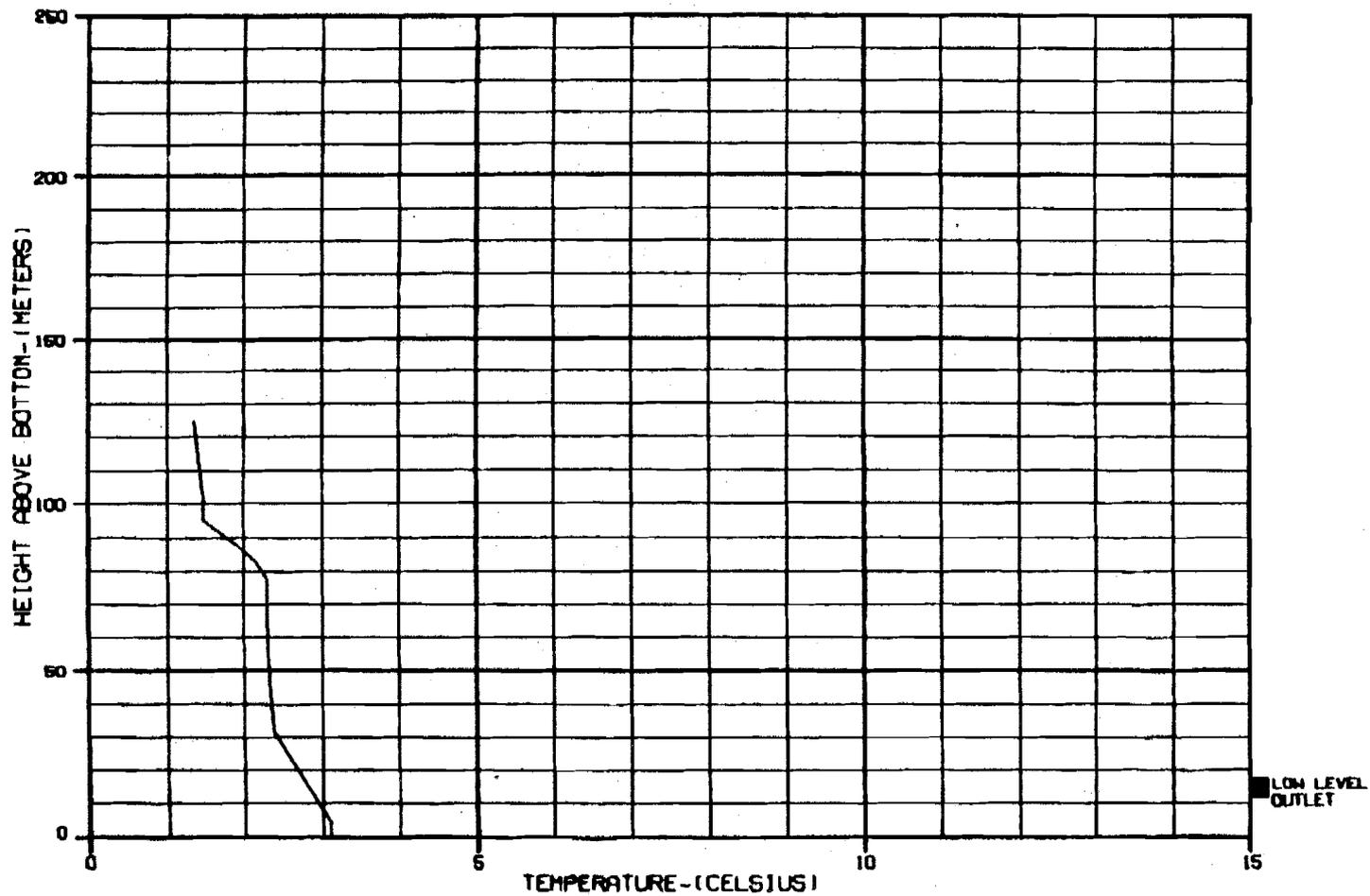
WATANA RESERVOIR
TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

ENCLOSURE - ALL PAGES

4 JAN 84

42-010-04



CASE: ■■ WABIFILA - WATANA FILLING OPERATION ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

_____ | MAY 1982
 - - - - - | JUNE 1982
 - · - · - | JULY 1982

ALASKA POWER AUTHORITY

WATANA PROJECT

DYNASH MODEL

WATANA RESERVOIR
TEMPERATURE PROFILES

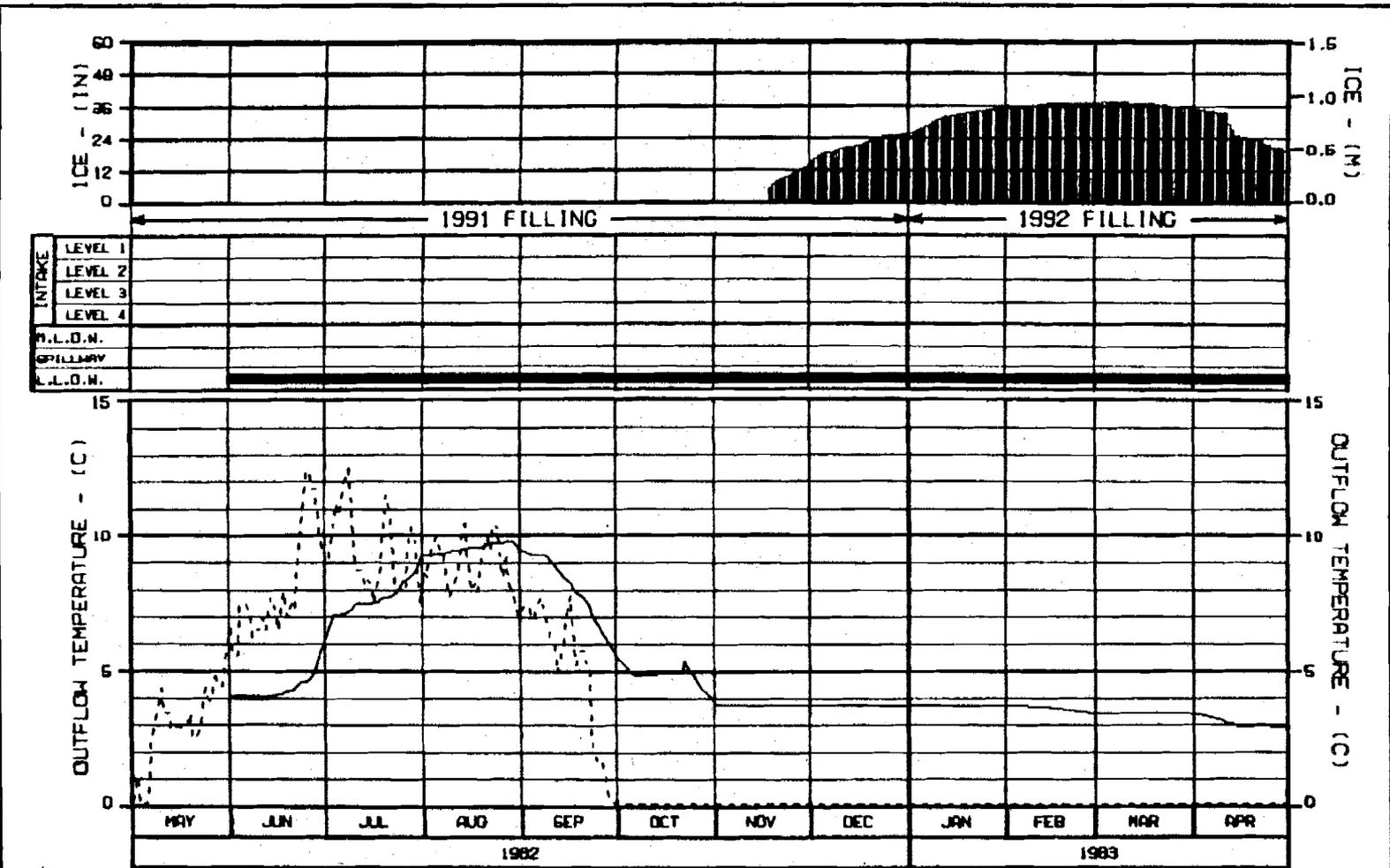
HARZA-EBASCO JOINT VENTURE

CHICAGO, ILLINOIS

4 JAN 84

42-010-04

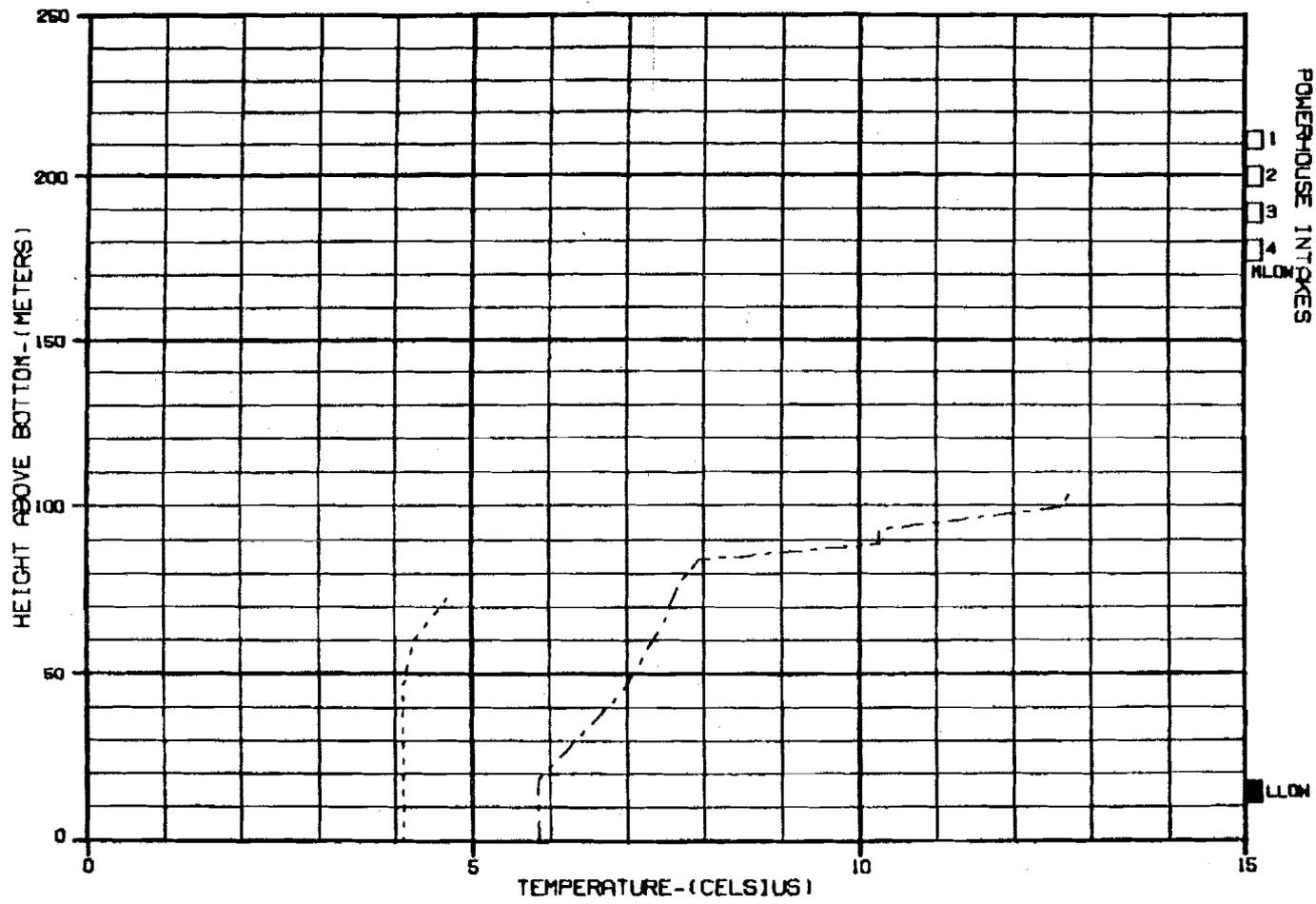
EXHIBIT N



LEGEND: CASE: WATANA HABIFILE - WATANA FILLING OPERATION
 FIRST YEAR FILLING STARTS IN MAY 1982
 ——— PREDICTED OUTFLOW TEMPERATURE
 - - - - - INFLOW TEMPERATURE

- NOTES: 1. INTAKE PORT LEVEL 1 AT ELEVATION 2151 FT (655.6 M)
 2. INTAKE PORT LEVEL 2 AT ELEVATION 2114 FT (644.3 M)
 3. INTAKE PORT LEVEL 3 AT ELEVATION 2077 FT (633.1 M)
 4. INTAKE PORT LEVEL 4 AT ELEVATION 2040 FT (621.0 M)
 5. CONE VALVE (INLOW) AT ELEVATION 2040 FT (621.0 M)
 6. SPILLWAY CREST AT ELEVATION 2149 FT (654.7 M)
 7. LOW LEVEL OUTLET WORKS (LOW) ELEV. 1609 FT (469.96 M)

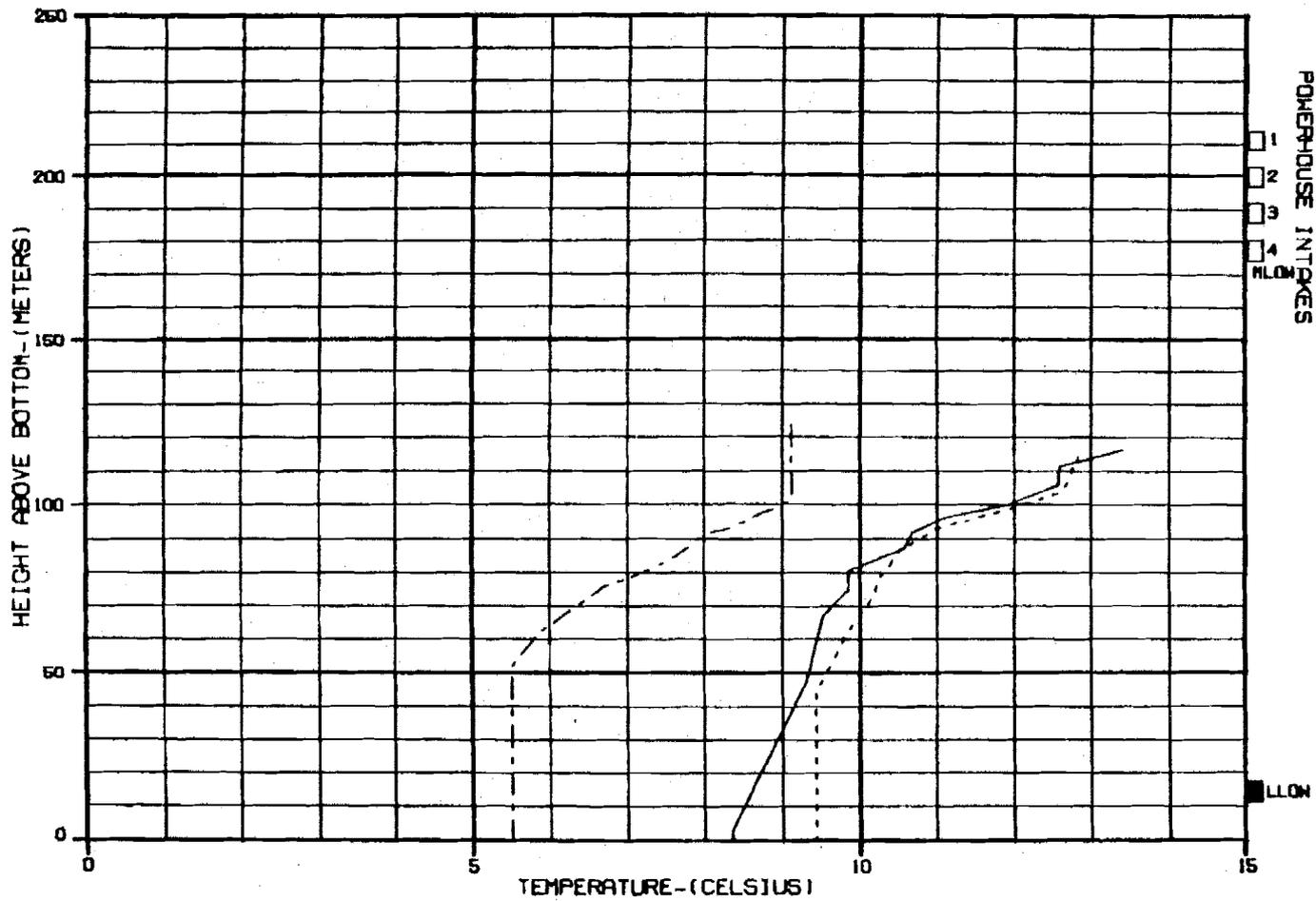
ALASKA POWER AUTHORITY	
SUBMITTA PROJECT	OPERON MODEL
WATANA RESERVOIR	
OUTFLOW TEMPERATURE	
AND ICE GROWTH	
HARZA-EPRI JOINT VENTURE	
CHARGE: ALP/OPS	BY JJA 84
48-910-04	



CASE: ■■ WAB11B21FILF - WATANA RESERVOIR FILLING ■■
 - FIRST YEAR FILLING STARTING IN MAY 1982
 - RESERVOIR ELEV. ALLOWS LOW-LEVEL OPERATION ONLY

LEGEND: PREDICTED TEMPERATURE PROFILES:
 _____ 1 MAY 1982
 1 JUNE 1982
 - - - - - 1 JULY 1982

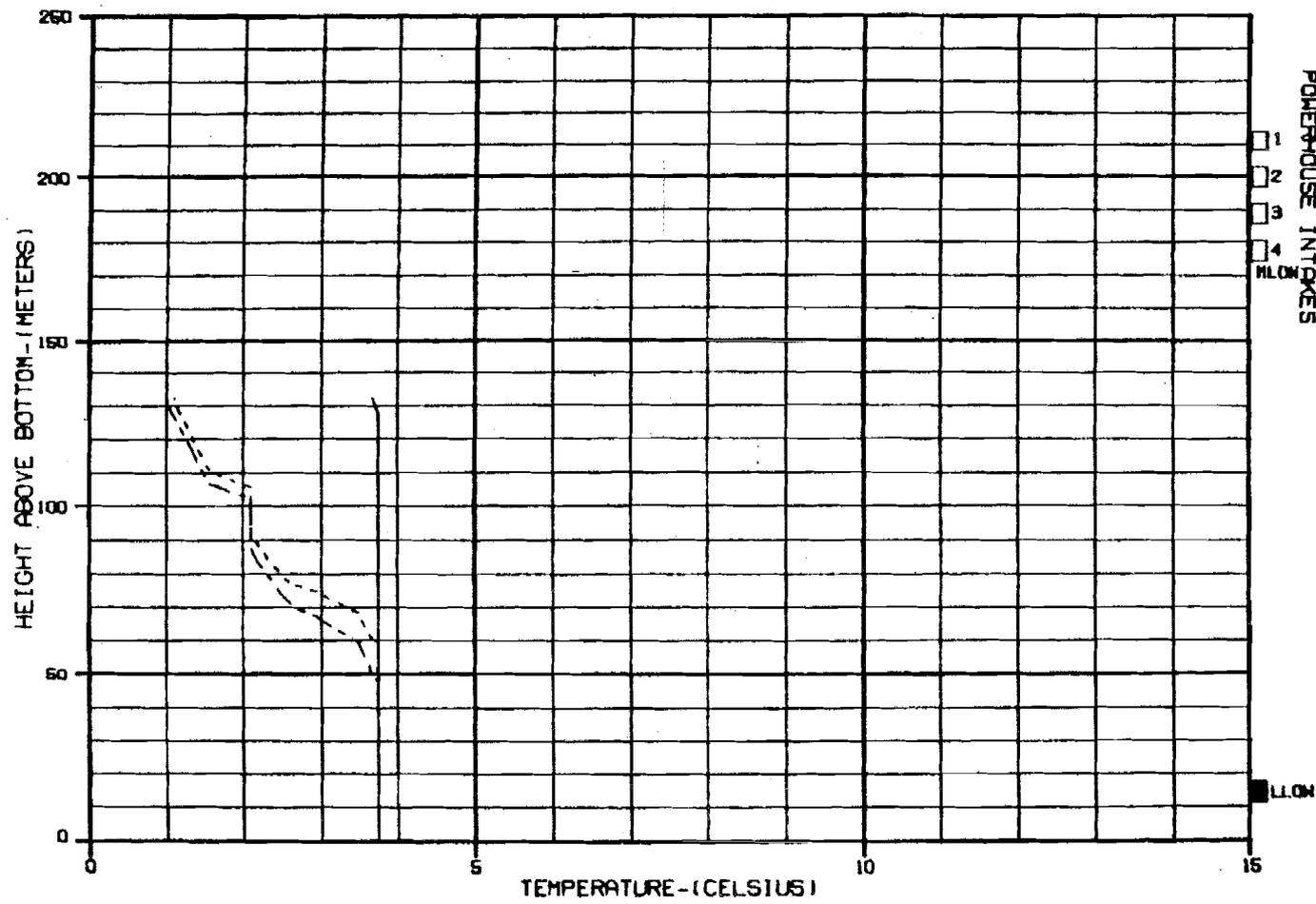
ALASKA POWER AUTHORITY	
SUBTNA PROJECT	OVERSH MODEL
WATANA RESERVOIR TEMPERATURE PROFILES	
WARZA-EBASCO JOINT VENTURE	
DESIGN. NUMBER	4E-010-04



CASE: WAB1(82)FILF - WATANA RESERVOIR FILLING WAB
 - FIRST YEAR FILLING STARTING IN MAY 1982
 RESERVOIR ELEV. ALLOWS LOW-LEVEL OPERATION ONLY

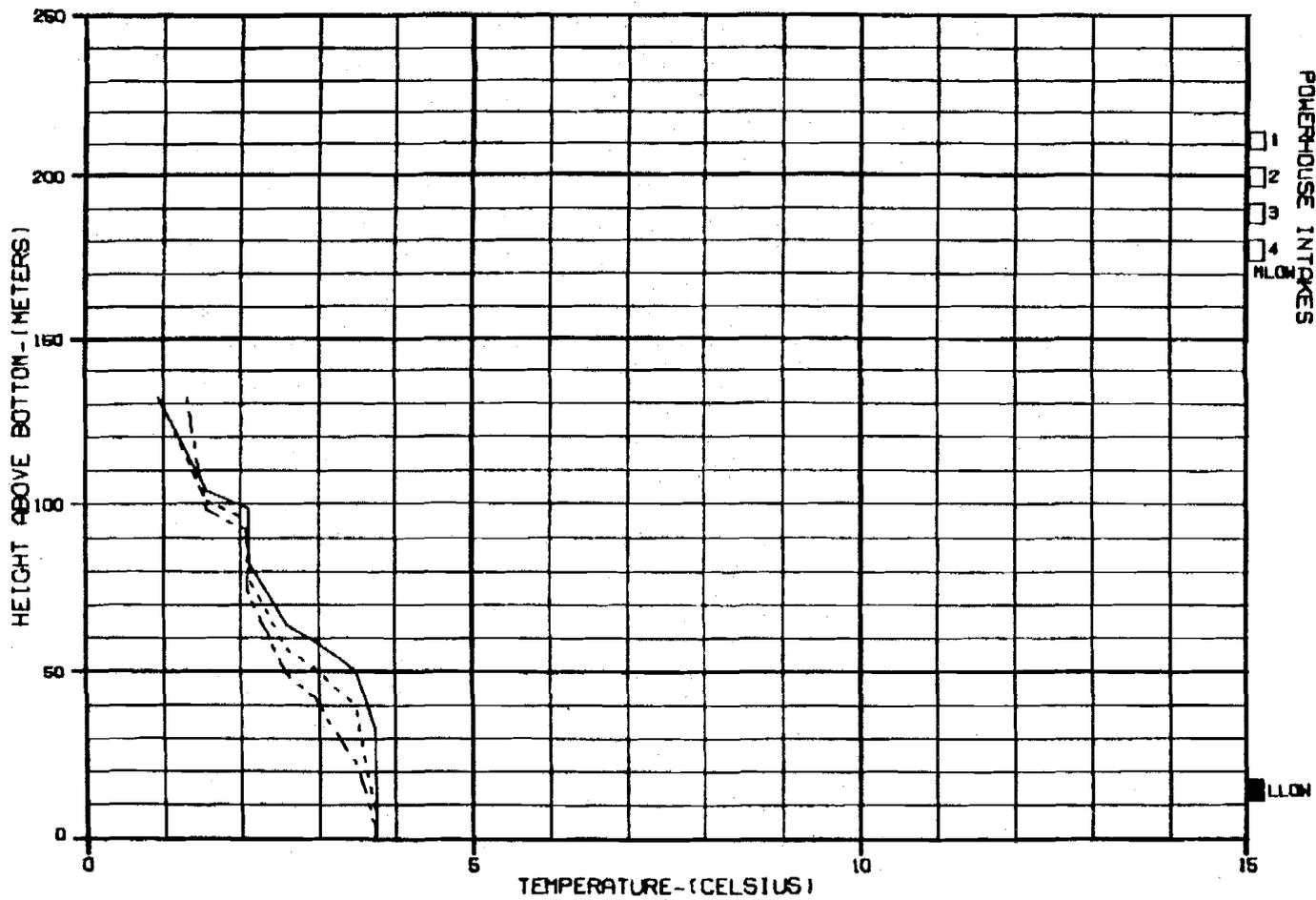
LEGEND: PREDICTED TEMPERATURE PROFILES:
 ——— 1 AUGUST 1982
 - - - - 1 SEPTEMBER 1982
 - · - · 1 OCTOBER 1982

ALASKA POWER AUTHORITY	
SUBITNA PROJECT	DYNEM MODEL
WATANA RESERVOIR TEMPERATURE PROFILES	
WARZA-EBASCO JOINT VENTURE	
DATE: 11-19-82 BY: JAM/SH	42-010-04



CASE: WAB11821FILF - WATANA RESERVOIR FILLING
 - FIRST YEAR FILLING STARTING IN MAY 1982
 RESERVOIR ELEV. ALLOWS LOW-LEVEL OPERATION ONLY
 LEGEND: PREDICTED TEMPERATURE PROFILES:
 _____ 1 NOVEMBER 1982
 - - - - - 1 DECEMBER 1982
 - . - . - 1 JANUARY 1983

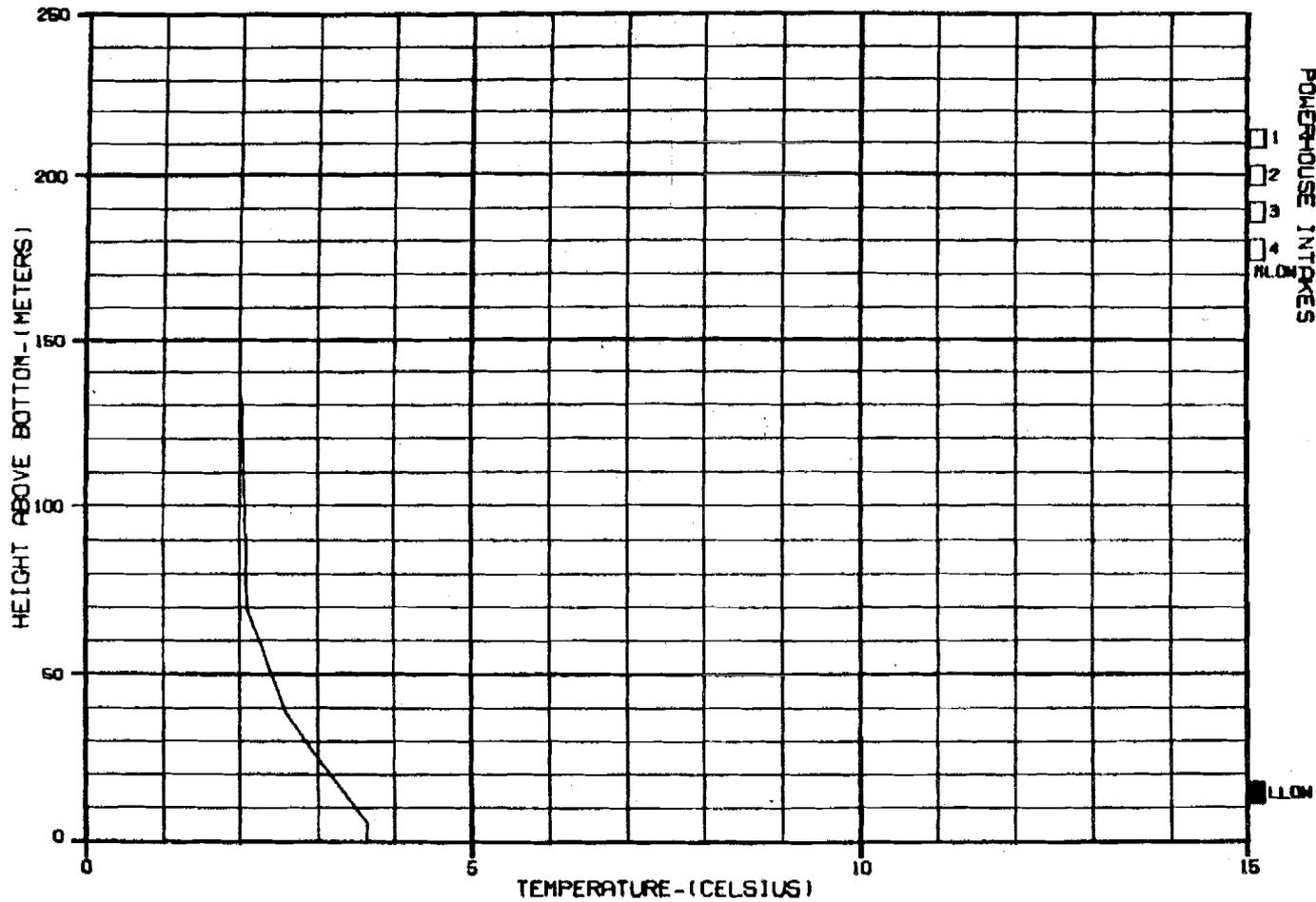
ALASKA POWER AUTHORITY	
SMITHA PROJECT	DAYREM MODEL
WATANA RESERVOIR TEMPERATURE PROFILES	
HARZA-EBASCO JOINT VENTURE	
DESIGN: 11.0.817	BY JJA 82
42-010-04	



CASE: WAB11821FILF - WATANA RESERVOIR FILLING
 - FIRST YEAR FILLING STARTING IN MAY 1982
 RESERVOIR ELEV. ALLOWS LOW-LEVEL OPERATION ONLY

LEGEND: PREDICTED TEMPERATURE PROFILES:
 _____ 1 FEBRUARY 1983
 1 MARCH 1983
 - - - - - 1 APRIL 1983

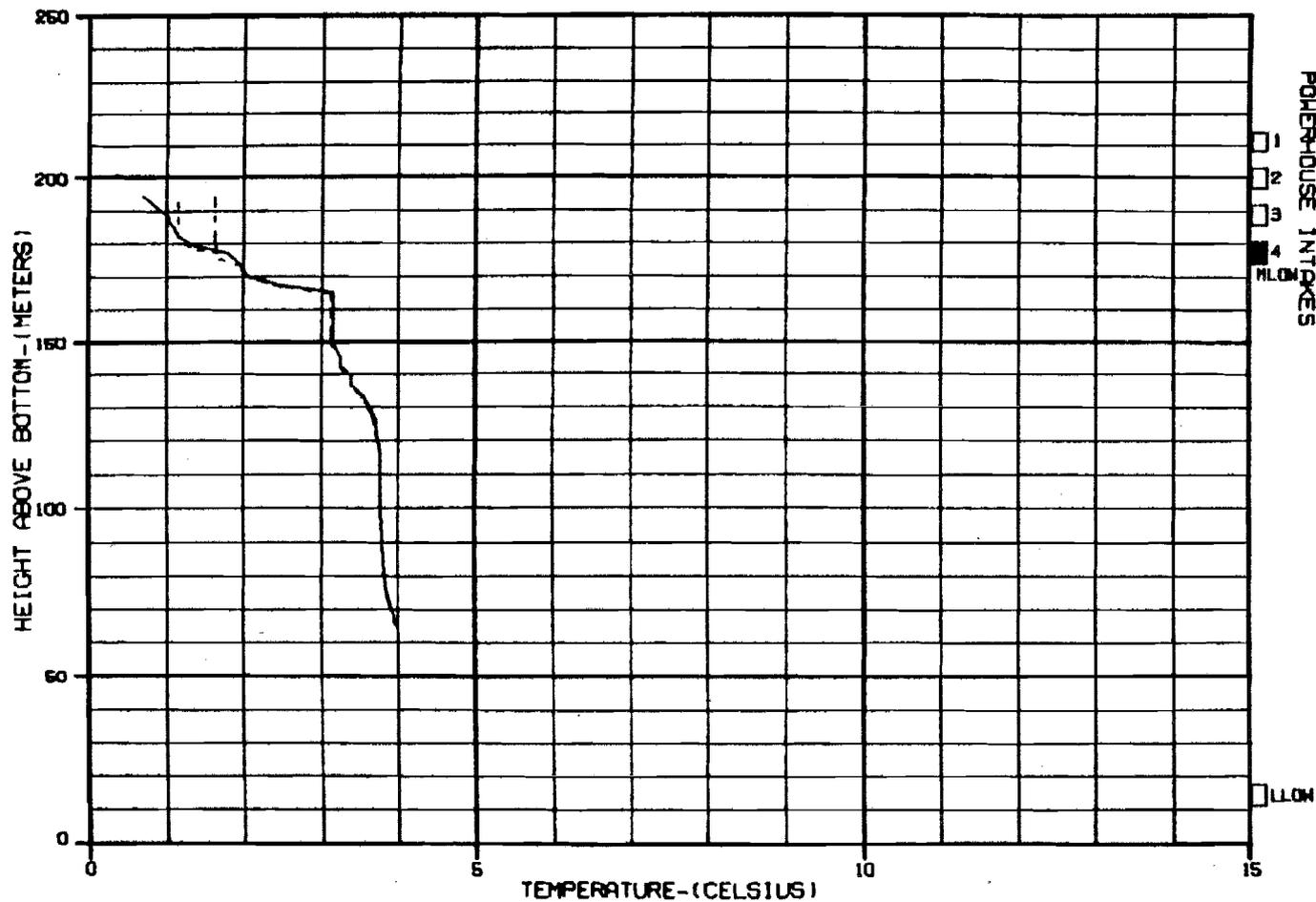
ALASKA POWER AUTHORITY	
SUSTAINA PROJECT	DYRESIN MODEL
WATANA RESERVOIR TEMPERATURE PROFILES	
HARZA-EBASCO JOINT VENTURE	
CHECKED: ALL DATE	BY JJA 84
42-010-04	



CASE: WAB11821FILF - WATANA RESERVOIR FILLING
 - FIRST YEAR FILLING STARTING IN MAY 1982
 RESERVOIR ELEV. ALLOWS LOW-LEVEL OPERATION ONLY
 LEGEND:
 PREDICTED TEMPERATURE PROFILES:
 _____ 1 MAY 1983
 - - - - - 1 JUNE 1983

ALASKA POWER AUTHORITY		
SUBMITTA PROJECT	DYNEM MODEL	
WATANA RESERVOIR		
TEMPERATURE PROFILES		
HARZA-EBASCO JOINT VENTURE		
DRAWN: L.L. BIRD	BY: J.M. SM	42-010-04

EXHIBIT O



CASE: WAB11821FILE - WATANA RESERVOIR FILLING WAB
 - LOW-LEVEL OUTLET OPERATION UNTIL RESERVOIR
 ELEVATION ALLOWS MID-LEVEL OPERATION (8 AUG 81)

LEGEND:
 PREDICTED TEMPERATURE PROFILES:
 ———— | FEBRUARY 1982
 - - - - | MARCH 1982
 - · - · | APRIL 1982

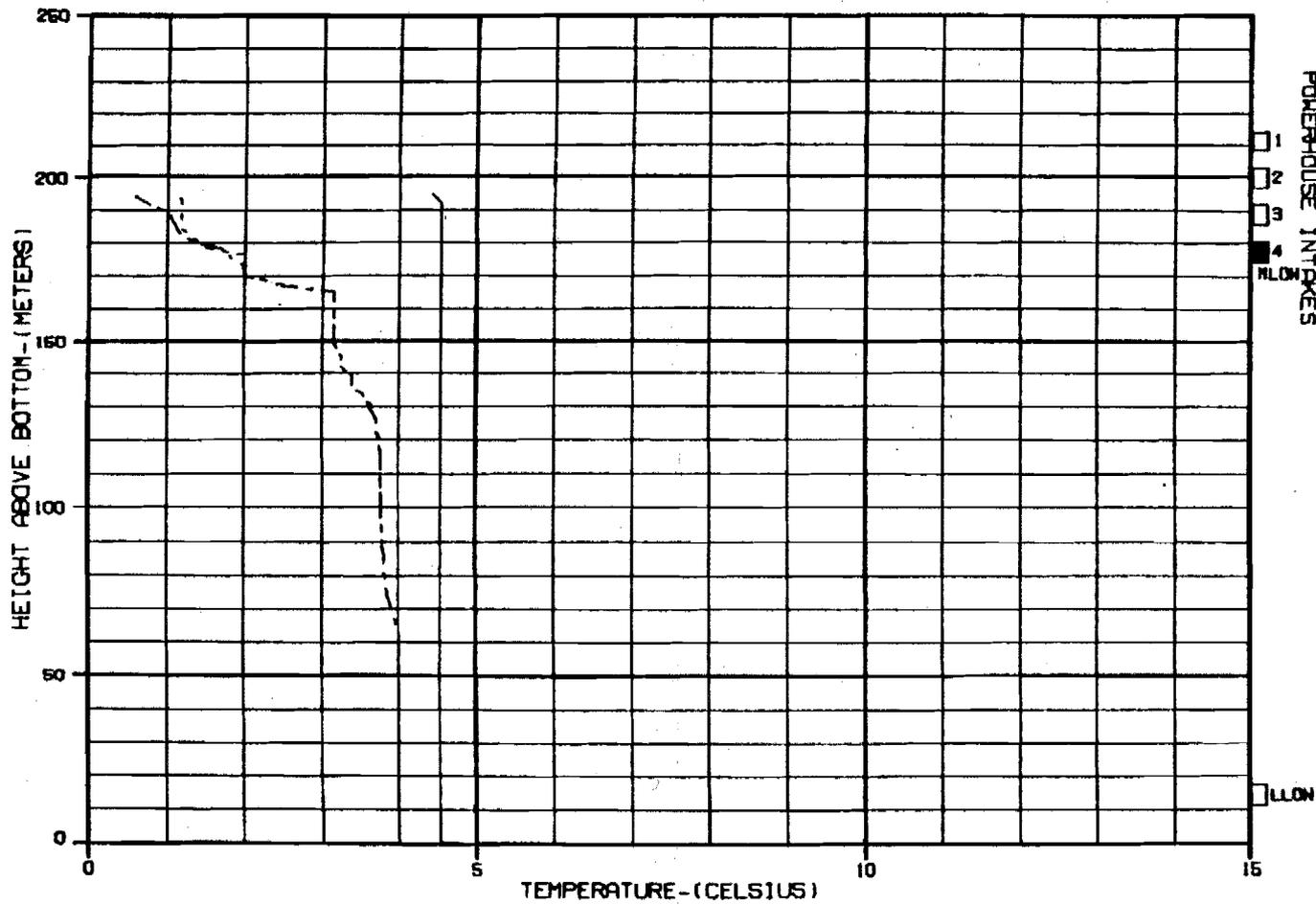
ALASKA POWER AUTHORITY

SUBITMA PROJECT | DYRESH MODEL

WATANA RESERVOIR
 TEMPERATURE PROFILES

HARZA-EBAGCO JOINT VENTURE

CHICAGO, ILLINOIS 98 JAN 84 48-010-04



CASE: *** WAB11821FILE - WATANA RESERVOIR FILLING ***
 - LOW-LEVEL OUTLET OPERATION UNTIL RESERVOIR
 ELEVATION ALLOWS MID-LEVEL OPERATION (8 AUG 81)

LEGEND:
 PREDICTED TEMPERATURE PROFILES:
 _____ 1 NOVEMBER 1981
 - - - - - 1 DECEMBER 1981
 - . - . - 1 JANUARY 1982

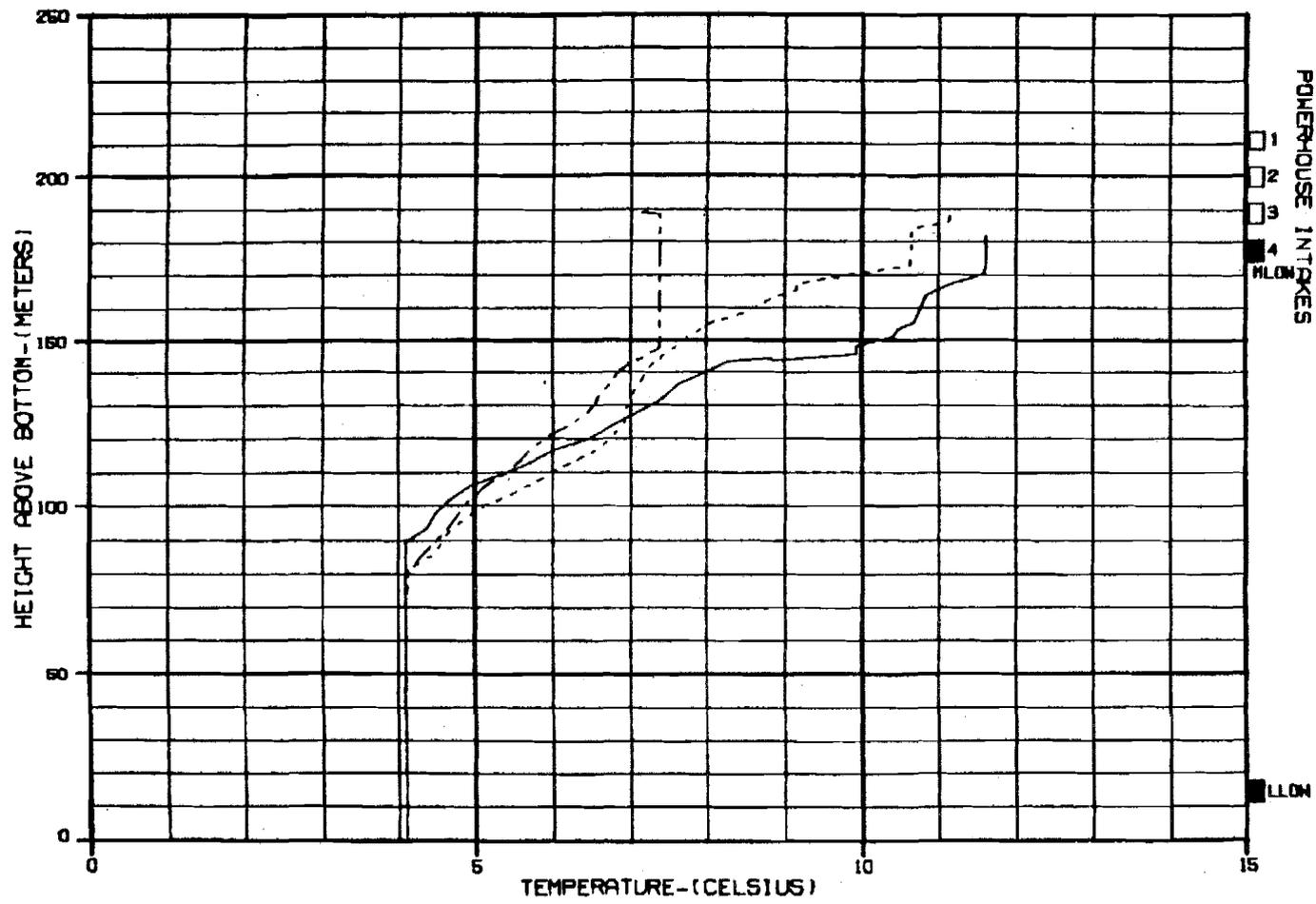
ALASKA POWER AUTHORITY

SUBSTRA PROJECT DYNESH MODEL

WATANA RESERVOIR
 TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

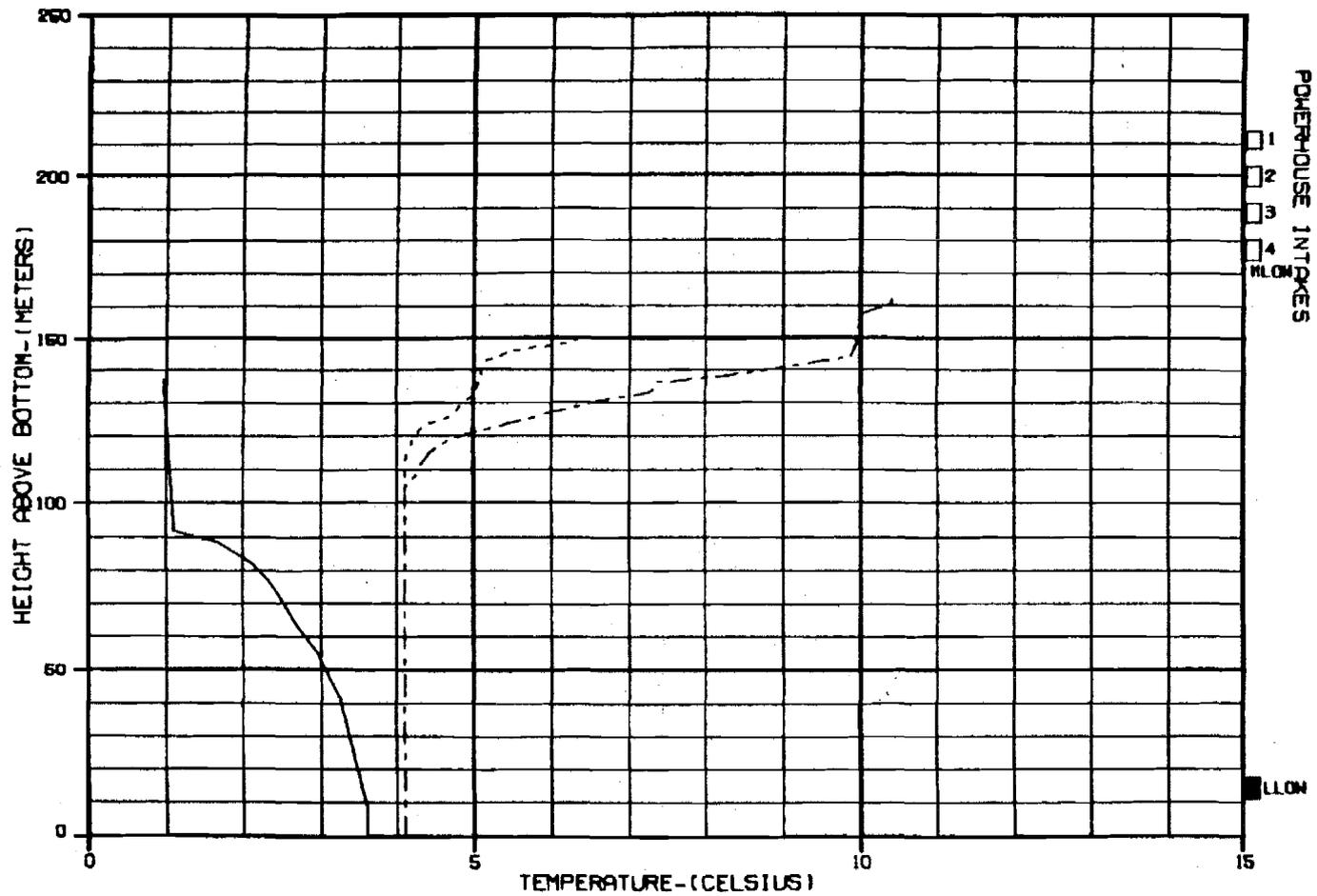
CHONG - ALPERS 25 JAN 84 42-010-04



CASE: WAB1182)FILE - WATANA RESERVOIR FILLING
 - LOW-LEVEL OUTLET OPERATION UNTIL RESERVOIR
 ELEVATION ALLOWS MID-LEVEL OPERATION (8 AUG 81)

LEGEND:
 PREDICTED TEMPERATURE PROFILES:
 _____ | AUGUST 1981
 - - - - - | SEPTEMBER 1981
 - . - . - | OCTOBER 1981

ALASKA POWER AUTHORITY	
SUBMITTA PROJECT	OPERATION MODEL
WATANA RESERVOIR TEMPERATURE PROFILES	
HARZA-EBASCO JOINT VENTURE	
CHGCRS. RLDPRTS	42-010-04



CASE: WAB1182)FILE - WATANA RESERVOIR FILLING

- LOW-LEVEL OUTLET OPERATION UNTIL RESERVOIR ELEVATION ALLOWS MID-LEVEL OPERATION (8 AUG 81)

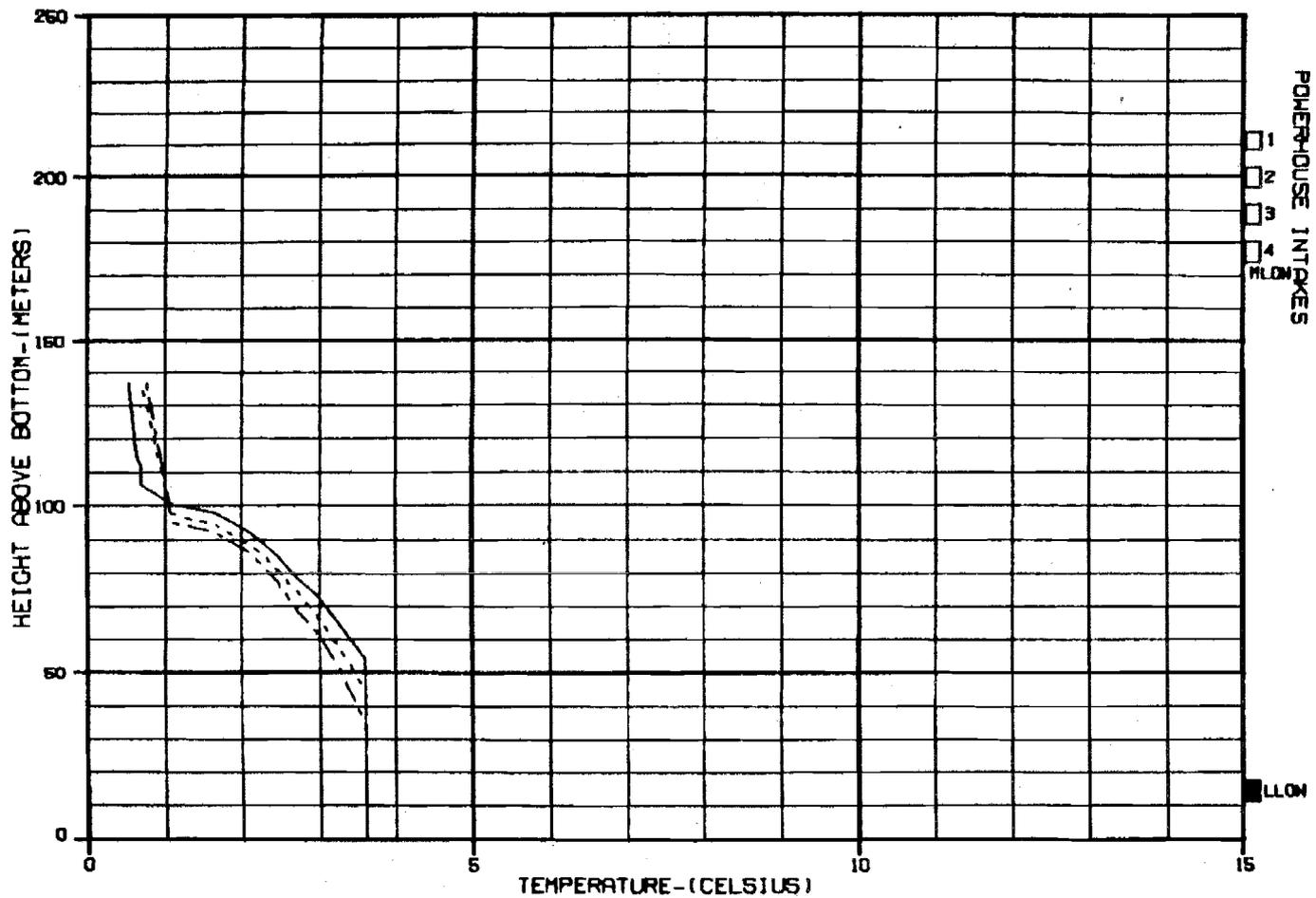
LEGEND: PREDICTED TEMPERATURE PROFILES:

_____ 1 MAY 1981

..... 1 JUNE 1981

----- 1 JULY 1981

ALASKA POWER AUTHORITY		
SUSTAINA PROJECT	DYRESEN MODEL	
WATANA RESERVOIR		
TEMPERATURE PROFILES		
HARZA-EBASCO JOINT VENTURE		
CHECKED: D.L. BERT	28 JAN 84	42-010-04



CASE: WAB1(B2)FILE - WATANA RESERVOIR FILLING W
 - LOW-LEVEL OUTLET OPERATION UNTIL RESERVOIR
 ELEVATION ALLOWS MID-LEVEL OPERATION (8 AUG 81)

LEGEND: PREDICTED TEMPERATURE PROFILES:
 _____ 1 FEBRUARY 1981
 1 MARCH 1981
 - - - - - 1 APRIL 1981

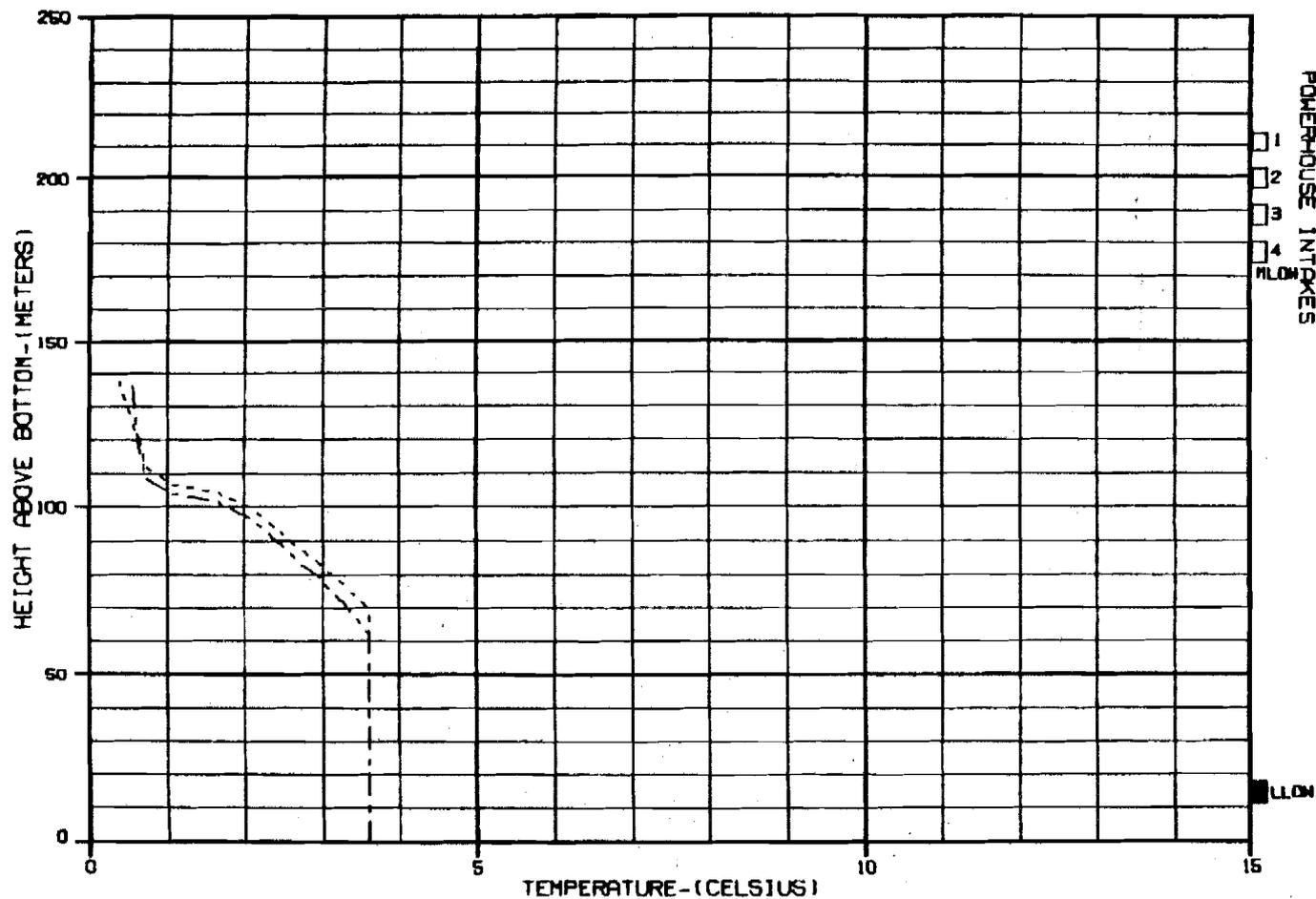
ALASKA POWER AUTHORITY

SUBMITTA PROJECT DYNEM MODEL

WATANA RESERVOIR
 TEMPERATURE PROFILES

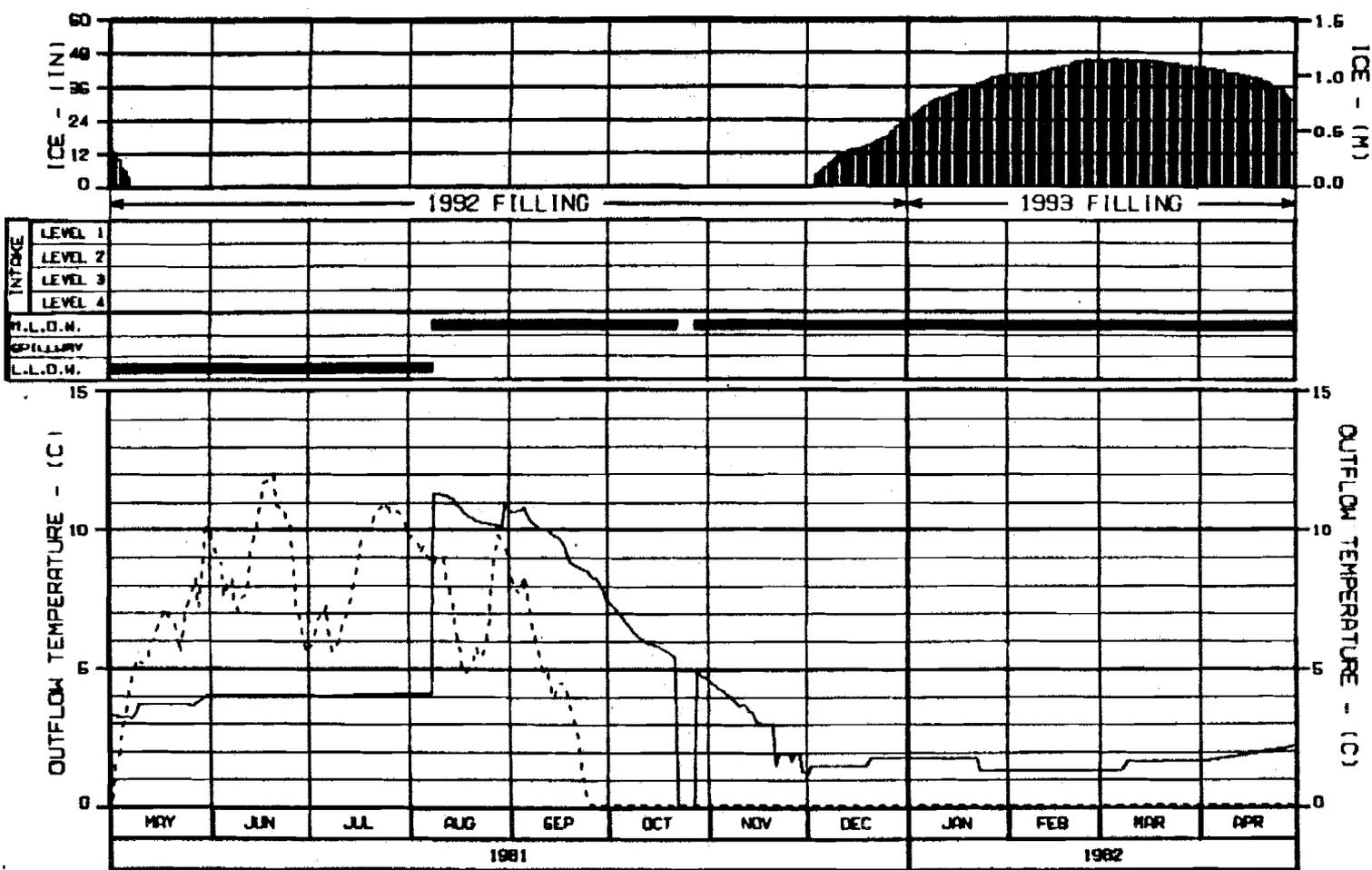
HARZA-EBASCO JOINT VENTURE

CHECKED: ALLIEN 20 JAN 84 42-D10-04



CASE: WAB11821FILE - WATANA RESERVOIR FILLING
 - LOW-LEVEL OUTLET OPERATION UNTIL RESERVOIR
 ELEVATION ALLOWS MID-LEVEL OPERATION (8 AUG 81)
 LEGEND:
 PREDICTED TEMPERATURE PROFILES:
 _____ 1 NOVEMBER 1980
 - - - - - 1 DECEMBER 1980
 - . - . - 1 JANUARY 1981

ALASKA POWER AUTHORITY	
SUBITNA PROJECT	OPENSH MODEL
WATANA RESERVOIR TEMPERATURE PROFILES	
HARZA-EBASCO JOINT VENTURE	
ENGINEER: J.L. BATES	DATE: JAN 81
42-010-04	



LEGEND: ■■■■■ HABIFILE - WATANA FILLING OPERATION ■■■■■
 LLOM OPERATION UNTIL RESERVOIR LEVEL ALLOWS FLOW OPERATION
 ——— PREDICTED OUTFLOW TEMPERATURE
 - - - - - INFLOW TEMPERATURE

- NOTES: 1. INTAKE PORT LEVEL 1 AT ELEVATION 2151 FT (655.6 M)
 2. INTAKE PORT LEVEL 2 AT ELEVATION 2114 FT (644.3 M)
 3. INTAKE PORT LEVEL 3 AT ELEVATION 2077 FT (633.1 M)
 4. INTAKE PORT LEVEL 4 AT ELEVATION 2040 FT (621.9 M)
 5. CONE VALVE (MLOM) AT ELEVATION 2040 FT (621.9 M)
 6. SPILLWAY CREST AT ELEVATION 2148 FT (654.7 M)
 7. LOW LEVEL OUTLET WORKS (LLOM) ELEV. 1509 FT (459.96 M)

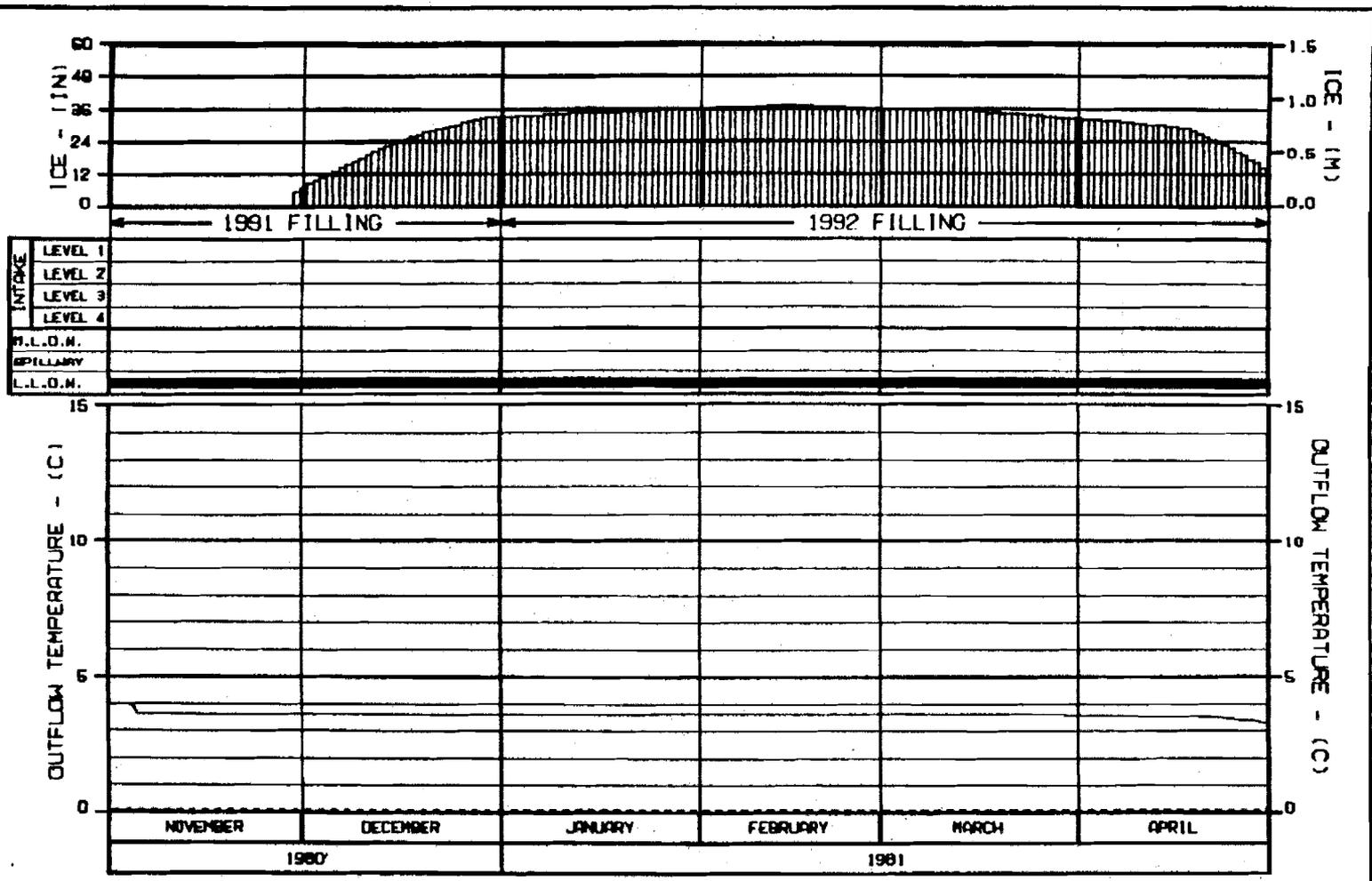
ALASKA POWER AUTHORITY

SUBMITTA PROJECT DYNESIM MODEL

WATANA RESERVOIR
 OUTFLOW TEMPERATURE
 AND ICE GROWTH

HARZA-EBASCO JOINT VENTURE

CHECKED: ELL-D-876 28 JUN 84 48-910-00



LEGEND: CASE: ■■■■■ WASIFILE - WATANA FILLING OPERATION ■■■■■
 ■■■■■ FLOW OPERATION UNTIL RESERVOIR LEVEL ALLOWS FLOW OPERATION
 ——— PREDICTED OUTFLOW TEMPERATURE
 - - - - - INFLOW TEMPERATURE

- NOTES: 1. INTAKE PORT LEVEL 1 AT ELEVATION 2151 FT (655.6 M)
 2. INTAKE PORT LEVEL 2 AT ELEVATION 2114 FT (644.3 M)
 3. INTAKE PORT LEVEL 3 AT ELEVATION 2077 FT (633.1 M)
 4. INTAKE PORT LEVEL 4 AT ELEVATION 2040 FT (621.9 M)
 5. CONE VALVE (FLOW) AT ELEVATION 2040 FT (621.9 M)
 6. SPILLWAY CREST AT ELEVATION 2149 FT (654.7 M)
 7. LOW LEVEL OUTLET WORKS (FLOW) ELEV. 1509 FT (468.96 M)

ALASKA POWER AUTHORITY

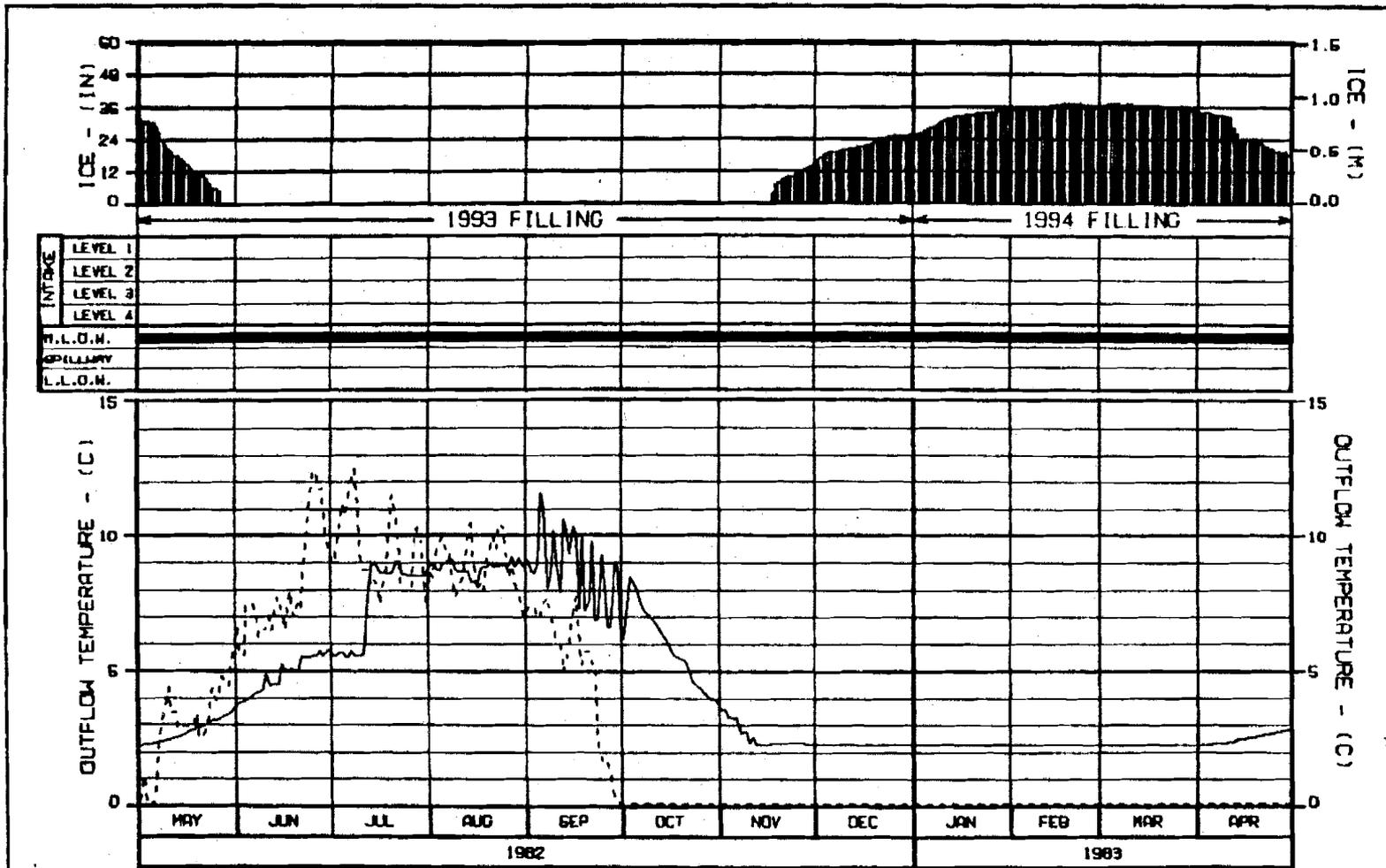
WATANA PROJECT DYNEMO MODEL

WATANA RESERVOIR
 OUTFLOW TEMPERATURE
 AND ICE GROWTH

HARZA-EBASCO JOINT VENTURE

ENGINEER: ILLINOIS 08 JUN 81 48-910-84

EXHIBIT P



LEGEND: CASE: WATANA RESERVOIR - WATANA FILLING OPERATION
 LLOW OPERATION UNTIL RESERVOIR LEVEL ALLOWS FLOW OPERATION
 ——— PREDICTED OUTFLOW TEMPERATURE
 - - - - - INFLOW TEMPERATURE

- NOTES:
1. INTAKE PORT LEVEL 1 AT ELEVATION 2151 FT (655.6 M)
 2. INTAKE PORT LEVEL 2 AT ELEVATION 2114 FT (644.3 M)
 3. INTAKE PORT LEVEL 3 AT ELEVATION 2077 FT (633.1 M)
 4. INTAKE PORT LEVEL 4 AT ELEVATION 2040 FT (621.8 M)
 5. CONE VALVE (INLOW) AT ELEVATION 2040 FT (621.8 M)
 6. SPILLWAY CREST AT ELEVATION 2148 FT (654.7 M)
 7. LOW LEVEL OUTLET WORKS (LLOW) ELEV. 1508 FT (459.96 M)

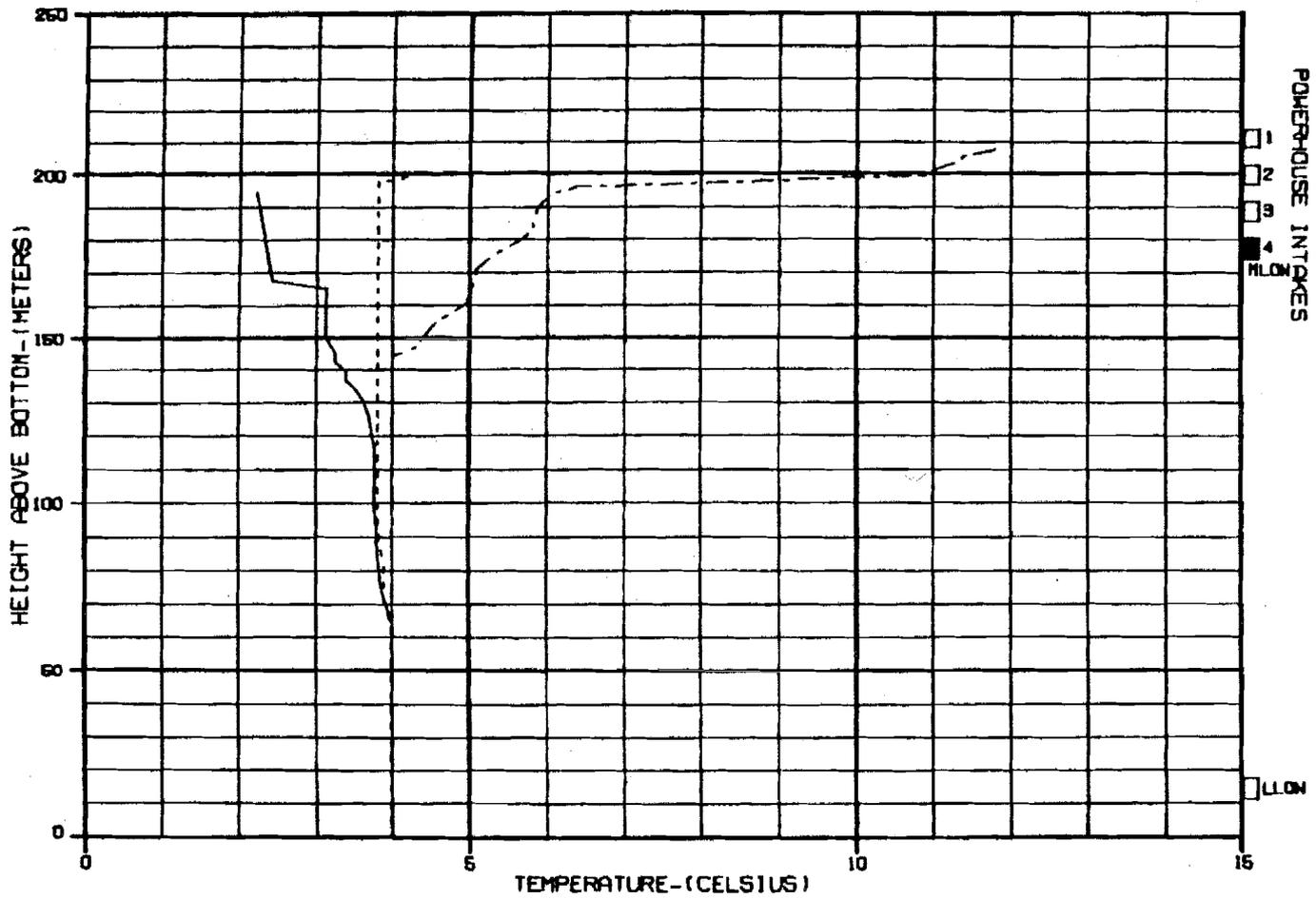
ALASKA POWER AUTHORITY

SUBMITTA PROJECT DYNESHA MODEL

WATANA RESERVOIR
 OUTFLOW TEMPERATURE
 AND ICE GROWTH

HARZA-EBASCO JOINT VENTURE

CHECKED: J.L. DAVIS 28 JUN 84 48-510-04



CASE: WAB11821 FILE - WATANA RESERVOIR FILLING
 - LOW-LEVEL OUTLET OPERATION UNTIL RESERVOIR
 ELEVATION ALLOWS MID-LEVEL OPERATION (8 AUG 81)

LEGEND: PREDICTED TEMPERATURE PROFILES:
 _____ | MAY 1982
 - - - - - | JUNE 1982
 - - - - - | JULY 1982

ALASKA POWER AUTHORITY	
SUBTNA PROJECT	DYNAM MODEL
WATANA RESERVOIR TEMPERATURE PROFILES	
HARZA-EBASCO JOINT VENTURE	
DESIGN - ALL DATA	26 JAN 84
42-010-04	

POWERHOUSE INTAKES
 1
 2
 3
 4
 H.L.O.M.
 L.L.O.M.



CASE: WAB1182)FILE - WATANA RESERVOIR FILLING WAB
 - LOW-LEVEL OUTLET OPERATION UNTIL RESERVOIR
 ELEVATION ALLOWS MID-LEVEL OPERATION (8 AUG 81)

LEGEND:

PREDICTED TEMPERATURE PROFILES:

— 1 AUGUST 1982
 - - - 1 SEPTEMBER 1982
 - . - . 1 OCTOBER 1982

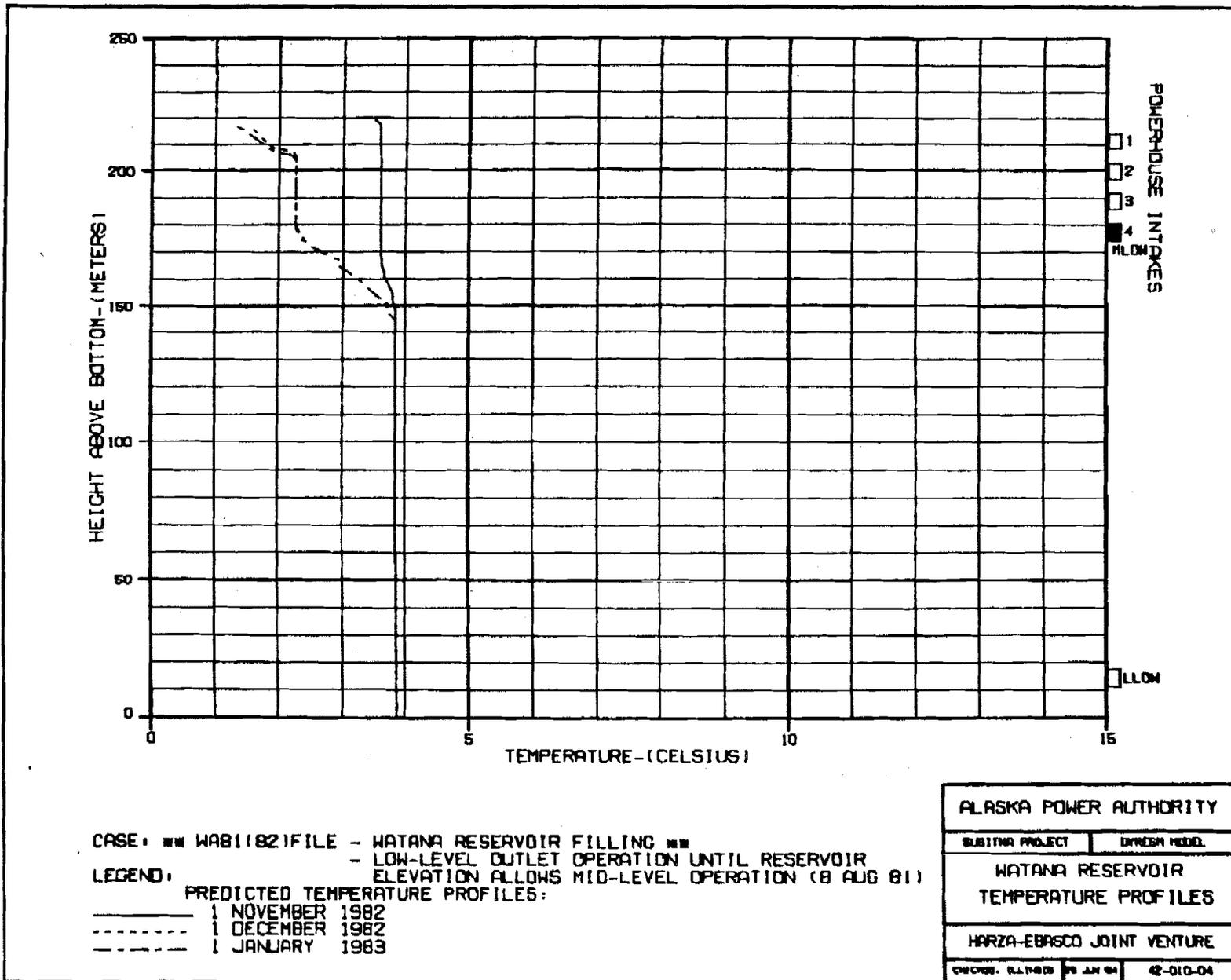
ALASKA POWER AUTHORITY

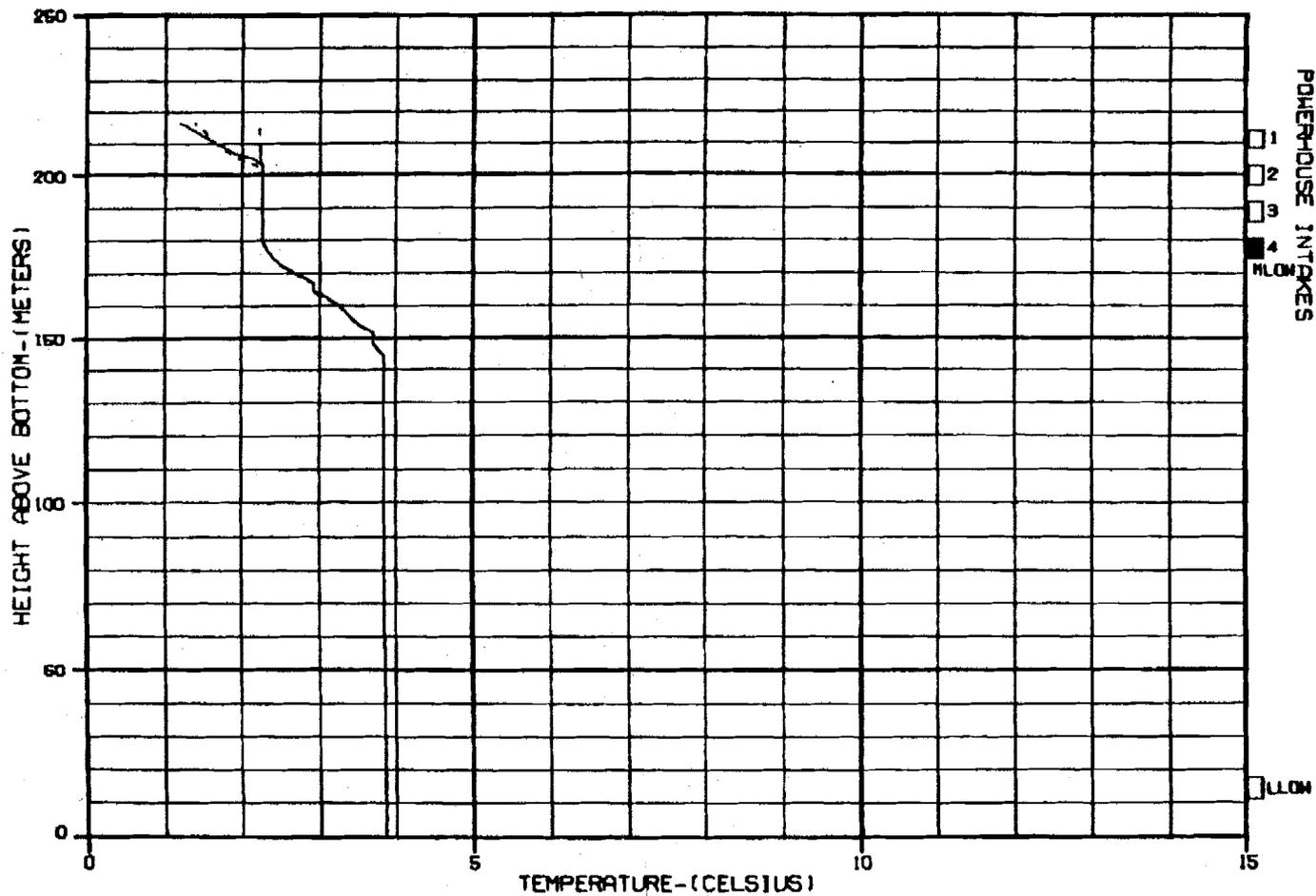
SUBITNA PROJECT DYNAM MODEL

WATANA RESERVOIR
 TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

DATE: 11/18/82 15 JAN 83 42-010-04

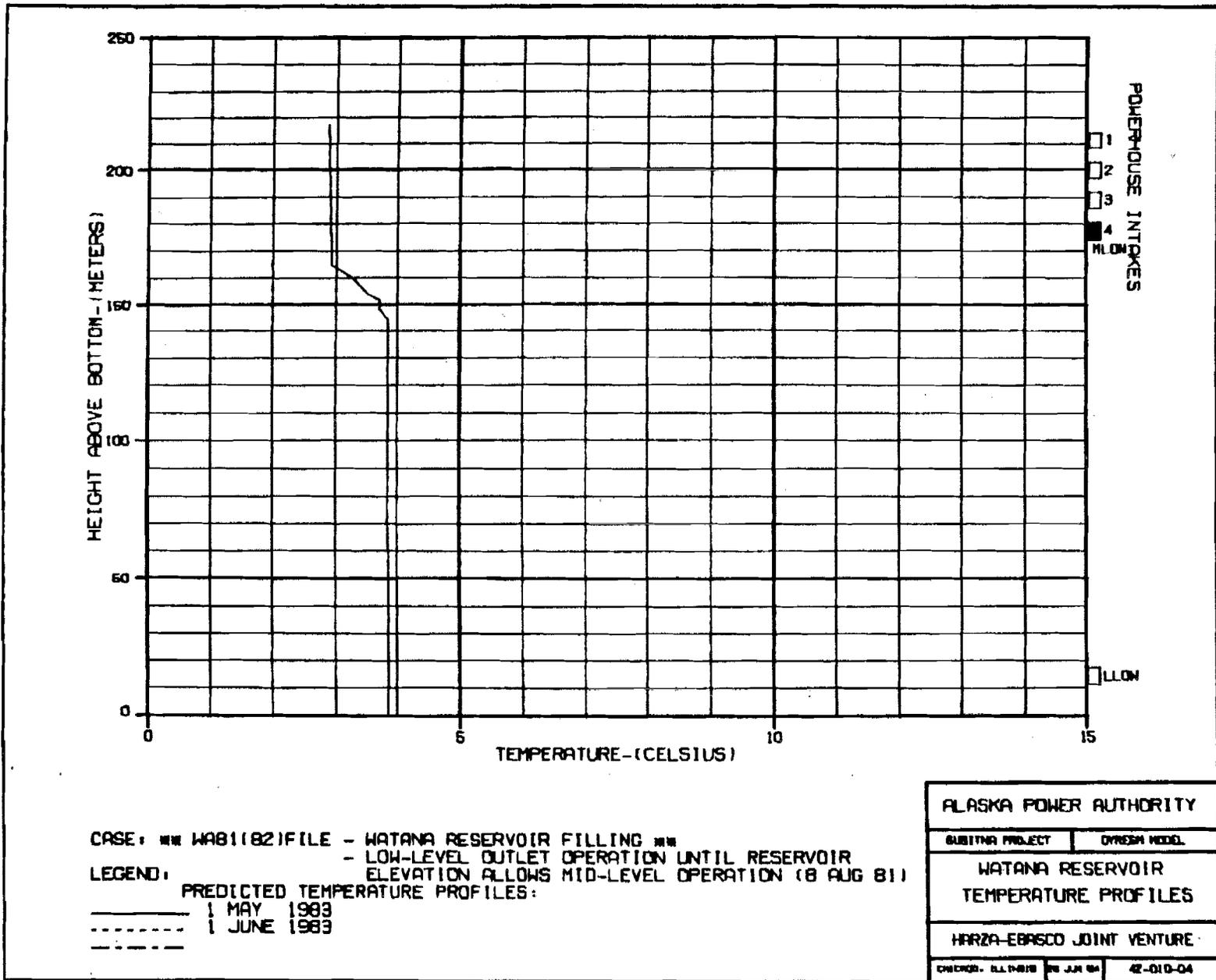




CASE: W811821FILE - WATANA RESERVOIR FILLING
 - LOW-LEVEL OUTLET OPERATION UNTIL RESERVOIR
 ELEVATION ALLOWS MID-LEVEL OPERATION (8 AUG 81)

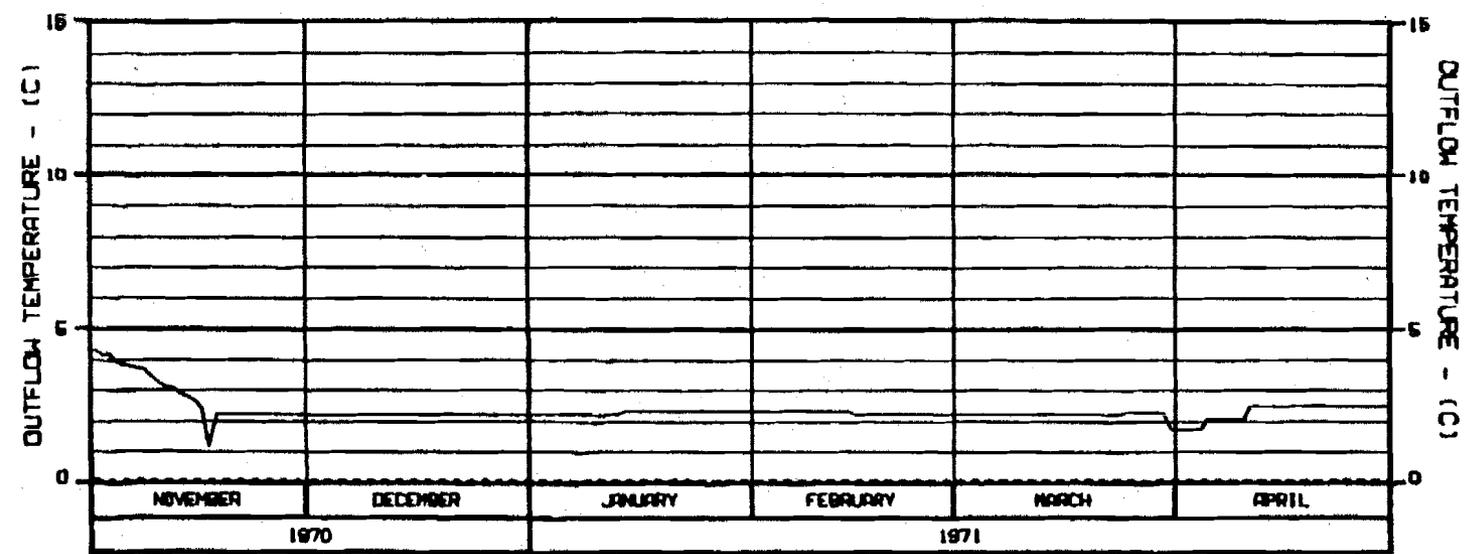
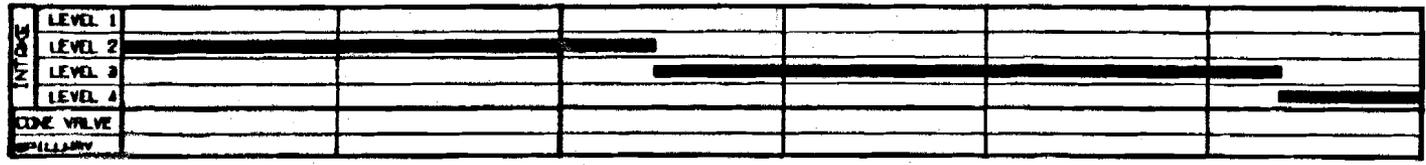
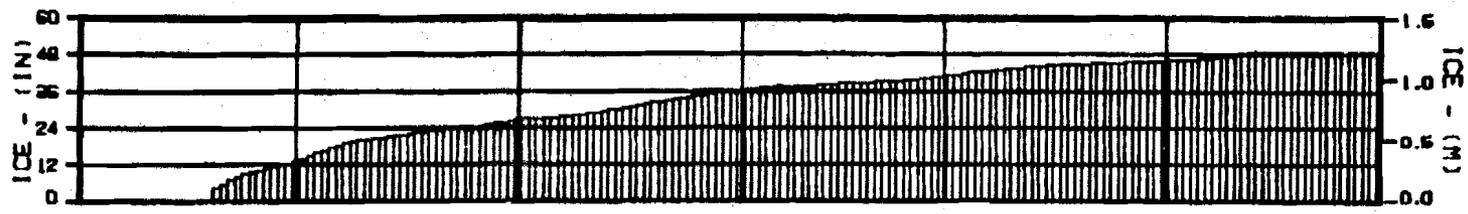
LEGEND:
 PREDICTED TEMPERATURE PROFILES:
 ———— 1 FEBRUARY 1983
 - - - - - 1 MARCH 1983
 1 APRIL 1983

ALASKA POWER AUTHORITY	
SUBITNA PROJECT	DYNOM MODEL
WATANA RESERVOIR TEMPERATURE PROFILES	
MARZA-EBASCO JOINT VENTURE	
DESIGN. REPORT NO. JAN 84	42-010-04



WATANA OPERATING
1996 Energy Demands

EXHIBIT Q

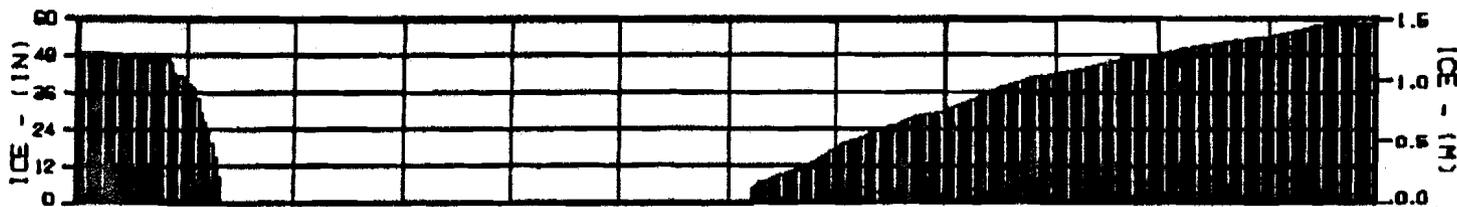


LEGEND: CASE: HA 7186A - WATANA OPERATION ALONE IN 1965 HA

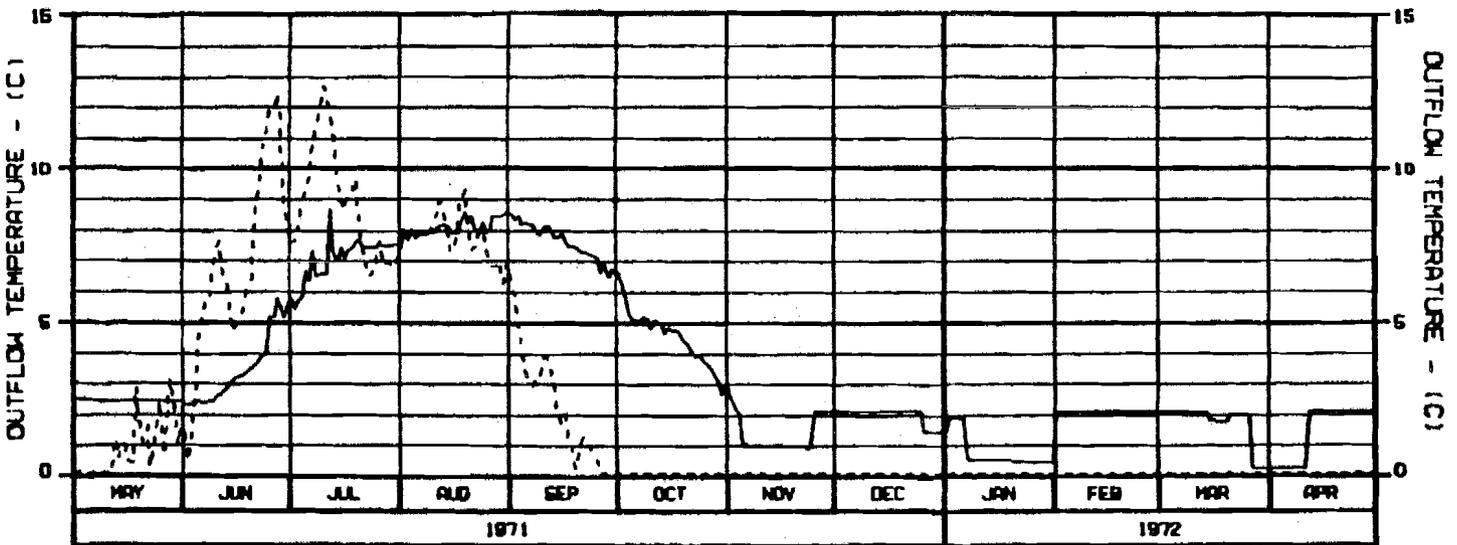
———— PREDICTED OUTFLOW TEMPERATURE
 - - - - - INFLOW TEMPERATURE

- NOTES:
1. INTAKE PORT LEVEL 1 AT ELEVATION 2161 FT (656.6 M)
 2. INTAKE PORT LEVEL 2 AT ELEVATION 2114 FT (644.3 M)
 3. INTAKE PORT LEVEL 3 AT ELEVATION 2077 FT (633.1 M)
 4. INTAKE PORT LEVEL 4 AT ELEVATION 2040 FT (621.8 M)
 5. CONE VALVE AT ELEVATION 2040 FT (621.8 M)
 6. SPILLWAY CREST AT ELEVATION 2148 FT (654.7 M)

ALASKA POWER AUTHORITY	
SUBMITTAL PROJECT	DFRASH WOOD
WATANA RESERVOIR OUTFLOW TEMPERATURE AND ICE GROWTH	
HARZA-EBASCO JOINT VENTURE	
DESIGNED: H. L. DODD	8 JAN 81
	4-000-01



INTAKE	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	CONE VALVE	SPILLWAY



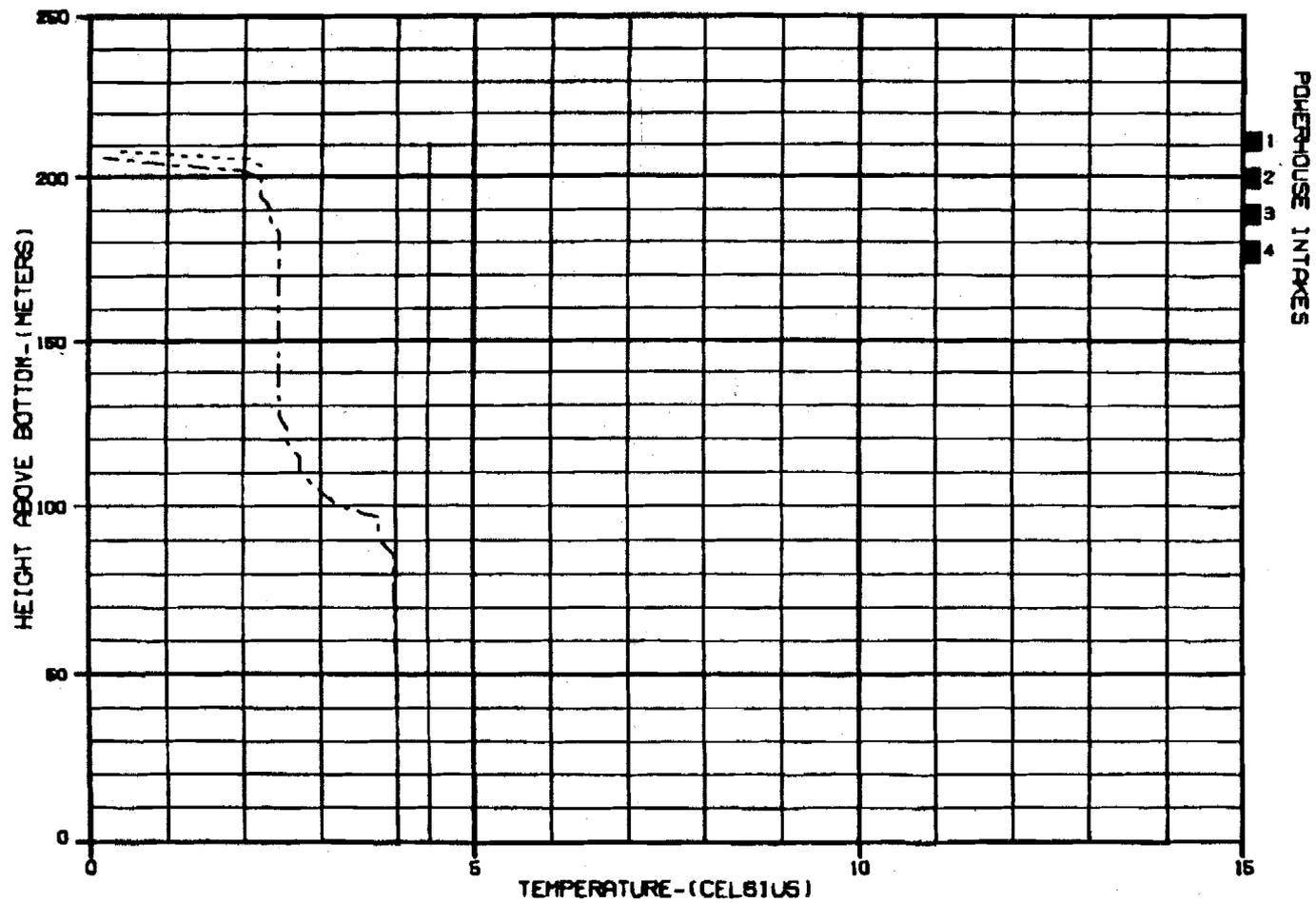
LEGEND: CASE: 88 MAY196A - WATANA OPERATION ALONE IN 1966

— PREDICTED OUTFLOW TEMPERATURE
 - - - INFLOW TEMPERATURE

- NOTES:
1. INTAKE PORT LEVEL 1 AT ELEVATION 2161 FT (656.6 M)
 2. INTAKE PORT LEVEL 2 AT ELEVATION 2114 FT (644.2 M)
 3. INTAKE PORT LEVEL 3 AT ELEVATION 2077 FT (633.1 M)
 4. INTAKE PORT LEVEL 4 AT ELEVATION 2040 FT (621.9 M)
 5. CONE VALVE AT ELEVATION 2040 FT (621.9 M)
 6. SPILLWAY CREST AT ELEVATION 2149 FT (654.7 M)

ALASKA POWER AUTHORITY

EXISTING PROJECT	OPENED MODEL
WATANA RESERVOIR OUTFLOW TEMPERATURE AND ICE GROWTH	
HARZA-EBASCO JOINT VENTURE	
ENGINEER: ILLINOIS	DATE: 8 JAN 81
48-100-01	



CASE: ■■ WA7196A - WATANA OPERATION ALONE IN 1996 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

————— | NOVEMBER 1970
 - - - - - | DECEMBER 1970
 - · - · - | JANUARY 1971

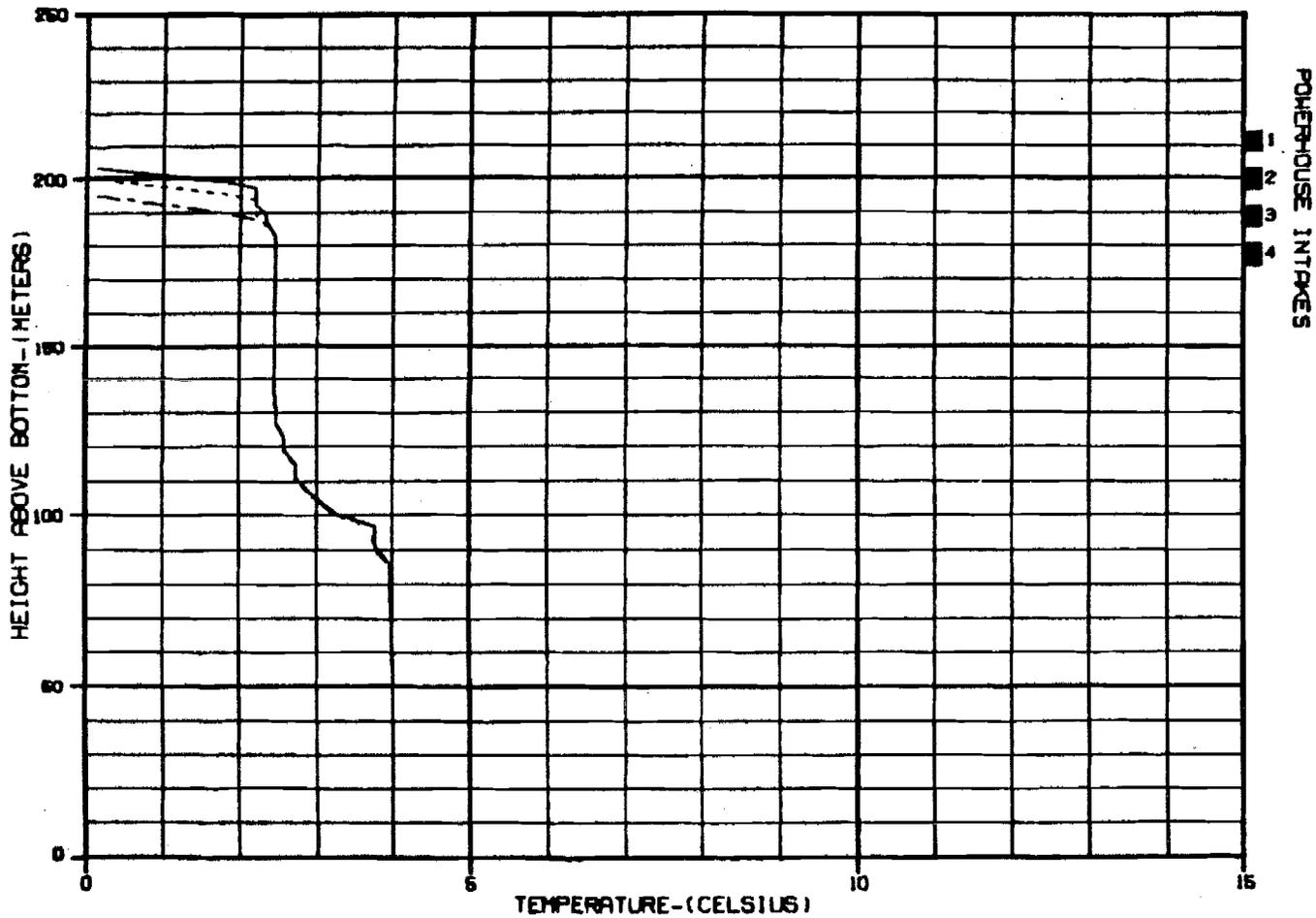
ALASKA POWER AUTHORITY

WATANA PROJECT DYKORN MODEL

WATANA RESERVOIR
 TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

DESIGN: ALL PAGES 8 JAN 81 ©-010-04



CASE: ■■ WA7196A - WATANA OPERATION ALONE IN 1996 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

— | FEBRUARY 1971
 | MARCH 1971
 - - - - | APRIL 1971

ALASKA POWER AUTHORITY

EXISTING PROJECT

HYDRO MODEL

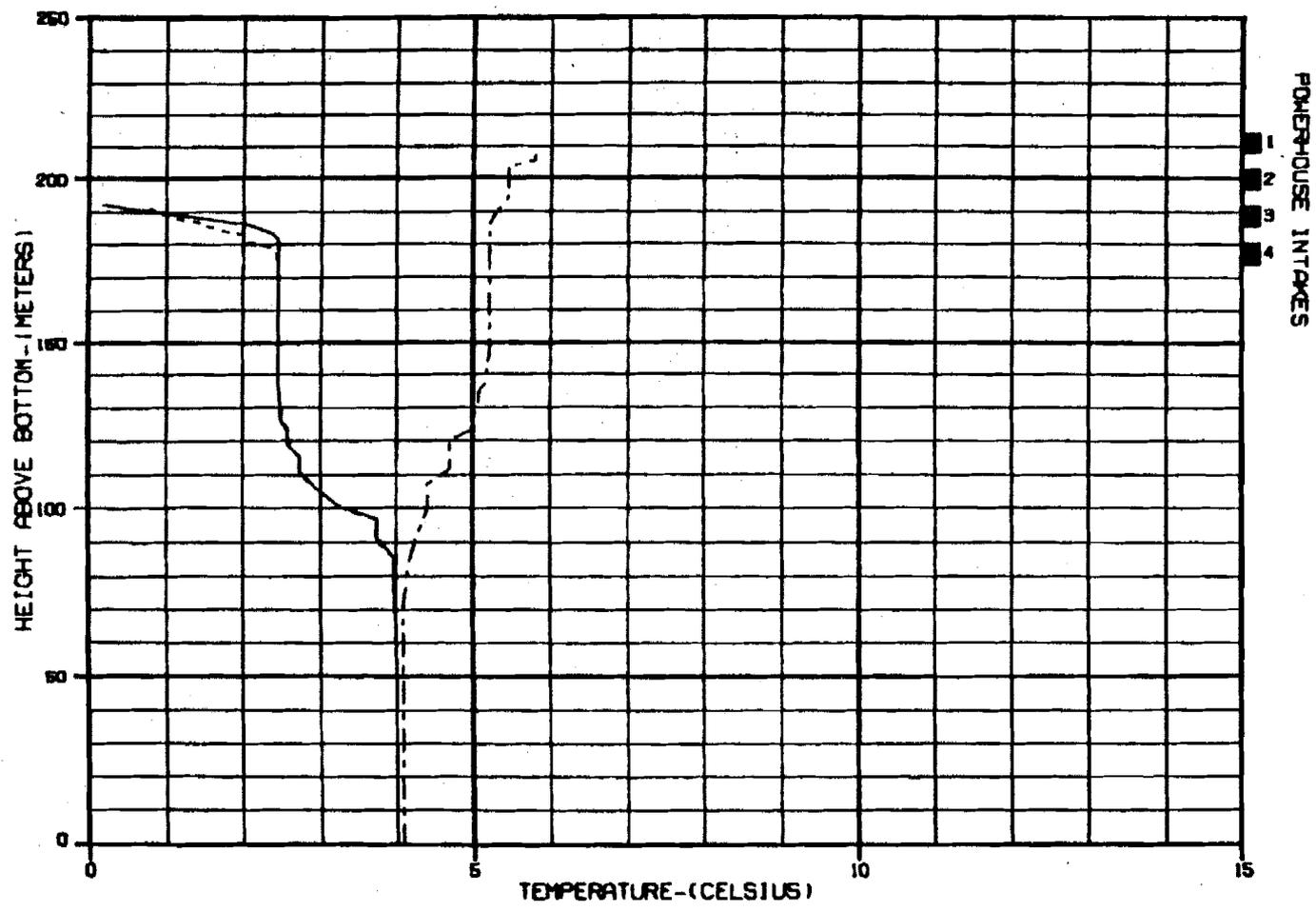
WATANA RESERVOIR
 TEMPERATURE PROFILES

WARZA-EBASCO JOINT VENTURE

CHUCK B. LINDS

8 JAN 84

42-010-04

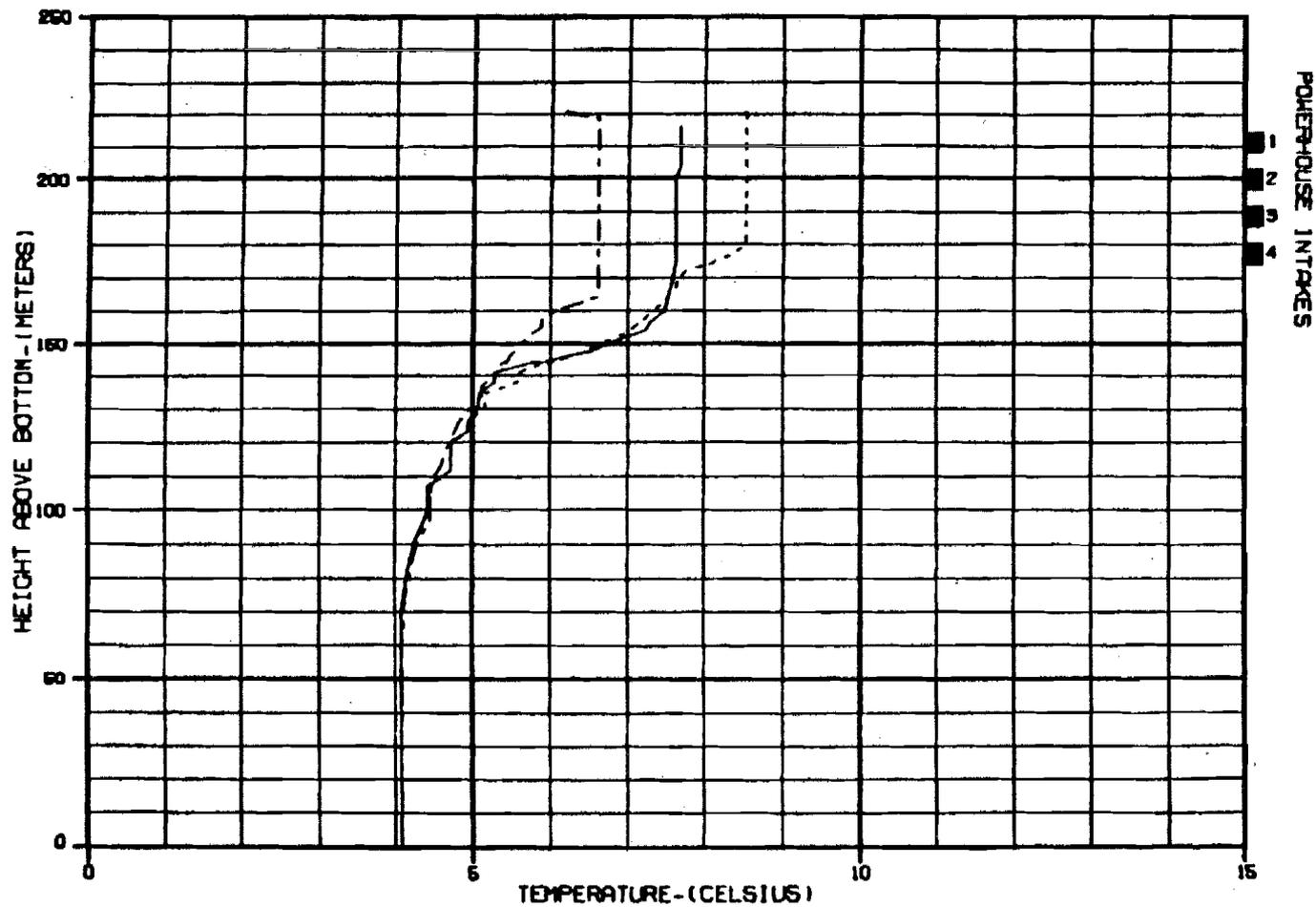


POWERHOUSE INTAKES
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4

CASE: ■■ WA7196A - WATANA OPERATION ALONE IN 1996 ■■

LEGEND: PREDICTED TEMPERATURE PROFILES:
 ——— 1 MAY 1971
 - - - - 1 JUNE 1971
 - · - · 1 JULY 1971

ALASKA POWER AUTHORITY		
WATANA PROJECT	DYNAMIC MODEL	
WATANA RESERVOIR TEMPERATURE PROFILES		
WARZA-EBRSCO JOINT VENTURE		
ENCLOS. 5.1.1.1.1.1.1	5 JAN 84	42-010-04



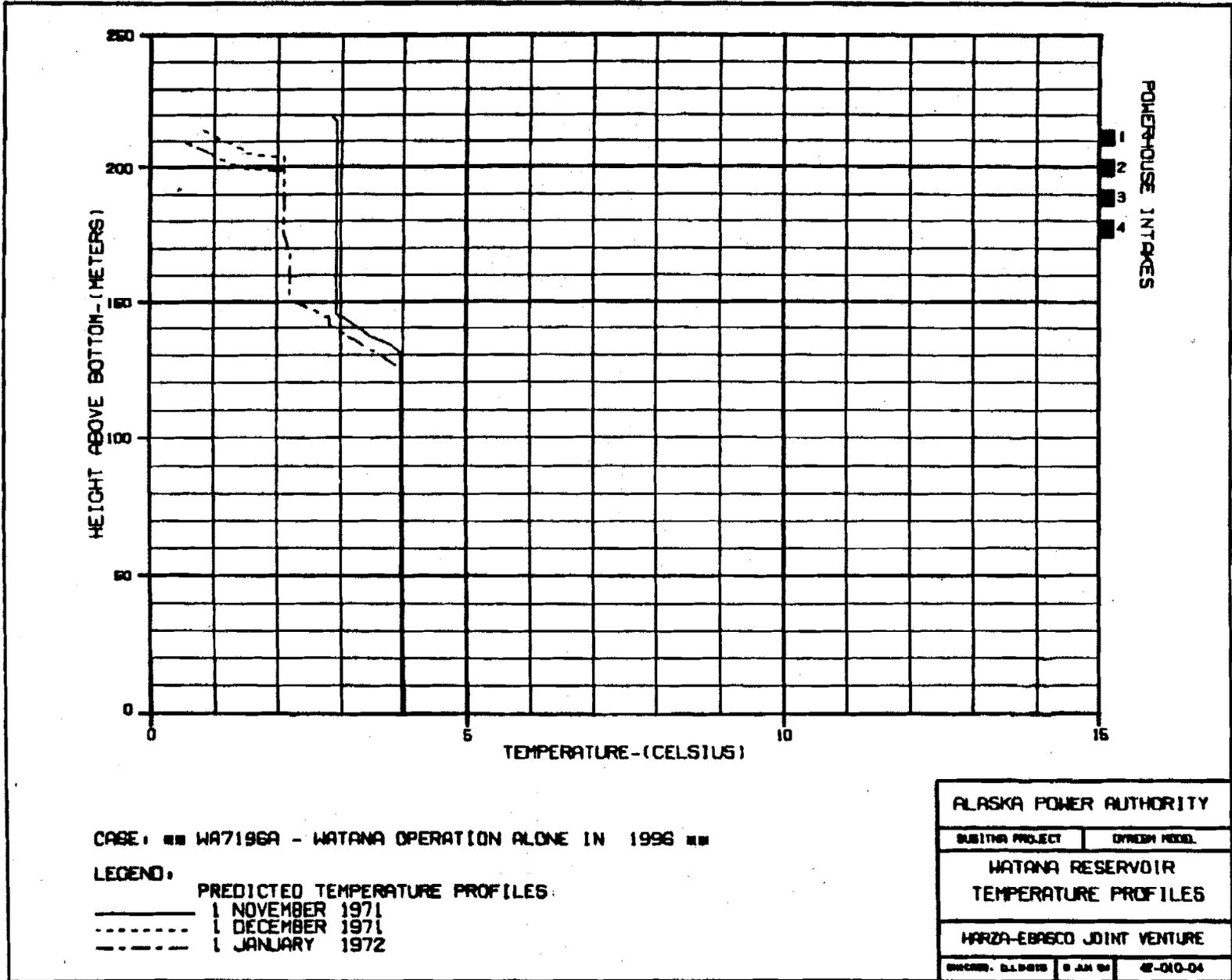
CASE: ■■ WA7196A - WATANA OPERATION ALONE IN 1996 ■■

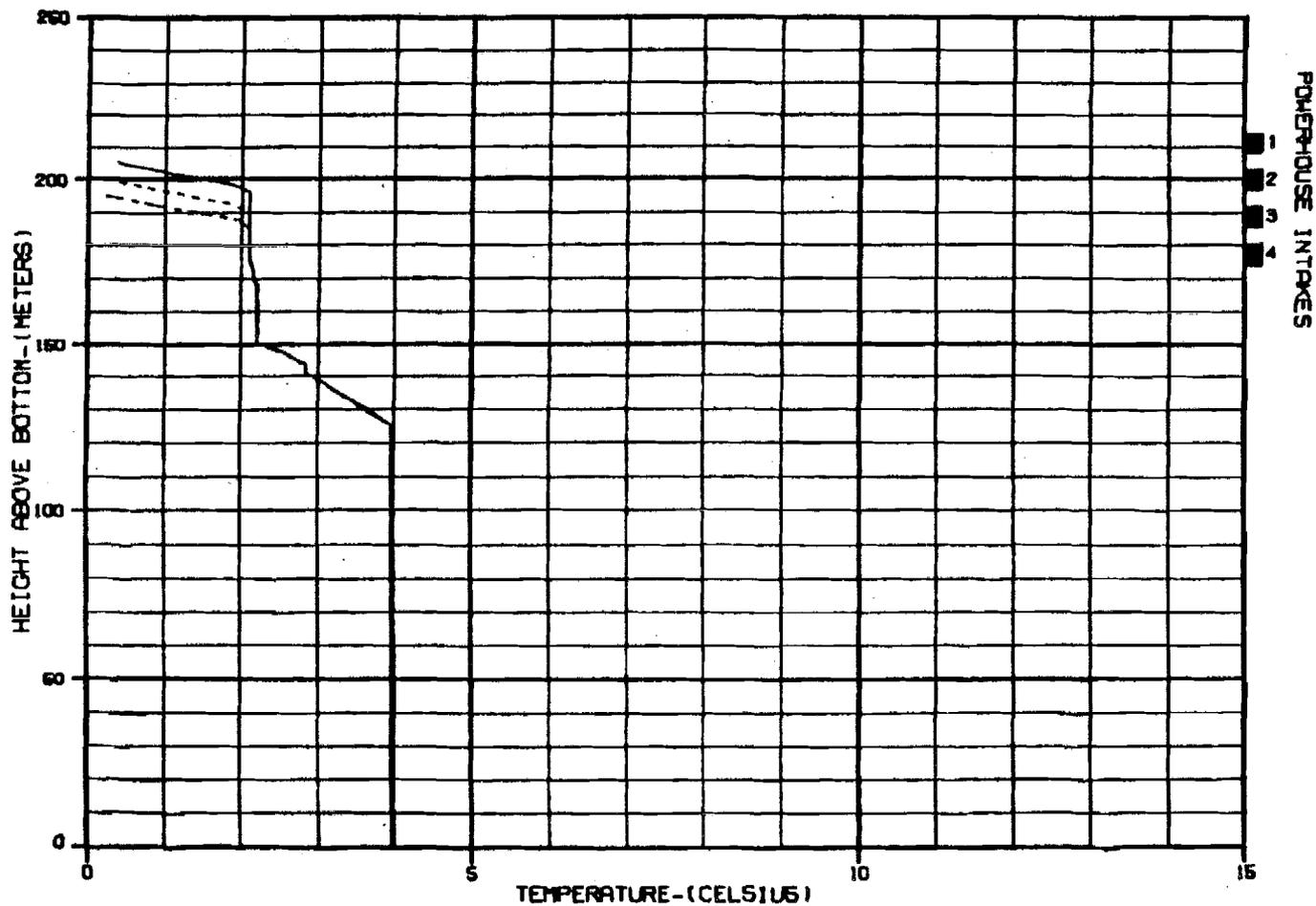
LEGEND:

PREDICTED TEMPERATURE PROFILES:

- | AUGUST 1971
- - - | SEPTEMBER 1971
- · - · | OCTOBER 1971

ALASKA POWER AUTHORITY		
BASELINE PROJECT	DYNEMO MODEL	
WATANA RESERVOIR		
TEMPERATURE PROFILES		
WARZA-EBASCO JOINT VENTURE		
DESIGN: ELLIOTT	9 JAN 81	4E-010-04

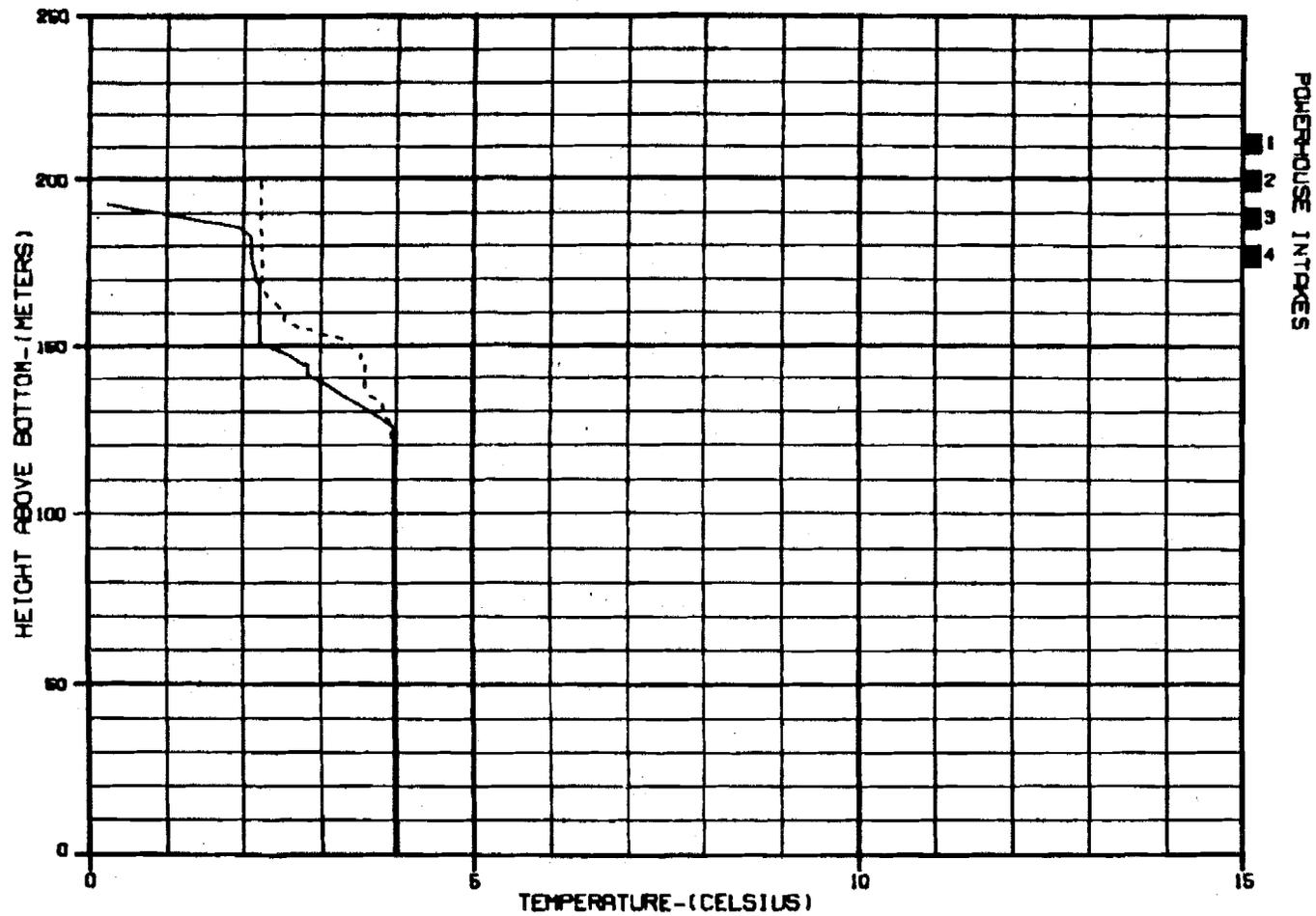




CASE: ■■ WA7196A - WATANA OPERATION ALONE IN 1996 ■■

LEGEND: PREDICTED TEMPERATURE PROFILES:
 ———— | FEBRUARY 1972
 - - - - - | MARCH 1972
 - · - · - | APRIL 1972

ALASKA POWER AUTHORITY		
SUBTHER PROJECT	DYNEM NEED	
WATANA RESERVOIR TEMPERATURE PROFILES		
WARZA-EBASCO JOINT VENTURE		
CHIEF: ALBEN	DATE: JAN 81	REV: 010-04



POWERHOUSE INTAKES

CASE: ■■ WA7196A - WATANA OPERATION ALONE IN 1996 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

- | MAY 1972
- | JUNE 1972
- · - · - | JULY 1972

ALASKA POWER AUTHORITY

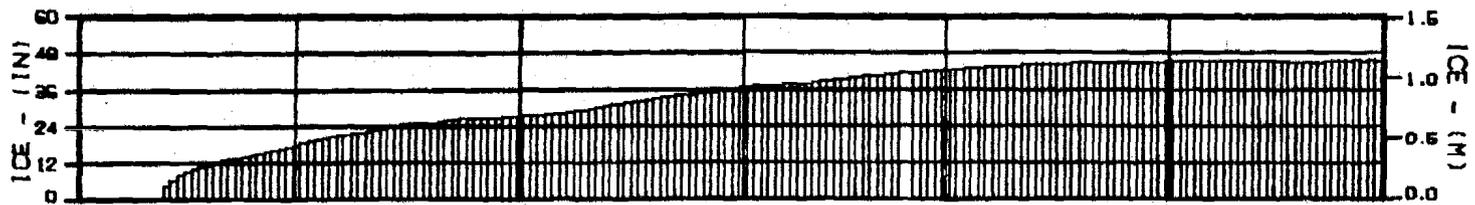
EXISTING PROJECT DYNOM MODEL

WATANA RESERVOIR
TEMPERATURE PROFILES

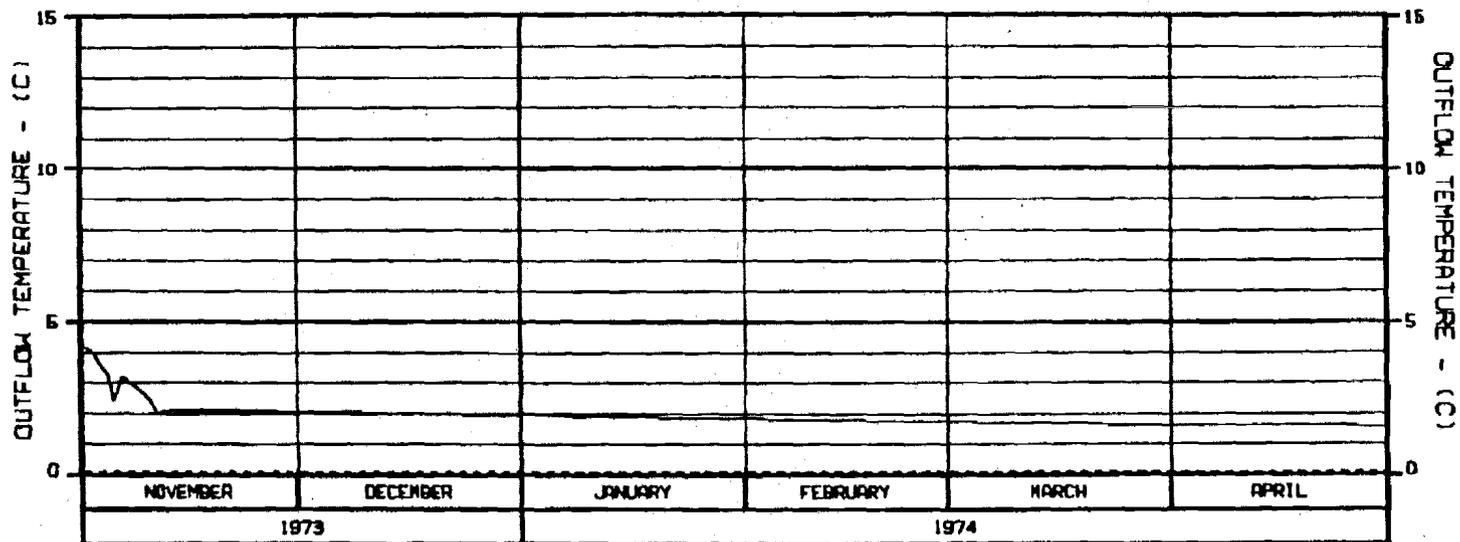
WARZA-EBASCO JOINT VENTURE

UNIVERS. ALASKA 8 JAN 84 42-010-04

EXHIBIT R



INTAKE	LEVEL 1	██████████				
	LEVEL 2	████████████████████				
	LEVEL 3	██				
	LEVEL 4	██				
	CONE VALVE					
	SPILLWAY					



LEGEND: CASE: W7486A - WATANA OPERATION ALONE IN 1996

———— PREDICTED OUTFLOW TEMPERATURE
 - - - - - INFLOW TEMPERATURE

- NOTES:
1. INTAKE PORT LEVEL 1 AT ELEVATION 2161 FT (655.6 M)
 2. INTAKE PORT LEVEL 2 AT ELEVATION 2114 FT (644.3 M)
 3. INTAKE PORT LEVEL 3 AT ELEVATION 2077 FT (633.1 M)
 4. INTAKE PORT LEVEL 4 AT ELEVATION 2040 FT (621.8 M)
 5. CONE VALVE AT ELEVATION 2040 FT (621.8 M)
 6. SPILLWAY CREST AT ELEVATION 2148 FT (654.7 M)

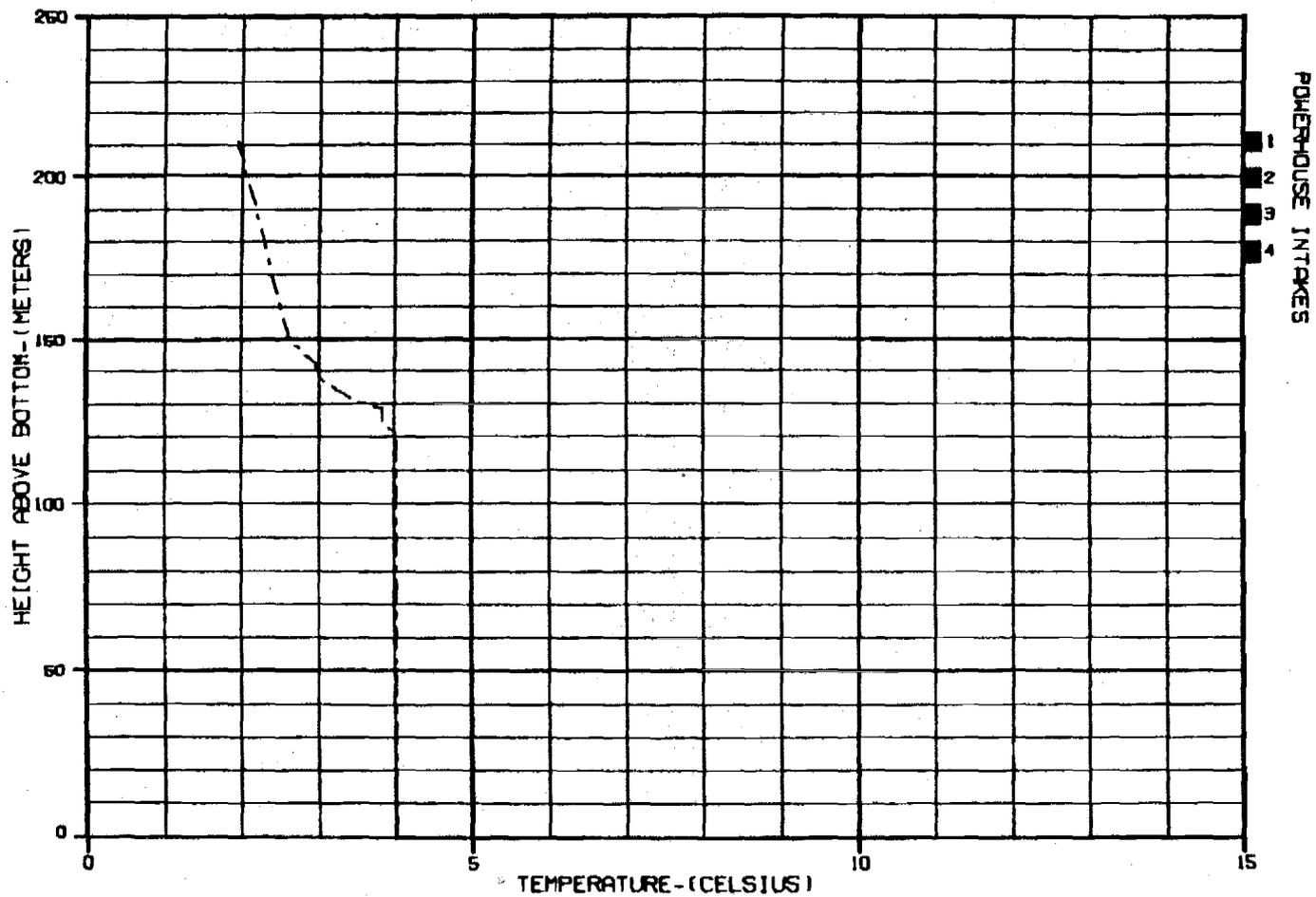
ALASKA POWER AUTHORITY

SUBSTRA PROJECT DYNESH MODEL

WATANA RESERVOIR
 OUTFLOW TEMPERATURE
 AND ICE GROWTH

HARZA-EBASCO JOINT VENTURE

CHECKED: ILLIUM 8 JUL 84 48-810-84



CASE: WA7496A - WATANA OPERATION ALONE IN 1996

LEGEND:

PREDICTED TEMPERATURE PROFILES:

— 1 NOVEMBER 1973
 - - - 1 DECEMBER 1973
 - · - 1 JANUARY 1974

ALASKA POWER AUTHORITY

GUBITNA PROJECT

DYNOSI MODEL

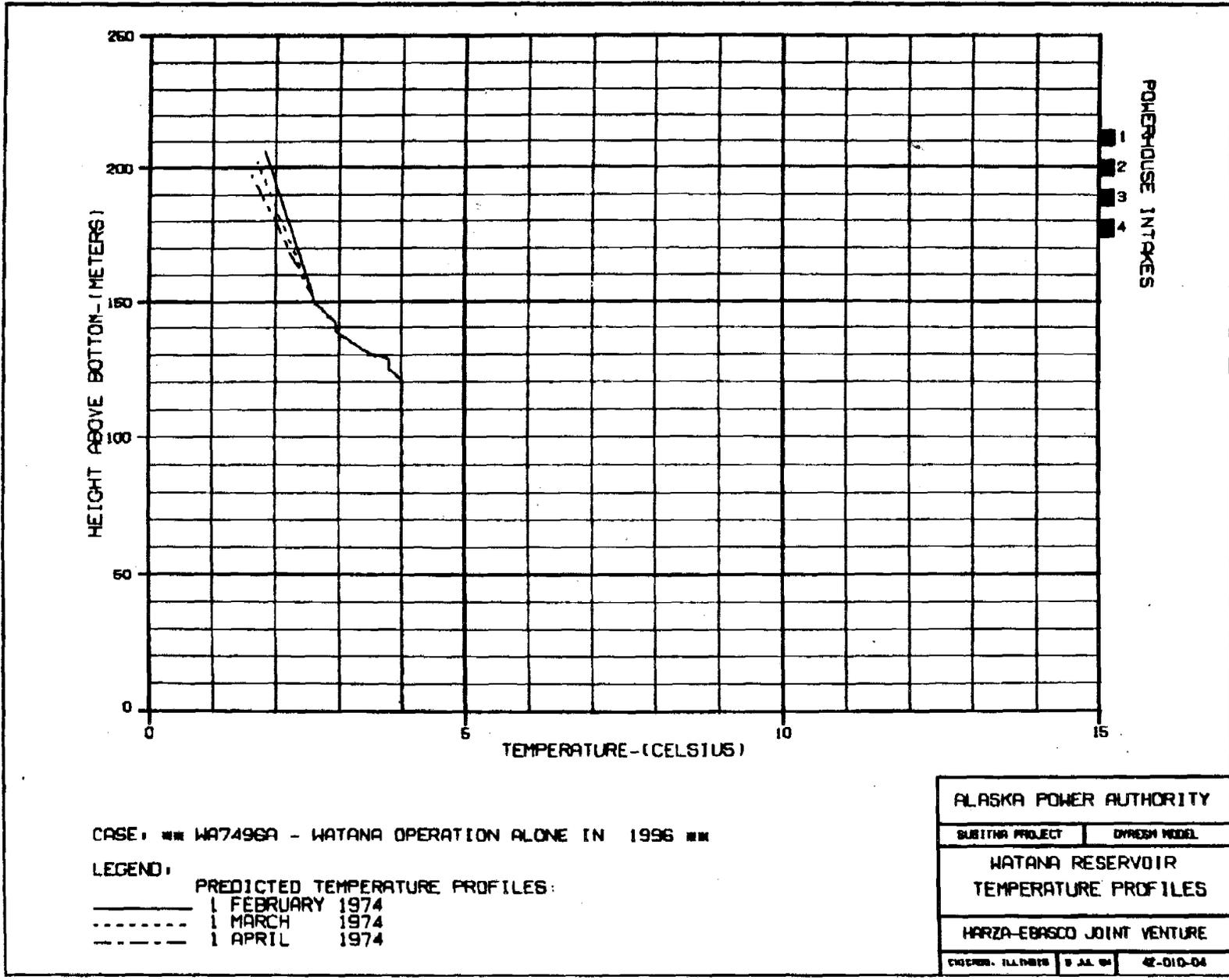
WATANA RESERVOIR
 TEMPERATURE PROFILES

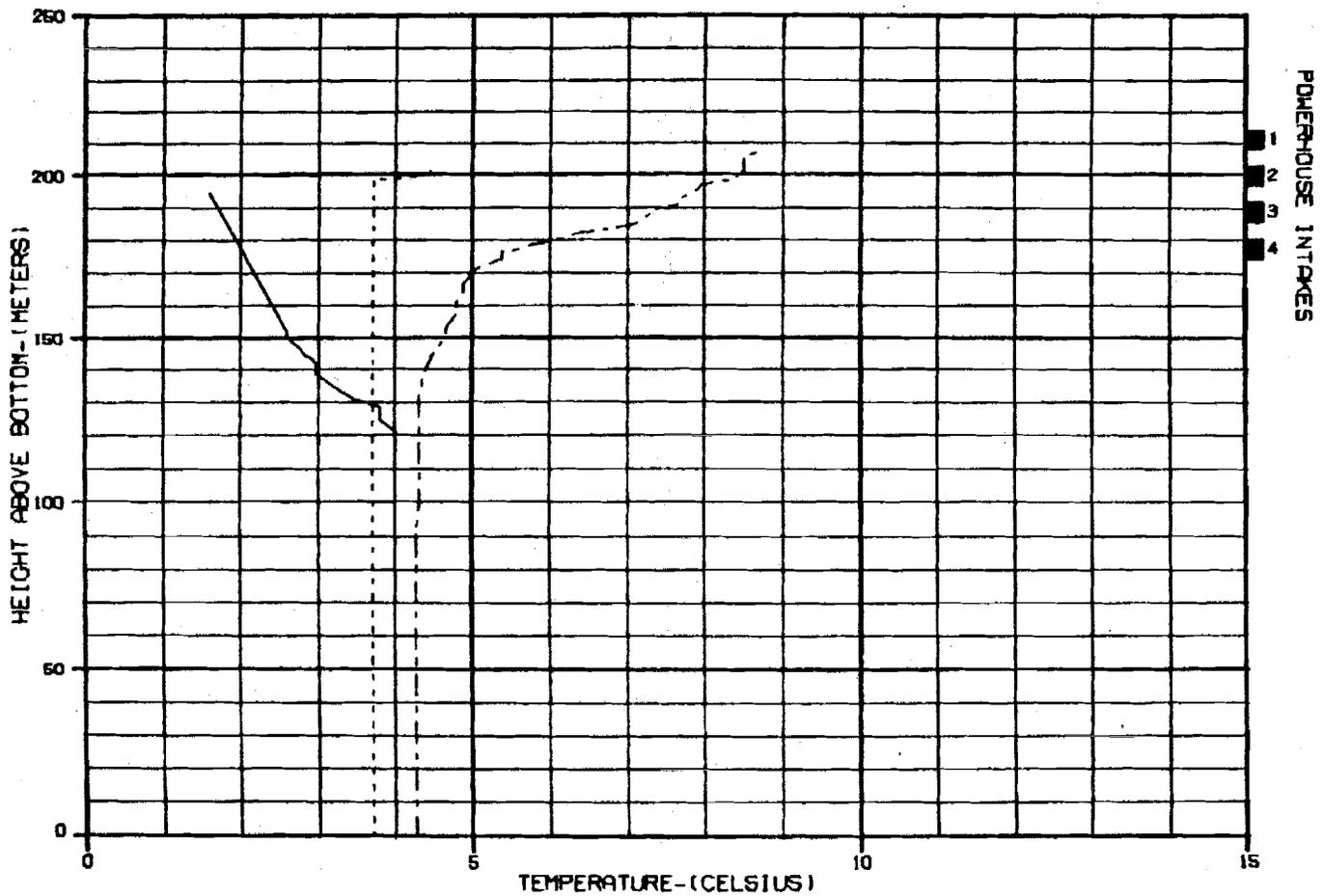
HARZA-EBASCO JOINT VENTURE

CHUCKER, ILLINOIS

8 JUL 84

42-010-04





CASE: WA7496A - WATANA OPERATION ALONE IN 1996

LEGEND:

PREDICTED TEMPERATURE PROFILES:

_____ 1 MAY 1974
 - - - - - 1 JUNE 1974
 1 JULY 1974
 - . - . - 1 JULY 1974

ALASKA POWER AUTHORITY

SUBMITTA PROJECT

DYNEM MODEL

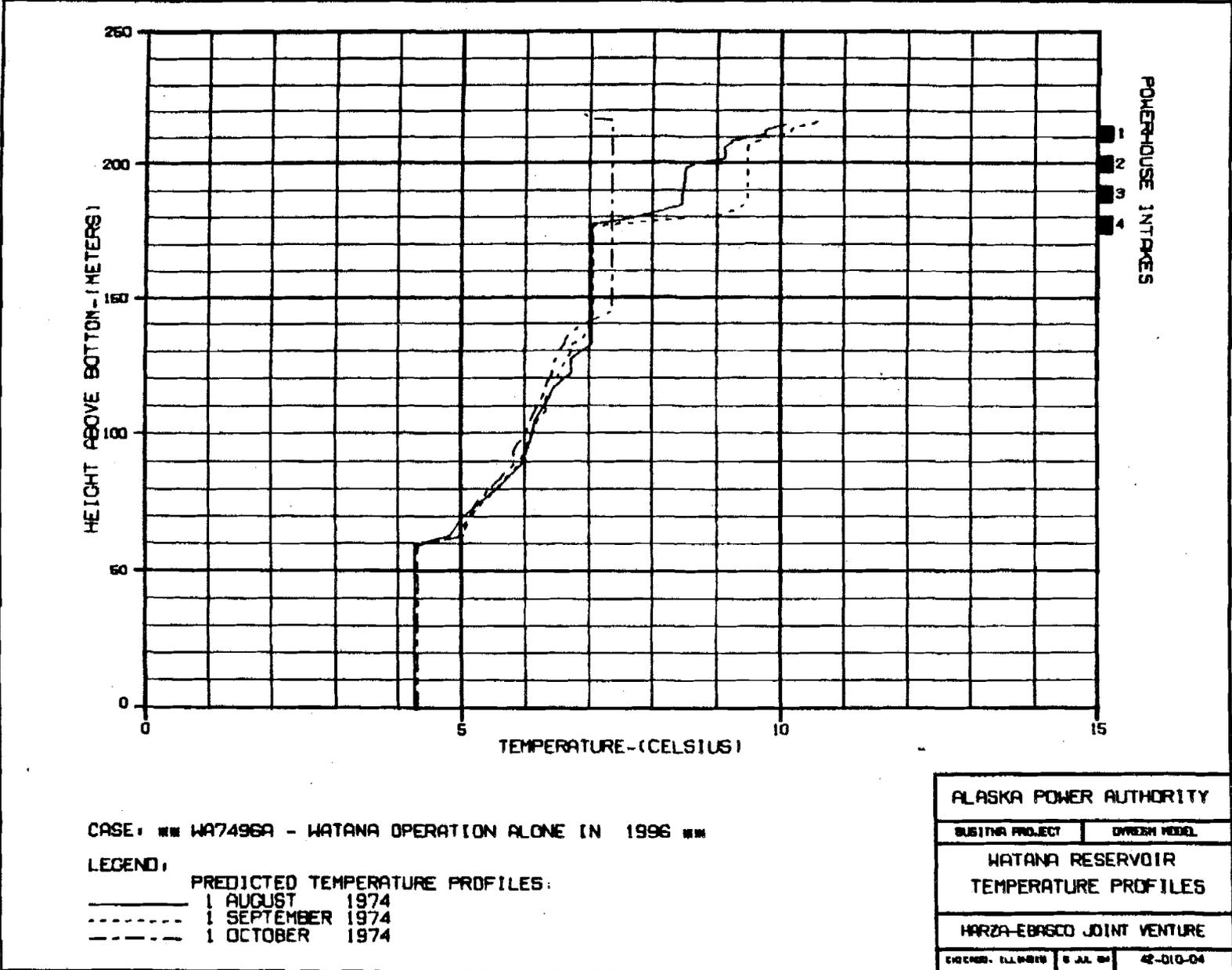
WATANA RESERVOIR
TEMPERATURE PROFILES

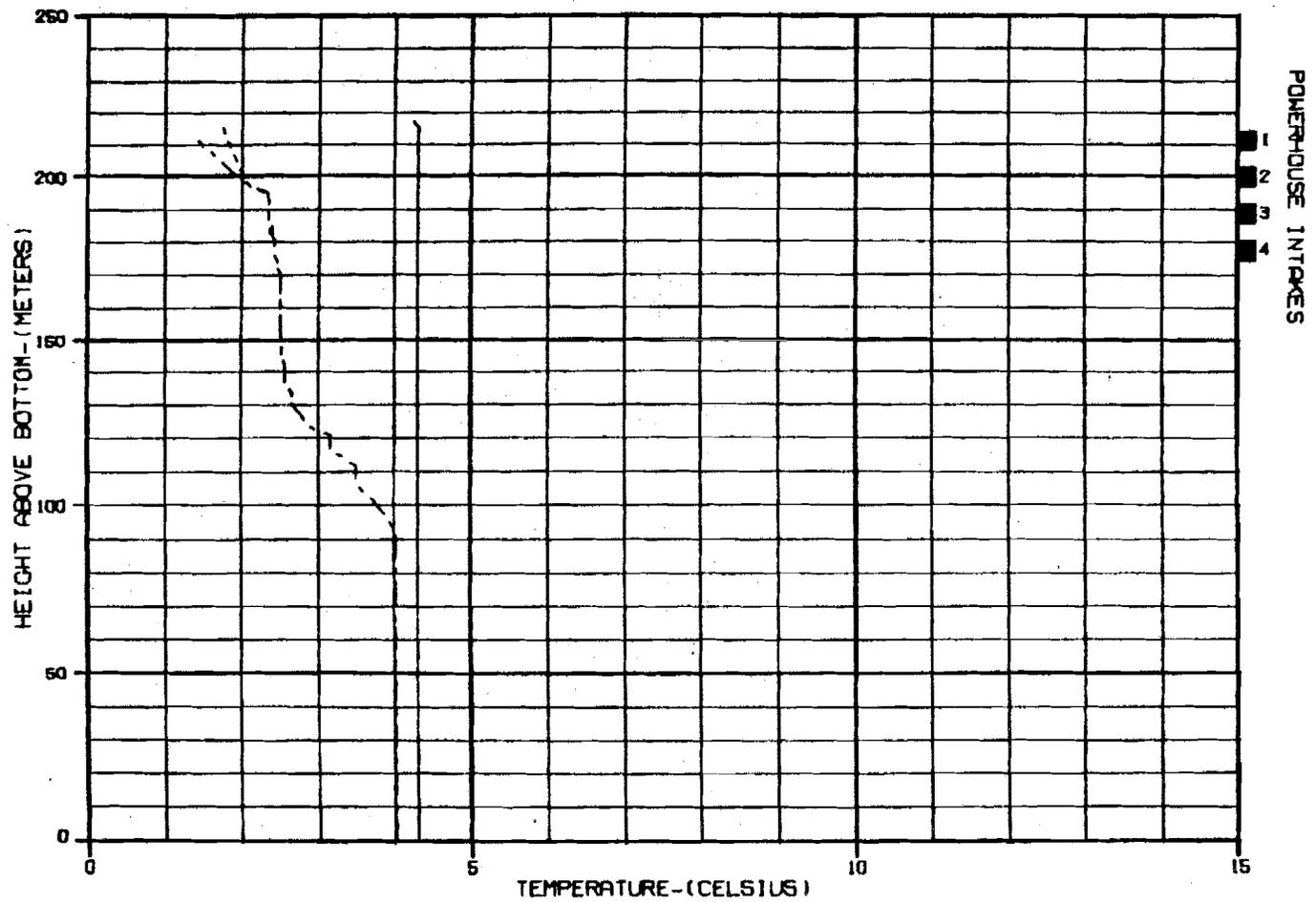
HARZA-EBASCO JOINT VENTURE

ENGINEER - R.L. THOMAS

6 JUL 84

42-010-04





CASE: WATANA OPERATION ALONE IN 1996 WAT

LEGEND:

PREDICTED TEMPERATURE PROFILES

— 1 NOVEMBER 1974
 - - - 1 DECEMBER 1974
 - · - 1 JANUARY 1975

ALASKA POWER AUTHORITY

SUBMITTA PROJECT

DYNEM MODEL

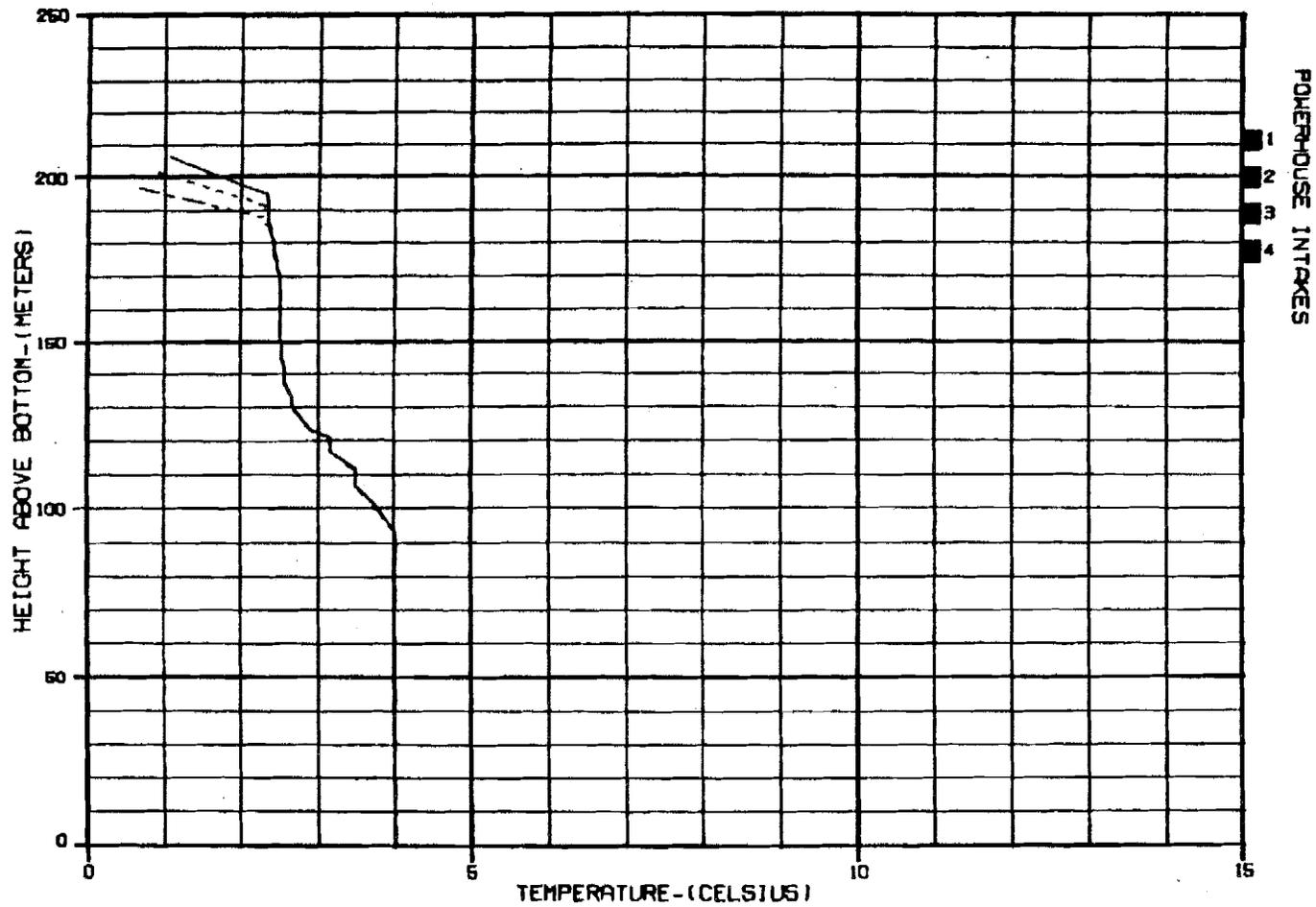
WATANA RESERVOIR
 TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

CHARGE: 11-1974

8 JUL 74

42-D10-04



CASE: ■■ WA7496A - WATANA OPERATION ALONE IN 1996 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

_____ 1 FEBRUARY 1975
 - - - - - 1 MARCH 1975
 - · - · - 1 APRIL 1975

ALASKA POWER AUTHORITY

GUSTINA PROJECT

DYKESH MODEL

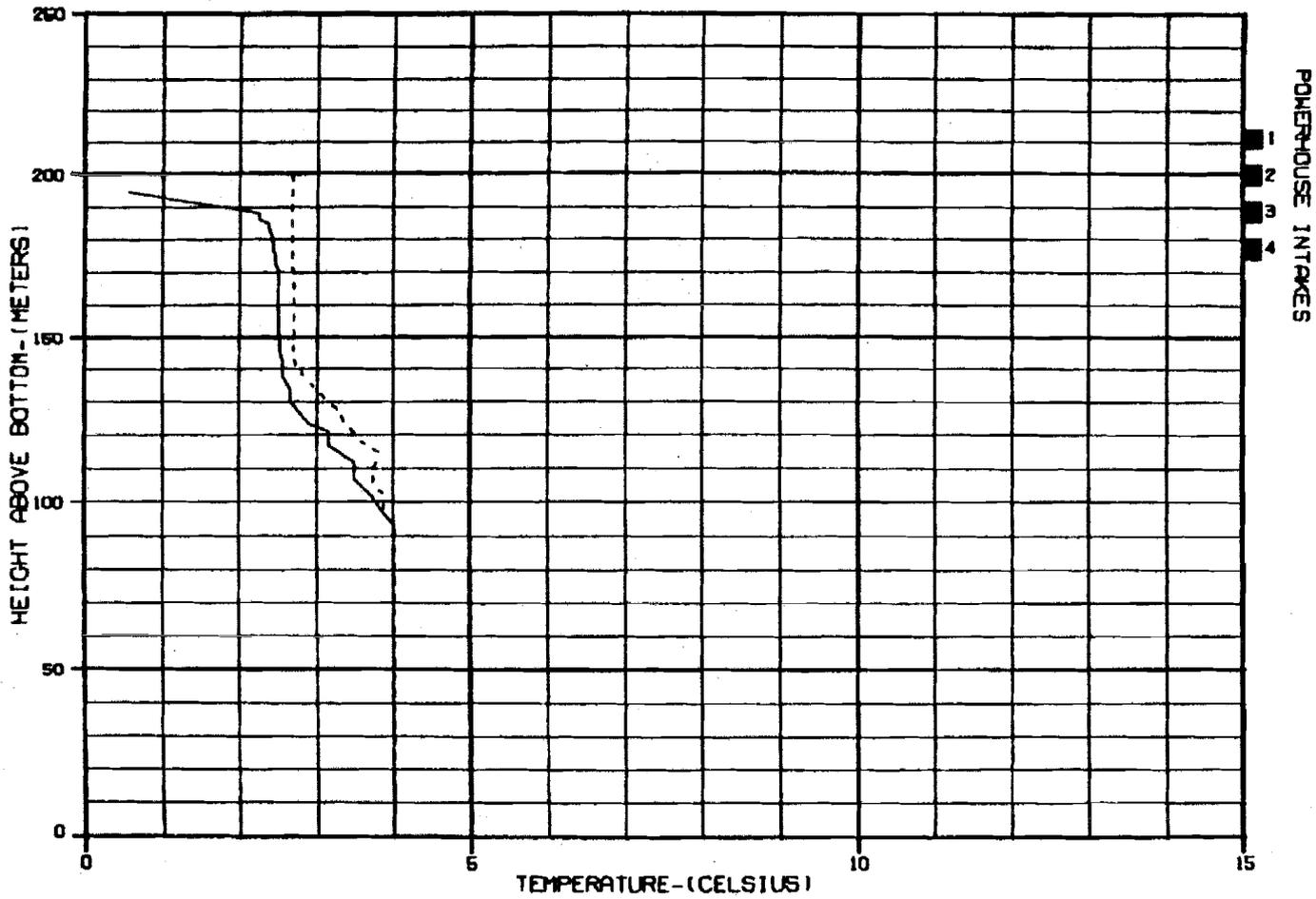
WATANA RESERVOIR
TEMPERATURE PROFILES

WARZA-EBASCO JOINT VENTURE

CHUCKS - ILLUMS

8 JUL 84

42-010-04



CASE: WW WA7496A - WATANA OPERATION ALONE IN 1996 WW

LEGEND:

PREDICTED TEMPERATURE PROFILES:

_____ 1 MAY 1975
 - - - - - 1 JUNE 1975
 - · - · - 1 JULY 1975

ALASKA POWER AUTHORITY

SUBTINA PROJECT

DYNEMO MODEL

WATANA RESERVOIR
TEMPERATURE PROFILES

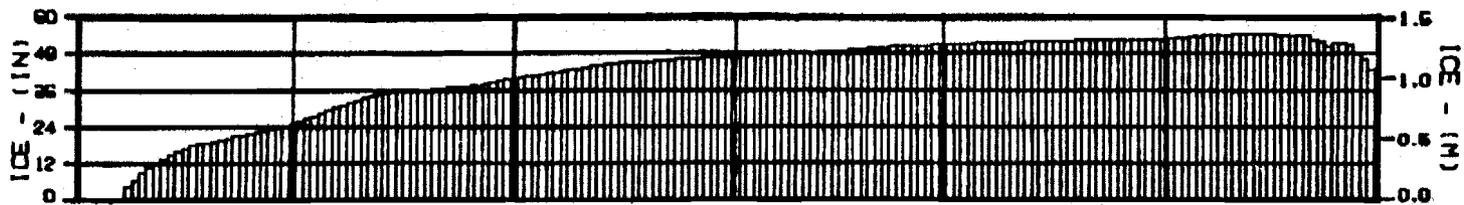
HARZA-EBASCO JOINT VENTURE

CHECKED: BLP:RFB

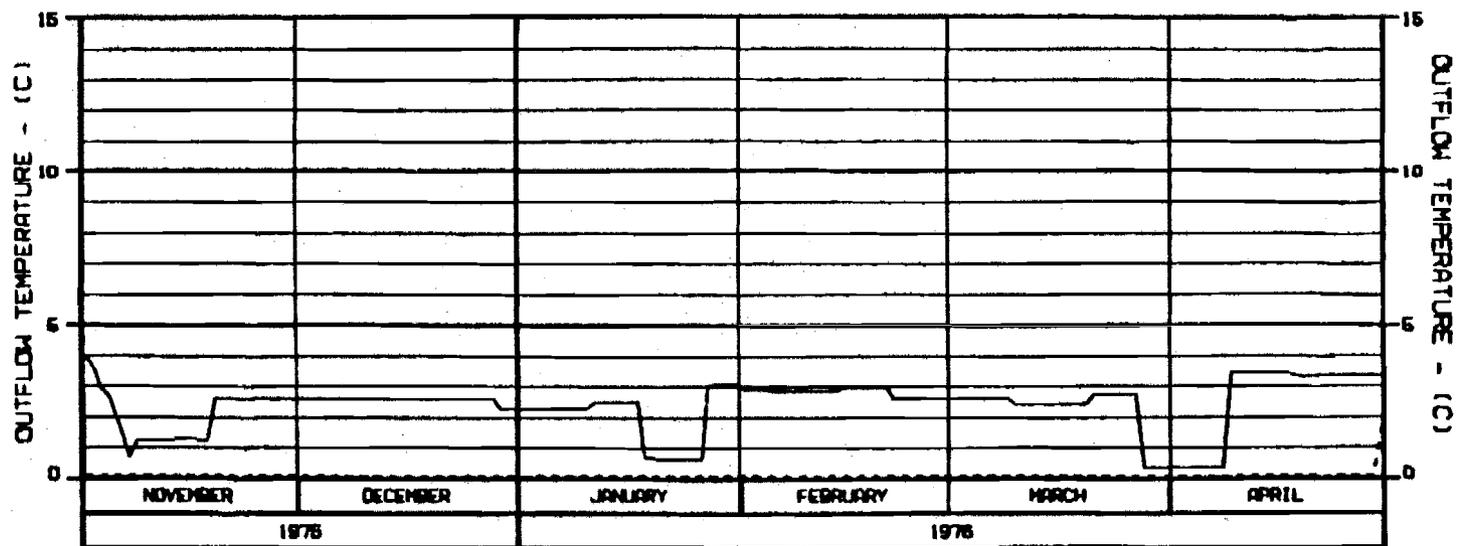
8 JUL 84

42-010-04

EXHIBIT S



INTAKE	LEVEL 1	NOVEMBER				
	LEVEL 2	NOVEMBER	DECEMBER			
	LEVEL 3			JANUARY	MARCH	
	LEVEL 4					APRIL
	CONE VALVE					
	SPILLWAY					



LEGEND: CASE: WATANA OPERATION ALONE IN 1986

— PREDICTED OUTFLOW TEMPERATURE
 - - - - - INFLOW TEMPERATURE

- NOTES:
1. INTAKE PORT LEVEL 1 AT ELEVATION 2161 FT (655.6 M)
 2. INTAKE PORT LEVEL 2 AT ELEVATION 2114 FT (644.3 M)
 3. INTAKE PORT LEVEL 3 AT ELEVATION 2077 FT (633.1 M)
 4. INTAKE PORT LEVEL 4 AT ELEVATION 2040 FT (621.8 M)
 5. CONE VALVE AT ELEVATION 2040 FT (621.8 M)
 6. SPILLWAY CREST AT ELEVATION 2148 FT (654.7 M)

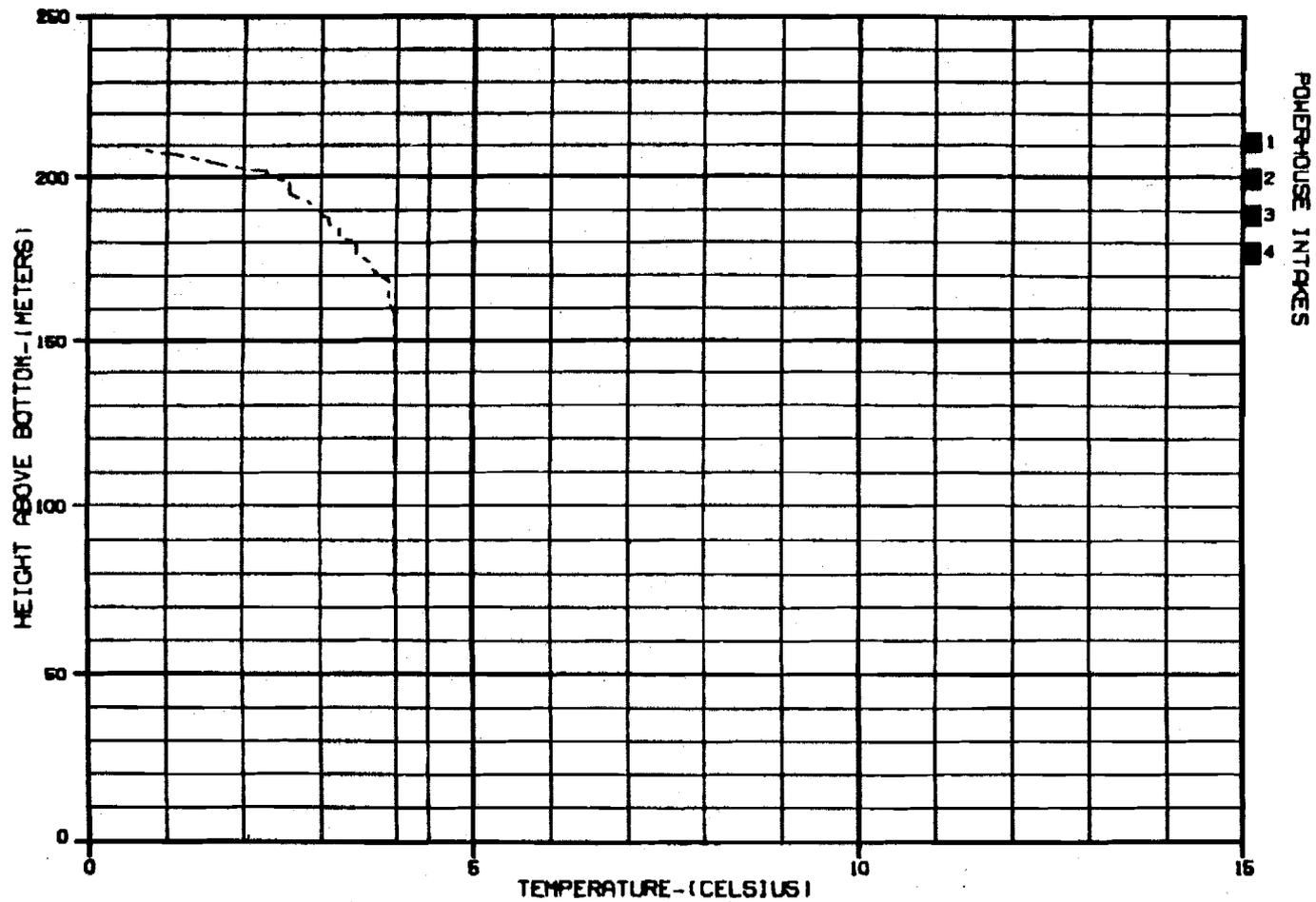
ALASKA POWER AUTHORITY

SUBMITTER PROJECT: WATANA RESERVOIR

OUTFLOW TEMPERATURE
 AND ICE GROWTH

HARZA-EBASCO JOINT VENTURE

DATE: 11/1986 8 JAN 87 4-86-24



CASE: ■■ WAT7696A - WATANA OPERATION ALONE IN 1996 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

——— | NOVEMBER 1975
 - - - - | DECEMBER 1975
 - · - · - | JANUARY 1976

ALASKA POWER AUTHORITY

SUBMITTER PROJECT

DIVISION MODEL

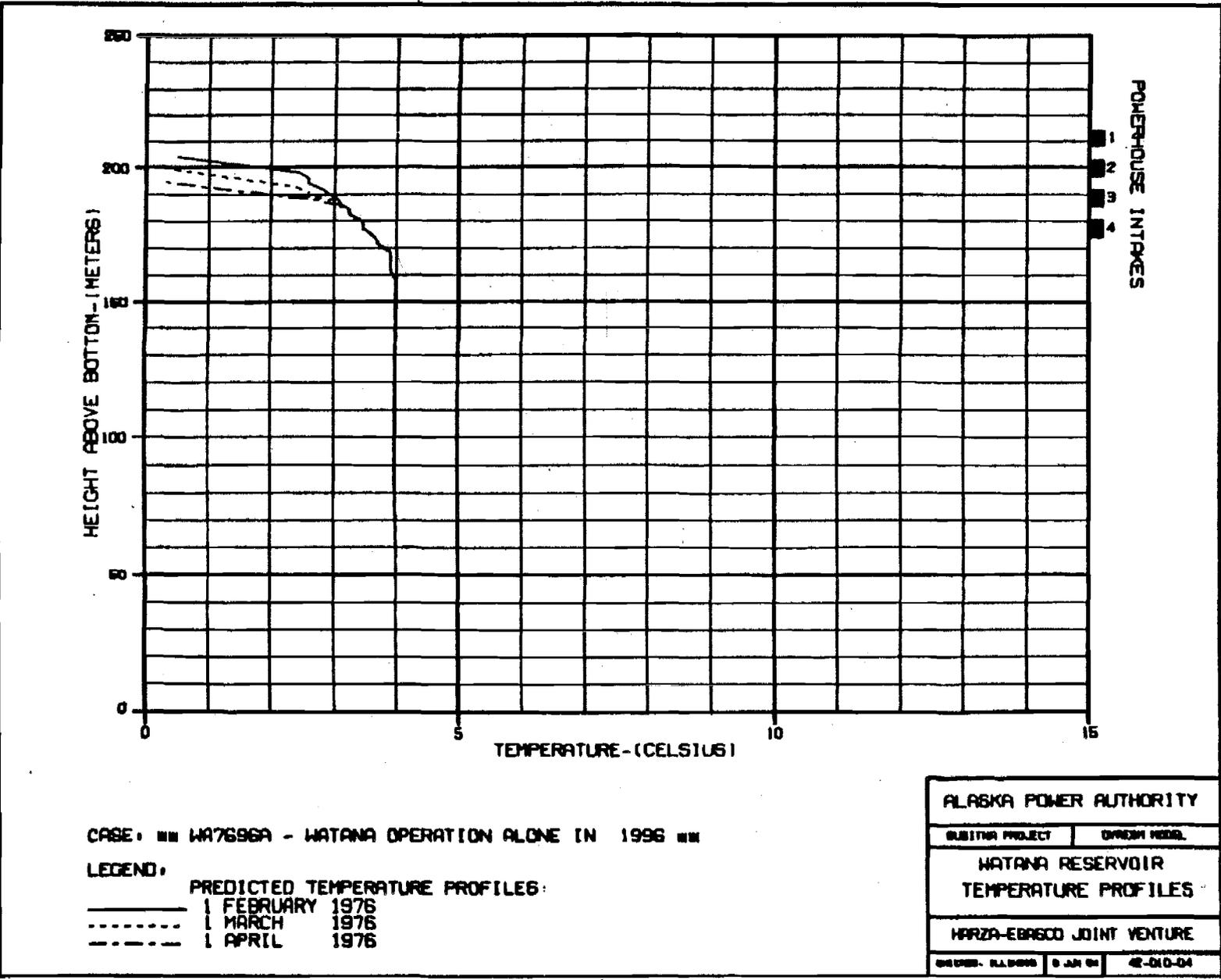
WATANA RESERVOIR
 TEMPERATURE PROFILES

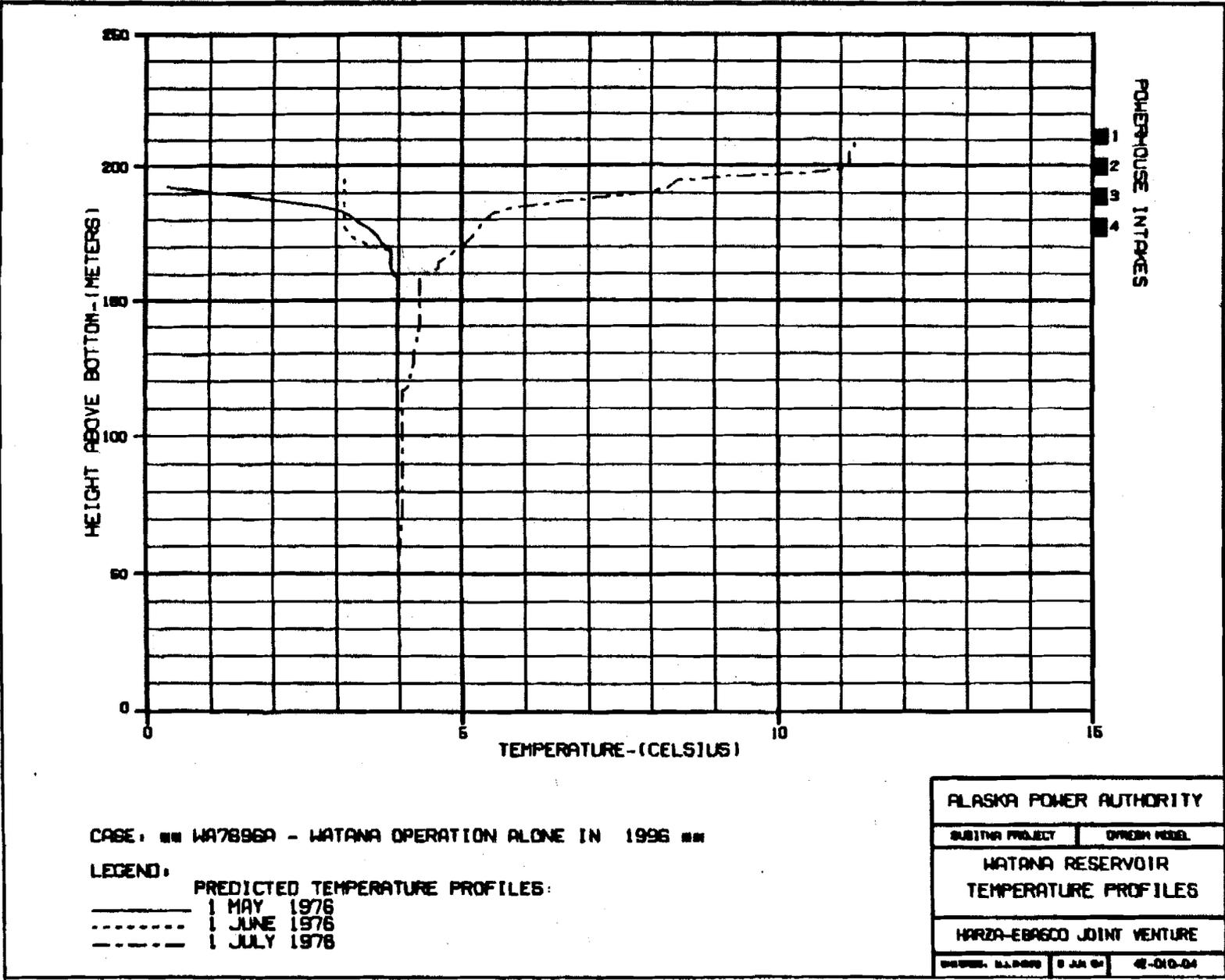
WARZA-EBASCO JOINT VENTURE

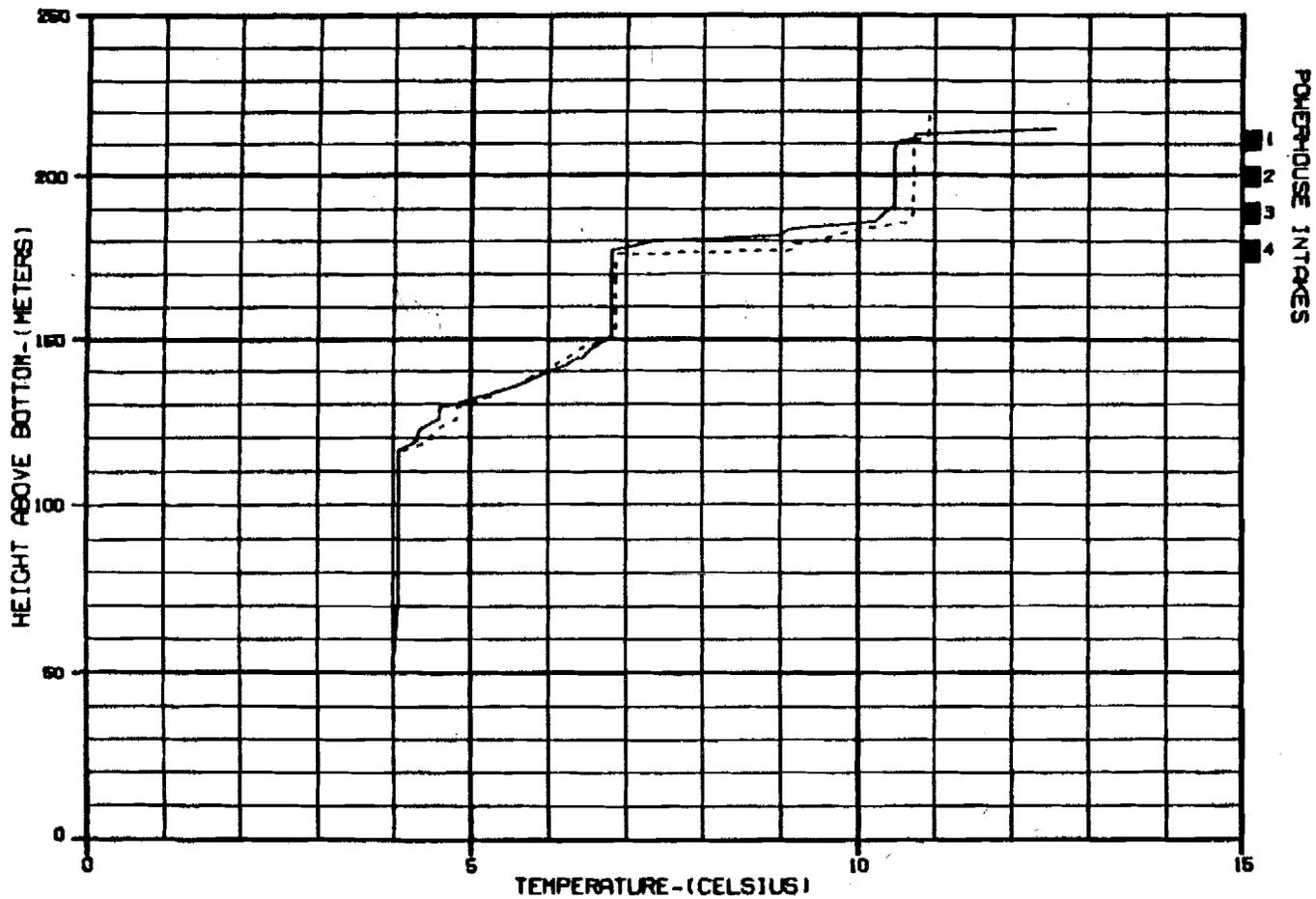
DESIGNED BY: J. J. JONES

DATE: 11 JAN 84

42-010-04







CASE: WAT7696A - WATANA OPERATION ALONE IN 1996 W/M

LEGEND:

PREDICTED TEMPERATURE PROFILES:

_____ | AUGUST 1976
 | SEPTEMBER 1976
 - - - - - | OCTOBER 1976

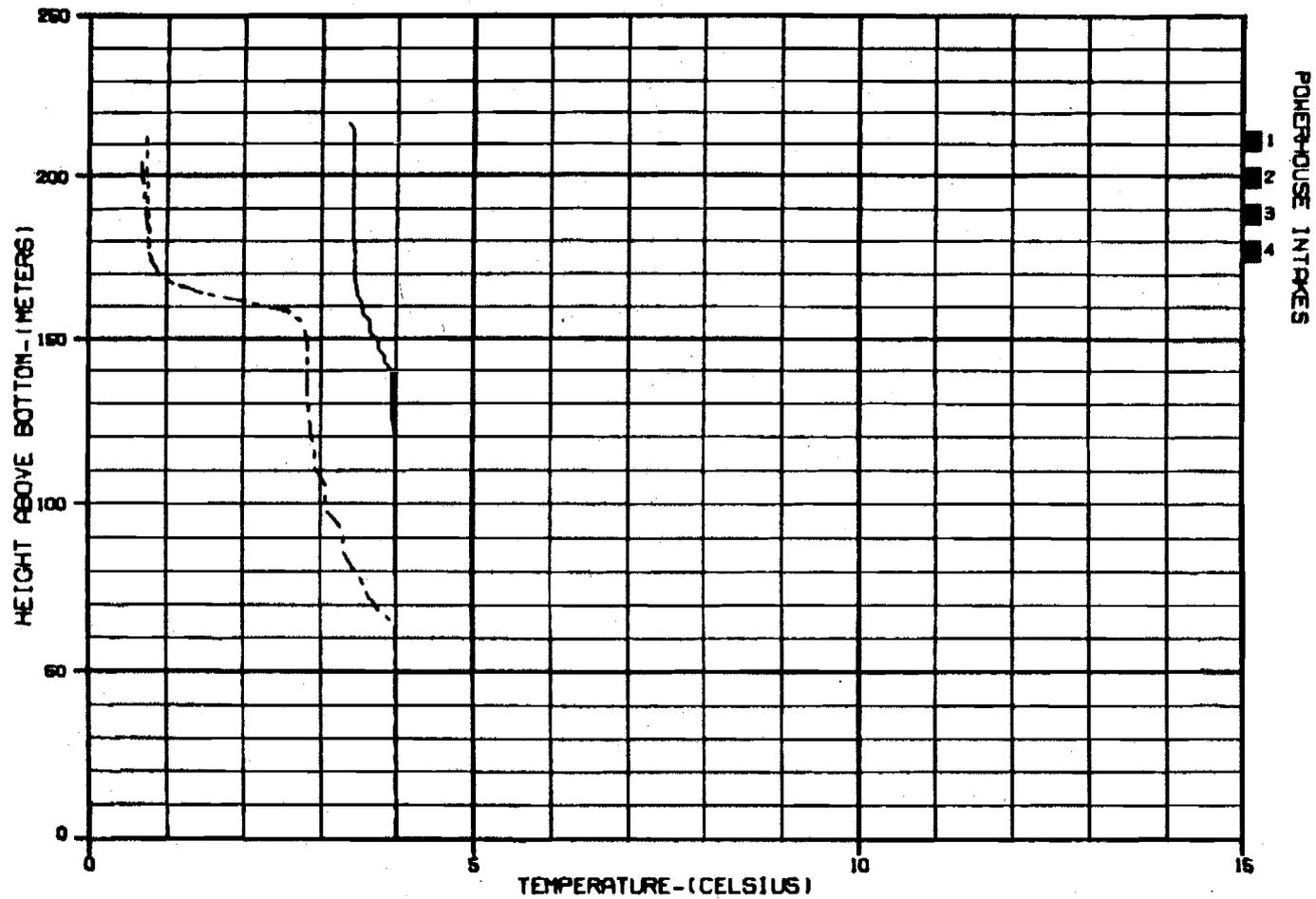
ALASKA POWER AUTHORITY

SUBMITTA PROJECT DRAWING NO.

WATANA RESERVOIR
TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

CHANGES: 01-0000 0 JAN 84 42-010-04



CASE: ■■ WA7696A - WATANA OPERATION ALONE IN 1996 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

- 1 NOVEMBER 1976
- 1 DECEMBER 1976
- · - · - 1 JANUARY 1977

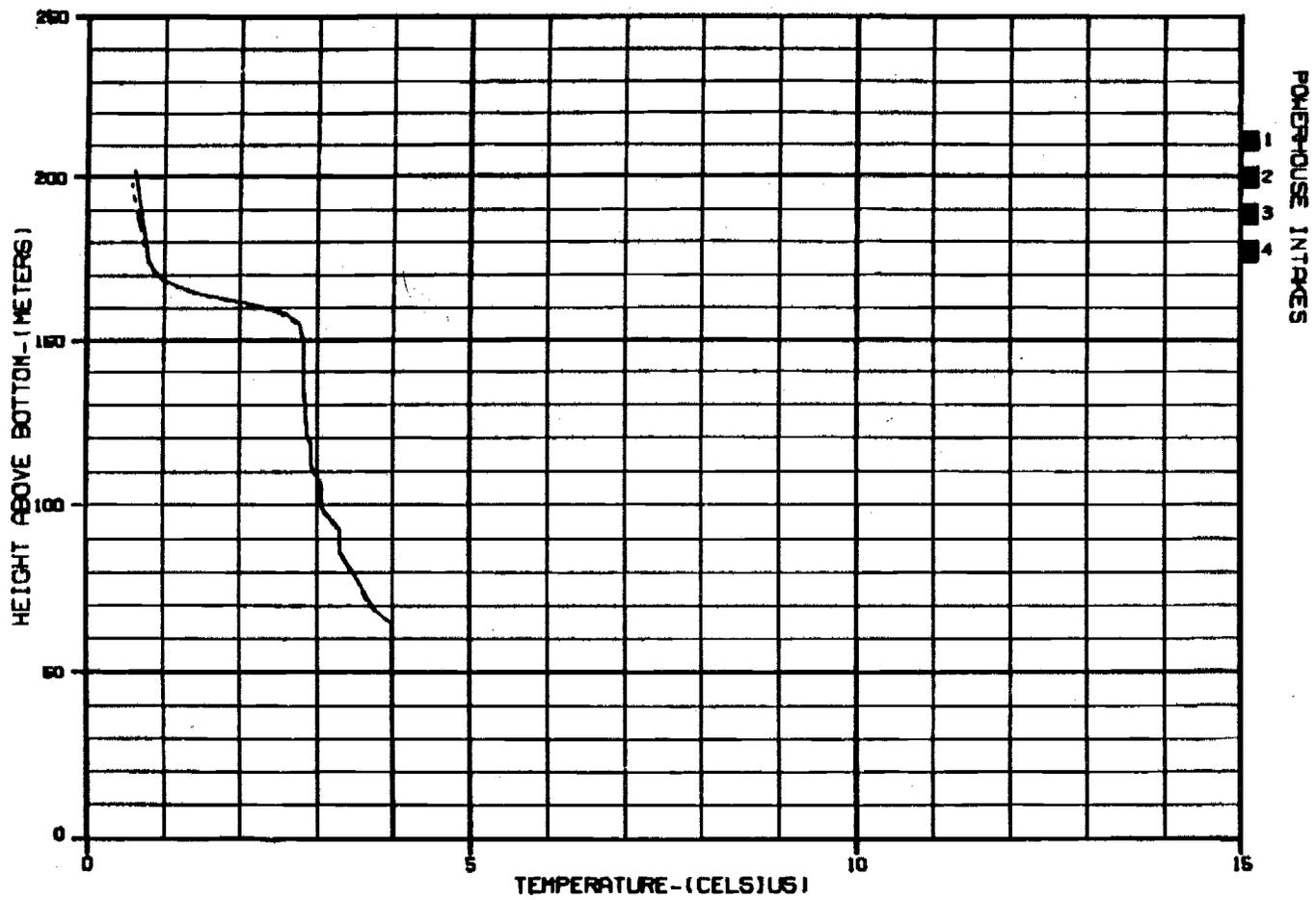
ALASKA POWER AUTHORITY

WATANA PROJECT OPENING MODEL

WATANA RESERVOIR
TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

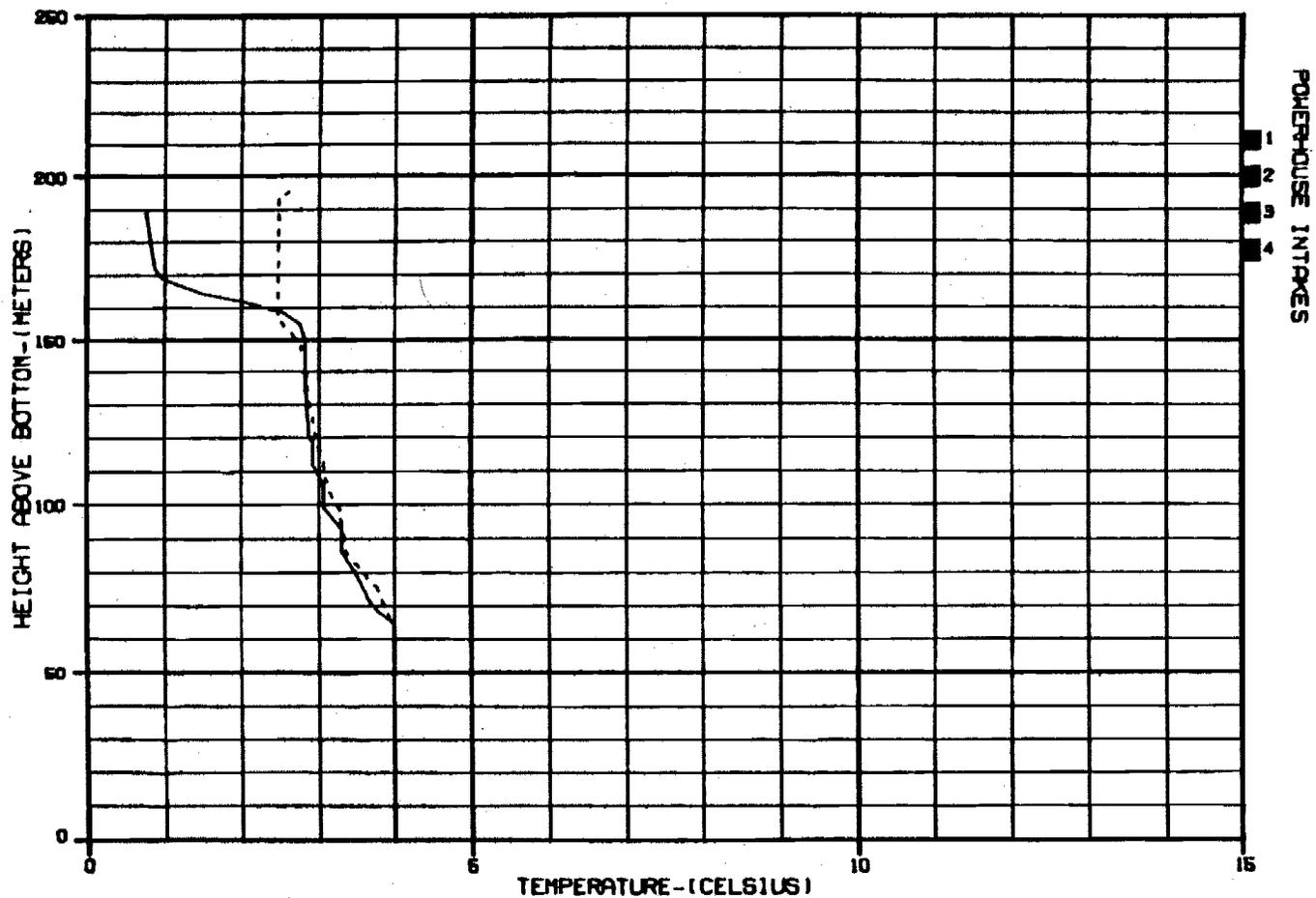
CHUCK - ELDER 2 JAN 81 4E-010-04



CASE: ■■ WA7696A - WATANA OPERATION ALONE IN 1996 ■■

LEGEND: PREDICTED TEMPERATURE PROFILES:
 ———— | FEBRUARY 1977
 - - - - | MARCH 1977
 - · - · | APRIL 1977

ALASKA POWER AUTHORITY		
SUBTNA PROJECT	OPERBN MOBL	
WATANA RESERVOIR TEMPERATURE PROFILES		
WARZA-EBASCO JOINT VENTURE		
DESIGN: B.L.P. 88	8 JAN 84	42-010-04



CASE: ■■ WAT7696A - WATANA OPERATION ALONE IN 1996 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

_____ | MAY 1977
 - - - - - | JUNE 1977
 - · - · - | JULY 1977

ALASKA POWER AUTHORITY

SUBMITTA PROJECT

OWNER MODEL

WATANA RESERVOIR
TEMPERATURE PROFILES

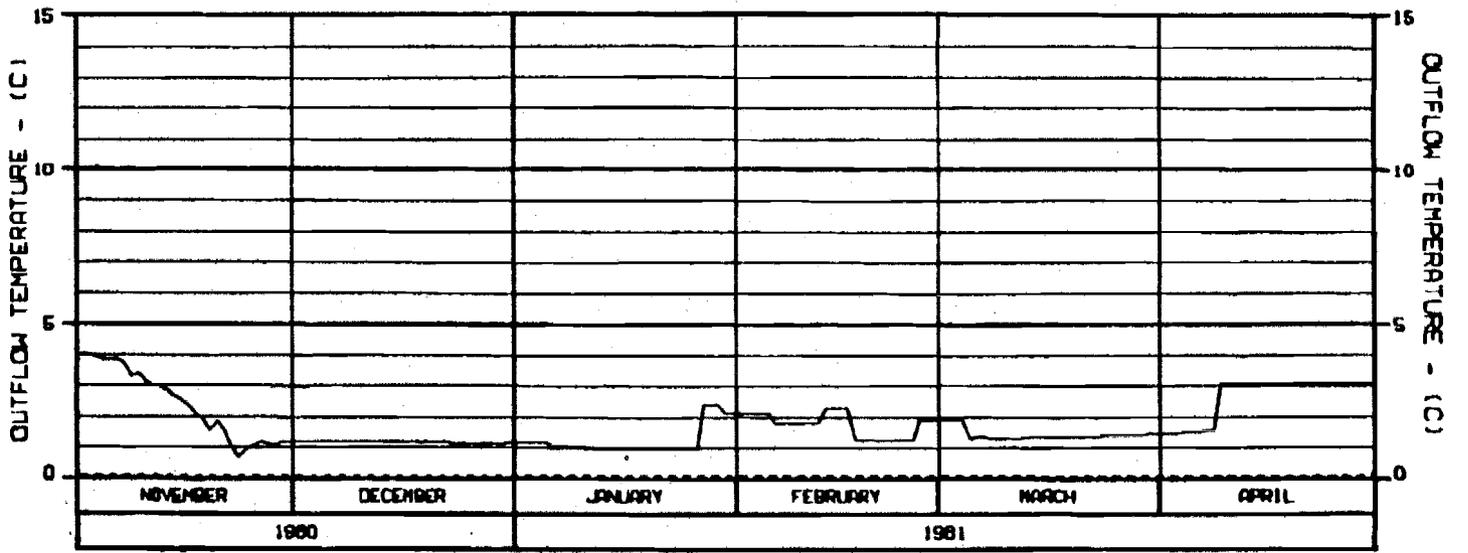
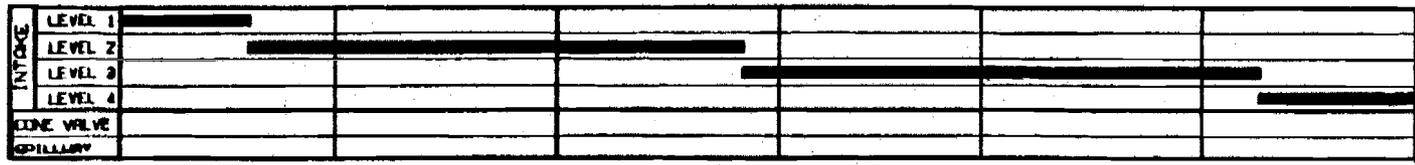
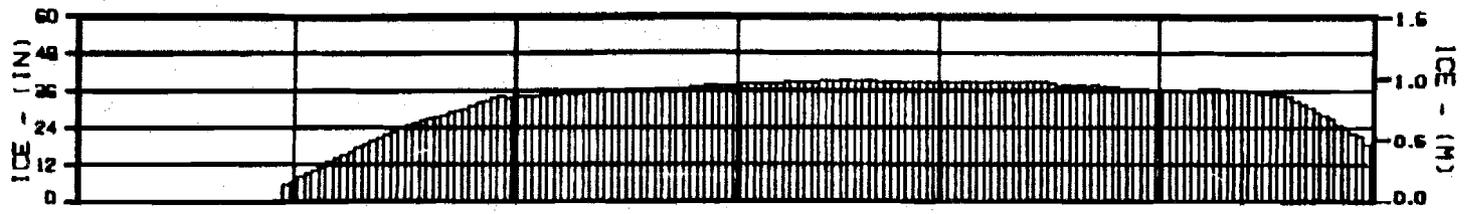
HARZA-EBASCO JOINT VENTURE

DESIGN: S.L.P.000

8 JAN 84

42-010-04

EXHIBIT T

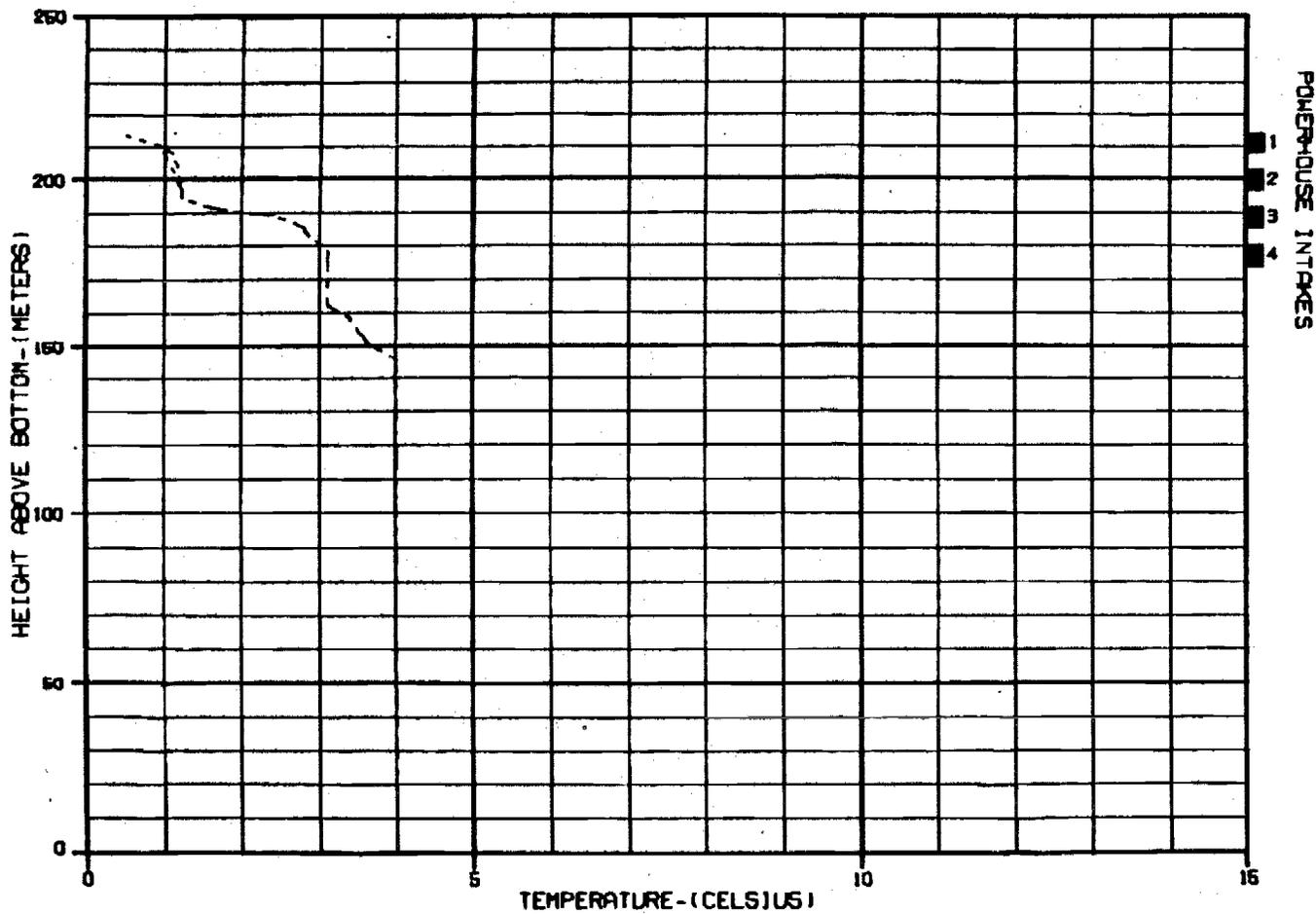


LEGEND: CASE: WAB1(82)08E - WATANA OPERATION IN 1986

— PREDICTED OUTFLOW TEMPERATURE
 - - - - - INFLOW TEMPERATURE

- NOTES:
1. INTAKE PORT LEVEL 1 AT ELEVATION 2161 FT (656.6 M)
 2. INTAKE PORT LEVEL 2 AT ELEVATION 2114 FT (644.3 M)
 3. INTAKE PORT LEVEL 3 AT ELEVATION 2077 FT (633.1 M)
 4. INTAKE PORT LEVEL 4 AT ELEVATION 2040 FT (621.9 M)
 5. CONE VALVE AT ELEVATION 2040 FT (621.9 M)
 6. SPILLWAY CREST AT ELEVATION 2148 FT (654.7 M)

ALASKA POWER AUTHORITY	
SUBITNA PROJECT	DYEDNA MODEL
WATANA RESERVOIR OUTFLOW TEMPERATURE AND ICE GROWTH	
HARZA-EBRACO JOINT VENTURE	
ENCLOS. 5.1 PART 5 JAN 81	48-515-04



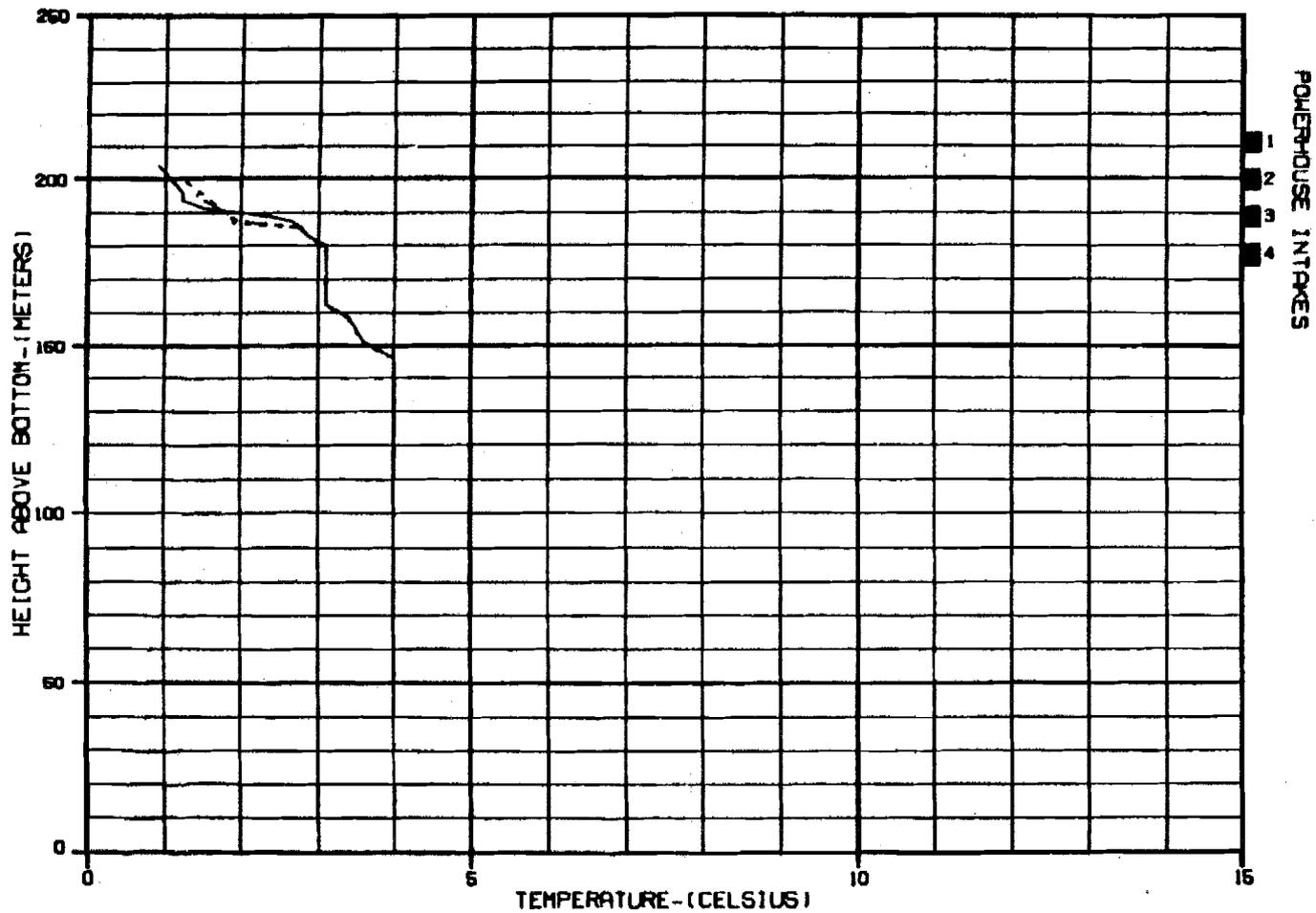
CASE: ■■ WAB11B2196E - WATANA OPERATION IN 1996 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

- 1 NOVEMBER 1980
- 1 DECEMBER 1980
- 1 JANUARY 1981

ALASKA POWER AUTHORITY	
SUBMITTA PROJECT	DYDRESM MODEL
WATANA RESERVOIR TEMPERATURE PROFILES	
WARZA-EBRECO JOINT VENTURE	
CHGDRS. ALL-DWG	© JAN 81 4E-DIG-04



CASE: ■■ WAB1182196E - WATANA OPERATION IN 1996 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

— | FEBRUARY 1981
 - - - | MARCH 1981
 - · - · | APRIL 1981

ALASKA POWER AUTHORITY

SUBMITTA PROJECT

OPERATION NEEDS

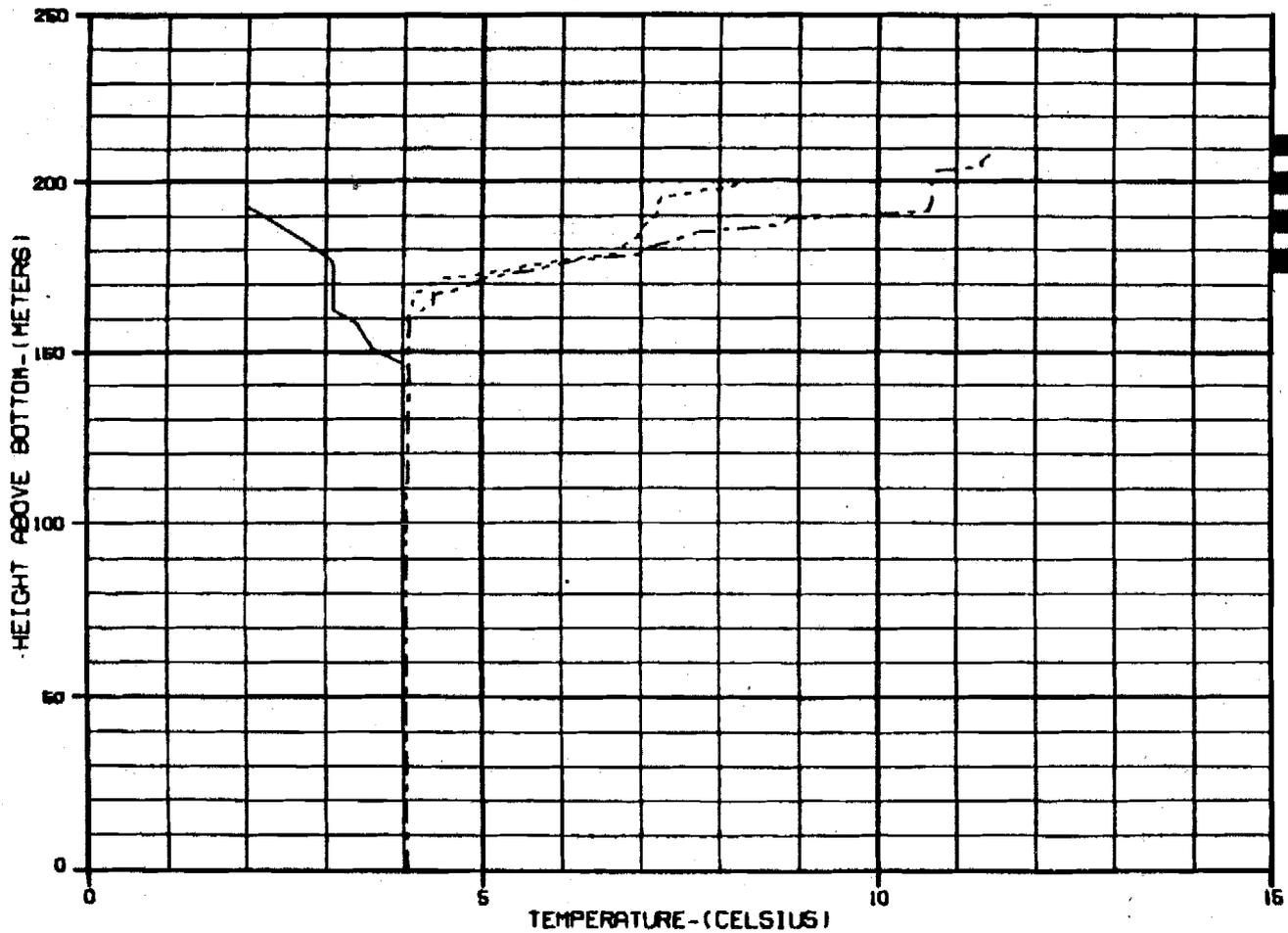
WATANA RESERVOIR
 TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

CHARGE: 810000

8 JUN 81

42-DIG-04



CASE: ■■ WAB11B2196E - WATANA OPERATION IN 1996 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

—— 1 MAY 1981
 - - - 1 JUNE 1981
 - · - · 1 JULY 1981

ALASKA POWER AUTHORITY

WATANA PROJECT

DYNEMO MODEL

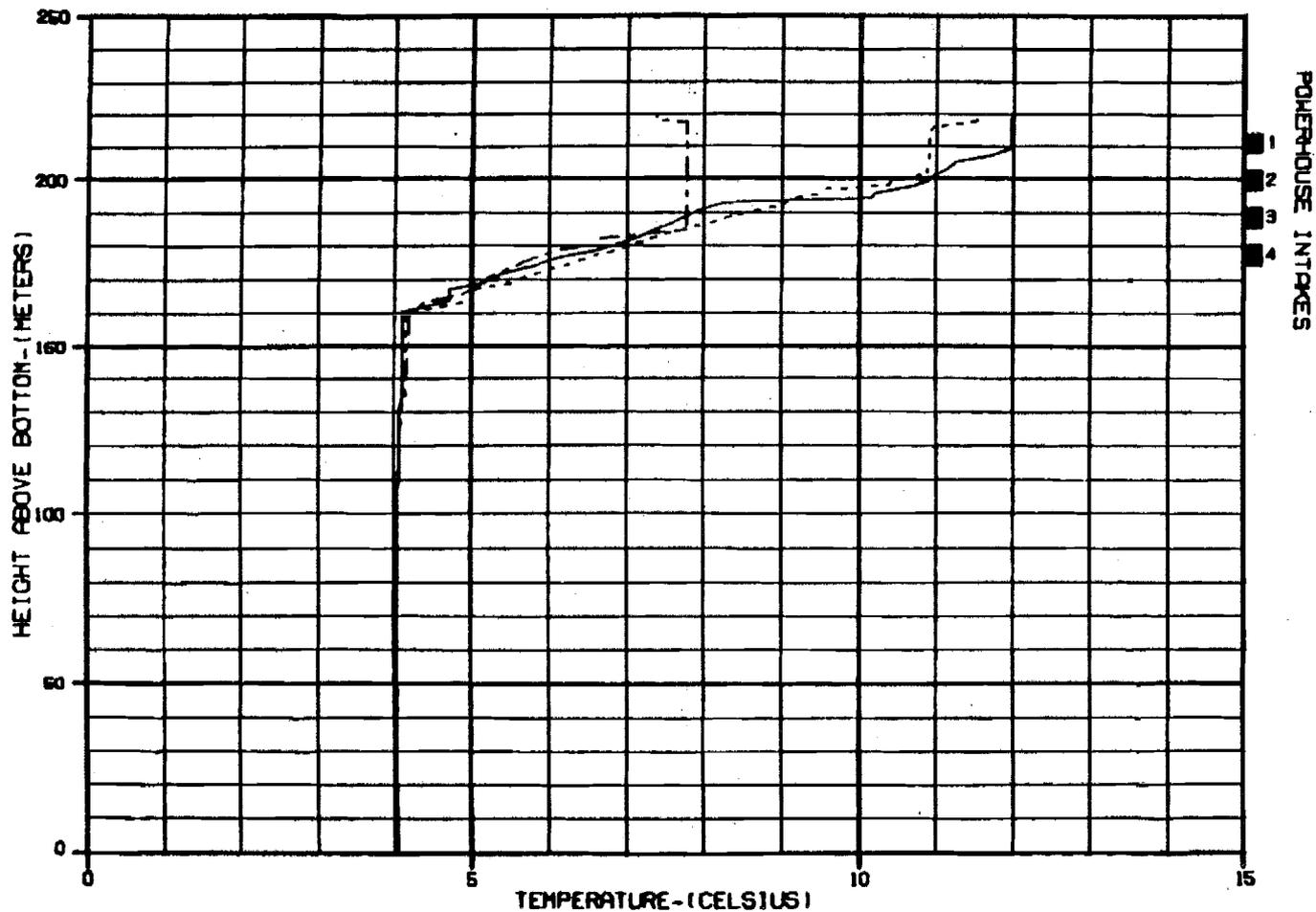
WATANA RESERVOIR
 TEMPERATURE PROFILES

WARZA-EBASCO JOINT VENTURE

CHGCRS. 8.1.1988

8 JAN 89

42-010-04



CASE: ■■ WAB1182196E - WATANA OPERATION IN 1996 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

- | AUGUST 1981
- | SEPTEMBER 1981
- - - - | OCTOBER 1981

ALASKA POWER AUTHORITY

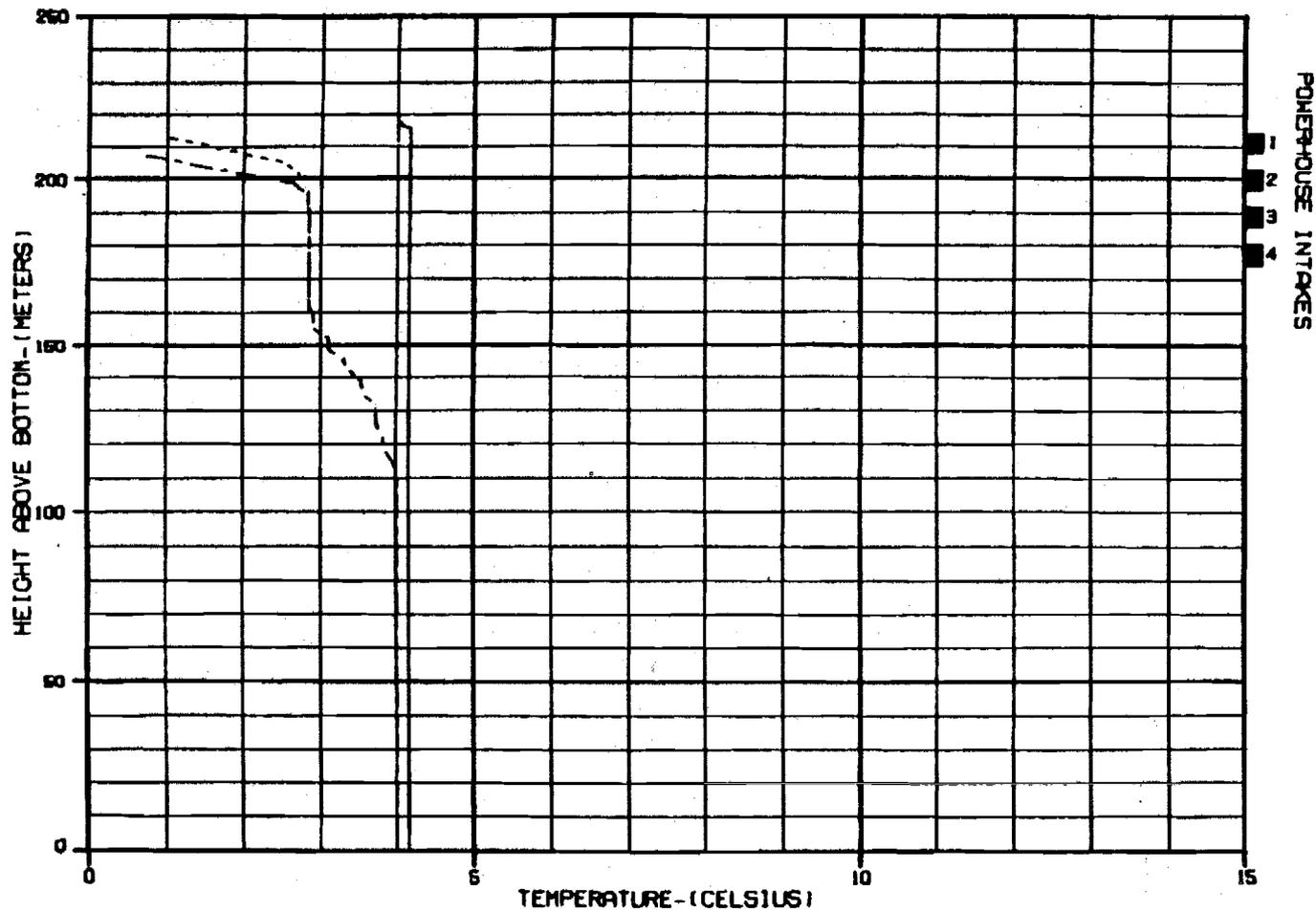
SUBSTRA PROJECT

OPER. MODEL

WATANA RESERVOIR
TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

DESIGN. 11.0000 | 8 JAN 81 | 42-010-04



CASE: WAB1182196E - WATANA OPERATION IN 1986

LEGEND:

PREDICTED TEMPERATURE PROFILES:

- 1 NOVEMBER 1981
- 1 DECEMBER 1981
- - - - - 1 JANUARY 1982

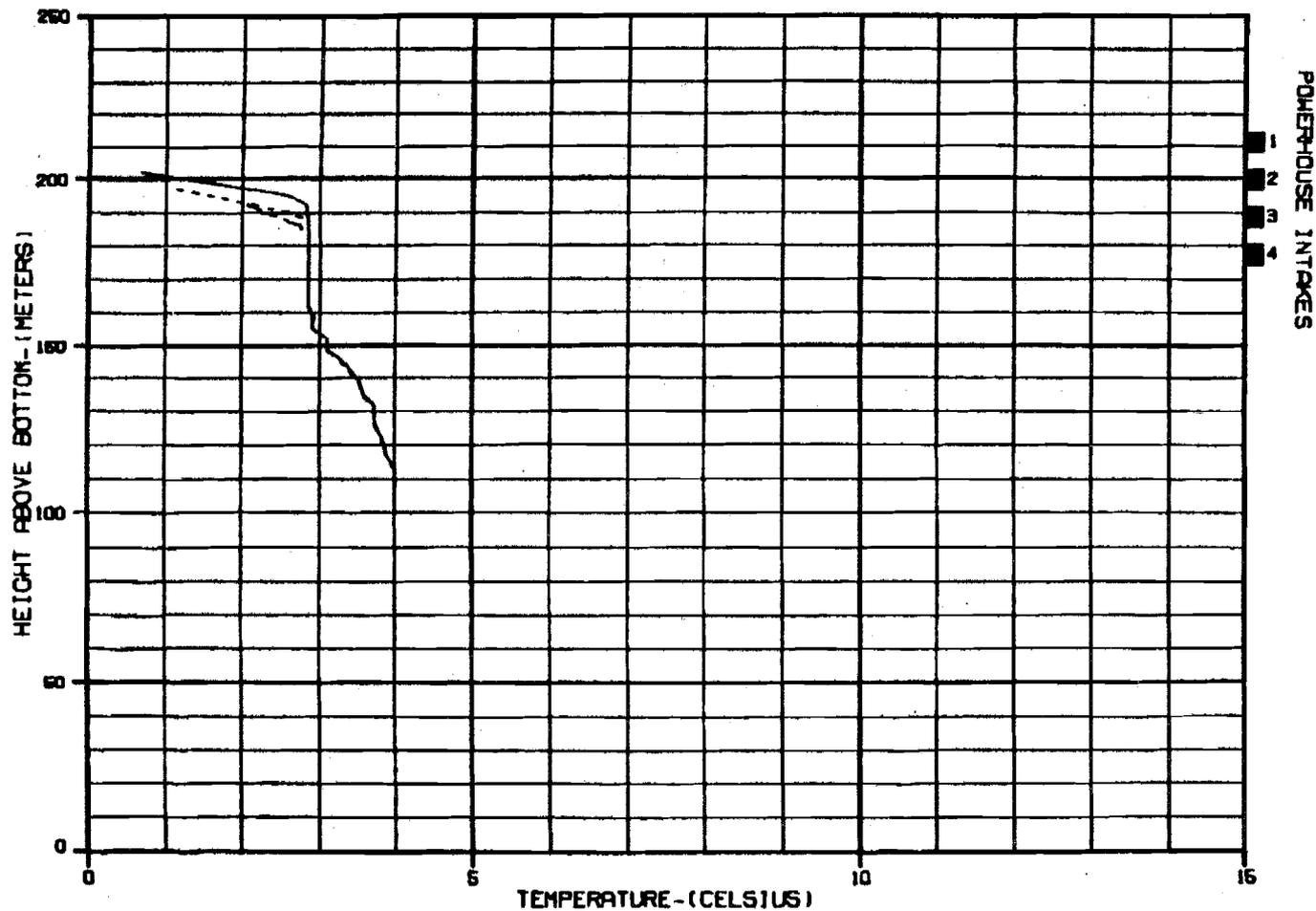
ALASKA POWER AUTHORITY

SUBMITTA PROJECT OPENING MODEL

WATANA RESERVOIR
TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

CHARGE: 8.1.86 9 JAN 81 42-010-04



CASE: ■■ WAB1182196E - WATANA OPERATION IN 1996 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

- 1 FEBRUARY 1982
- - - 1 MARCH 1982
- · - · 1 APRIL 1982

ALASKA POWER AUTHORITY

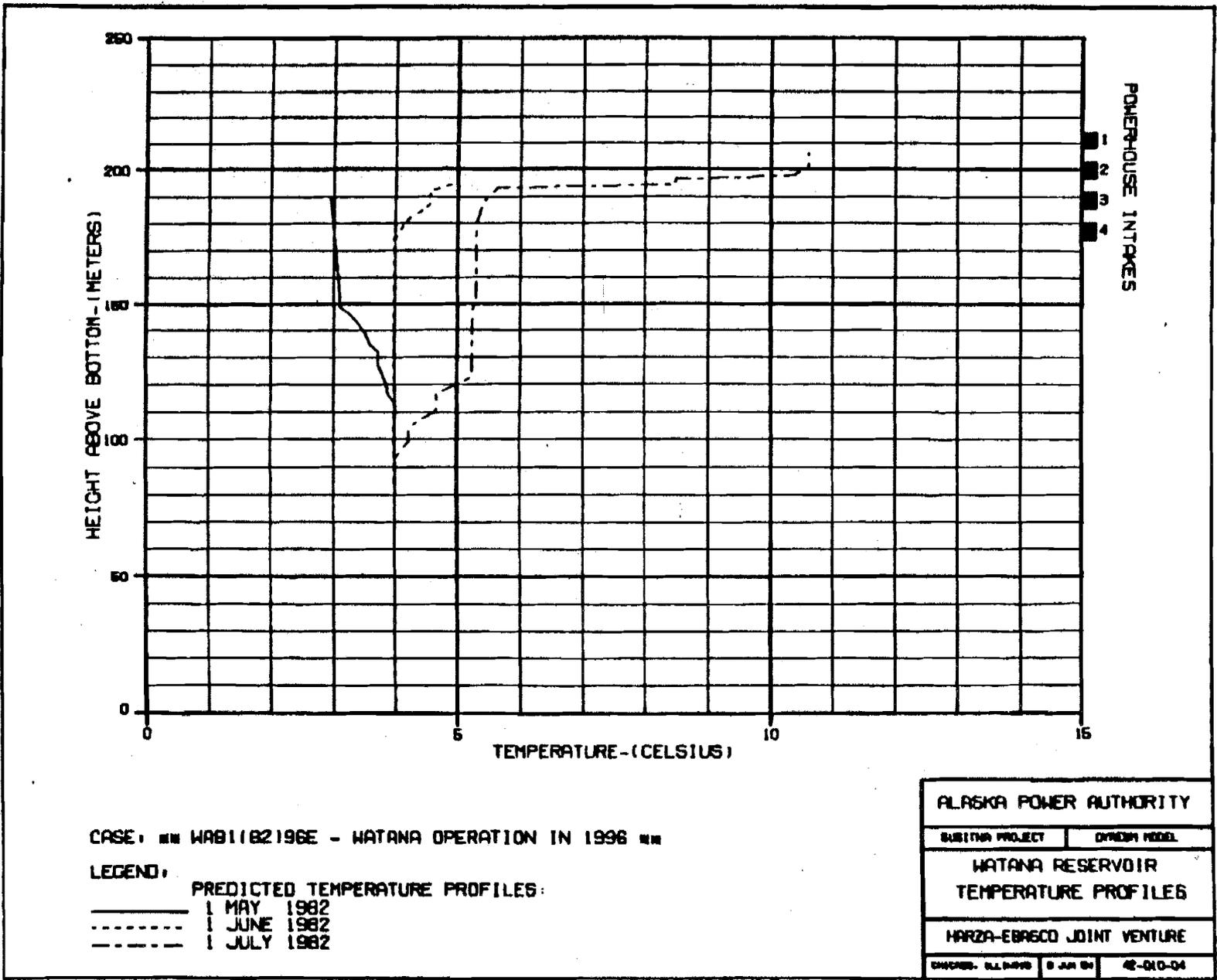
WATANA PROJECT DYNEM MODEL

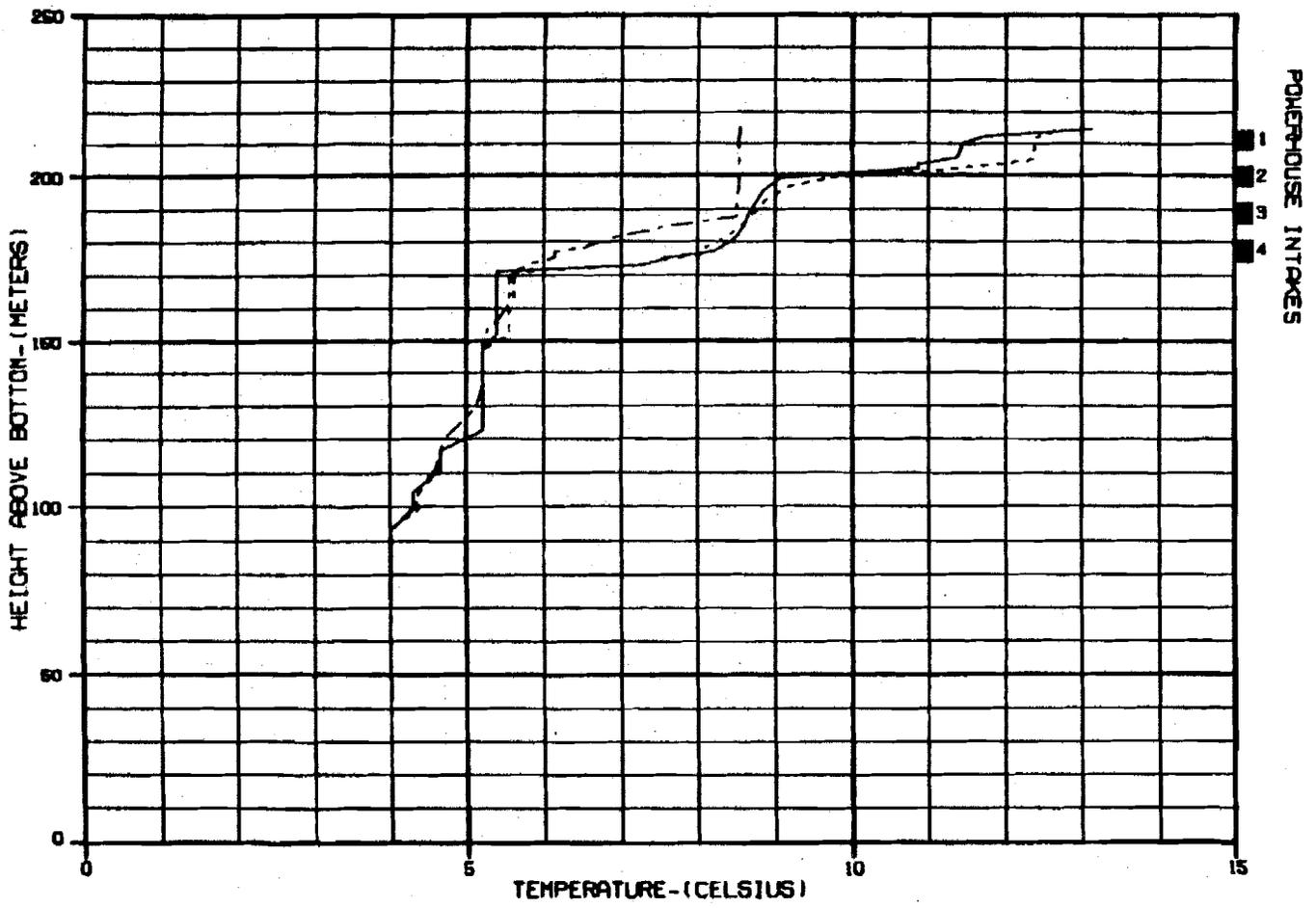
WATANA RESERVOIR
TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

DESIGNER: R.L. DODD DRAWN BY: 42-010-04

EXHIBIT U

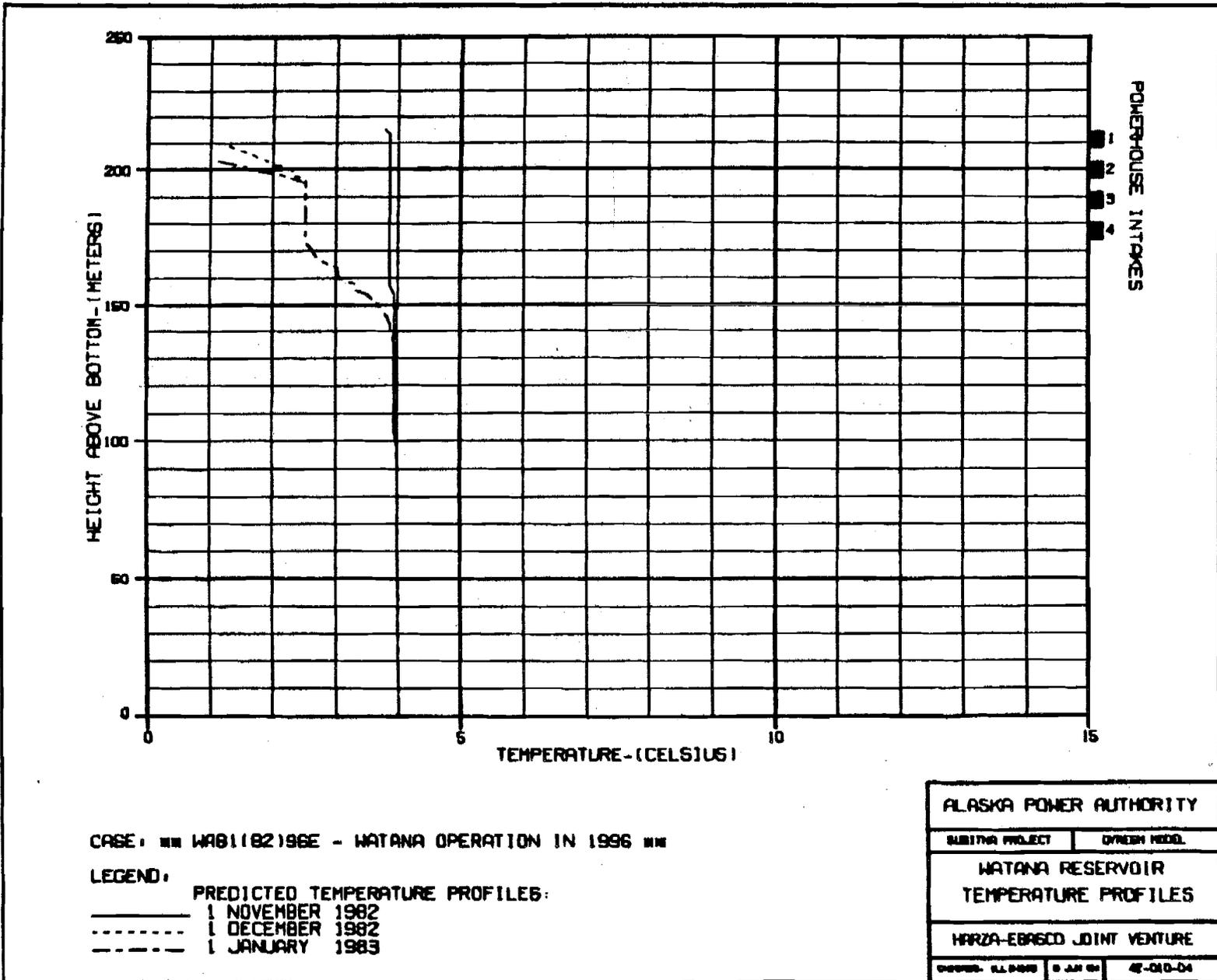


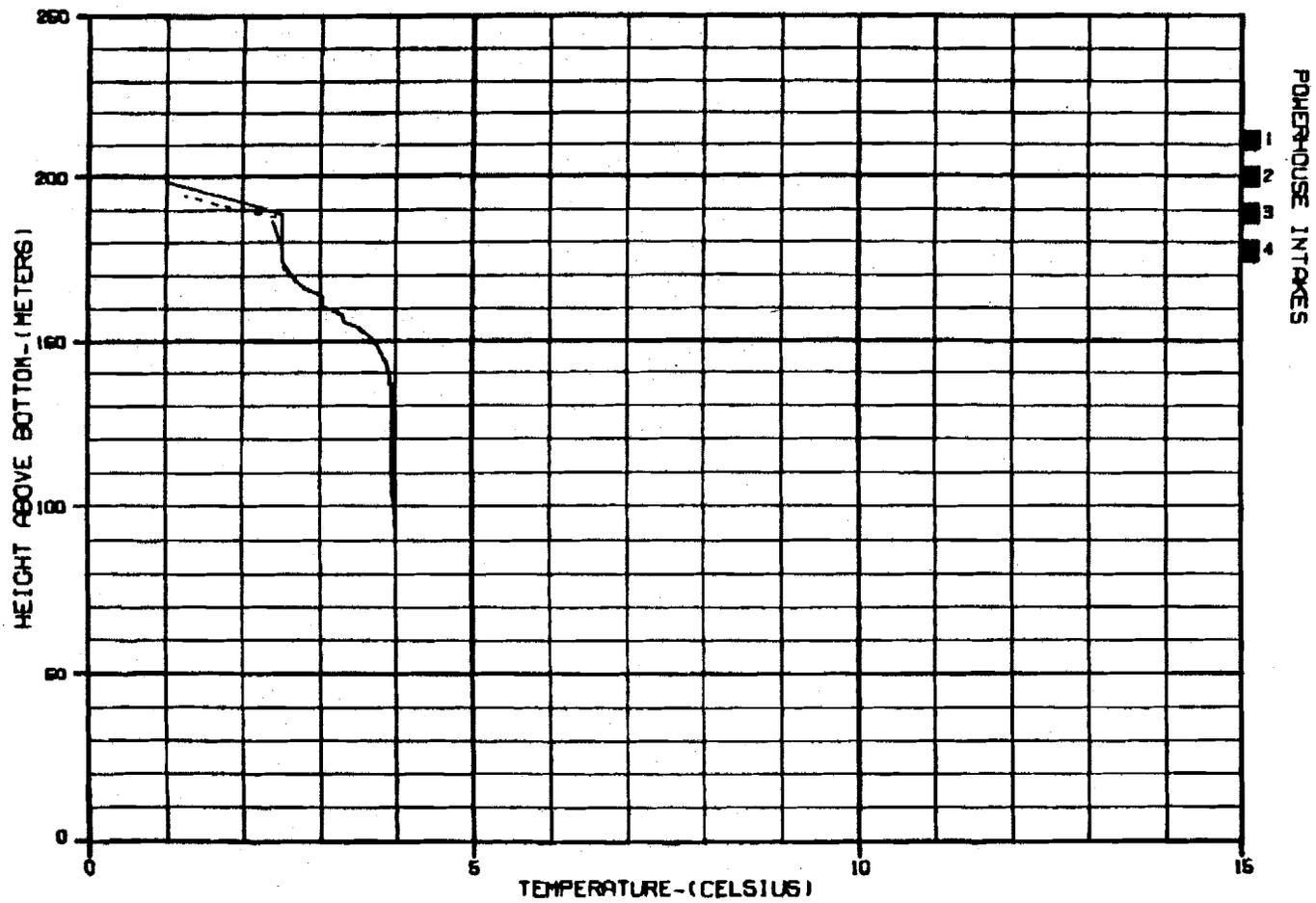


CASE: WAB1182196E - WATANA OPERATION IN 1986

LEGEND: PREDICTED TEMPERATURE PROFILES:
 ———— | AUGUST 1982
 - - - - | SEPTEMBER 1982
 - · - · | OCTOBER 1982

ALASKA POWER AUTHORITY	
SUBMITTA PROJECT	OPERATION MODEL
WATANA RESERVOIR TEMPERATURE PROFILES	
HARZA-EBASCO JOINT VENTURE	
PROJECT: WAB1182196E	DATE: 8 JAN 87
42-010-04	

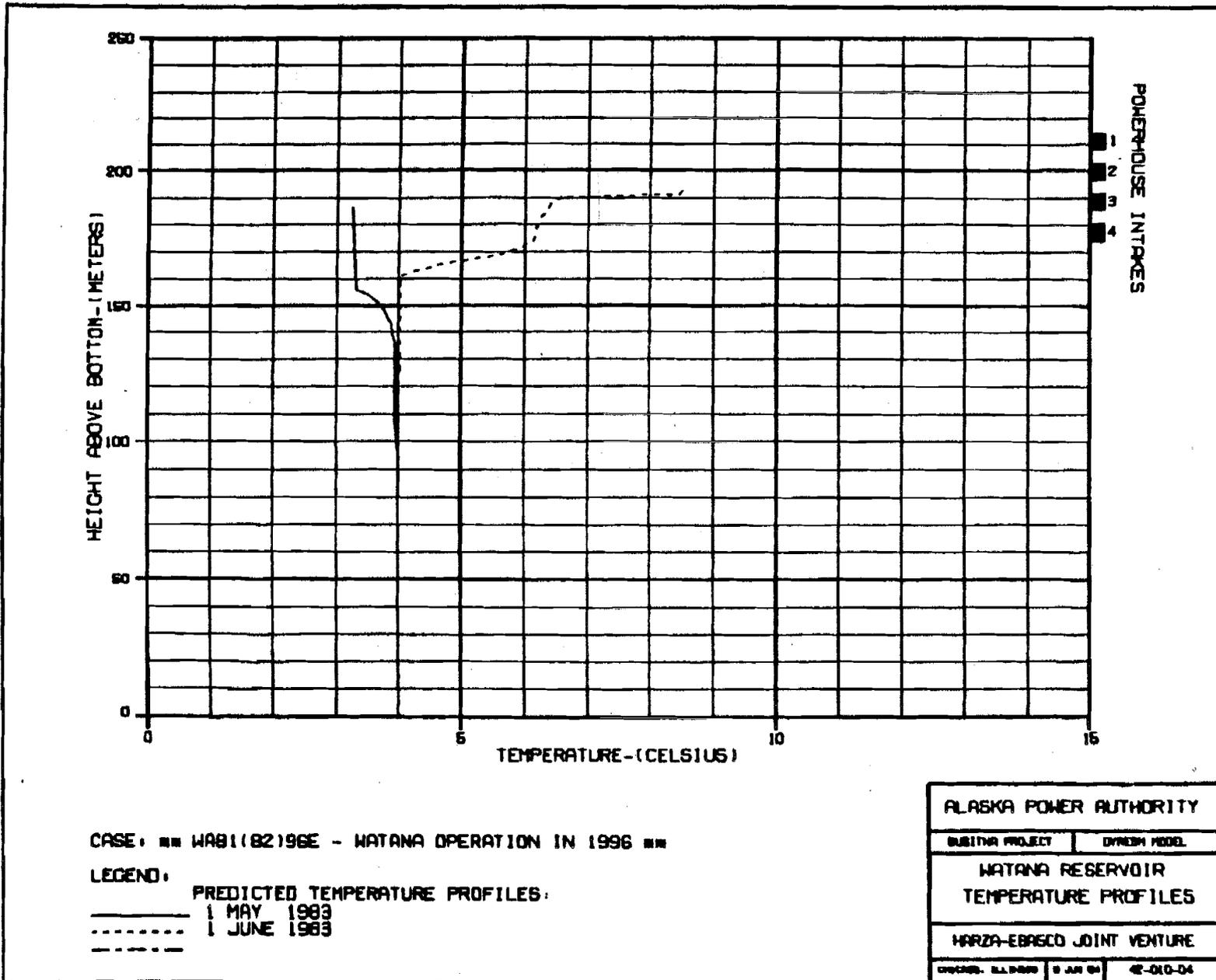




CASE: ■■ WAB1102196E - WATANA OPERATION IN 1996 ■■

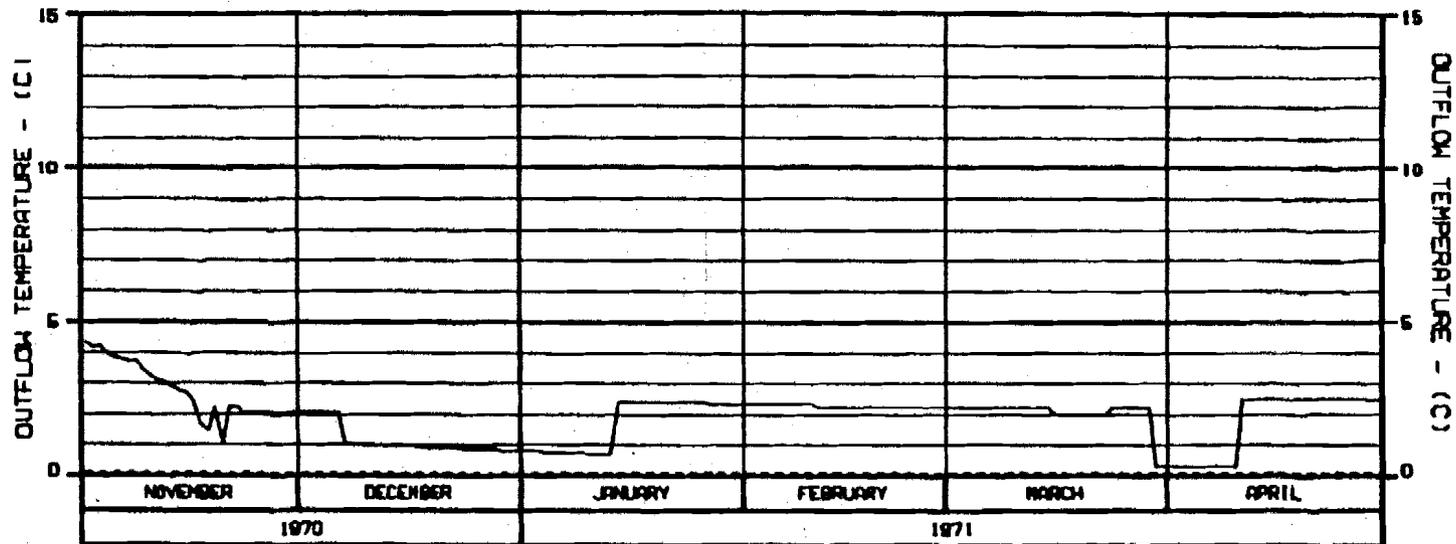
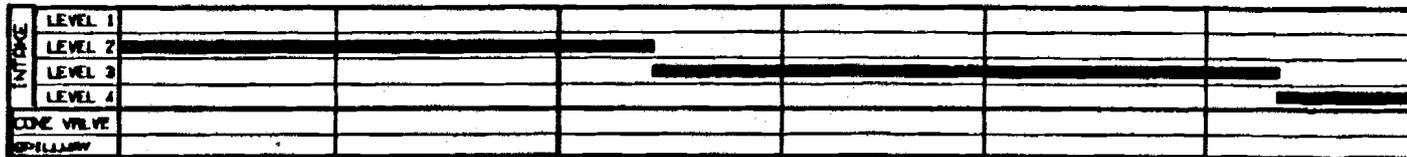
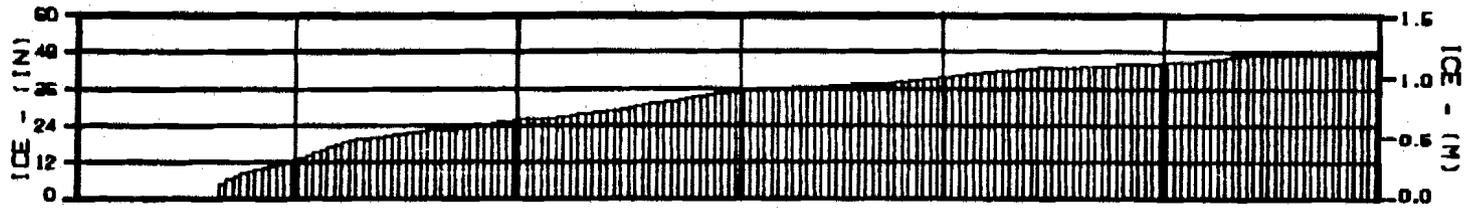
LEGEND:
 PREDICTED TEMPERATURE PROFILES:
 ———— | FEBRUARY 1983
 | MARCH 1983
 - - - - | APRIL 1983

ALASKA POWER AUTHORITY	
SUBMITTA PROJECT	DYNEMH MODL
WATANA RESERVOIR TEMPERATURE PROFILES	
HARZA-EBASCO JOINT VENTURE	
ENCLOS. ALL PAGES	8 JAN 84
42-010-04	



WATANA OPERATING
2001 Energy Demands

EXHIBIT V



LEGEND: CASE: ■■ M7101A - WATANA OPERATION ALONE IN 2001 ■■

———— PREDICTED OUTFLOW TEMPERATURE
 - - - - - INFLOW TEMPERATURE

- NOTES: 1. INTAKE PORT LEVEL 1 AT ELEVATION 2161 FT (656.6 M)
 2. INTAKE PORT LEVEL 2 AT ELEVATION 2114 FT (644.3 M)
 3. INTAKE PORT LEVEL 3 AT ELEVATION 2077 FT (633.1 M)
 4. INTAKE PORT LEVEL 4 AT ELEVATION 2040 FT (621.8 M)
 5. CONE VALVE AT ELEVATION 2040 FT (621.8 M)
 6. SPILLWAY CREST AT ELEVATION 2148 FT (654.7 M)

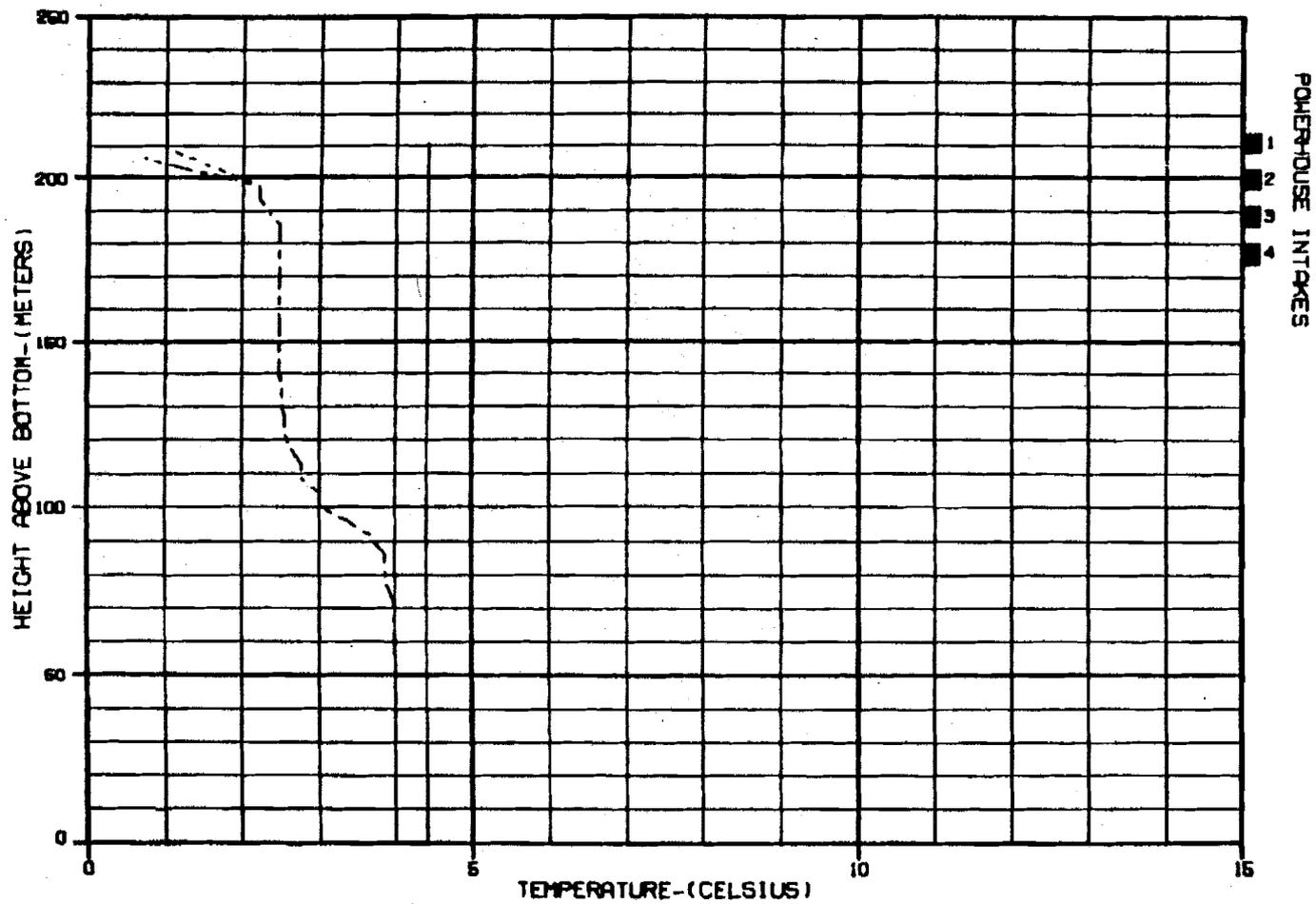
ALASKA POWER AUTHORITY

WATANA PROJECT DRYDEN MODEL

WATANA RESERVOIR
 OUTFLOW TEMPERATURE
 AND ICE GROWTH

HARZA-EBRACO JOINT VENTURE

DRAWN: S.L. DEW 9 JAN 71 42-000-04



CASE: WA7101A - WATANA OPERATION ALONE IN 2001

LEGEND:

PREDICTED TEMPERATURE PROFILES:

— 1 NOVEMBER 1970
 - - - 1 DECEMBER 1970
 - · - · 1 JANUARY 1971

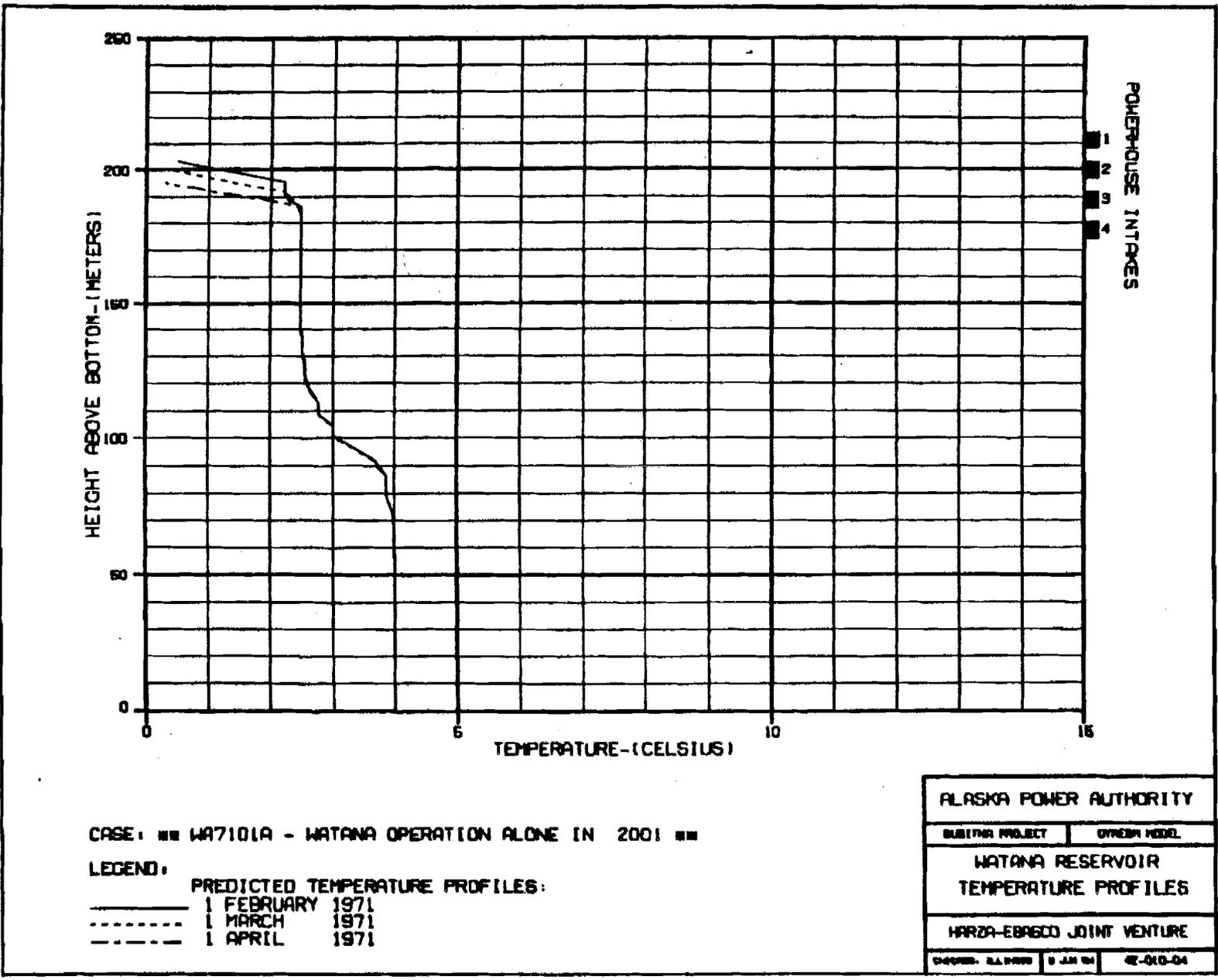
ALASKA POWER AUTHORITY

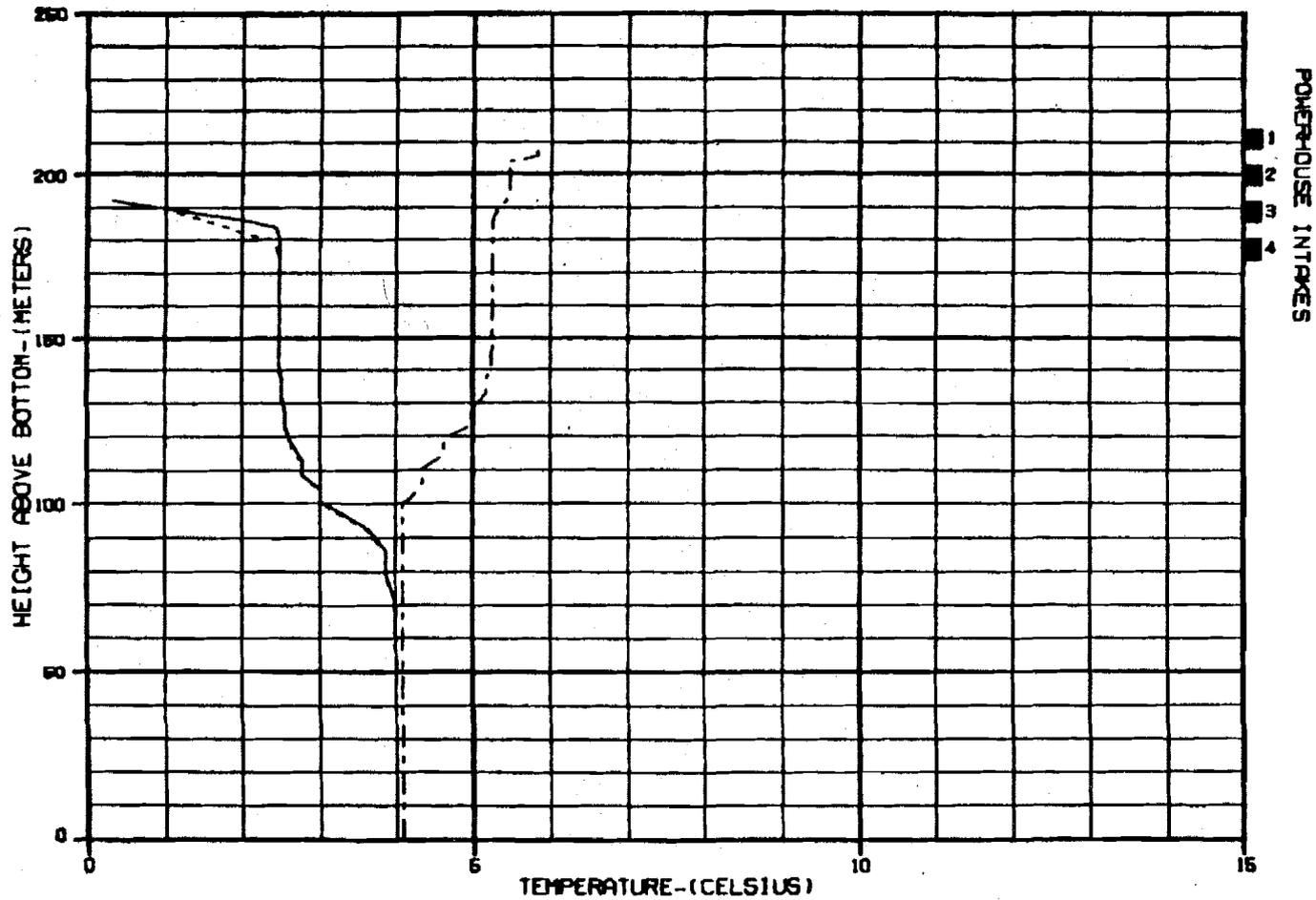
SUBITRA PROJECT DIVISION HEAD

WATANA RESERVOIR
 TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

CHECKED: ALL DATA 5 JUN 71 42-010-04





CASE: ■■ WA7101A - WATANA OPERATION ALONE IN 2001 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

— 1 MAY 1971
 - - - 1 JUNE 1971
 - · - · 1 JULY 1971

ALASKA POWER AUTHORITY

WATANA PROJECT

OPENING MODEL

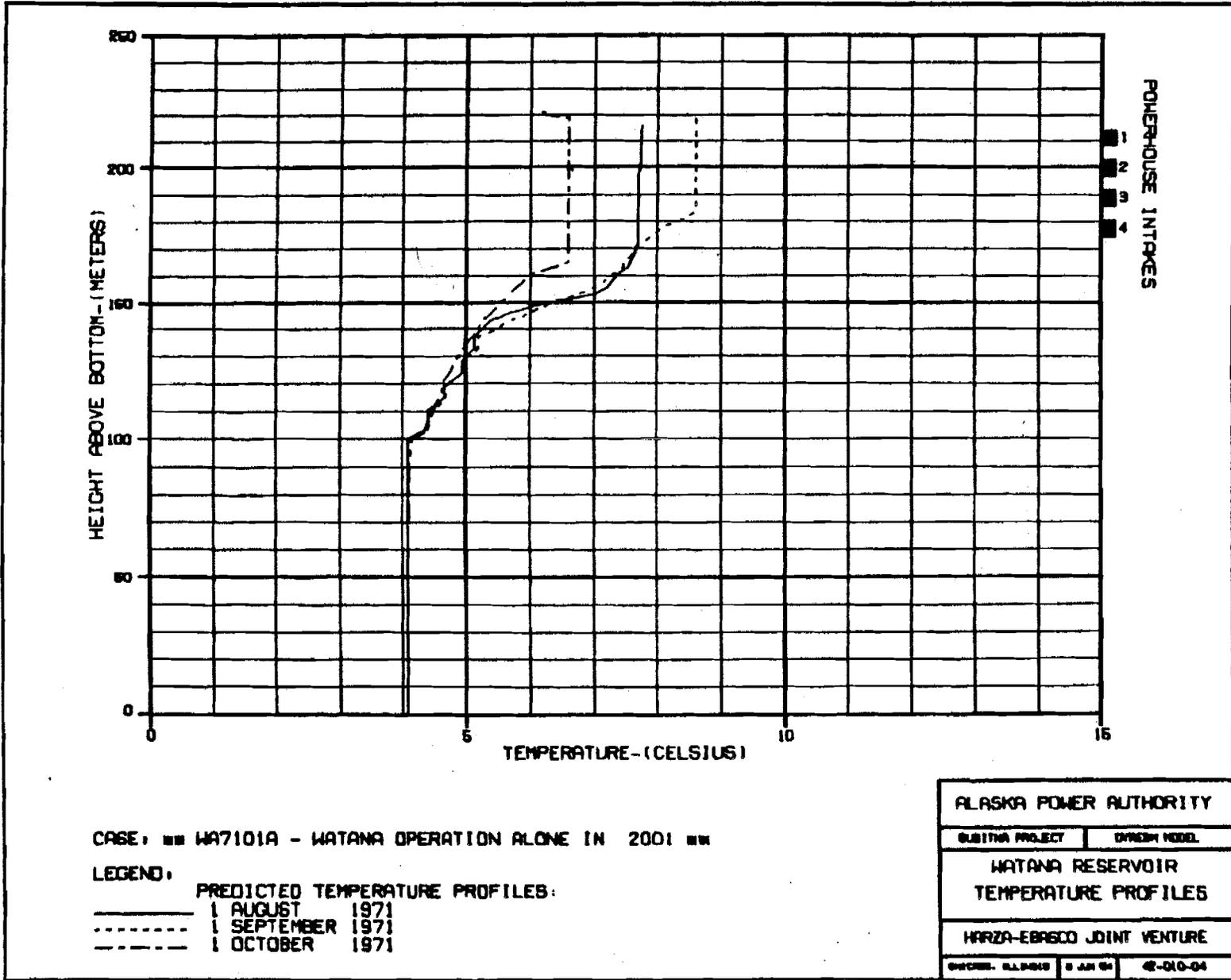
WATANA RESERVOIR
 TEMPERATURE PROFILES

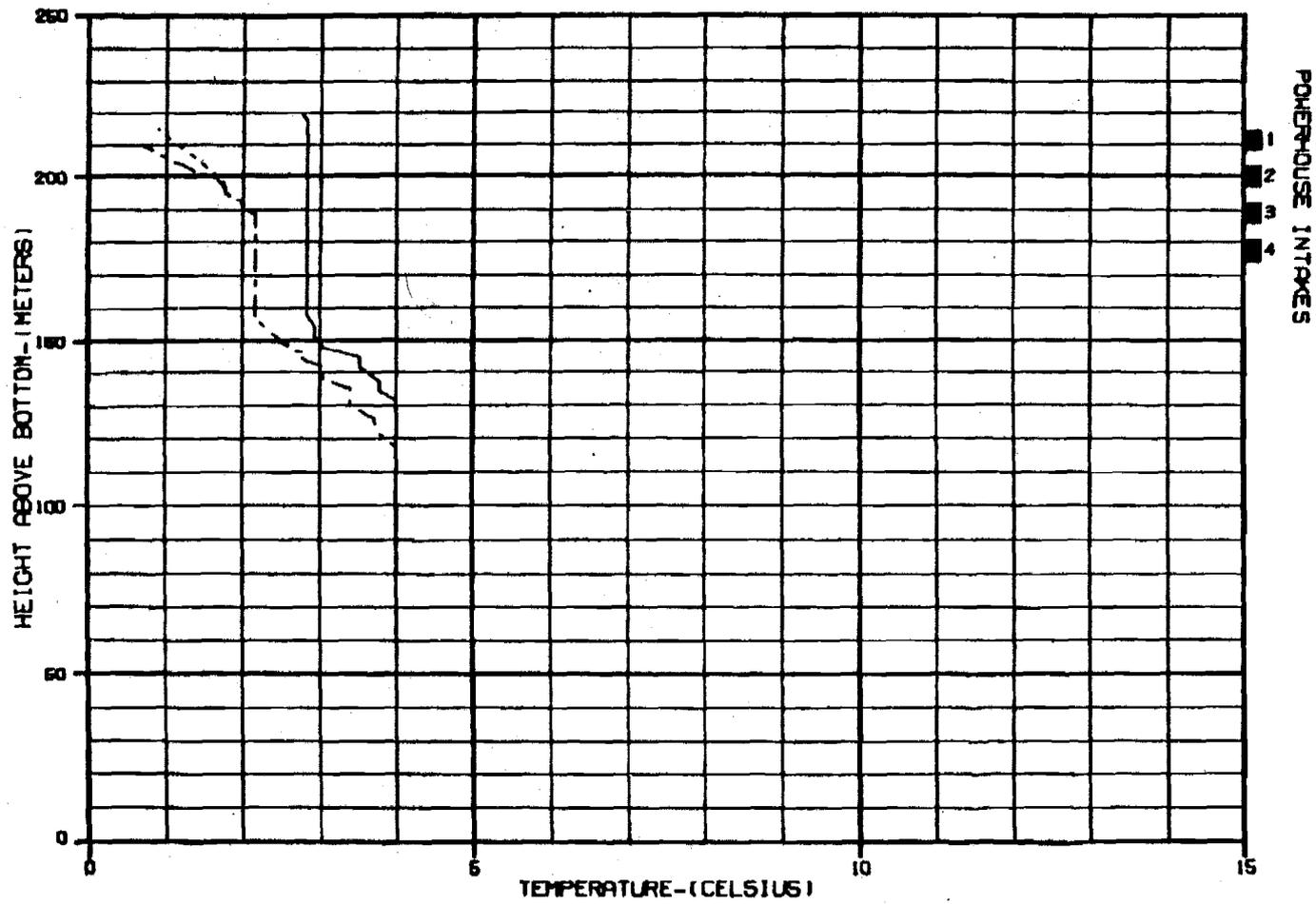
HARZA-EBASCO JOINT VENTURE

CHANGES - EL PASO

9 JAN 80

4E-010-04

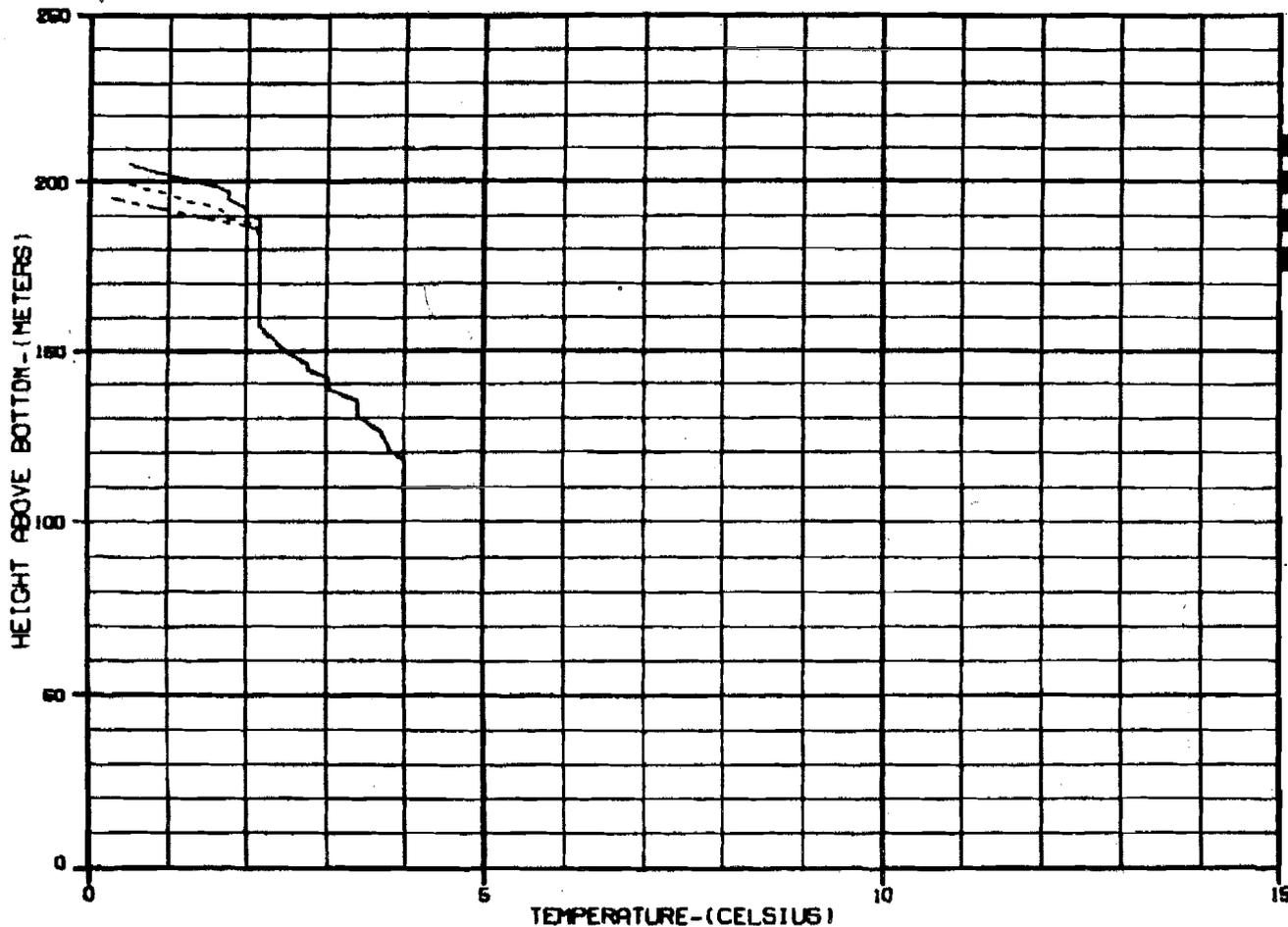




CASE: ■■ WA7101A - WATANA OPERATION ALONE IN 2001 ■■

LEGEND:
 PREDICTED TEMPERATURE PROFILES:
 ———— | NOVEMBER 1971
 | DECEMBER 1971
 - - - - | JANUARY 1972

ALASKA POWER AUTHORITY		
EXISTING PROJECT	OPERATION PERIOD	
WATANA RESERVOIR TEMPERATURE PROFILES		
HARZA-EBASCO JOINT VENTURE		
DESIGNED BY	DATE	REV
ALP/MS	8 JAN 81	42-010-04



CASE: ■■ WA7101A - WATANA OPERATION ALONE IN 2001 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

——— | FEBRUARY 1972
 - - - - | MARCH 1972
 - · - · | APRIL 1972

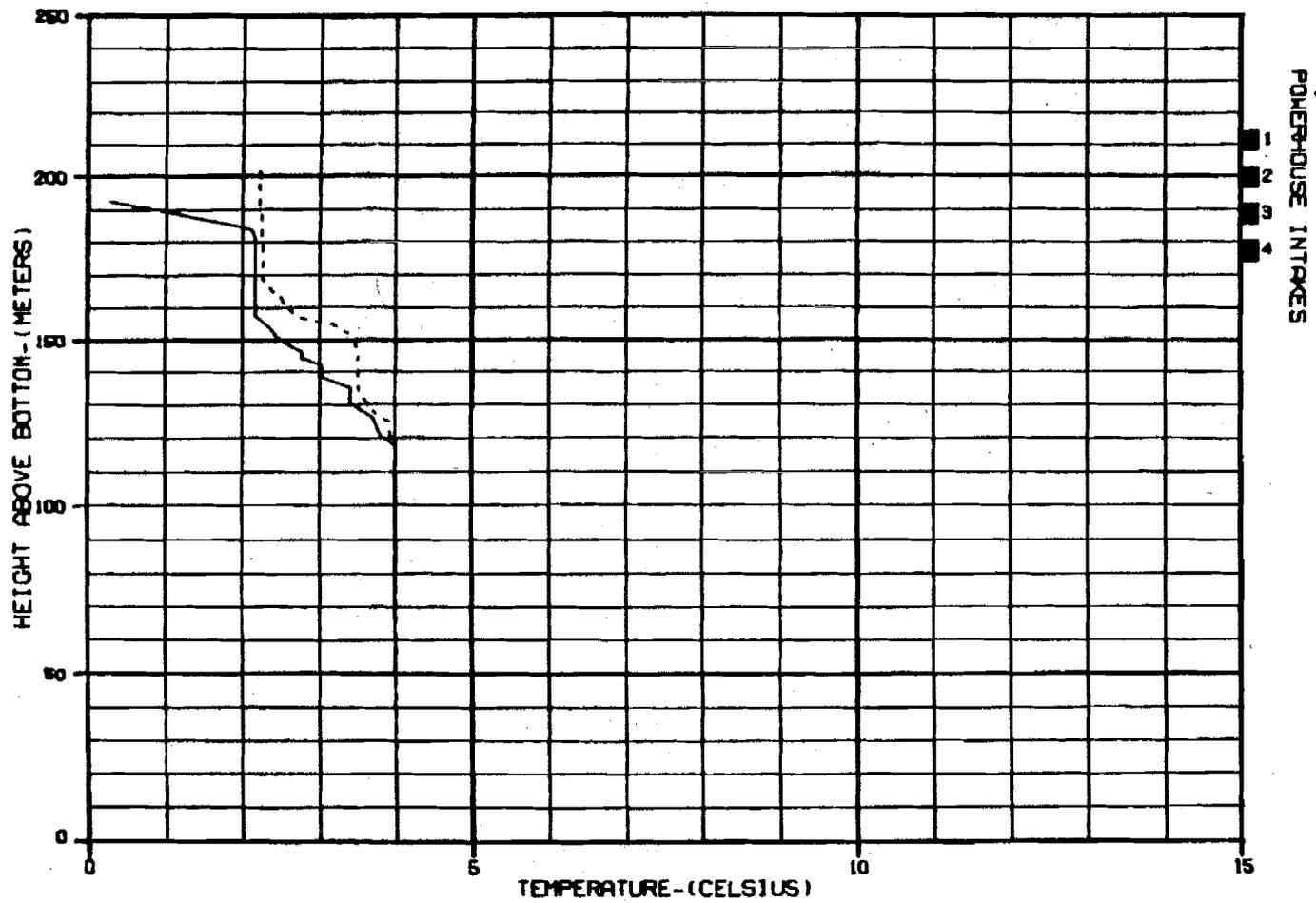
ALASKA POWER AUTHORITY

GLIBTINA PROJECT | OPENIN MODEL

WATANA RESERVOIR
TEMPERATURE PROFILES

HARZA-EBRACO JOINT VENTURE

CHUCKER, R. LINDS | 8 JAN 81 | 4E-010-04



CASE: ■■ WA7101A - WATANA OPERATION ALONE IN 2001 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

————— | MAY 1972
 | JUNE 1972
 - - - - - | JULY 1972

ALASKA POWER AUTHORITY

WATANA PROJECT

OPERATION MODEL

WATANA RESERVOIR
 TEMPERATURE PROFILES

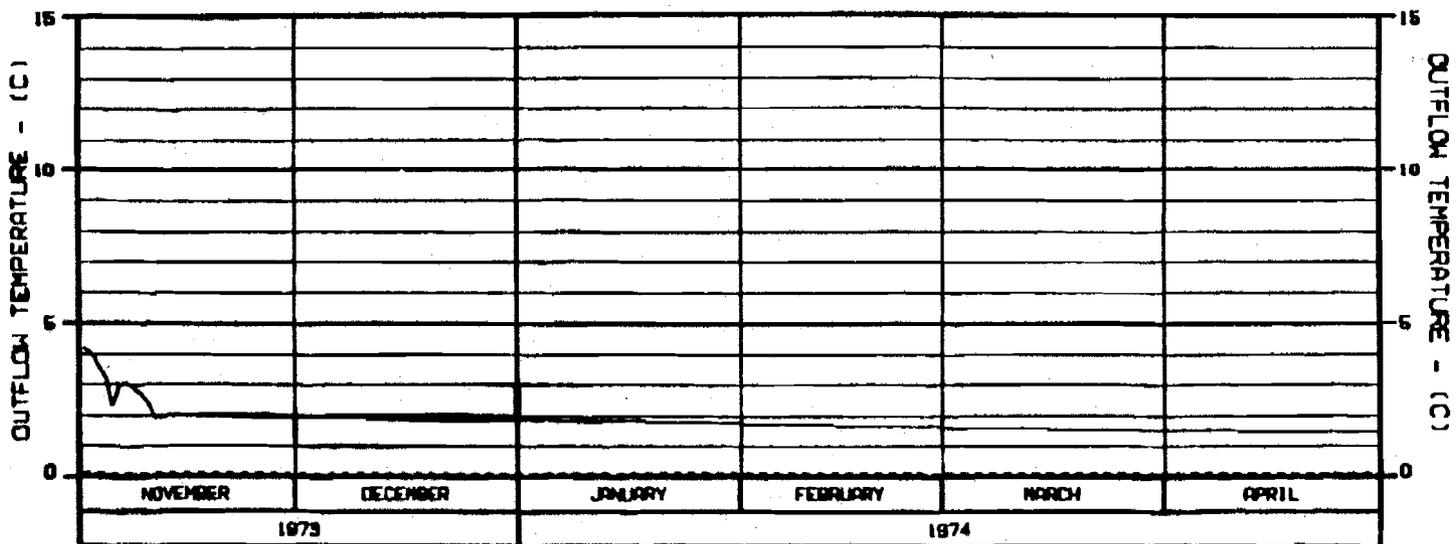
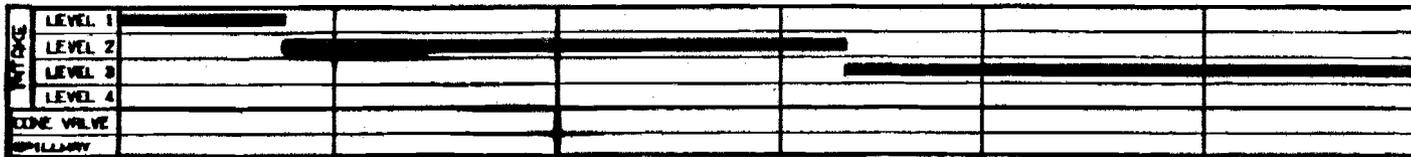
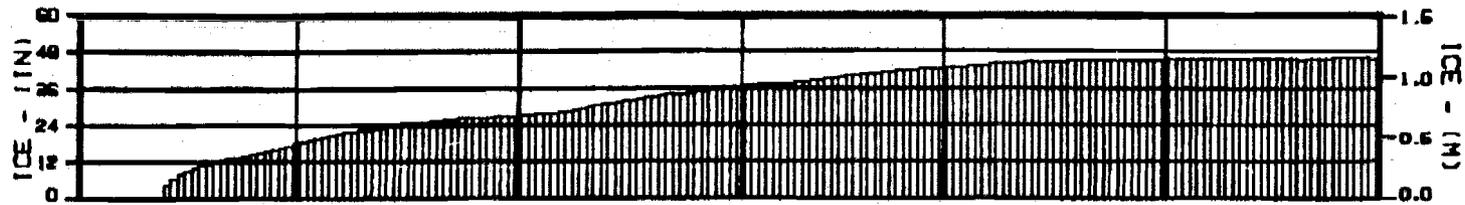
HARZA-EBASCO JOINT VENTURE

CHART NO. WA-000

0 JAN 81

42-010-04

EXHIBIT W



LEGEND: CASE: ■■ WA7401A - WATANA OPERATION ALONE IN 2001 ■■

———— PREDICTED OUTFLOW TEMPERATURE
 - - - - - INFLOW TEMPERATURE

- NOTES:
1. INTAKE PORT LEVEL 1 AT ELEVATION 2161 FT (656.6 M)
 2. INTAKE PORT LEVEL 2 AT ELEVATION 2114 FT (644.3 M)
 3. INTAKE PORT LEVEL 3 AT ELEVATION 2077 FT (633.1 M)
 4. INTAKE PORT LEVEL 4 AT ELEVATION 2040 FT (621.9 M)
 5. CONE VALVE AT ELEVATION 2040 FT (621.9 M)
 6. SPILLWAY CREST AT ELEVATION 2149 FT (654.7 M)

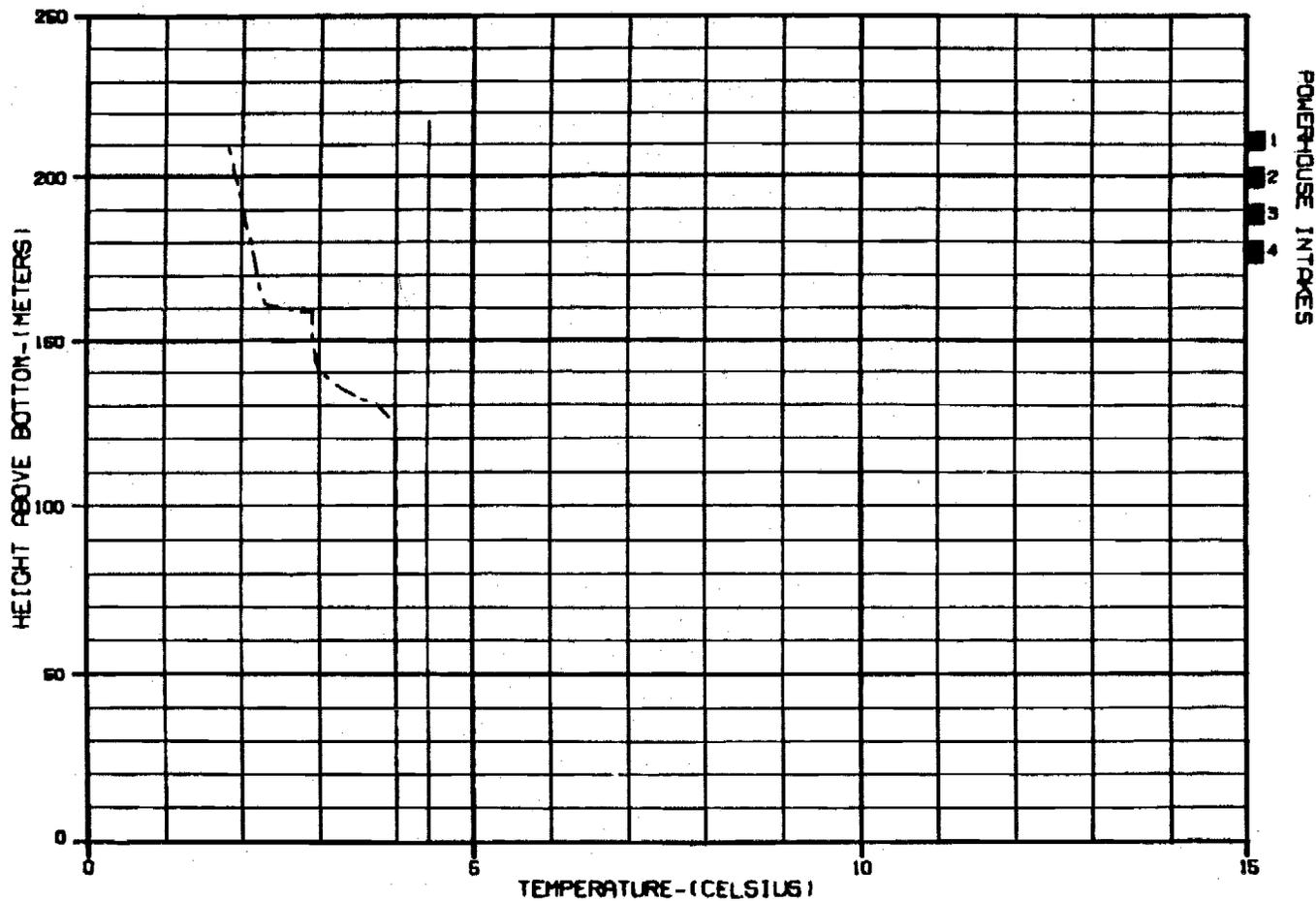
ALASKA POWER AUTHORITY

EXISTING PROJECT DYNEMO MODEL

WATANA RESERVOIR
 OUTFLOW TEMPERATURE
 AND ICE GROWTH

HARZA-EBRSCO JOINT VENTURE

DESIGN: 11-10-83 9 JAN 84 48-010-04



CASE: ■■ WA7401A - WATANA OPERATION ALONE IN 2001 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

_____ 1 NOVEMBER 1973
 - - - - - 1 DECEMBER 1973
 - · - · - 1 JANUARY 1974

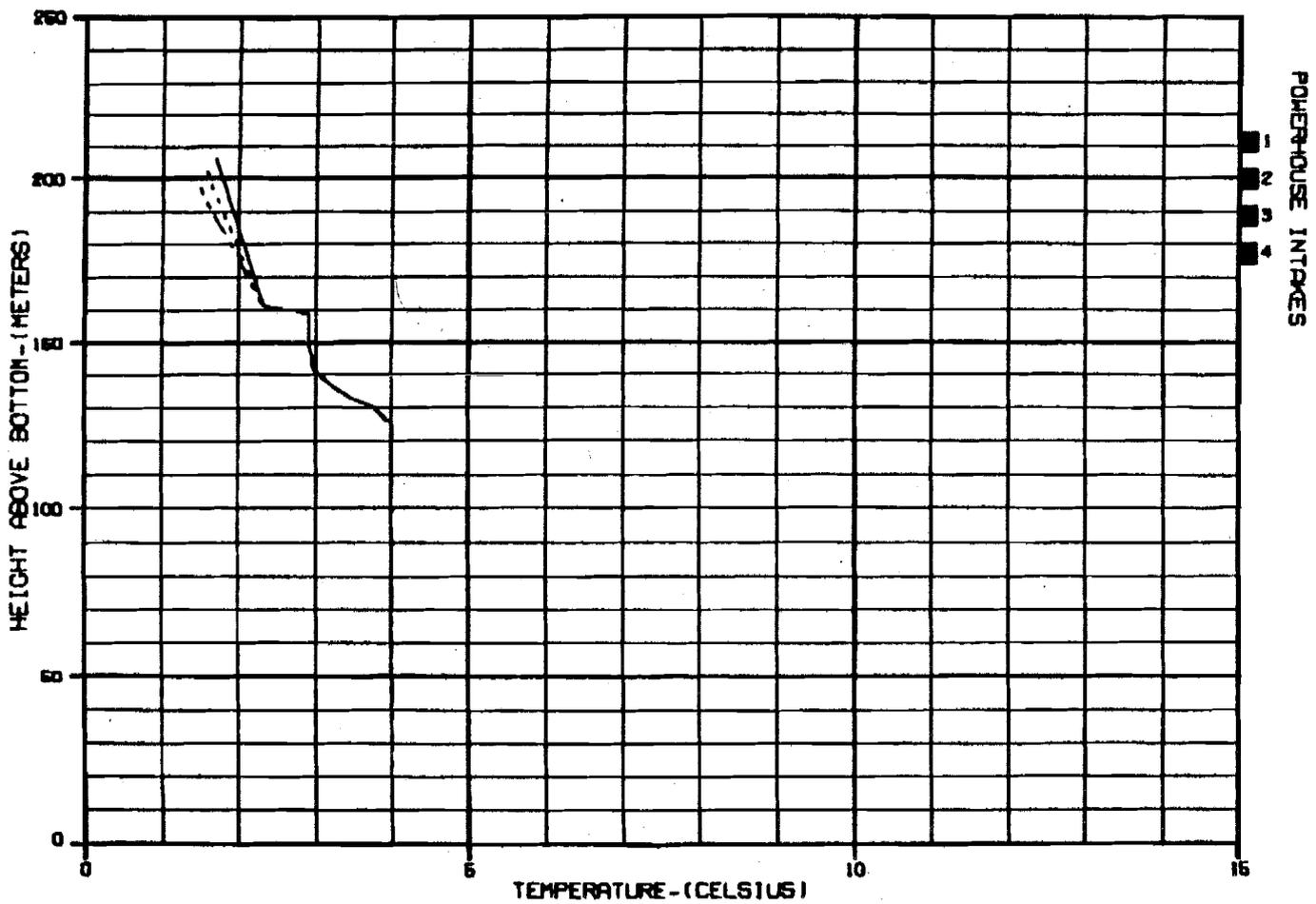
ALASKA POWER AUTHORITY

SUBITNA PROJECT DYNOM MODEL

WATANA RESERVOIR
TEMPERATURE PROFILES

HARZA-EBRACO JOINT VENTURE

CHARGE: 44-0000 8 JAN 84 4E-010-04



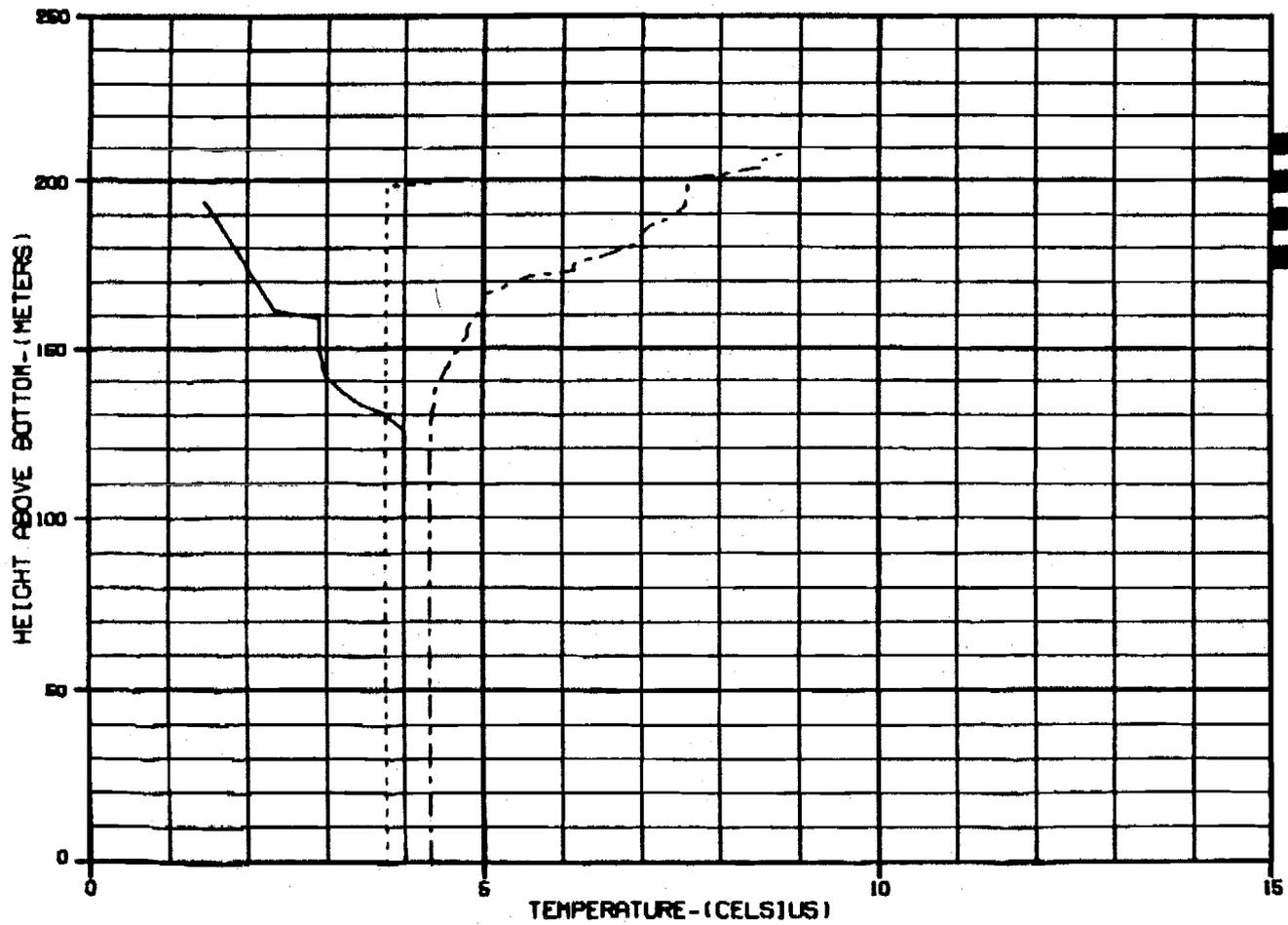
CASE: WA7401A - WATANA OPERATION ALONE IN 2001

LEGEND:

PREDICTED TEMPERATURE PROFILES:

- FEBRUARY 1974
- - - MARCH 1974
- · - · - APRIL 1974

ALASKA POWER AUTHORITY		
DESIGN PROJECT	DYNAMIC MODEL	
WATANA RESERVOIR		
TEMPERATURE PROFILES		
WARZA-EBRSCO JOINT VENTURE		
DESIGN: ALBORN	8 JAN 84	4E-010-04



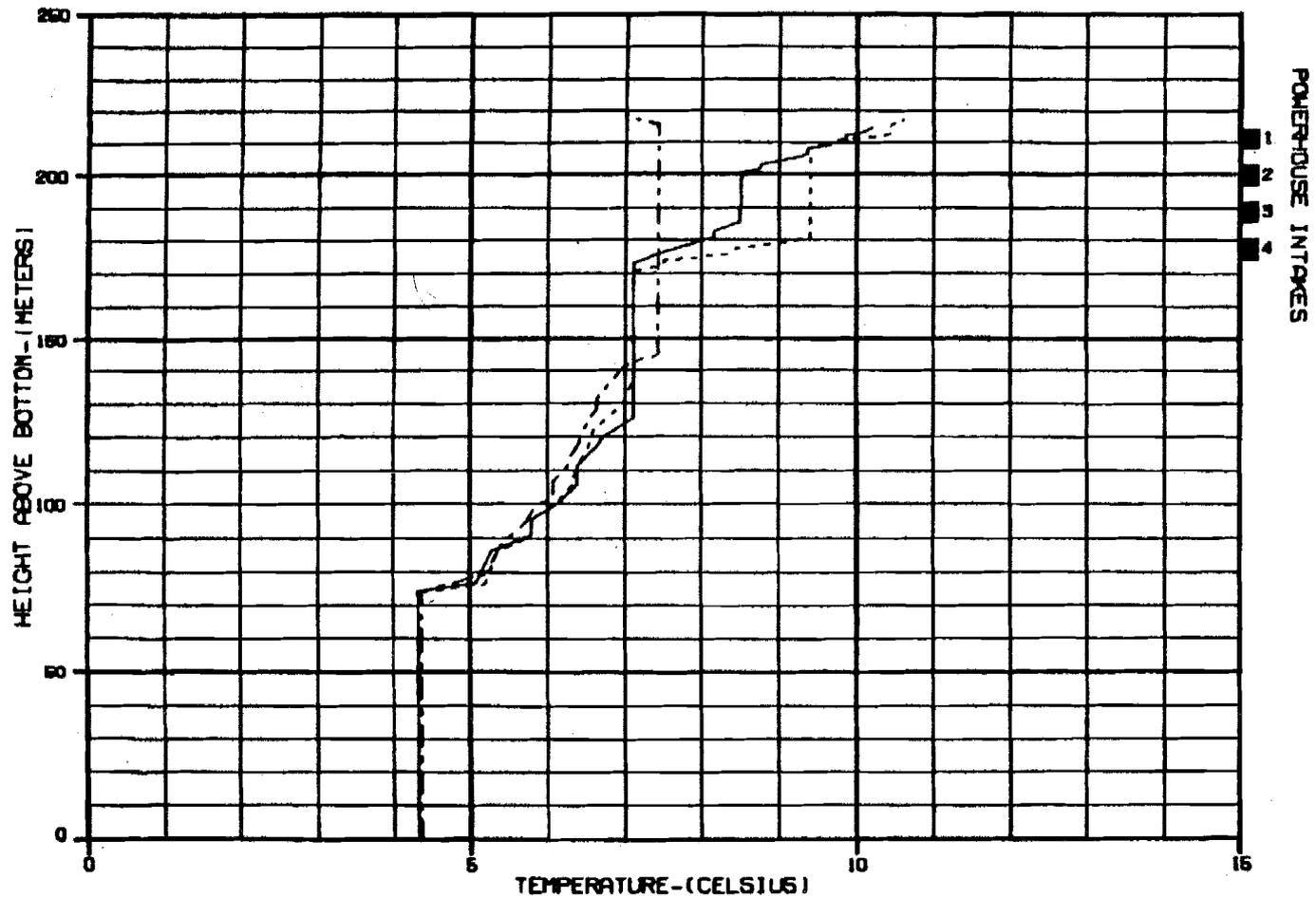
CASE: WA7401A - WATANA OPERATION ALONE IN 2001

LEGEND:

PREDICTED TEMPERATURE PROFILES:

——— | MAY 1974
 - - - - | JUNE 1974
 - · - · - | JULY 1974

ALASKA POWER AUTHORITY		
DESIGN PROJECT	DESIGN MODEL	
WATANA RESERVOIR		
TEMPERATURE PROFILES		
MARZA-EBASCO JOINT VENTURE		
DOC. NO.	DATE	REV.
42-010-04	8 JAN 84	42-010-04



CASE: WA7401A - WATANA OPERATION ALONE IN 2001

LEGEND:

PREDICTED TEMPERATURE PROFILES:

_____ 1 AUGUST 1974
 - - - - - 1 SEPTEMBER 1974
 - . - . - 1 OCTOBER 1974

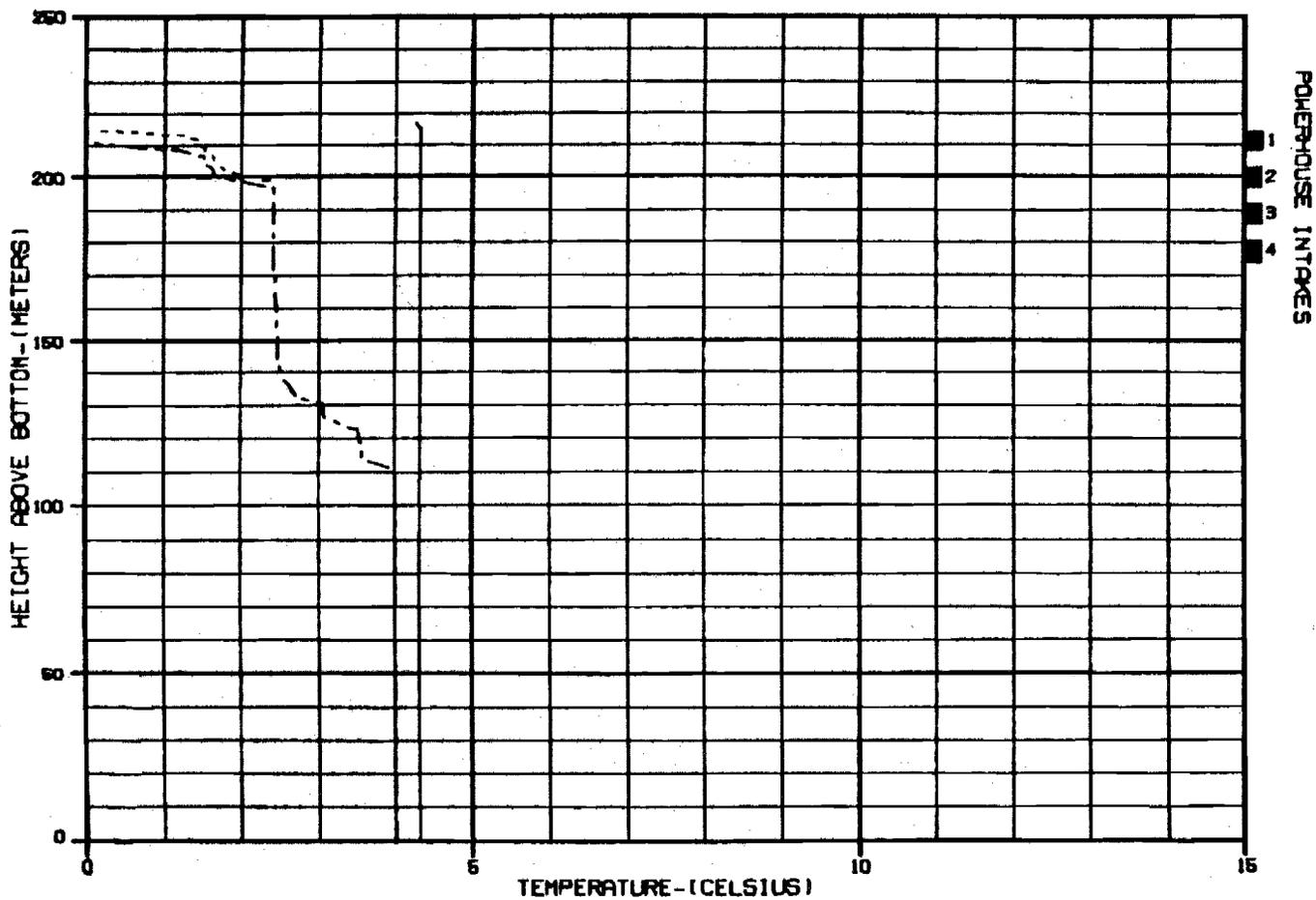
ALASKA POWER AUTHORITY

WATANA PROJECT GREEN HILL

WATANA RESERVOIR
TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

DATE: 11/10/88 BY: J.M. G. 42-010-04



CASE: ■■ WA7401A - WATANA OPERATION ALONE IN 2001 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

_____ | NOVEMBER 1974
 - - - - - | DECEMBER 1974
 - · - · - | JANUARY 1975

ALASKA POWER AUTHORITY

SUBMITTA PROJECT

OPERATION MODEL

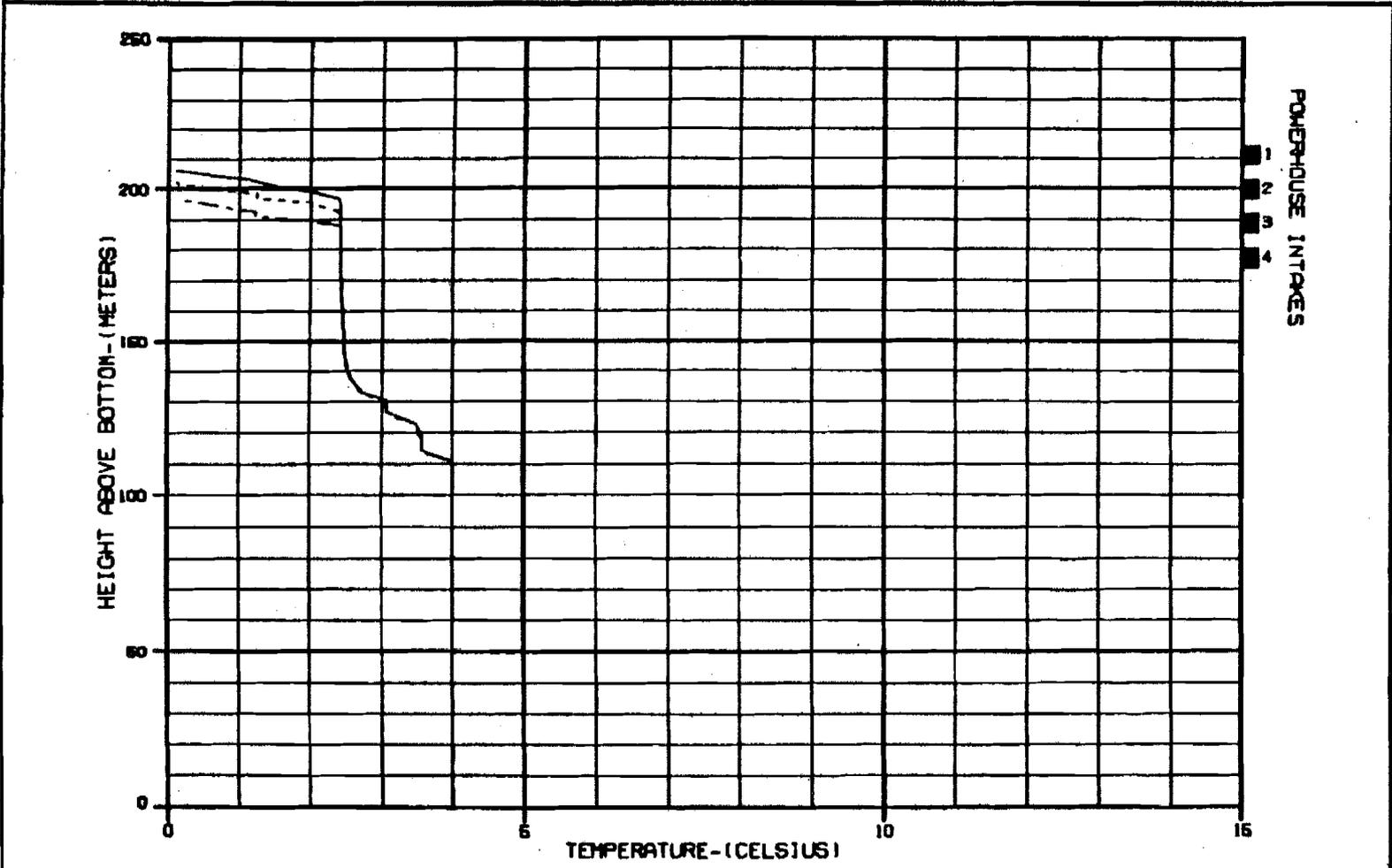
WATANA RESERVOIR
TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

CHARGE: 44-0000

8 JAN 84

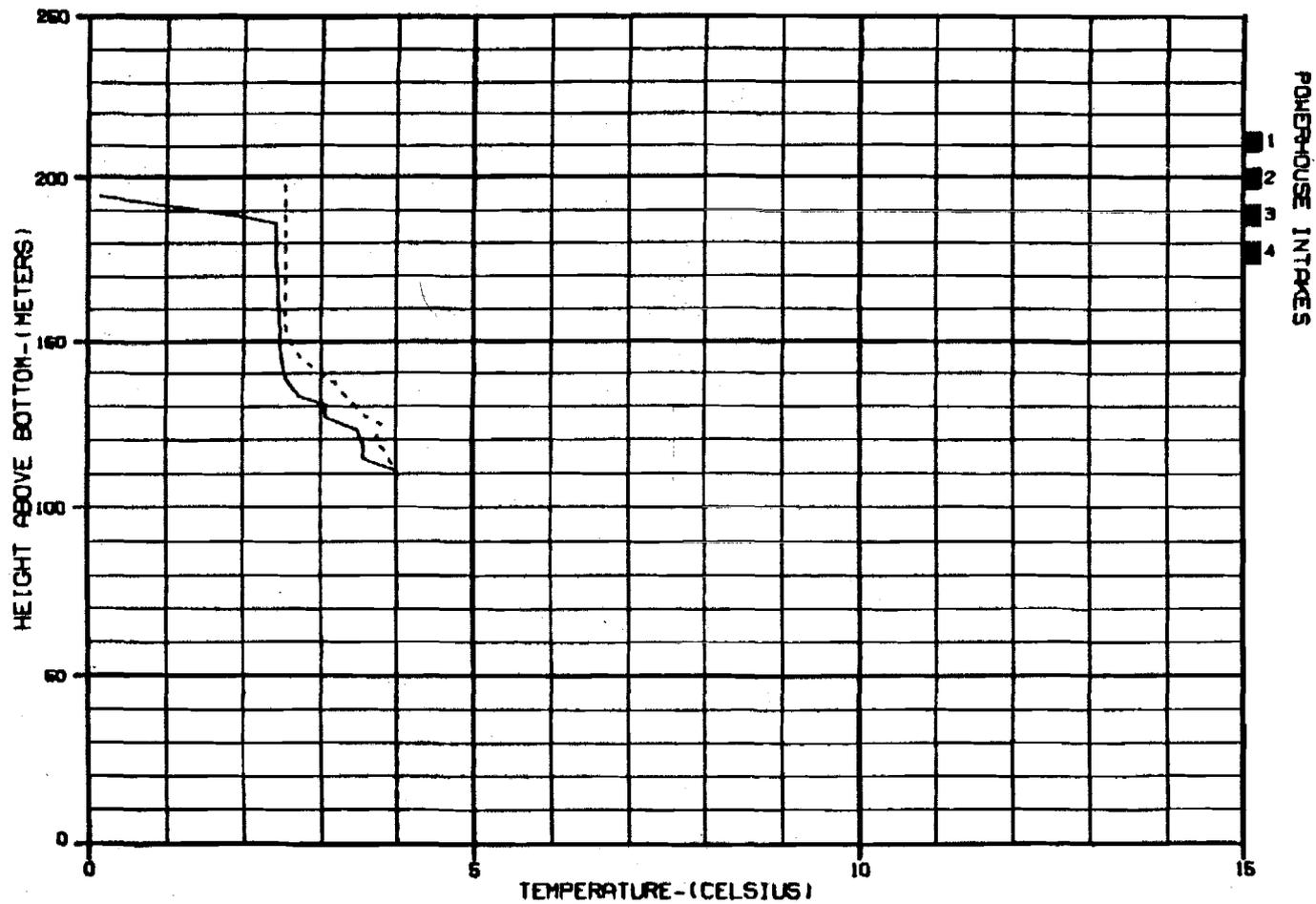
4E-D10-04



CASE: WA7401A - WATANA OPERATION ALONE IN 2001

LEGEND: PREDICTED TEMPERATURE PROFILES:
 ———— | FEBRUARY 1975
 | MARCH 1975
 - - - - | APRIL 1975

ALASKA POWER AUTHORITY		
SUBMITTA PROJECT	OPENING MODEL	
WATANA RESERVOIR TEMPERATURE PROFILES		
HARZA-EBASCO JOINT VENTURE		
OWNER: ALASKA	DRAWN BY: J. J. J.	DATE: 42-010-04



CASE: ■■ WA7401A - WATANA OPERATION ALONE IN 2001 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

_____ | MAY 1975
 - - - - - | JUNE 1975
 - · - · - | JULY 1975

ALASKA POWER AUTHORITY

SUBMITTA PROJECT

OVERSEEN MODEL

WATANA RESERVOIR
TEMPERATURE PROFILES

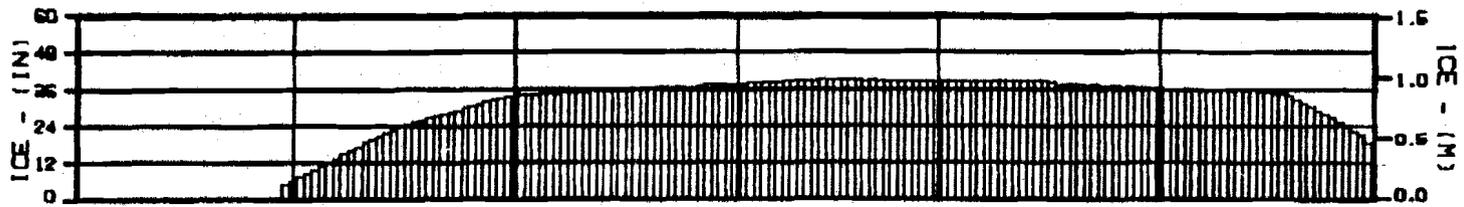
HARZA-EBASCO JOINT VENTURE

DESIGNED BY: ALP/AM

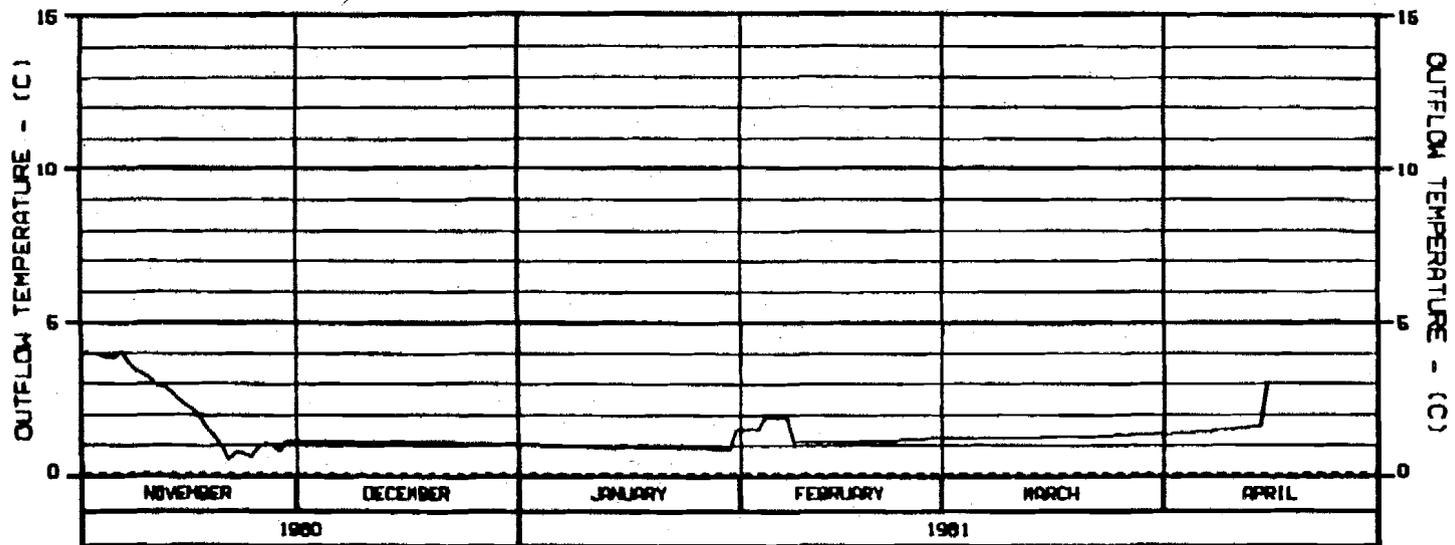
8 JAN 81

42-010-04

EXHIBIT X



INTAKE	LEVEL 1	██████████				
	LEVEL 2	████████████████████				
	LEVEL 3		████████████████████			
	LEVEL 4			████████████████████		
	CONE VALVE					
	SPILLWAY					



LEGEND: CASE # WAB182101A - WATANA OPERATION ALONE IN 2001

— PREDICTED OUTFLOW TEMPERATURE
 - - - - - INFLOW TEMPERATURE

- NOTES:
1. INTAKE PORT LEVEL 1 AT ELEVATION 2161 FT (655.6 M)
 2. INTAKE PORT LEVEL 2 AT ELEVATION 2114 FT (644.3 M)
 3. INTAKE PORT LEVEL 3 AT ELEVATION 2077 FT (633.1 M)
 4. INTAKE PORT LEVEL 4 AT ELEVATION 2040 FT (621.9 M)
 5. CONE VALVE AT ELEVATION 2040 FT (621.9 M)
 6. SPILLWAY CREST AT ELEVATION 2148 FT (654.7 M)

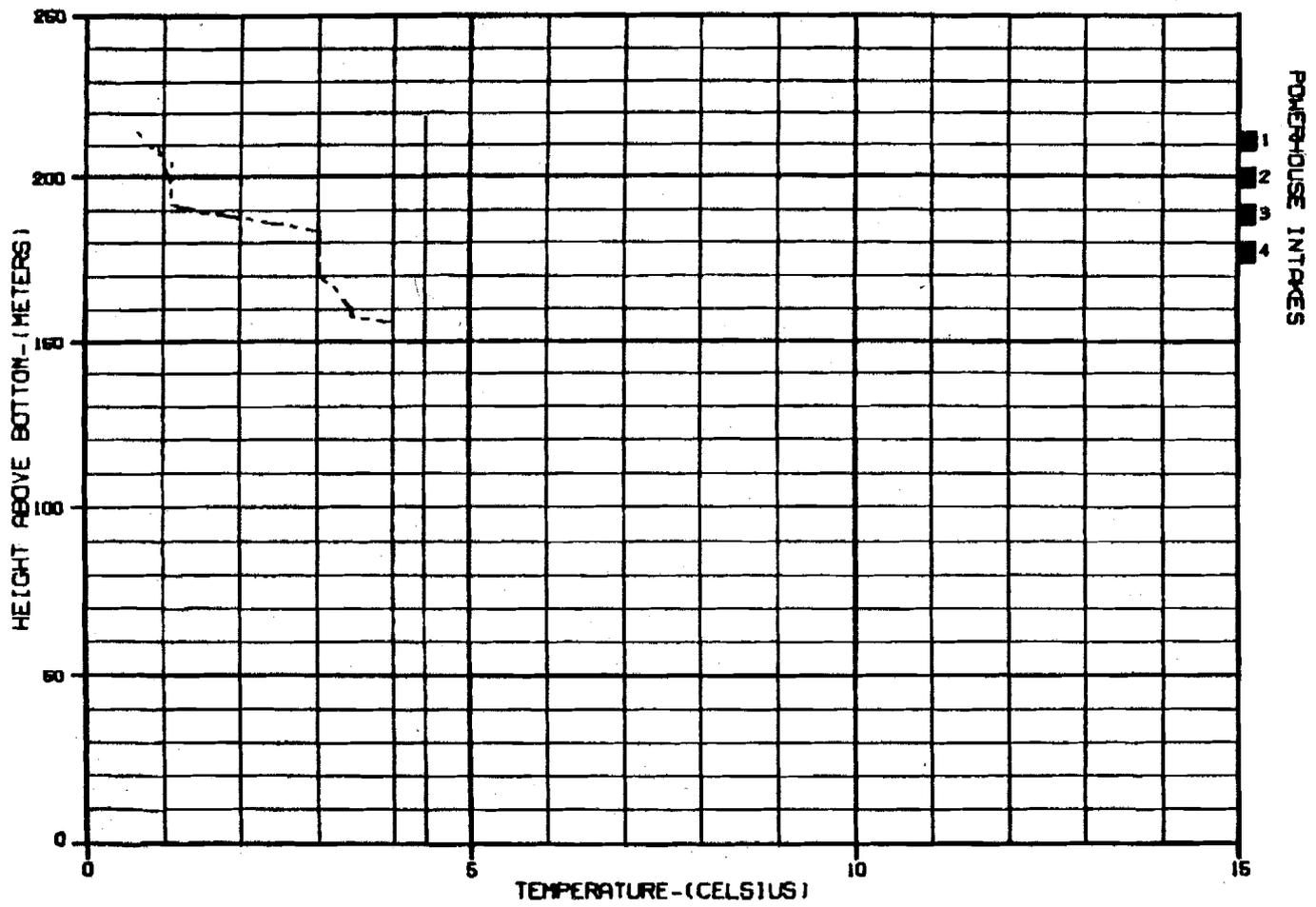
ALASKA POWER AUTHORITY

SUBMITTA PROJECT DYNEM MODEL

WATANA RESERVOIR
 OUTFLOW TEMPERATURE
 AND ICE GROWTH

HARZA-EBASCO JOINT VENTURE

DRAWN: S.L. BROWN 8 JAN 01 42-000-04



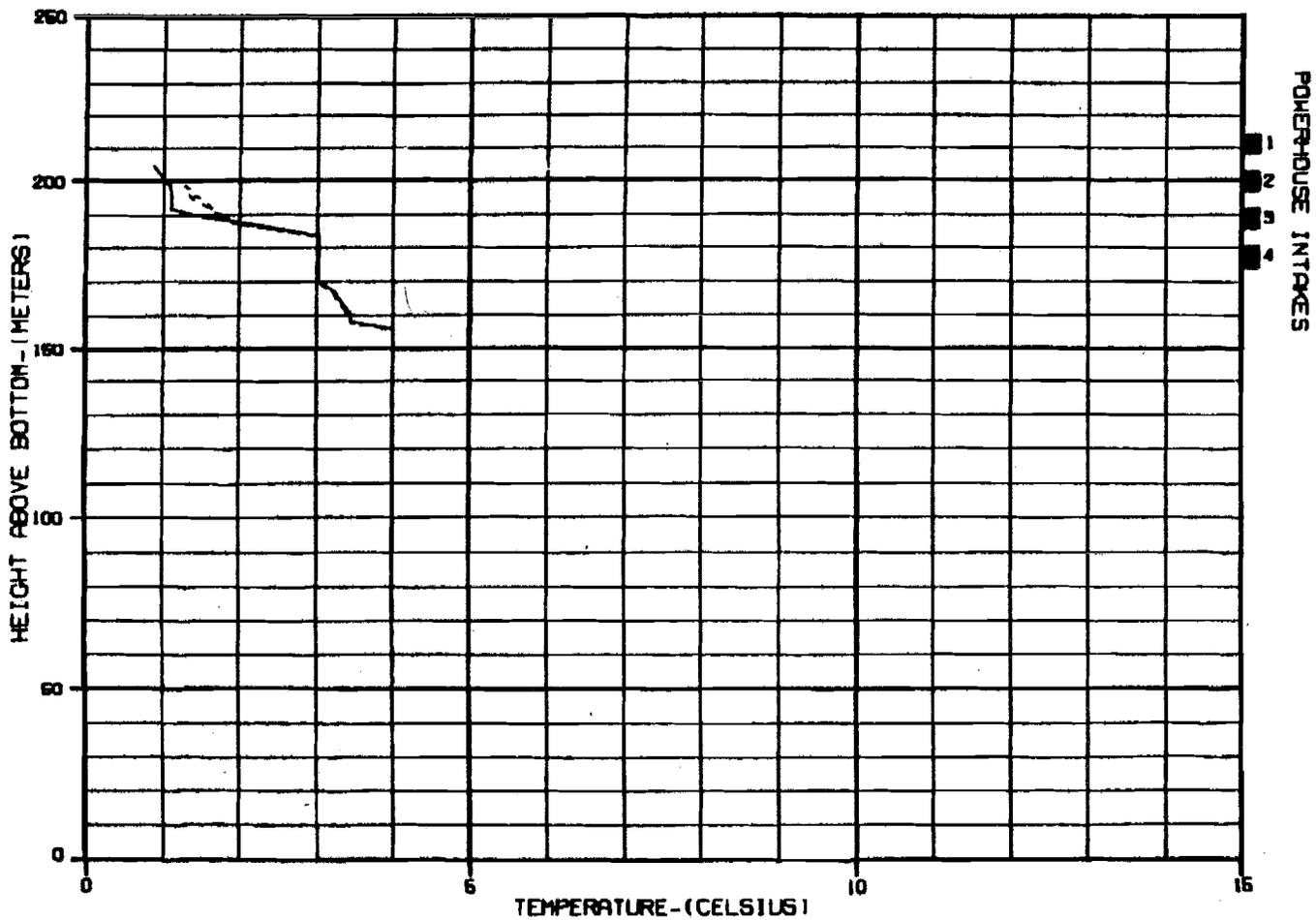
CASE: ■■ WAB11B2101A - WATANA OPERATION ALONE IN 2001 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

- | NOVEMBER 1980
- | DECEMBER 1980
- | JANUARY 1981

ALASKA POWER AUTHORITY	
WATANA PROJECT	OWNERS MODEL
WATANA RESERVOIR TEMPERATURE PROFILES	
WARZA-EBAGCO JOINT VENTURE	
DATE: 11/10/80	42-010-04



CASE: ■■ WAB1182101A - WATANA OPERATION ALONE IN 2001 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

_____ | FEBRUARY 1981
 - - - - - | MARCH 1981
 - · - · - | APRIL 1981

ALASKA POWER AUTHORITY

DISTRIBUTION PROJECT

DYKEMA MODEL

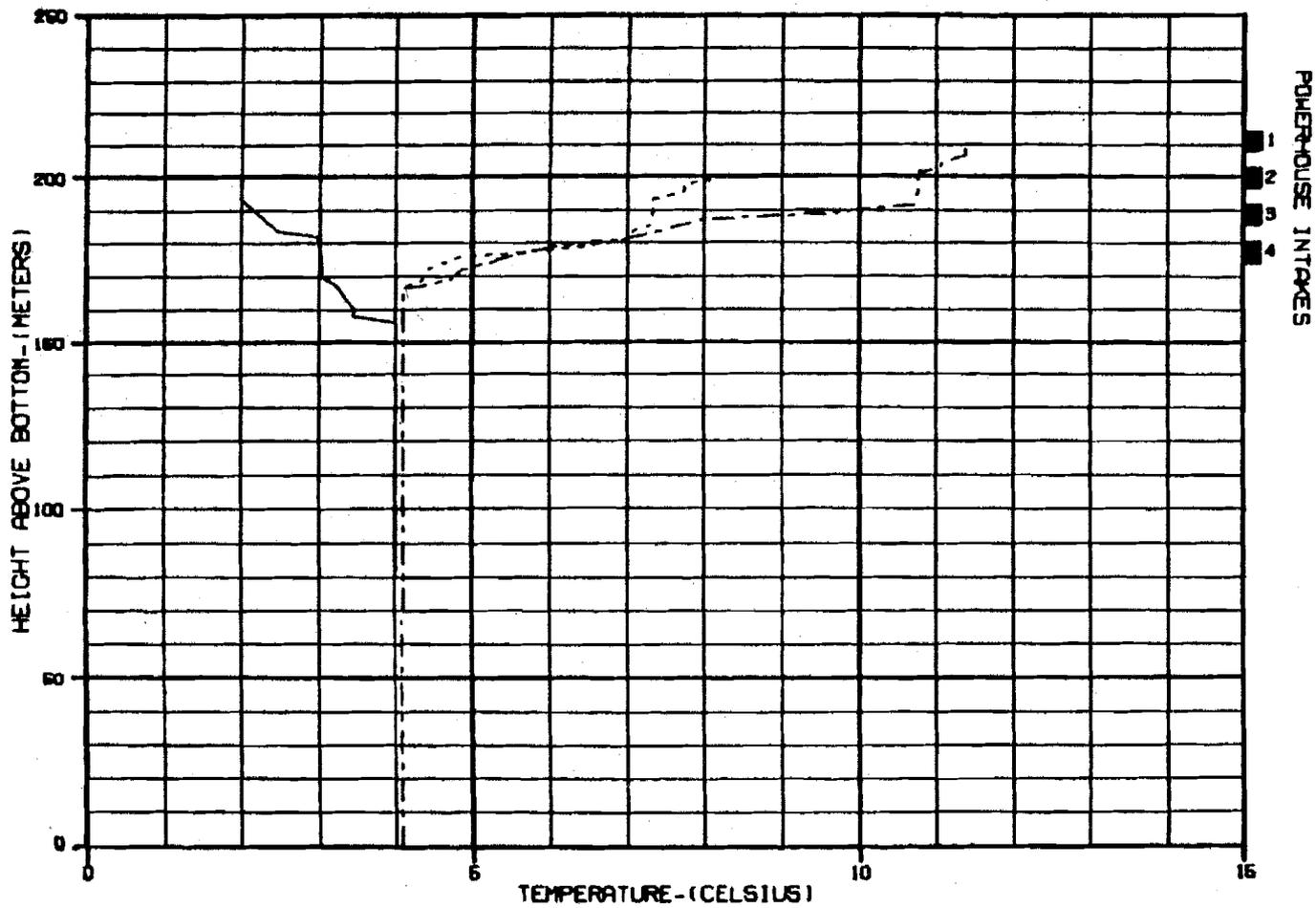
WATANA RESERVOIR
TEMPERATURE PROFILES

HARZA-EDBECO JOINT VENTURE

EVERETT - 8110000

8 JAN 80

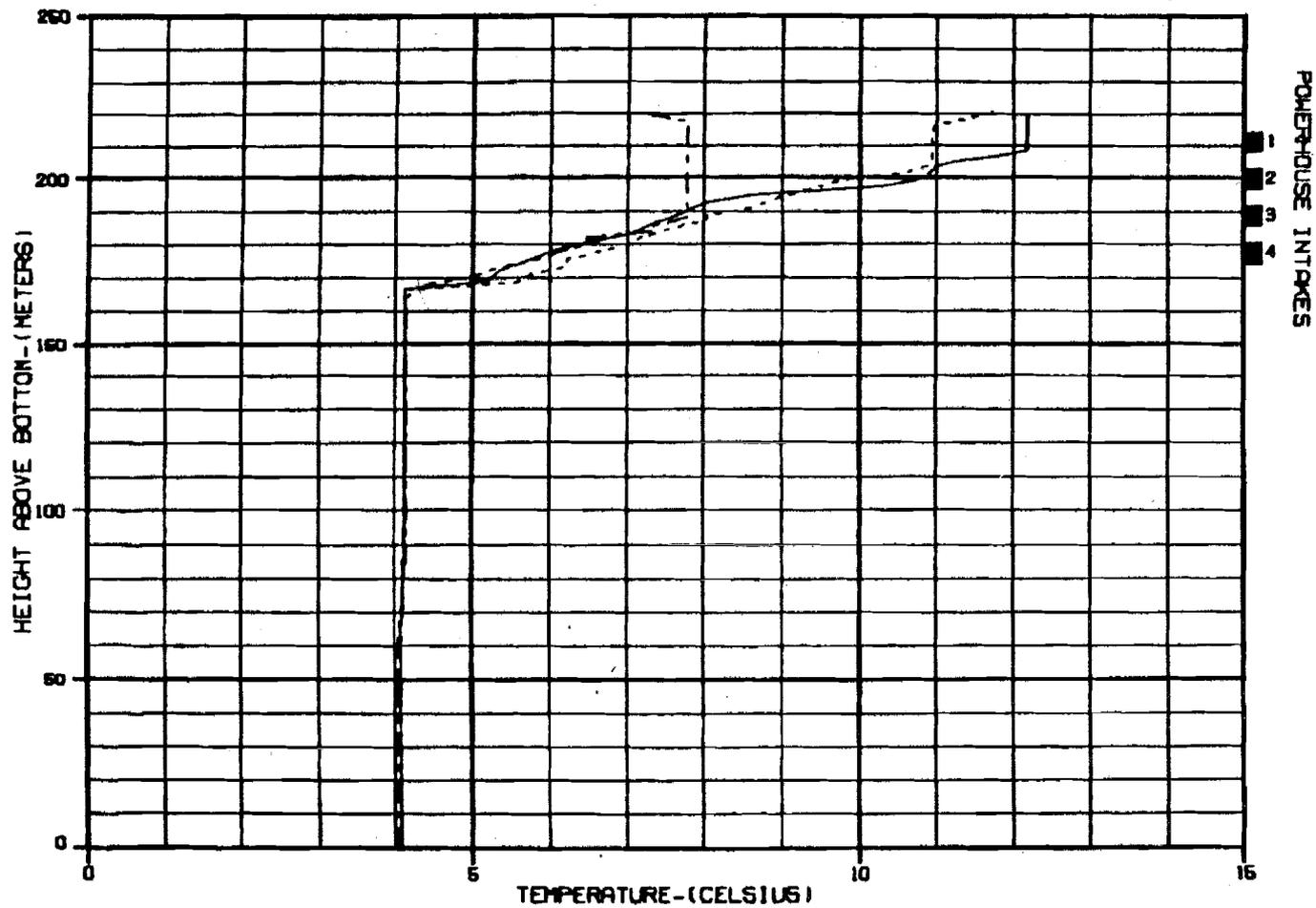
4E-010-04



CASE: WAB1182101A - WATANA OPERATION ALONE IN 2001

LEGEND: PREDICTED TEMPERATURE PROFILES:
 ———— 1 MAY 1981
 1 JUNE 1981
 - - - - 1 JULY 1981

ALASKA POWER AUTHORITY		
QUALITY PROJECT	DYNAMIC MODEL	
WATANA RESERVOIR TEMPERATURE PROFILES		
WARZA-EBRSCO JOINT VENTURE		
DESIGNED BY: B.L. HAYES	DATE: 0 JUN 81	REV: 02-010-04



CASE: ■■ WAB11B2101A - WATANA OPERATION ALONE IN 2001 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

- | AUGUST 1981
- - - | SEPTEMBER 1981
- · - · | OCTOBER 1981

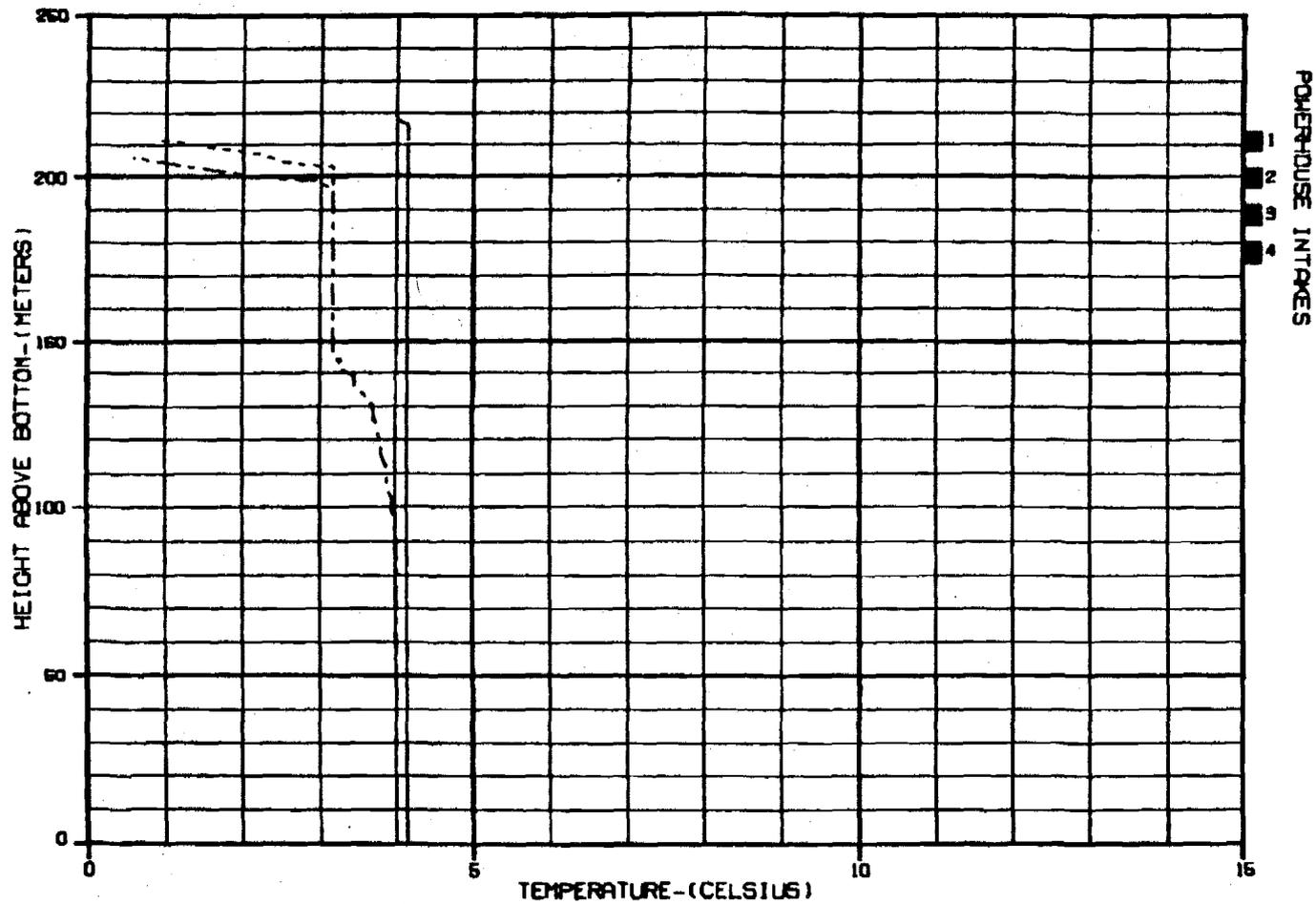
ALASKA POWER AUTHORITY

WATANA PROJECT OPENING MODEL

WATANA RESERVOIR
TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

DESIGN: ELDON B. JAMES 4E-010-04



CASE: ■■■ WAB1182101A - WATANA OPERATION ALONE IN 2001 ■■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

- | NOVEMBER 1981
- | DECEMBER 1981
- · - · - | JANUARY 1982

ALASKA POWER AUTHORITY

WATANA PROJECT

DYKEMA MODEL

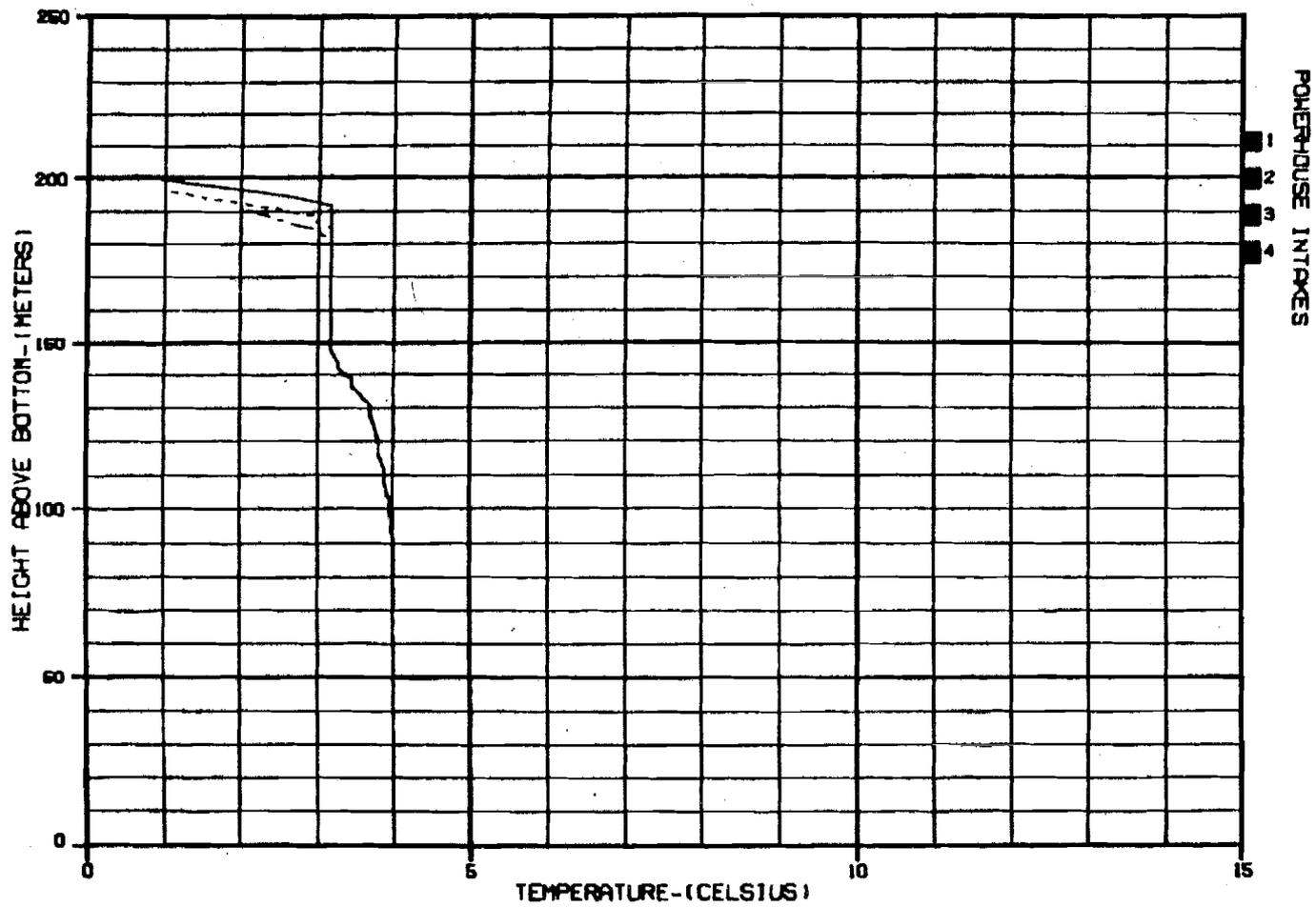
WATANA RESERVOIR
TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

CHUCK - 11/1988

9 JUN 89

42-010-04



CASE: ■■ WAB1182101A - WATANA OPERATION ALONE IN 2001 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

— | FEBRUARY 1982
 | MARCH 1982
 - - - - | APRIL 1982

ALASKA POWER AUTHORITY

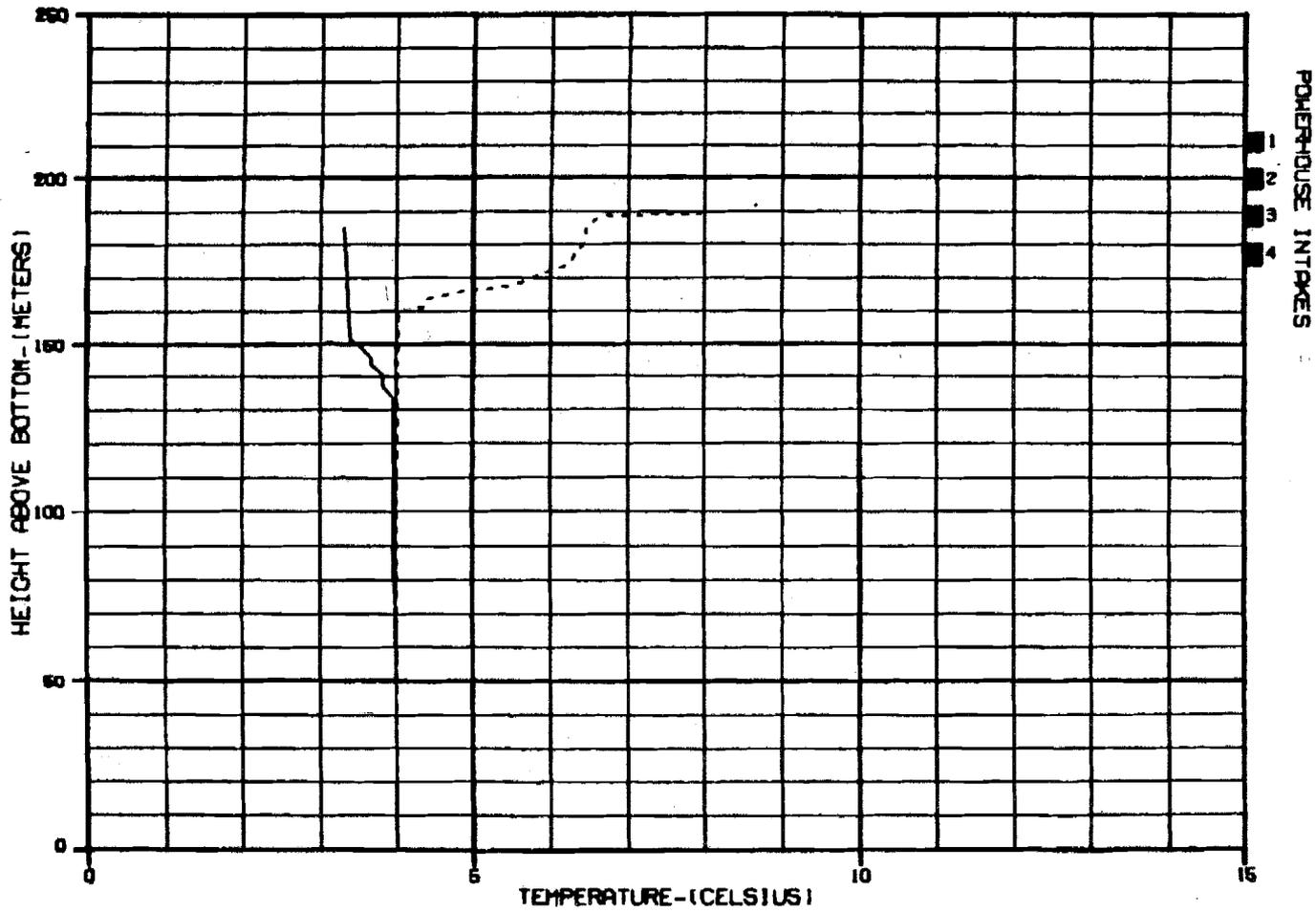
WATANA PROJECT | OTHER MODEL

WATANA RESERVOIR
 TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

CHECKED: B.L.L. 05 JAN 82 42-010-04

EXHIBIT Y



CASE: ■■ WAB1182101A - WATANA OPERATION ALONE IN 2001 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

— 1 MAY 1983
 - - - 1 JUNE 1983

ALASKA POWER AUTHORITY

WATANA PROJECT

DYKIN MODEL

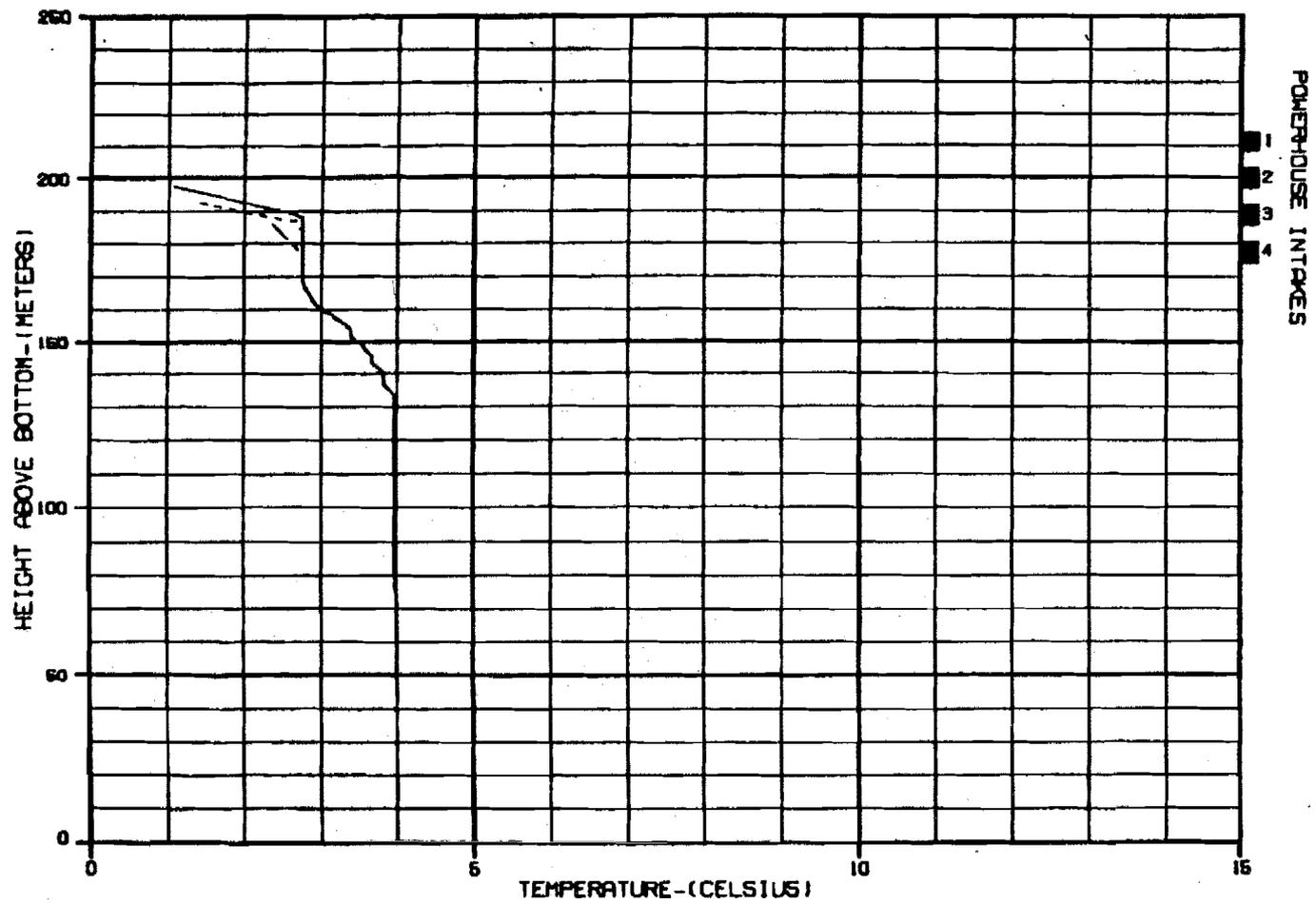
WATANA RESERVOIR
 TEMPERATURE PROFILES

WARZA-EBASCO JOINT VENTURE

CHASCO, ALASKA

8 JAN 84

42-010-04

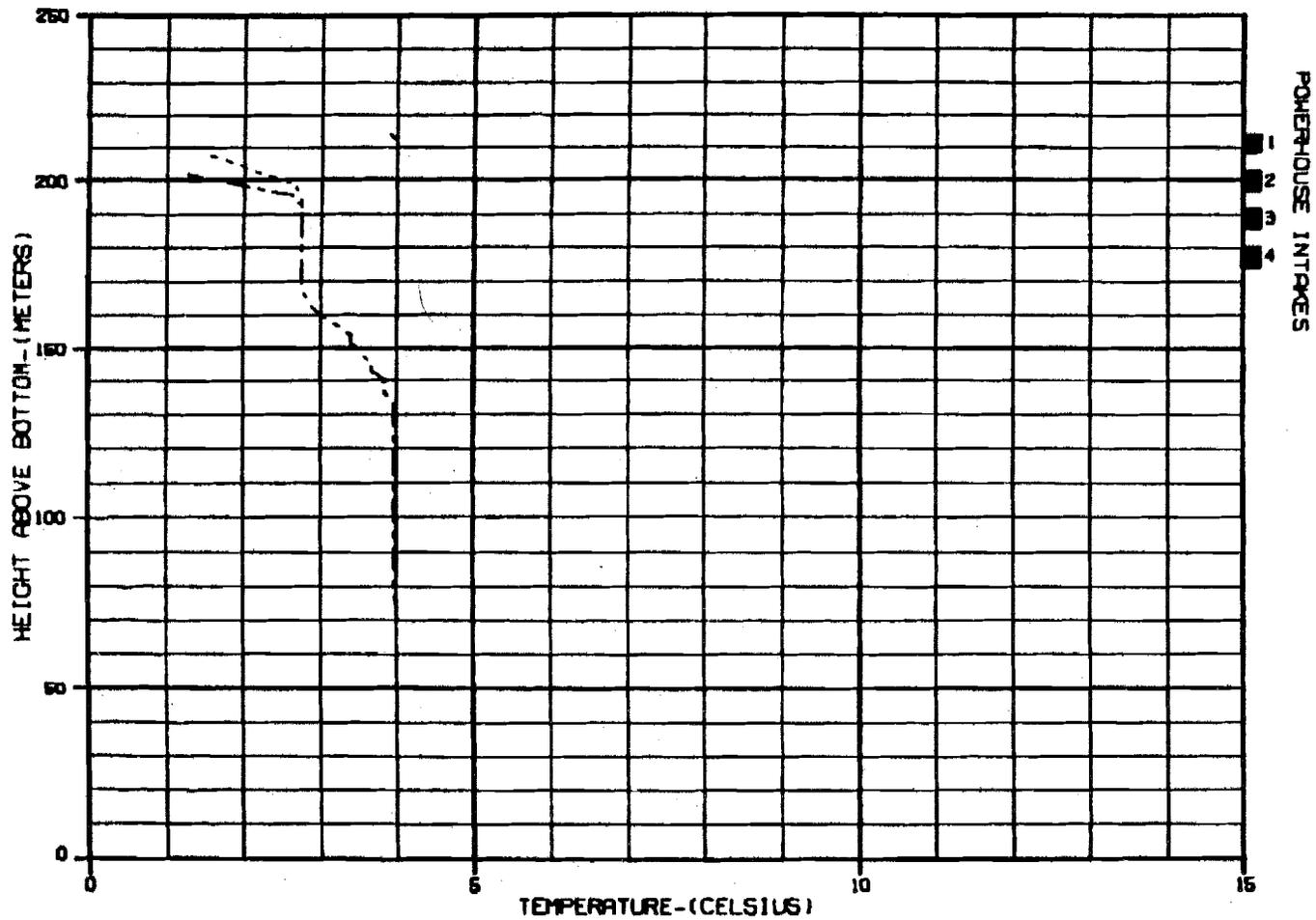


POWERHOUSE INTAKES

CASE: ■■ WAB1182101A - WATANA OPERATION ALONE IN 2001 ■■

LEGEND: PREDICTED TEMPERATURE PROFILES:
 ———— 1 FEBRUARY 1983
 - - - - - 1 MARCH 1983
 - · - · - 1 APRIL 1983

ALASKA POWER AUTHORITY	
SUBMITTA PROJECT	DYNOSM MODEL
WATANA RESERVOIR TEMPERATURE PROFILES	
HARZA-EBRSCO JOINT VENTURE	
CHARGE: BLD 0000	42-010-04



POWERHOUSE INTAKES

- 1
- 2
- 3
- 4

CASE: ■■ WAB1(82)01A - WATANA OPERATION ALONE IN 2001 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

- 1 NOVEMBER 1982
- 1 DECEMBER 1982
- - - - 1 JANUARY 1983

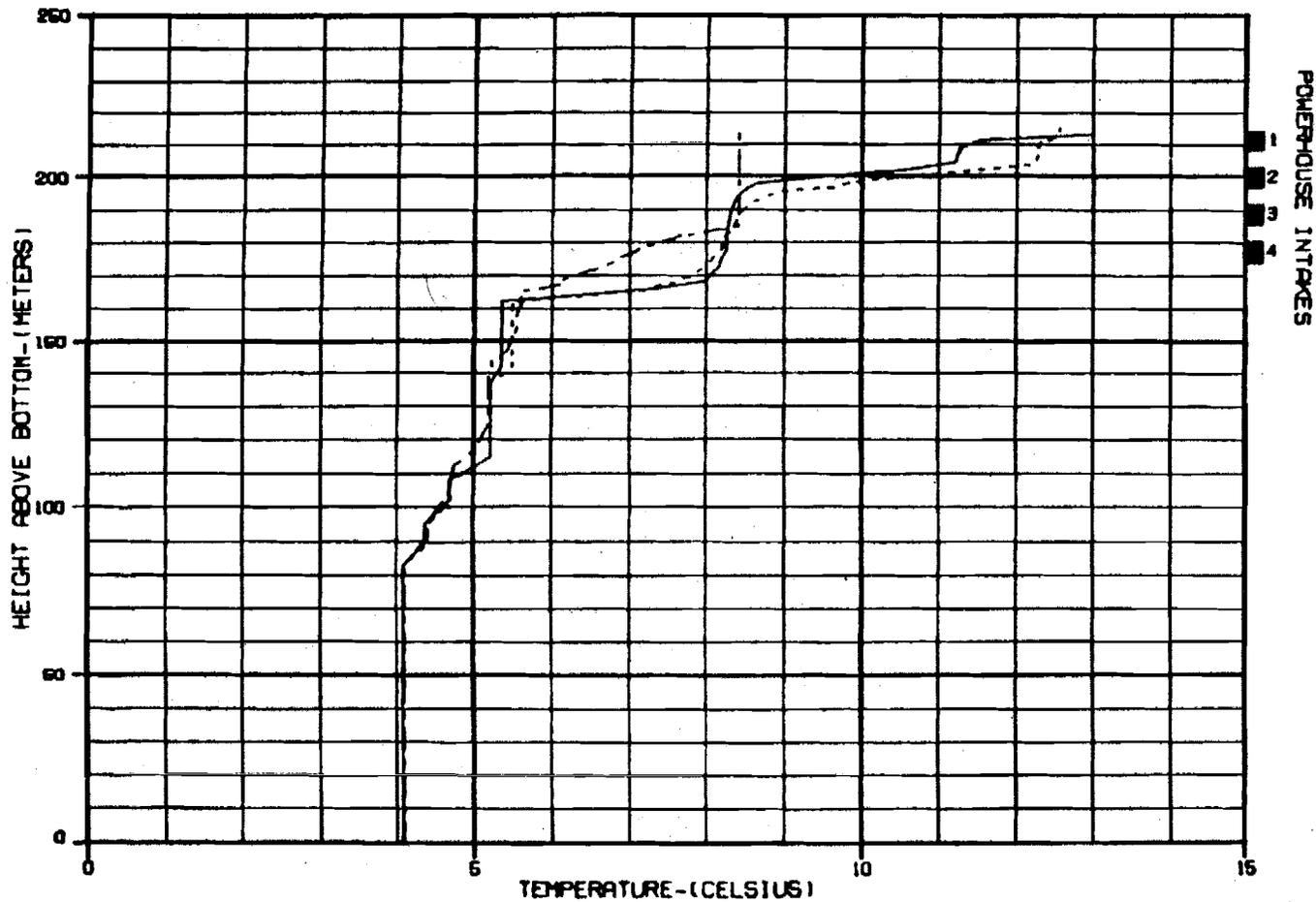
ALASKA POWER AUTHORITY

WATANA PROJECT DYKOR REEEL

WATANA RESERVOIR
TEMPERATURE PROFILES

HARZA-EBRACO JOINT VENTURE

DESIGN: ELL-008 8 JAN 83 42-010-04



CASE: ■■ WAB1(B2)01A - WATANA OPERATION ALONE IN 2001 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

— 1 AUGUST 1982
 1 SEPTEMBER 1982
 - - - - 1 OCTOBER 1982

ALASKA POWER AUTHORITY

SUBMITTA PROJECT

OPERATION MODEL

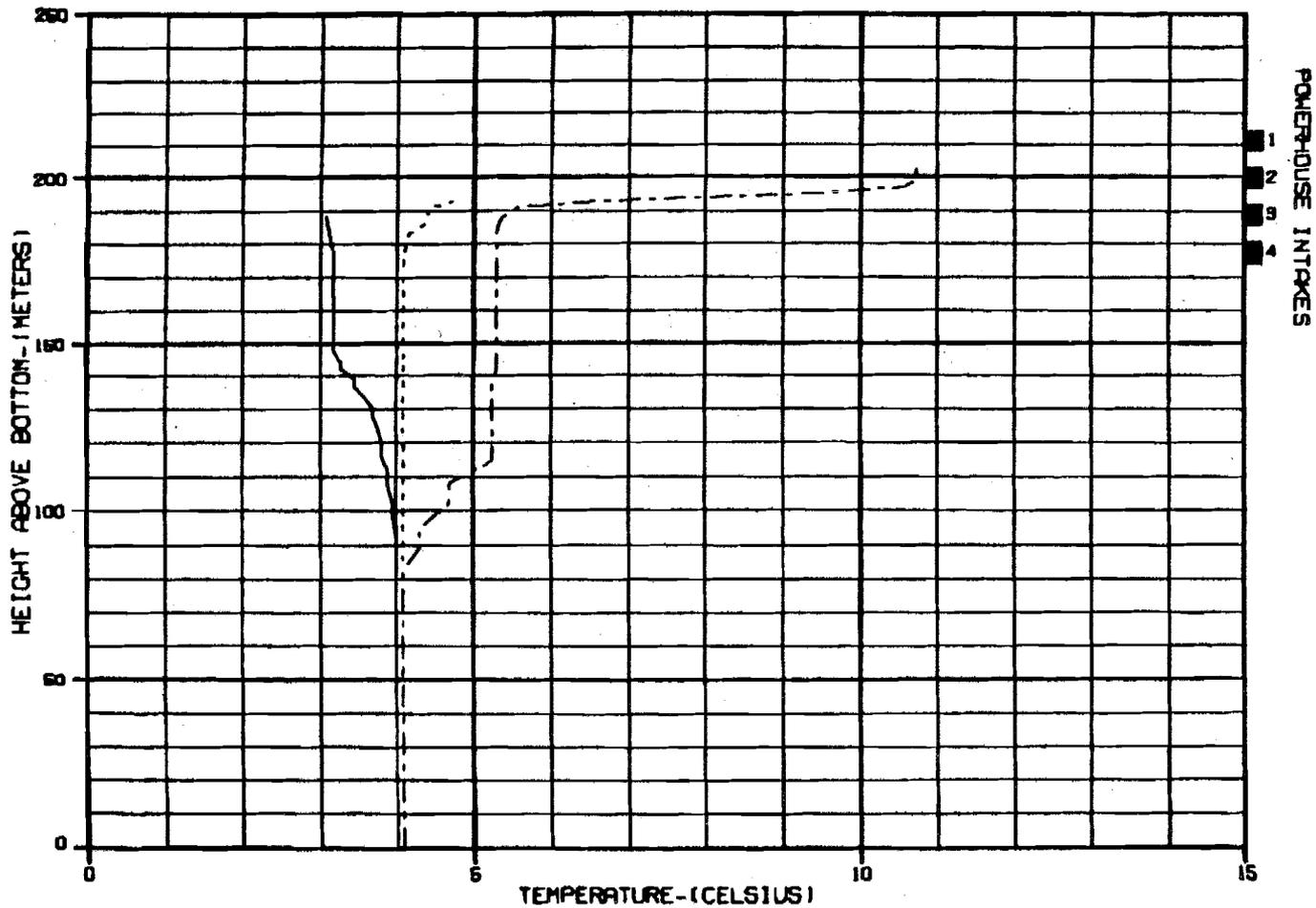
WATANA RESERVOIR
 TEMPERATURE PROFILES

WARZA-EBRSCO JOINT VENTURE

CHANGES: ALL DATES

9 JAN 84

4E-010-04



CASE: ■■ WAB11B2101A - WATANA OPERATION ALONE IN 2001 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

— | MAY 1982
 - - - | JUNE 1982
 - · - · | JULY 1982

ALASKA POWER AUTHORITY

UNITINA PROJECT | OPTION MODEL

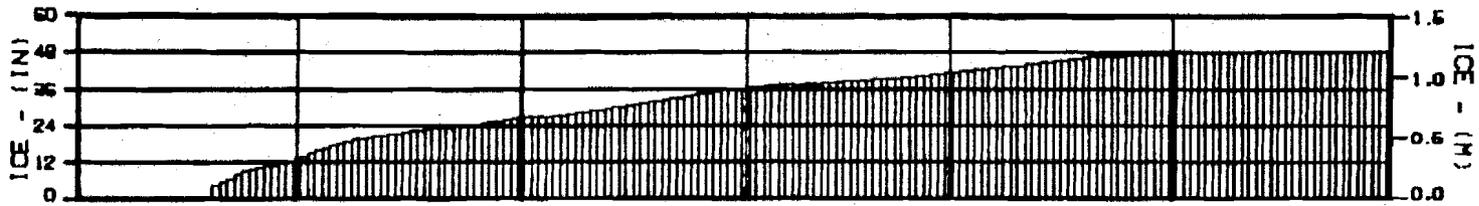
WATANA RESERVOIR
 TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

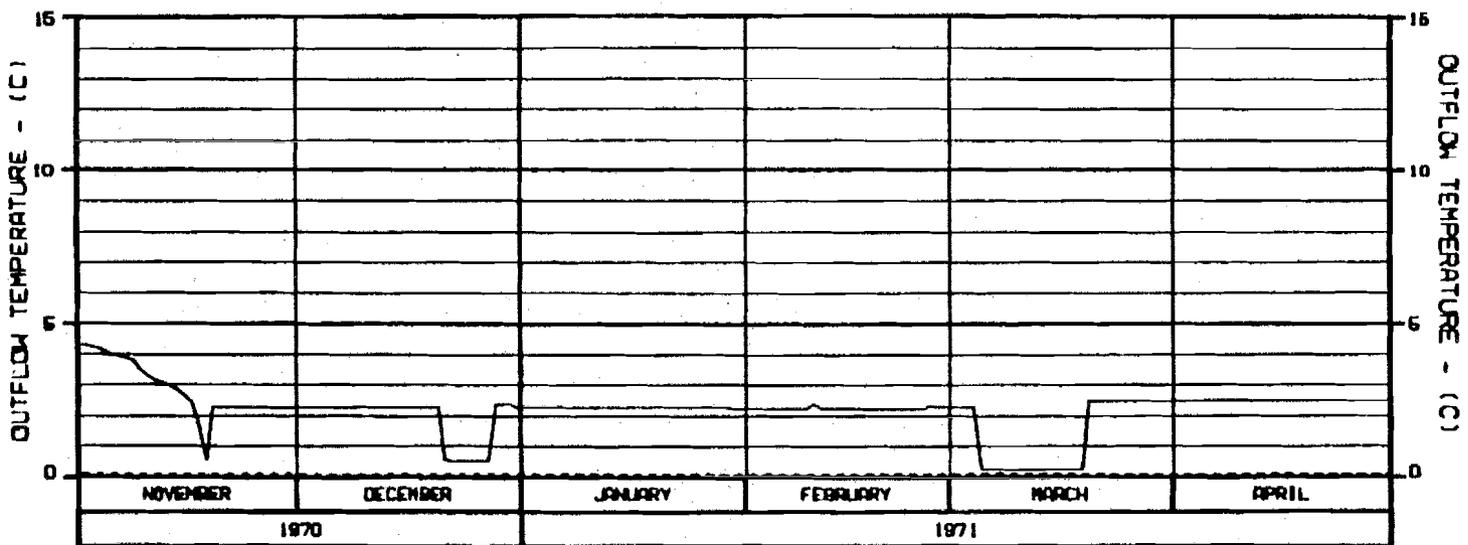
CHUCK. BLANKS | 8 JAN 84 | 4E-010-04

WATANA AND DEVIL CANYON OPERATING
2002 Energy Demands
Watana Reservoir Temperatures

EXHIBIT Z



INTAKE	LEVEL 1					
	LEVEL 2	█				
	LEVEL 3		█			
	LEVEL 4				█	
	LINE VALVE					
	SPILLWAY					

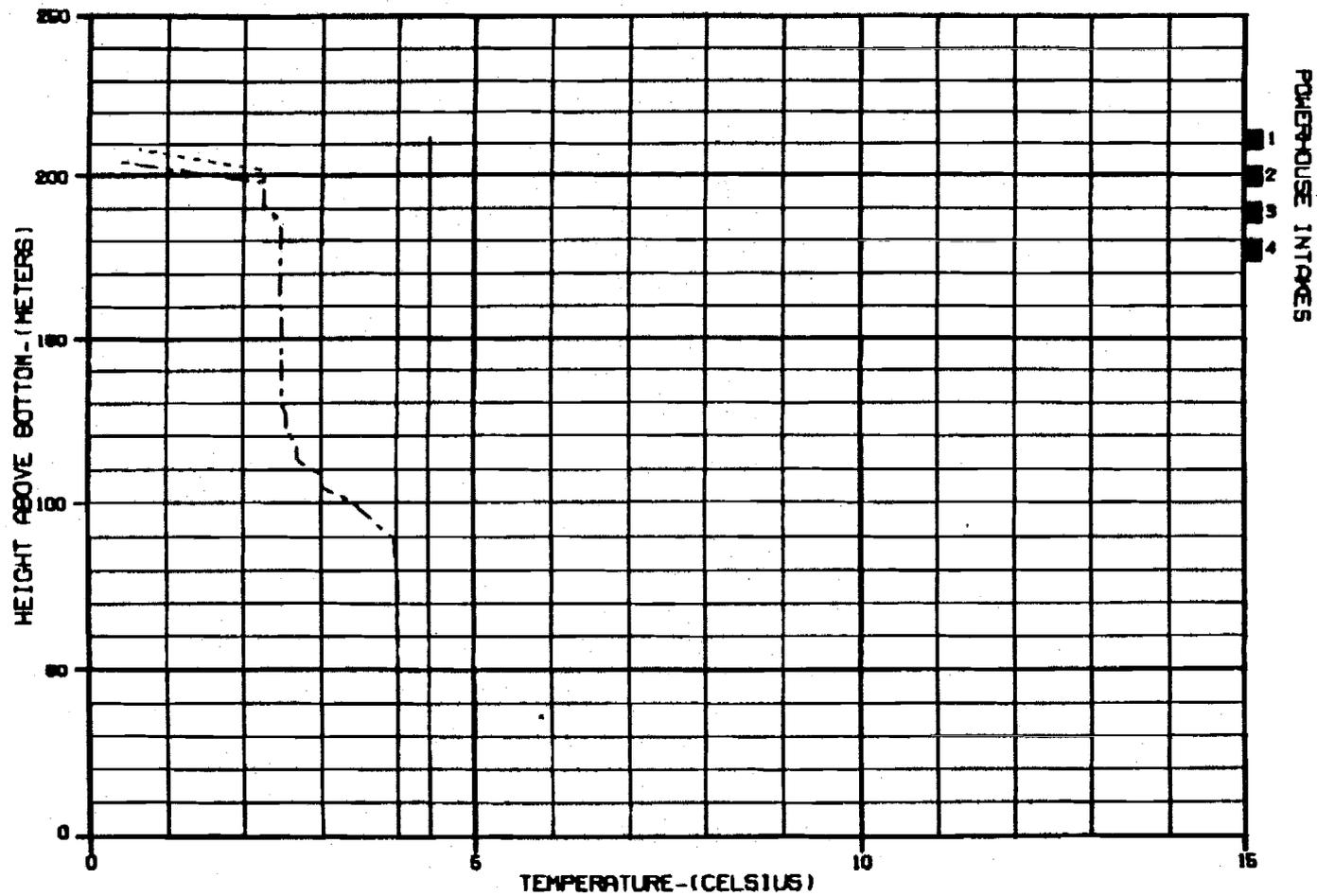


LEGEND: CASE: ■■ WA7102A - WATANA OPERATION WITH DEVIL CANYON IN 2002 ■■

———— PREDICTED OUTFLOW TEMPERATURE
 - - - - - INFLOW TEMPERATURE

- NOTES:
1. INTAKE PORT LEVEL 1 AT ELEVATION 2161 FT (656.6 M)
 2. INTAKE PORT LEVEL 2 AT ELEVATION 2114 FT (644.3 M)
 3. INTAKE PORT LEVEL 3 AT ELEVATION 2077 FT (633.1 M)
 4. INTAKE PORT LEVEL 4 AT ELEVATION 2040 FT (621.9 M)
 5. CONE VALVE AT ELEVATION 2040 FT (621.9 M)
 6. SPILLWAY CREST AT ELEVATION 2149 FT (654.7 M)

ALASKA POWER AUTHORITY	
SUBITRA PROJECT	DEVILHILL MODEL
WATANA RESERVOIR	
OUTFLOW TEMPERATURE	
AND ICE GROWTH	
HARZA-EBASCO JOINT VENTURE	
DATE: 01-15-81	BY: JAM/SH
01-15-81	01-15-81



CASE: WWA7102A - WATANA OPERATION WITH DEVIL CANYON IN 2002 WWA

LEGEND:

PREDICTED TEMPERATURE PROFILES:

— | NOVEMBER 1970
 - - - | DECEMBER 1970
 - · - · | JANUARY 1971

ALASKA POWER AUTHORITY

SUBMITTA PROJECT

OPERATION MODEL

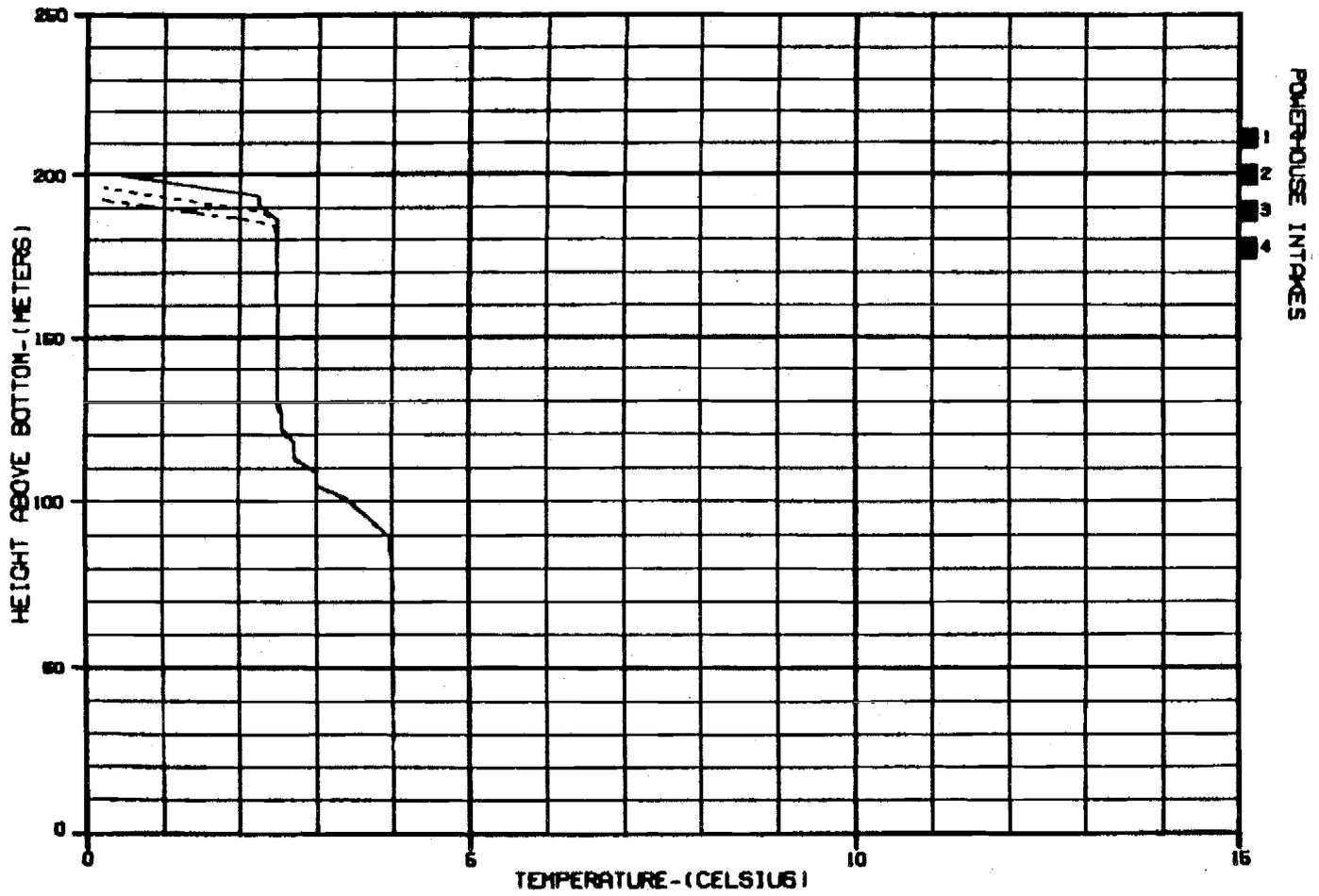
WATANA RESERVOIR
 TEMPERATURE PROFILES

HAZRA-EBRSCO JOINT VENTURE

ISSUED: 11/08/71

7 JAN 81

42-010-04



CASE: ■■ WA7102A - WATANA OPERATION WITH DEVIL CANYON IN 2002 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

- | FEBRUARY 1971
- | MARCH 1971
- · - · - | APRIL 1971

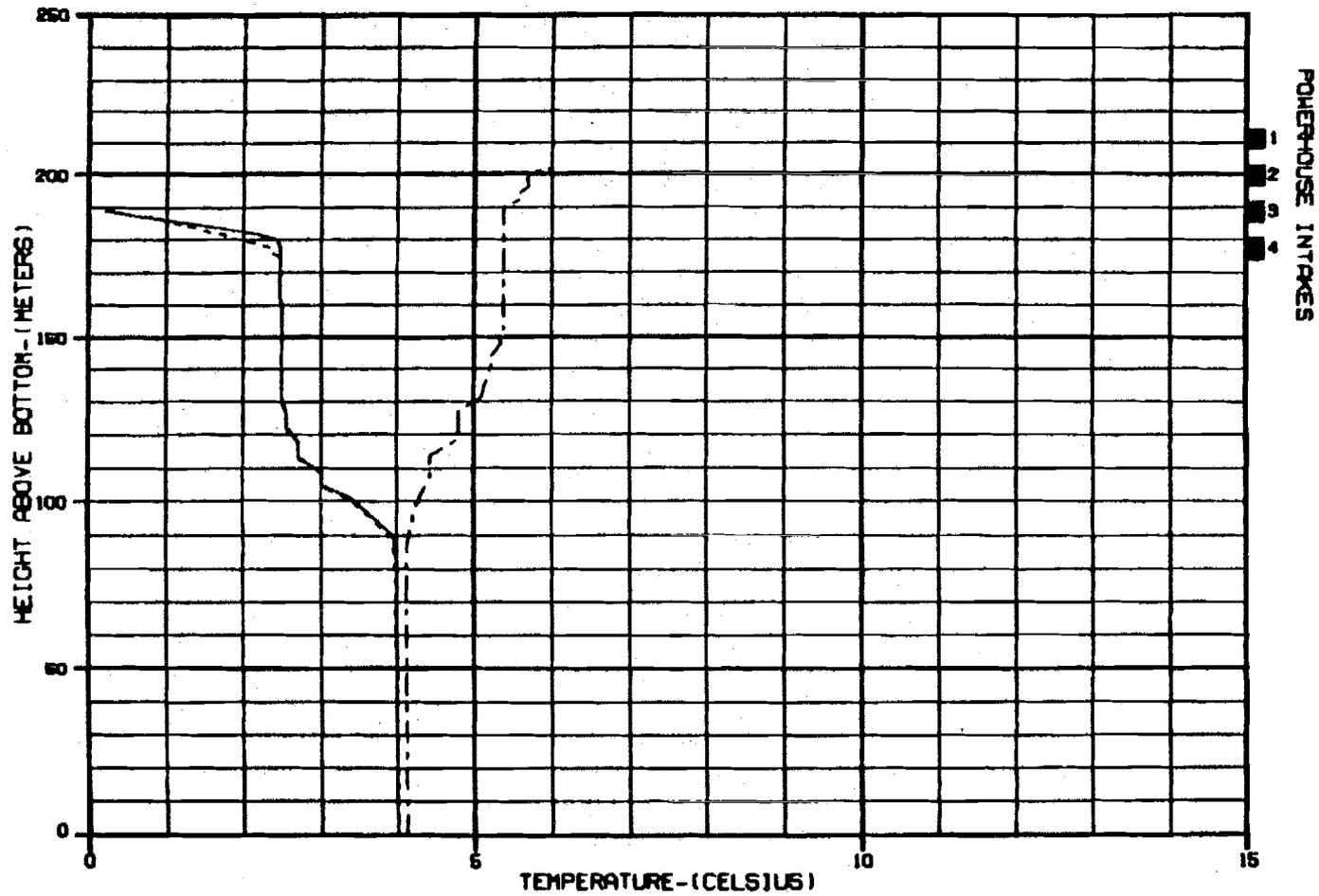
ALASKA POWER AUTHORITY

WATANA PROJECT | DYWIDOR MODEL

WATANA RESERVOIR
TEMPERATURE PROFILES

HARZA-EBRACD JOINT VENTURE

ORDER: 44-000 | 7 JAN 81 | 42-010-04



CASE: ■■ WA7102A - WATANA OPERATION WITH DEVIL CANYON IN 2002 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

————— | MAY 1971
 - - - - - | JUNE 1971
 - · - · - | JULY 1971

ALASKA POWER AUTHORITY

SUBMITTER PROJECT DIVISION NUMBER

WATANA RESERVOIR
 TEMPERATURE PROFILES

HAZRA-EBASCO JOINT VENTURE

DATE: 01/08/04 7 JAN 04 42-010-04

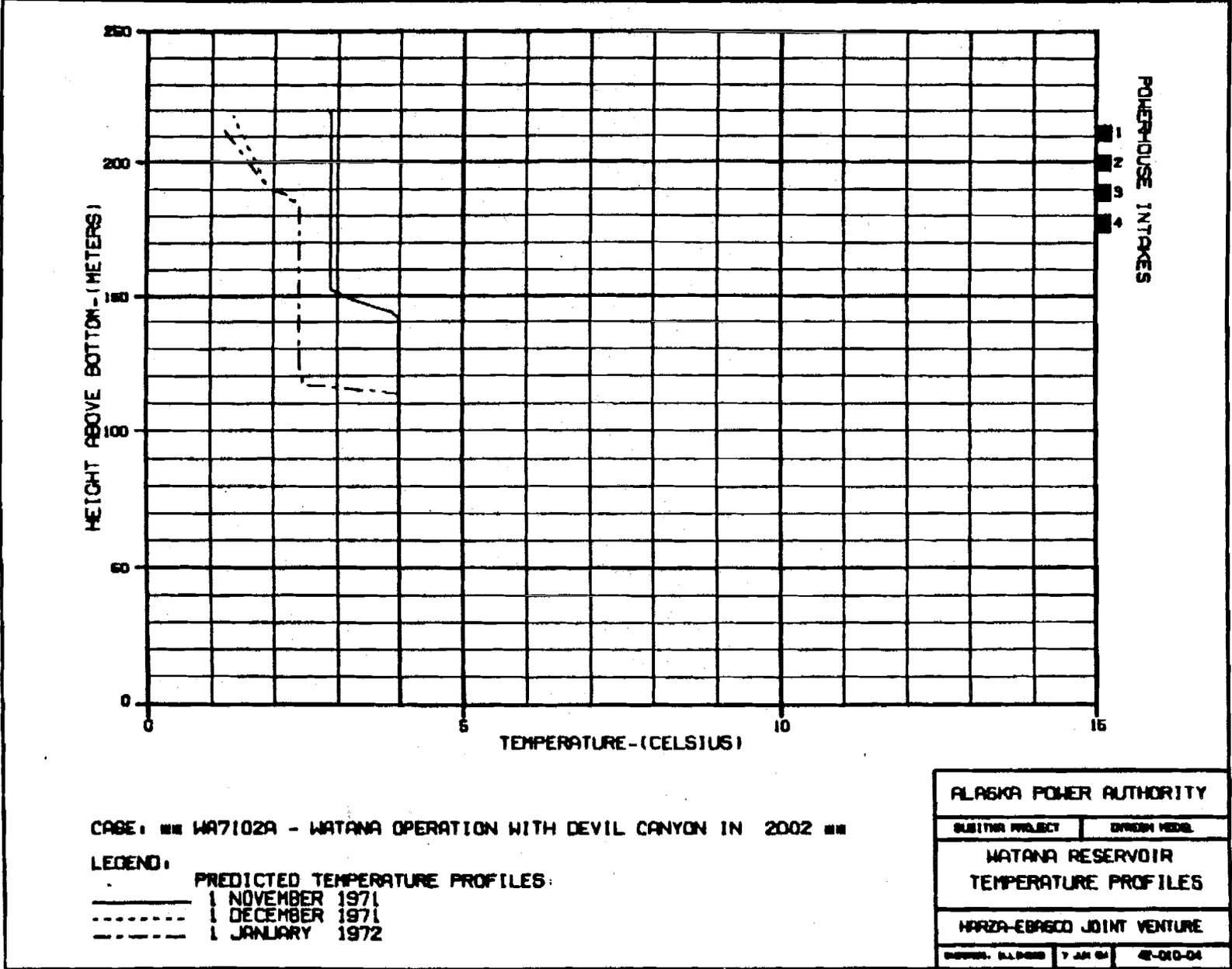


POWERHOUSE INTAKES

CASE: WA7102A - WATANA OPERATION WITH DEVIL CANYON IN 2002

LEGEND: PREDICTED TEMPERATURE PROFILES:
 ———— | AUGUST 1971
 - - - - - | SEPTEMBER 1971
 - · - · - | OCTOBER 1971

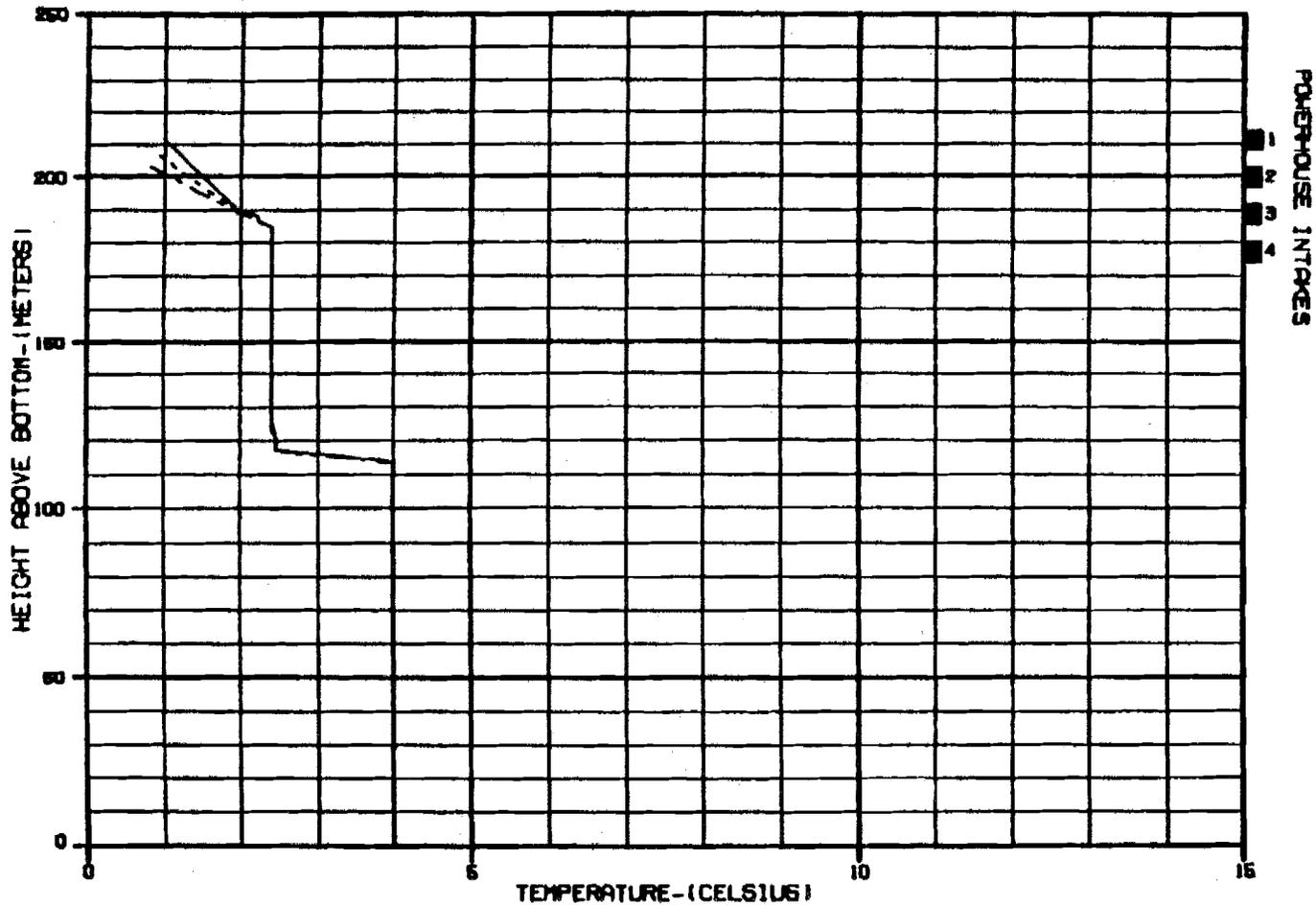
ALASKA POWER AUTHORITY	
SUBMITTER PROJECT	DEVIL CANYON
WATANA RESERVOIR TEMPERATURE PROFILES	
WARZA-EBASCO JOINT VENTURE	
ISSUED: 11/20/02	42-010-04



CASE: ■■ WA7102A - WATANA OPERATION WITH DEVIL CANYON IN 2002 ■■

LEGEND:
 PREDICTED TEMPERATURE PROFILES:
 ———— 1 NOVEMBER 1971
 1 DECEMBER 1971
 - - - - - 1 JANUARY 1972

ALASKA POWER AUTHORITY		
SUBMITTER PROJECT	DRAWING NUMBER	
WATANA RESERVOIR TEMPERATURE PROFILES		
WARZA-EBRACCO JOINT VENTURE		
DESIGNED BY	DRAWN BY	DATE
ALP/MS	YAK/MS	4E-010-04



CASE: WA7102A - WATANA OPERATION WITH DEVIL CANYON IN 2002

LEGEND:

PREDICTED TEMPERATURE PROFILES:

— 1 FEBRUARY 1972
 - - - 1 MARCH 1972
 - · - · 1 APRIL 1972

ALASKA POWER AUTHORITY

SUBMITTER PROJECT

DYKEMA MODEL

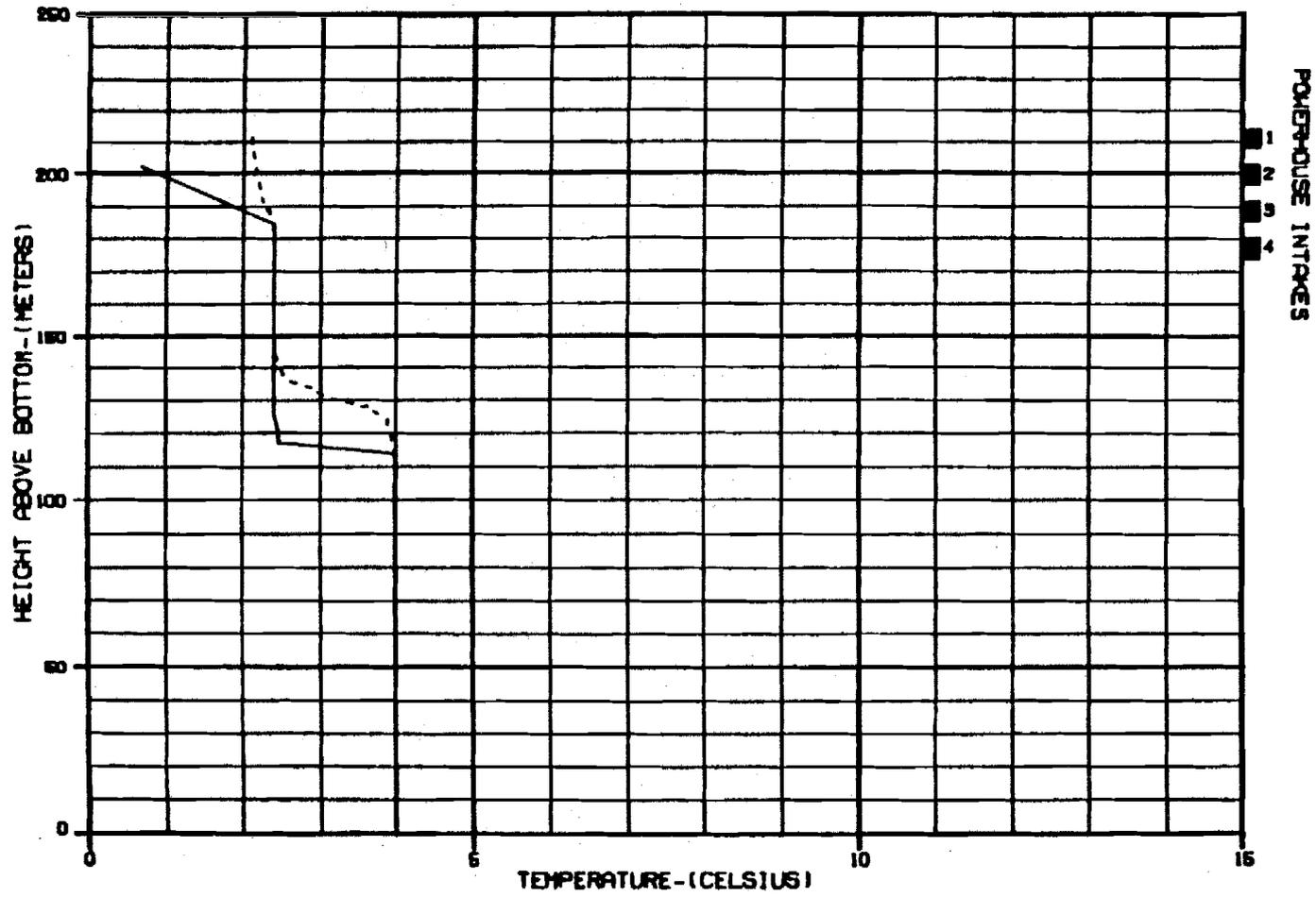
WATANA RESERVOIR
 TEMPERATURE PROFILES

HAZZA-EBRACO JOINT VENTURE

ISSUED: 01/08/04

7 JAN 04

42-010-04

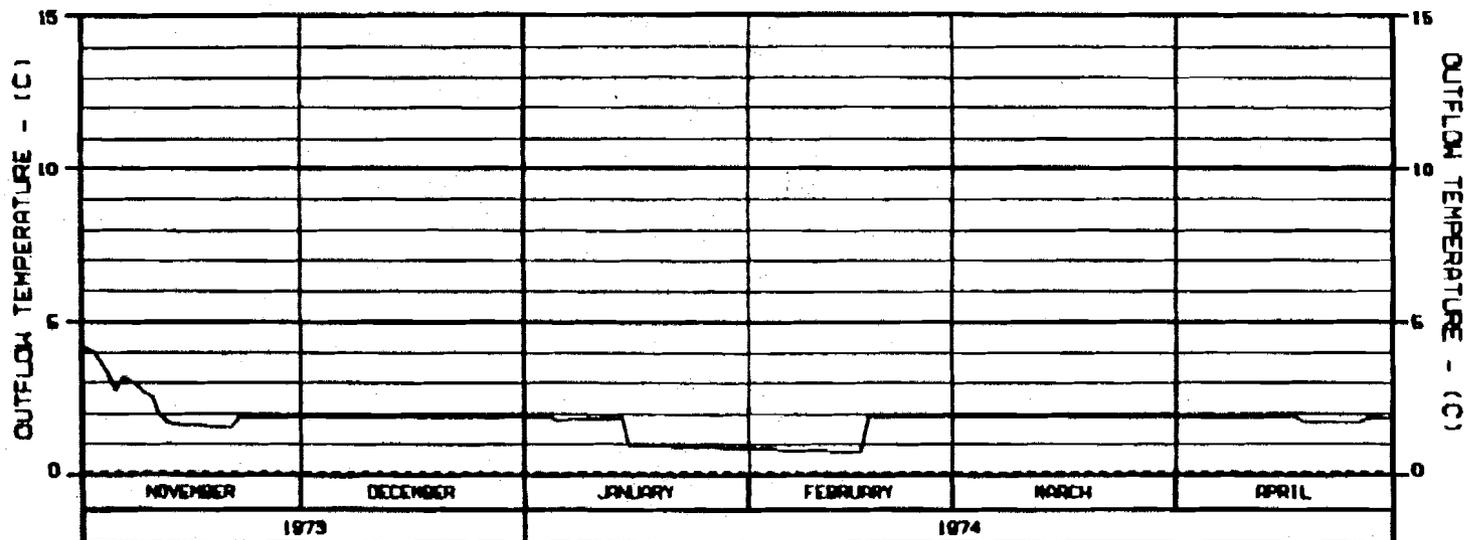
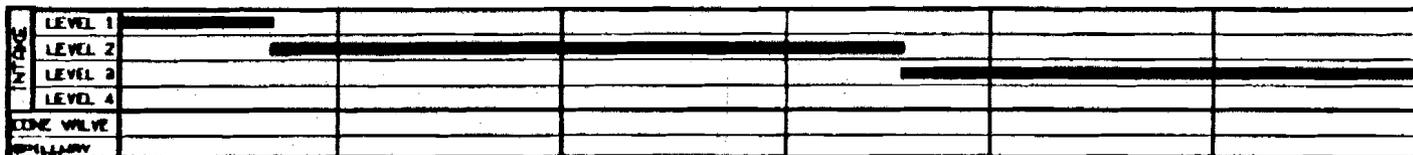
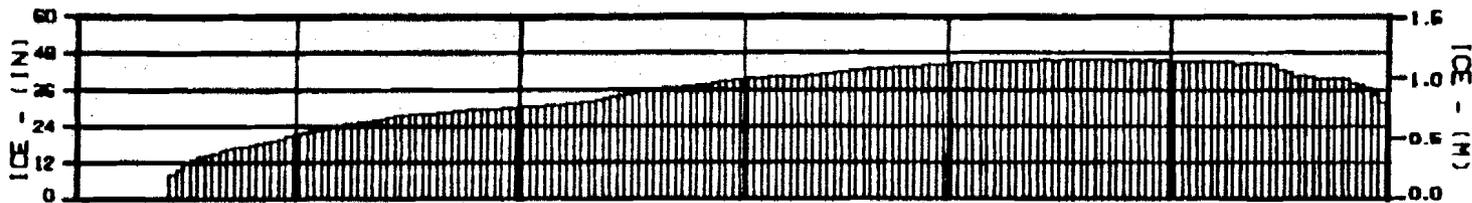


CASE: WA7102A - WATANA OPERATION WITH DEVIL CANYON IN 2002

LEGEND: PREDICTED TEMPERATURE PROFILES:
 ——— MAY 1972
 - - - - - JUNE 1972
 ······ JULY 1972

ALASKA POWER AUTHORITY		
PROJECT	DRAWING NO.	
WATANA RESERVOIR		
TEMPERATURE PROFILES		
WARZA-EBASCO JOINT VENTURE		
DATE	SCALE	REV.
1972	1:1	01

EXHIBIT AA



LEGEND: CASE: # W7402A - NATANA OPERATION WITH DEVIL CANYON IN 2002 #

----- PREDICTED OUTFLOW TEMPERATURE
 - - - - - INFLOW TEMPERATURE

- NOTES:
1. INTAKE PORT LEVEL 1 AT ELEVATION 2151 FT (655.6 M)
 2. INTAKE PORT LEVEL 2 AT ELEVATION 2114 FT (644.3 M)
 3. INTAKE PORT LEVEL 3 AT ELEVATION 2077 FT (633.1 M)
 4. INTAKE PORT LEVEL 4 AT ELEVATION 2040 FT (621.9 M)
 5. CONE VALVE AT ELEVATION 2040 FT (621.9 M)
 6. SPILLWAY CREST AT ELEVATION 2148 FT (654.7 M)

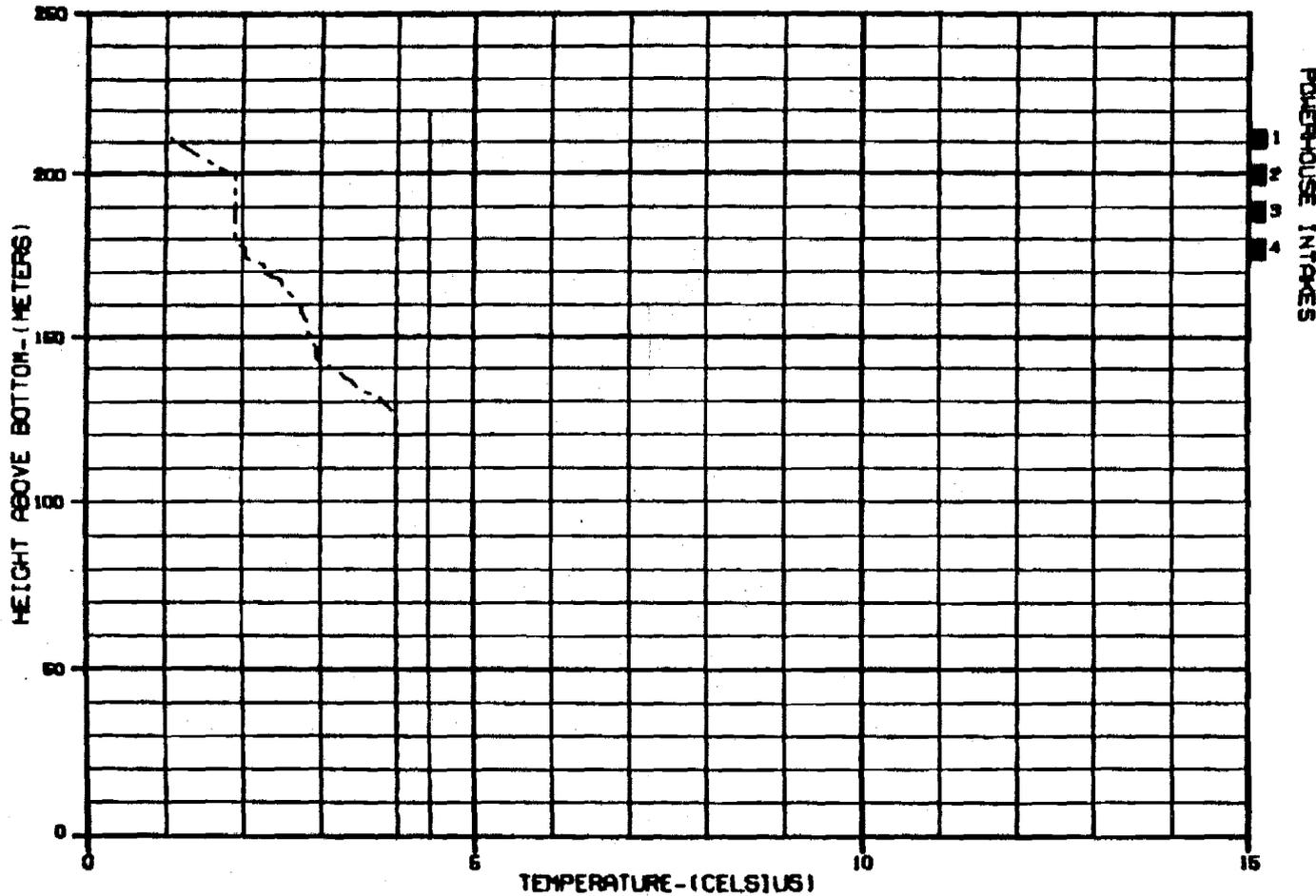
ALASKA POWER AUTHORITY

SUBMITTER PROJECT DESIGN MODEL

NATANA RESERVOIR
 OUTFLOW TEMPERATURE
 AND ICE GROWTH

WARZA-EBASCO JOINT VENTURE

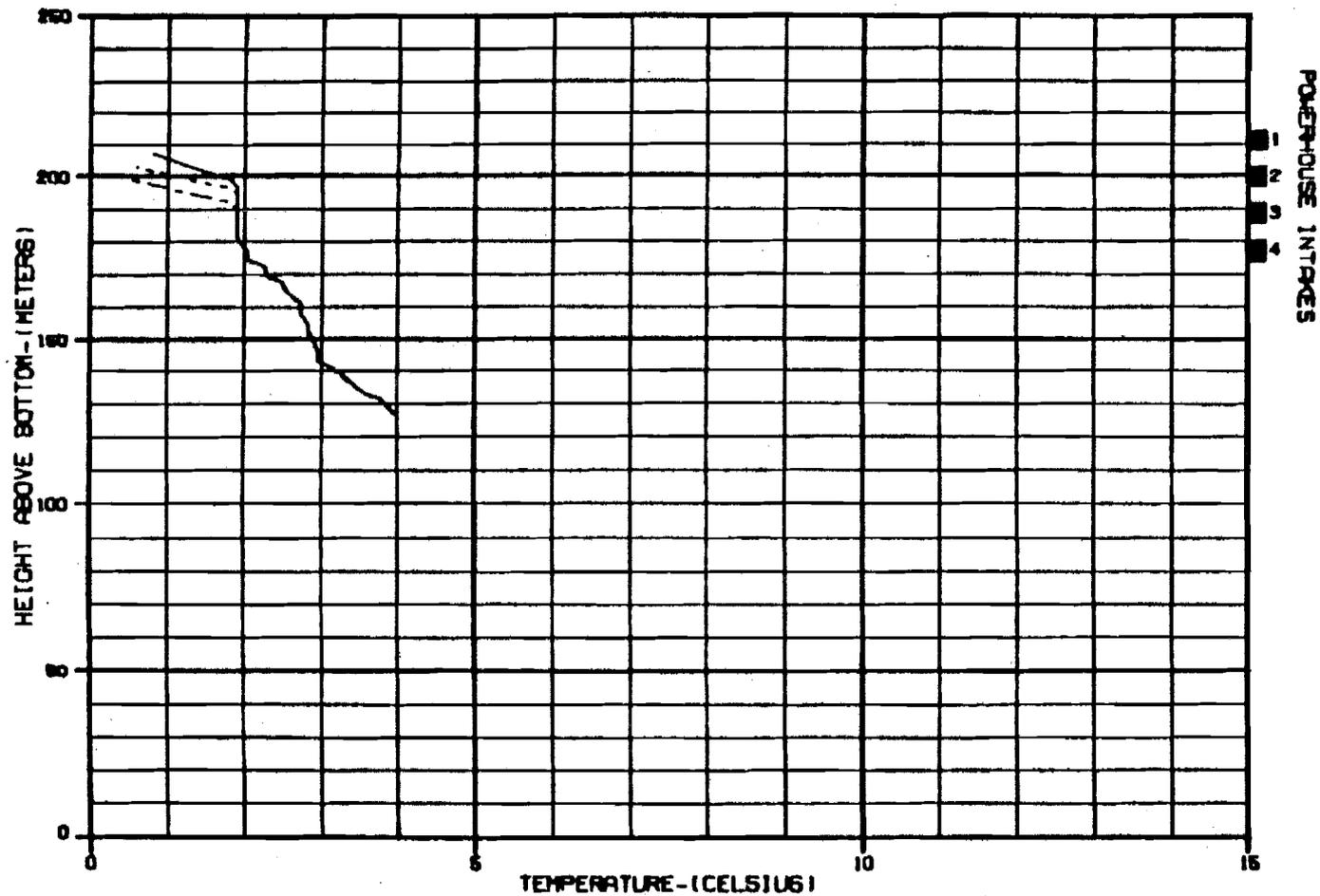
DESIGN: ELLIOTT 7 JAN 84 45-510-04



CASE: WA7402A - WATANA OPERATION WITH DEVIL CANYON IN 2002

LEGEND:
 PREDICTED TEMPERATURE PROFILES:
 ———— | NOVEMBER 1973
 - - - - | DECEMBER 1973
 - · - · | JANUARY 1974

ALASKA POWER AUTHORITY		
SUBMITTER PROJECT	OPERATION MODEL	
WATANA RESERVOIR TEMPERATURE PROFILES		
HARZA-EBERCO JOINT VENTURE		
ISSUED: 01/08/74	7 JAN 84	42-010-04



CASE: WA7402A - WATANA OPERATION WITH DEVIL CANYON IN 2002

LEGEND:

PREDICTED TEMPERATURE PROFILES:

- FEBRUARY 1974
- - - MARCH 1974
- · - · APRIL 1974

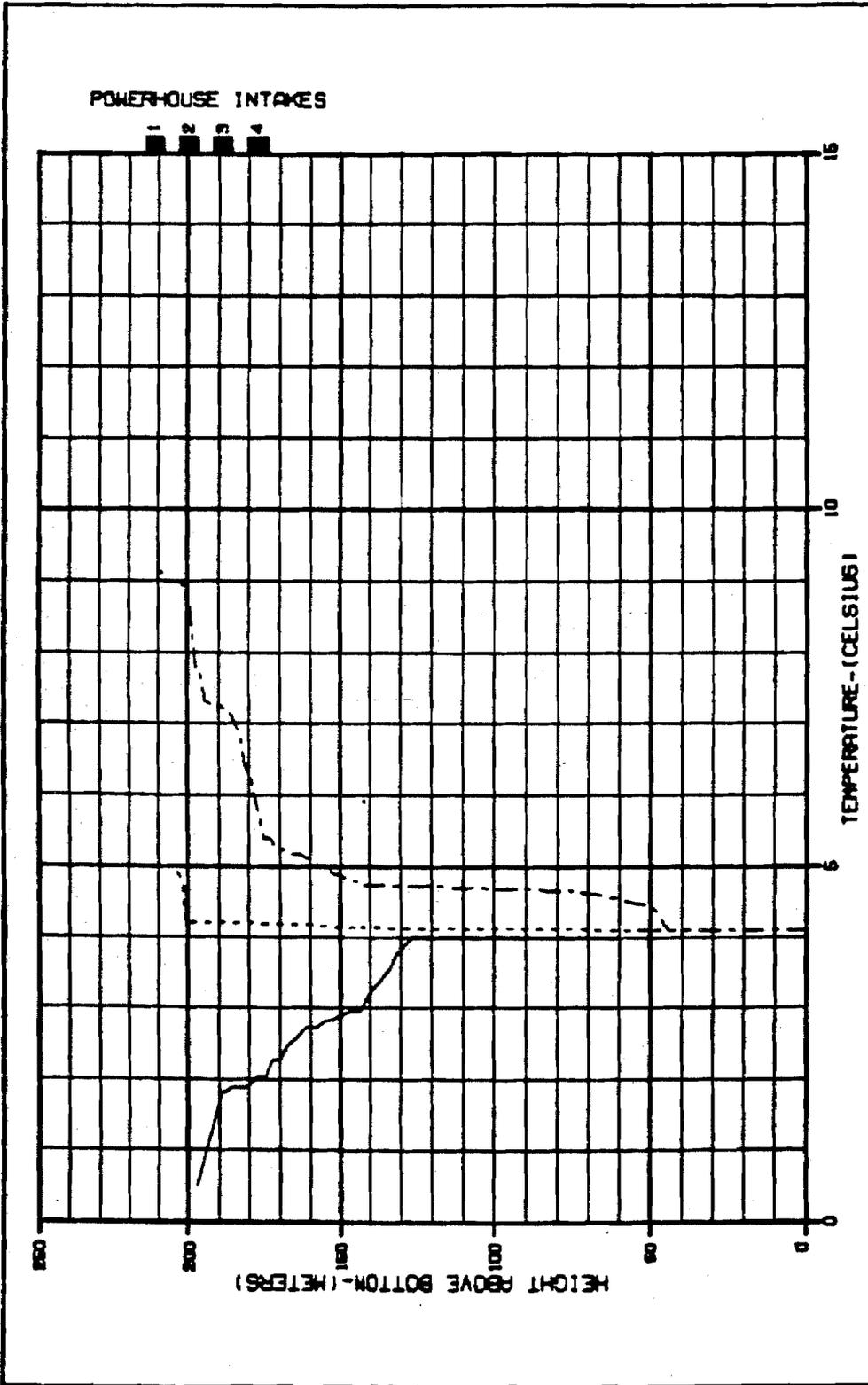
ALASKA POWER AUTHORITY

SUBMITTER PROJECT | DESIGN MODEL

WATANA RESERVOIR
TEMPERATURE PROFILES

HARZA-EBAGCO JOINT VENTURE

DESIGN - DRAWING | 7.00 OF | 42-010-04

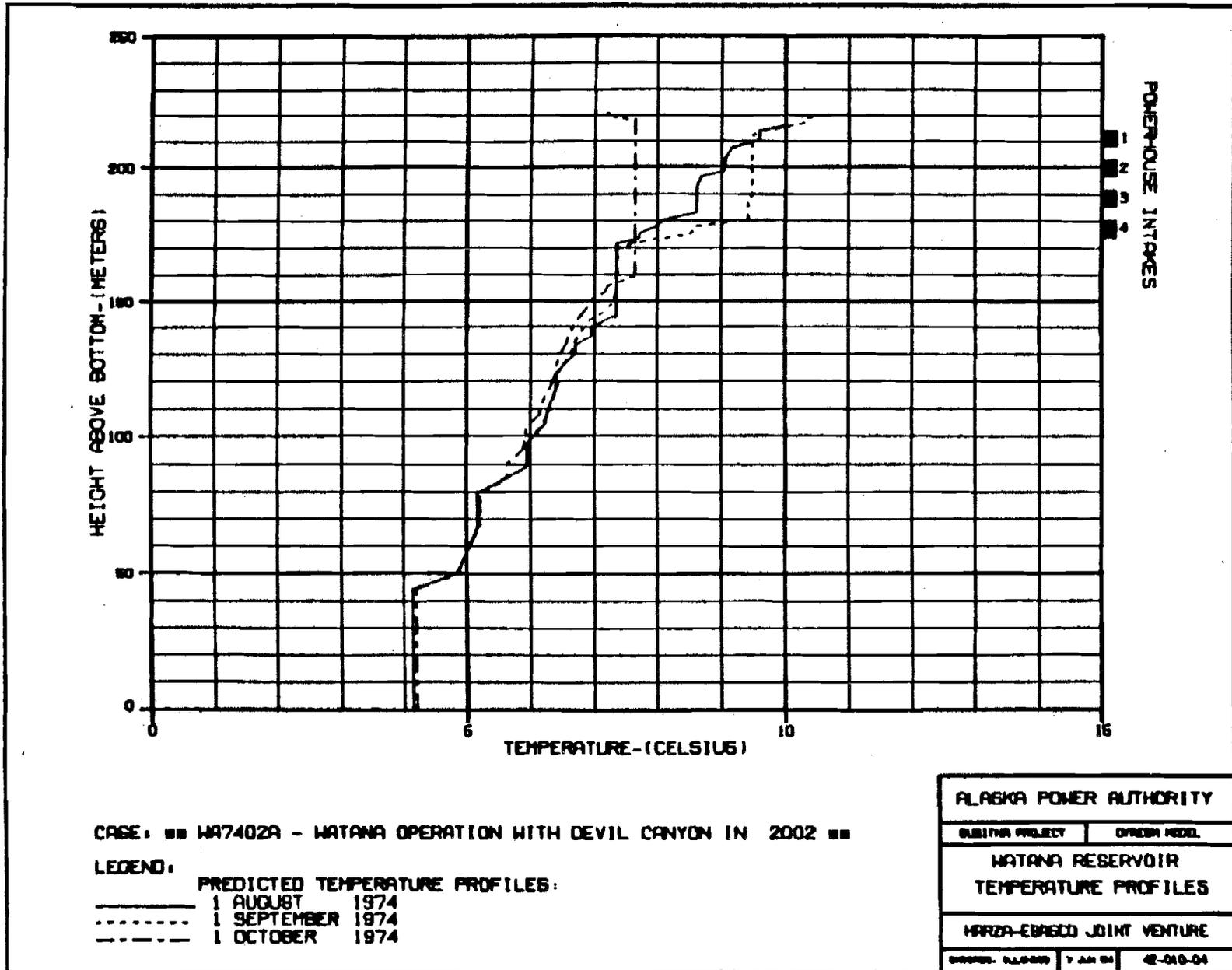


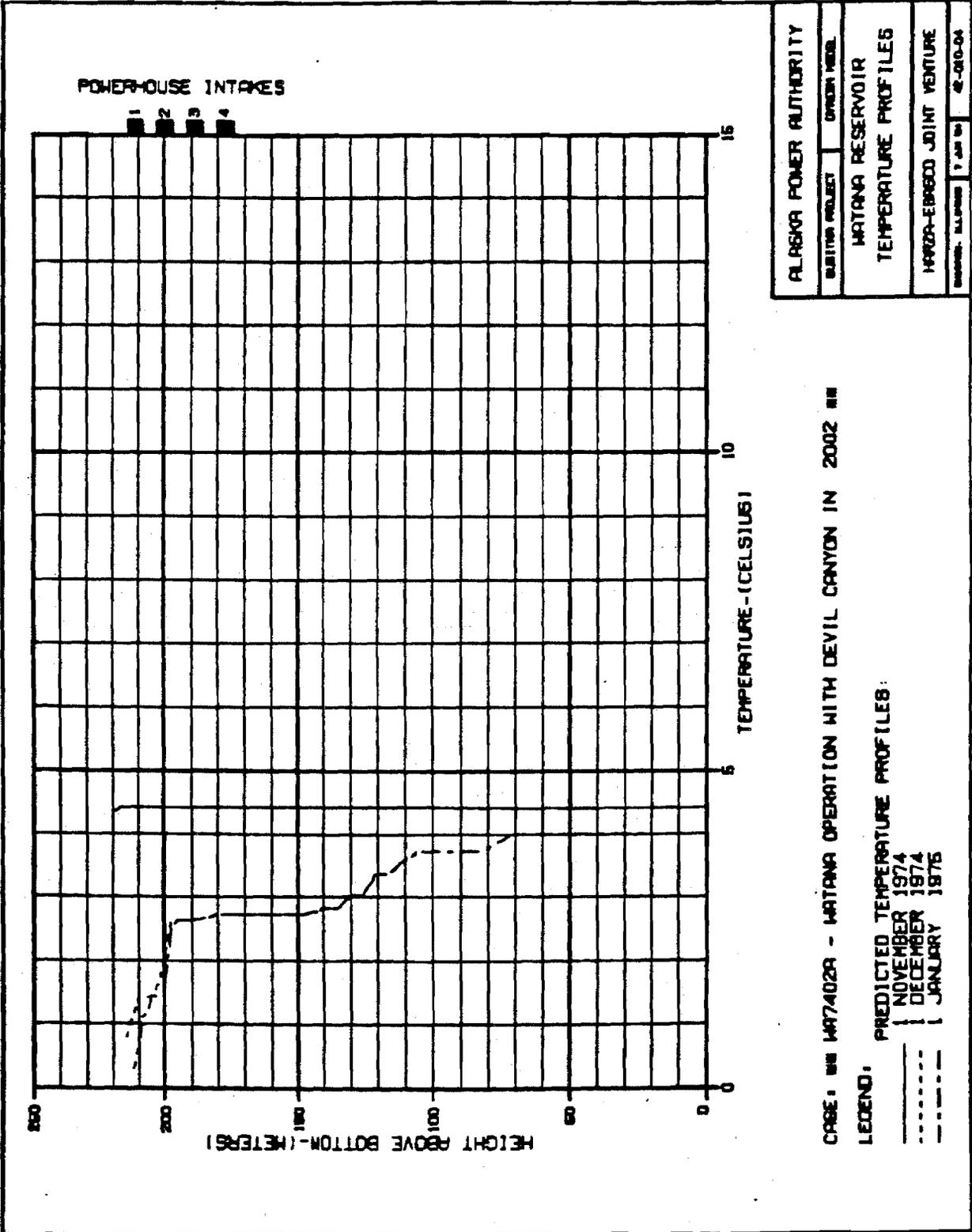
ALASKA POWER AUTHORITY	
SUBMITTER PROJECT	OPERATOR NAME
MATANA RESERVOIR	
TEMPERATURE PROFILES	
MAY 1974 - JUNE 1974	
DATE	BY
11/10/04	CE-010-04

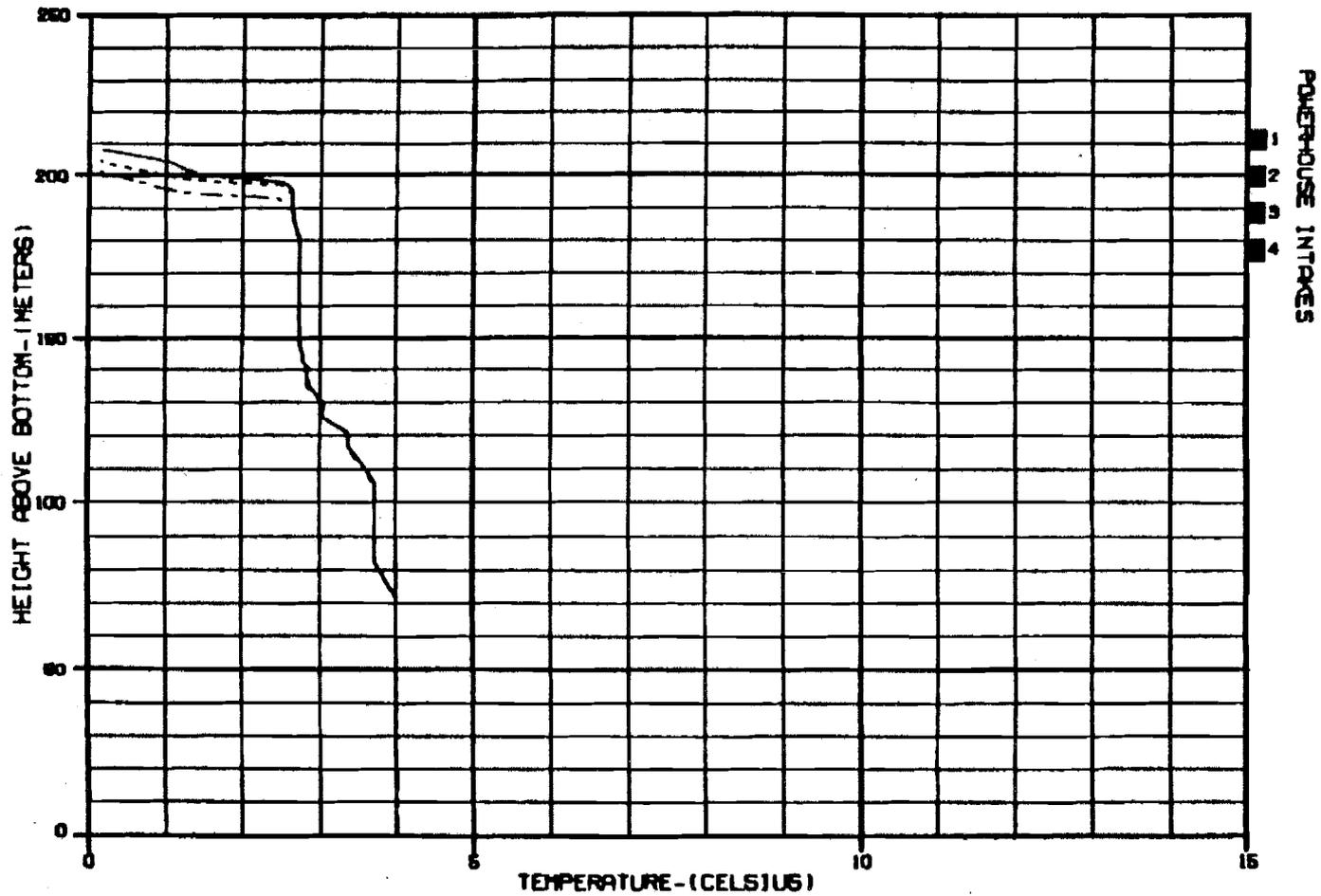
CASE: # W47402A - MATANA OPERATION WITH DEVIL CANYON IN 2002

LEGEND:

- MAY 1974
- - - JUNE 1974
- · · JULY 1974







CASE: ■■ WA7402A - WATANA OPERATION WITH DEVIL CANYON IN 2002 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

— FEBRUARY 1975
 MARCH 1975
 - - - - - APRIL 1975

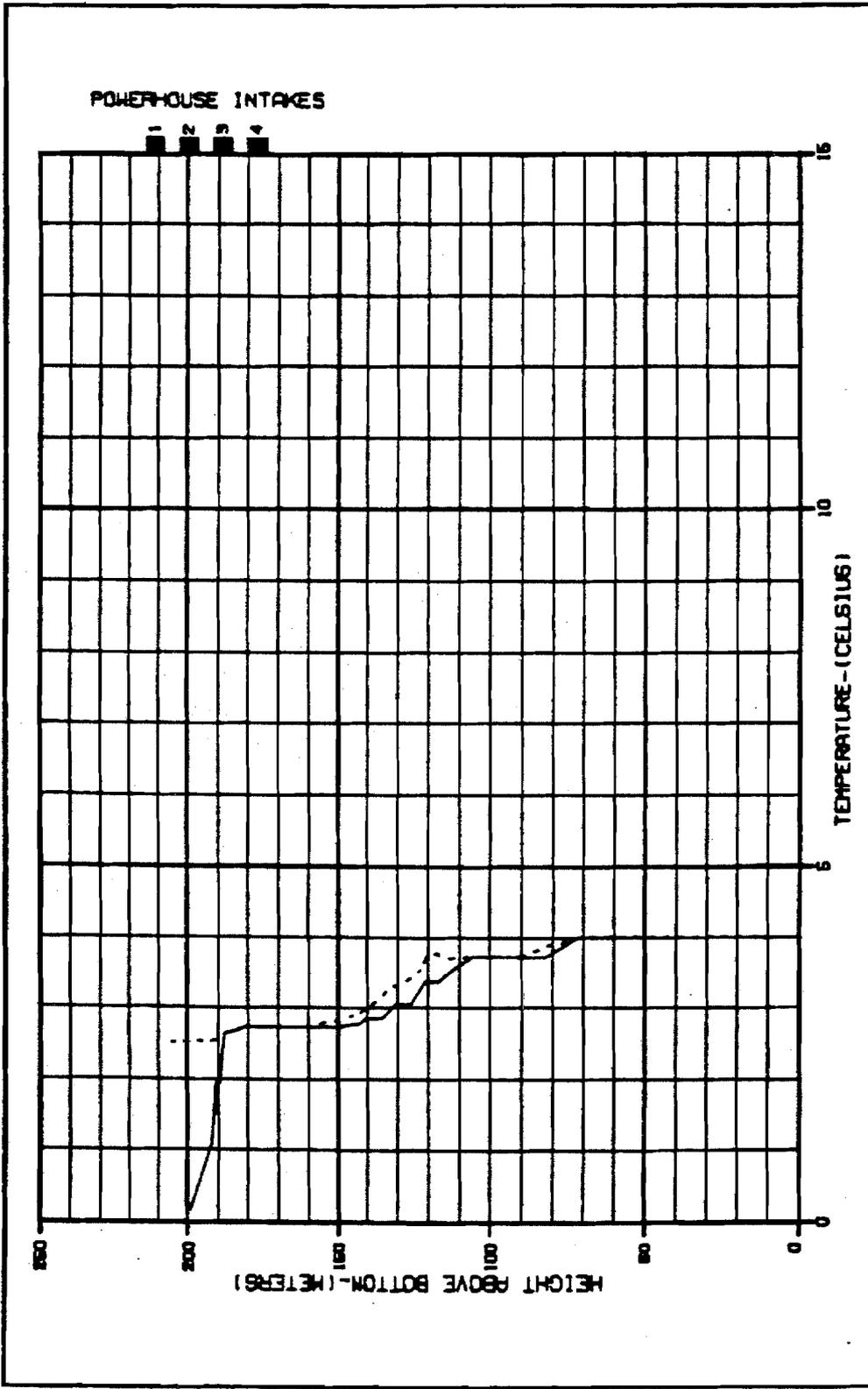
ALASKA POWER AUTHORITY

EXISTING PROJECT DAM/RESERVOIR

WATANA RESERVOIR
 TEMPERATURE PROFILES

WARZA-EBASCO JOINT VENTURE

DESIGN: ELLIOTT DRAWING: 42-010-04



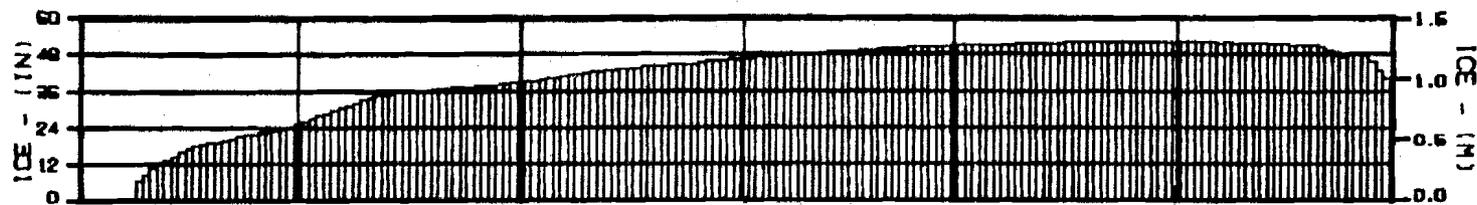
ALASKA POWER AUTHORITY	
SUBMITTER PROJECT	DEVIL CANYON
MATANA RESERVOIR	
TEMPERATURE PROFILES	
HARZA-EBASCO JOINT VENTURE	
DATE	1 JUN 81
PROJECT NO.	42-010-04

CASE: 42-010-04 - MATANA OPERATION WITH DEVIL CANYON IN 2002

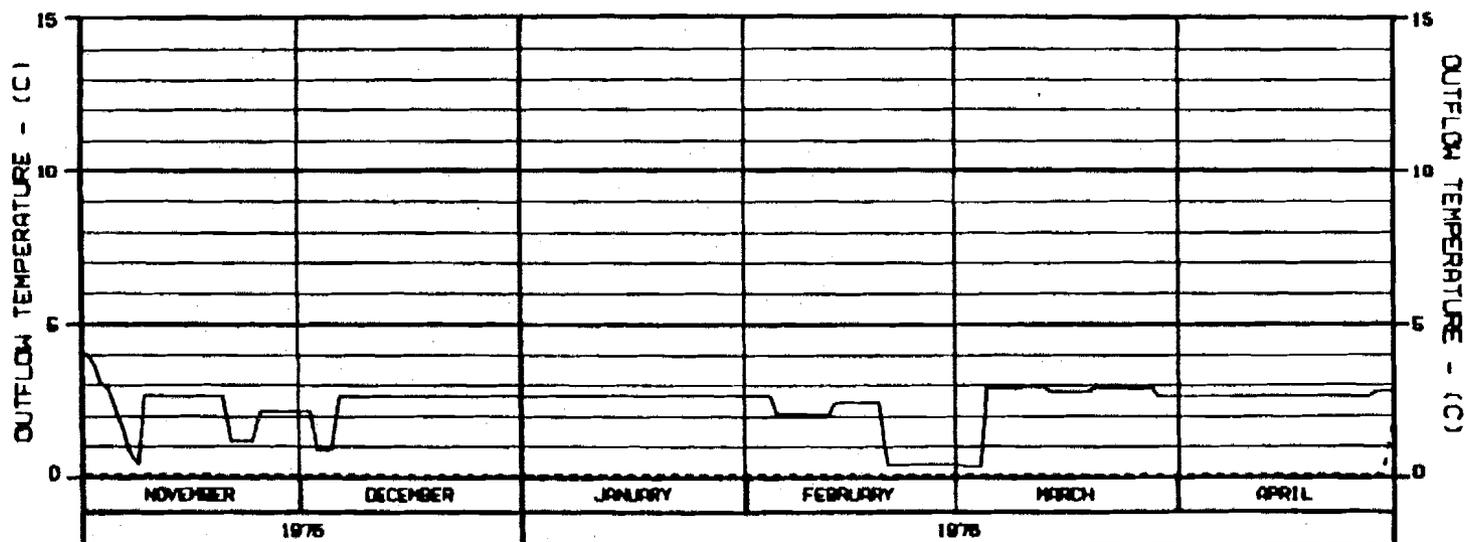
LEGEND: PREDICTED TEMPERATURE PROFILES:

- MAY 1975
- - - JUNE 1975
- · · · · JULY 1975

EXHIBIT AB



INTAKE	LEVEL 1	██████████				
	LEVEL 2		██████████			
	LEVEL 3			██████████		
	LEVEL 4				██████████	
	CONE VALVE					
	SPILLWAY					



LEGEND: CASE: ■ WATANA OPERATION WITH DEVIL CANYON IN 2002 ■■

———— PREDICTED OUTFLOW TEMPERATURE
 - - - - - INFLOW TEMPERATURE

- NOTES:
1. INTAKE PORT LEVEL 1 AT ELEVATION 2161 FT (655.6 M)
 2. INTAKE PORT LEVEL 2 AT ELEVATION 2114 FT (644.3 M)
 3. INTAKE PORT LEVEL 3 AT ELEVATION 2077 FT (633.1 M)
 4. INTAKE PORT LEVEL 4 AT ELEVATION 2040 FT (621.0 M)
 5. CONE VALVE AT ELEVATION 2040 FT (621.0 M)
 6. SPILLWAY CREST AT ELEVATION 2148 FT (654.7 M)

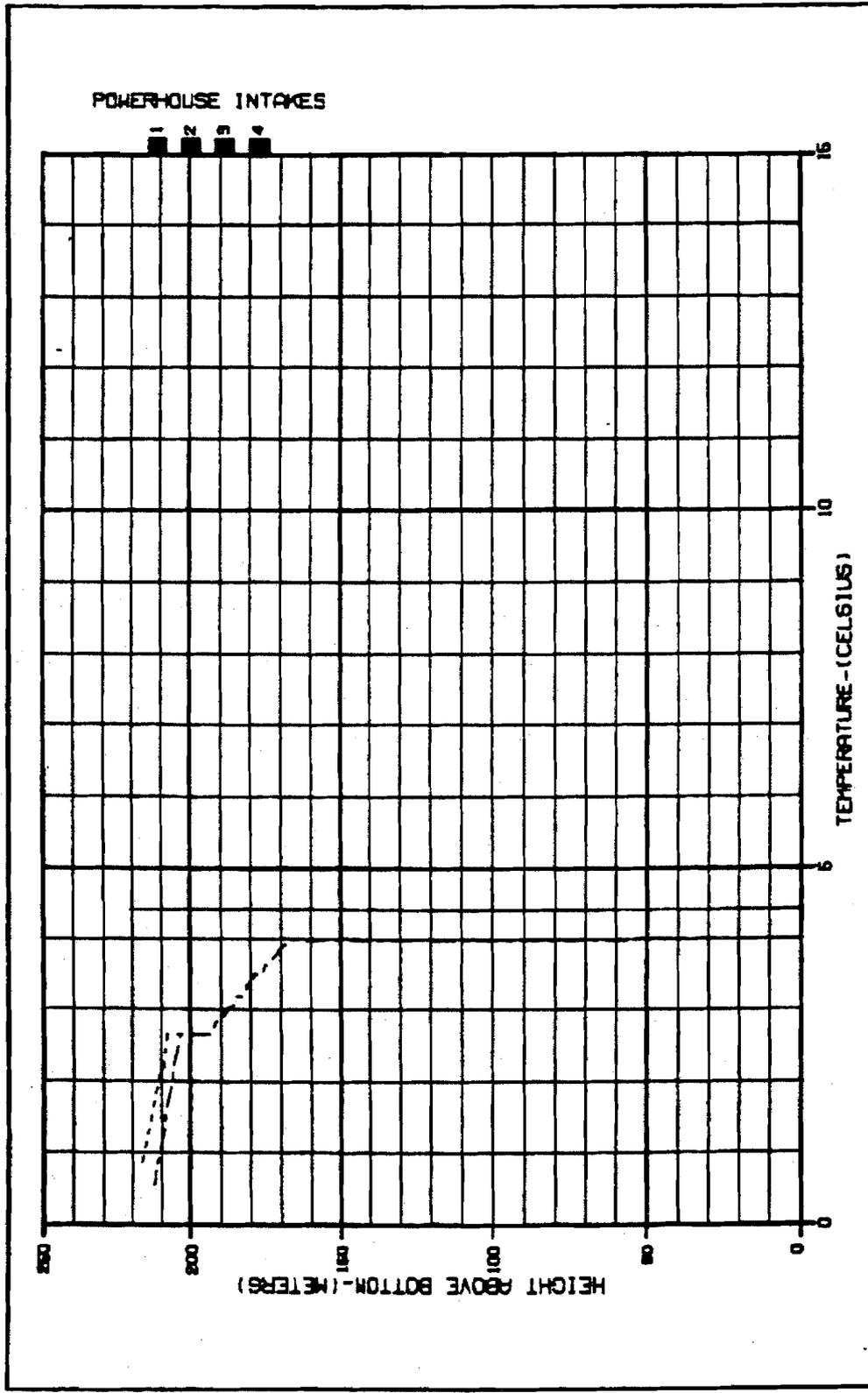
ALASKA POWER AUTHORITY

SUBMITTAL PROJECT DESIGN MODEL

WATANA RESERVOIR
 OUTFLOW TEMPERATURE
 AND ICE GROWTH

HARZA-EBRACCO JOINT VENTURE

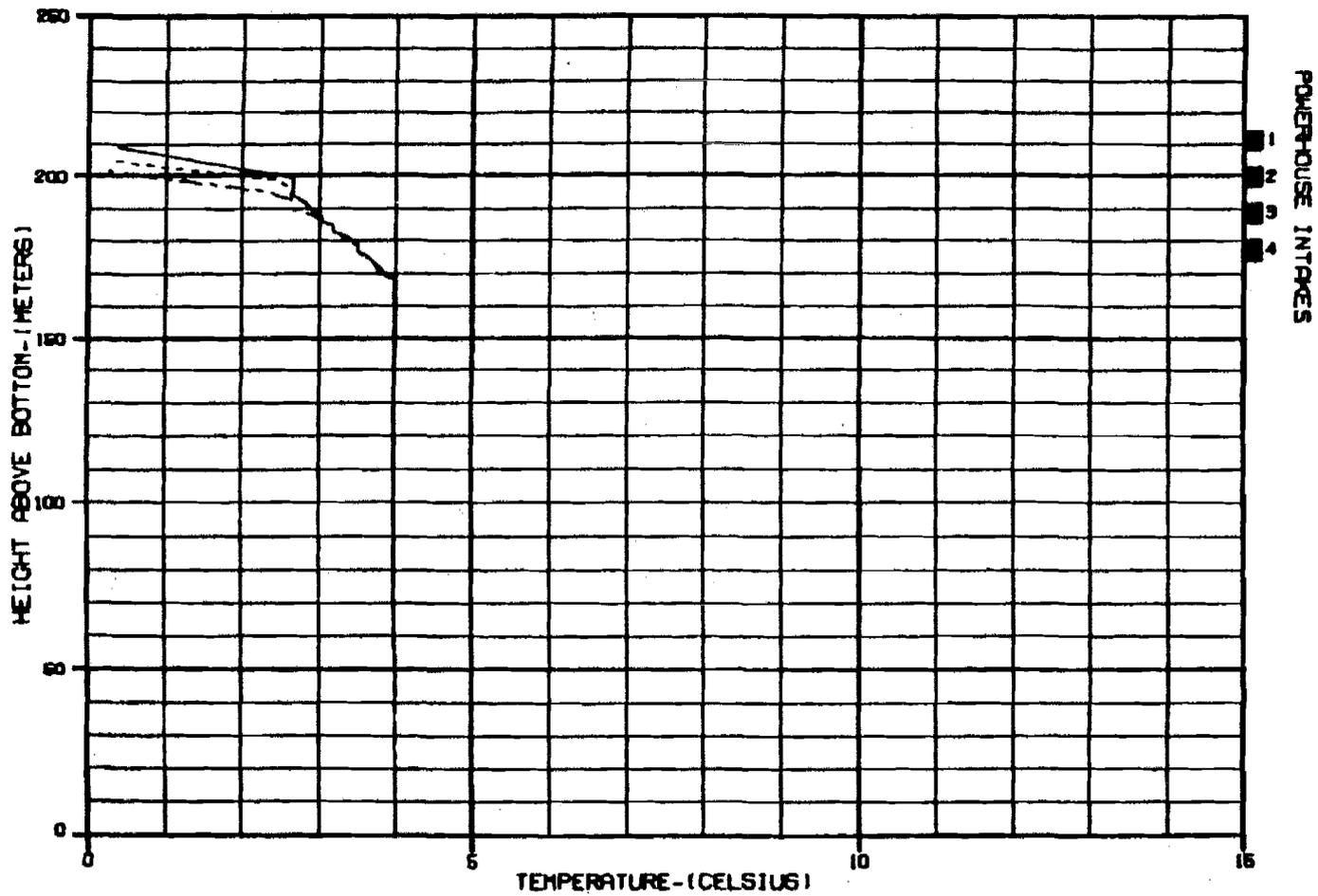
DESIGN: S.L.P. 7 JAN 81 45-010-01



ALASKA POWER AUTHORITY	
SUBSTITUTION PROJECT	DIVISION HEAD
MATANA RESERVOIR	
TEMPERATURE PROFILES	
WAZA-EBROD JOINT VENTURE	
DATE: 1 JAN 75	BY: 42-210-04

CASE: ■■ WAZA-EBROD - MATANA OPERATION WITH DEVIL CANYON IN 2002 ■■

LEGEND:
 ———— 1 NOVEMBER 1975
 - - - - - 1 DECEMBER 1975
 - · - · - 1 JANUARY 1975



CASE: WAT7802A - WATANA OPERATION WITH DEVIL CANYON IN 2002

LEGEND:

PREDICTED TEMPERATURE PROFILES:

— 1 FEBRUARY 1976
 - - - 2 MARCH 1976
 . . . 3 APRIL 1976

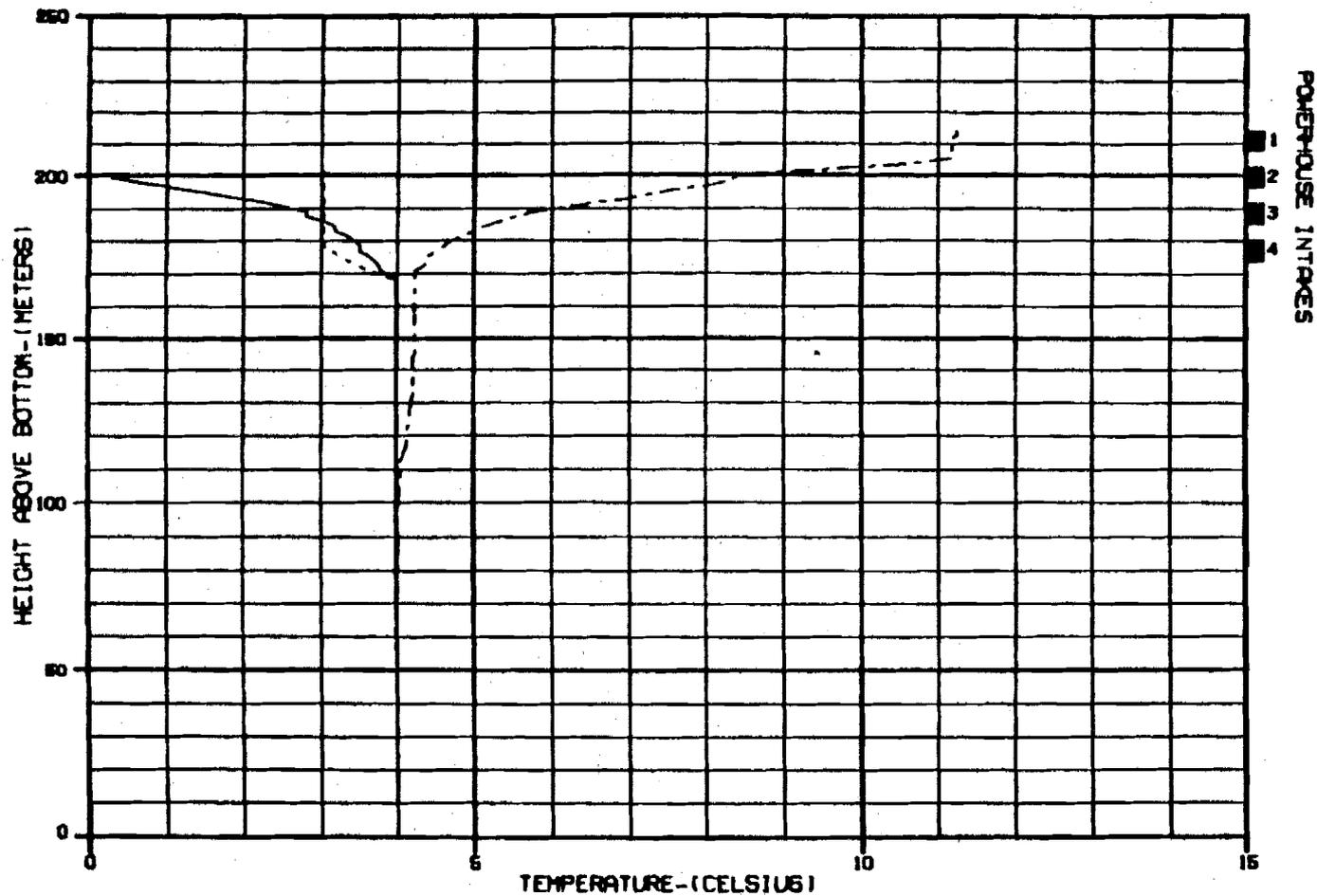
ALASKA POWER AUTHORITY

GLITTER PROJECT OPERA MODEL

WATANA RESERVOIR
 TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

WORKSHEET 7 JAN 81 42-010-04



CASE: ■■ WA7602A - WATANA OPERATION WITH DEVIL CANYON IN 2002 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

_____ 1 MAY 1976
 1 JUNE 1976
 - - - - - 1 JULY 1976

ALASKA POWER AUTHORITY

WATANA PROJECT

GREEN VEEDL

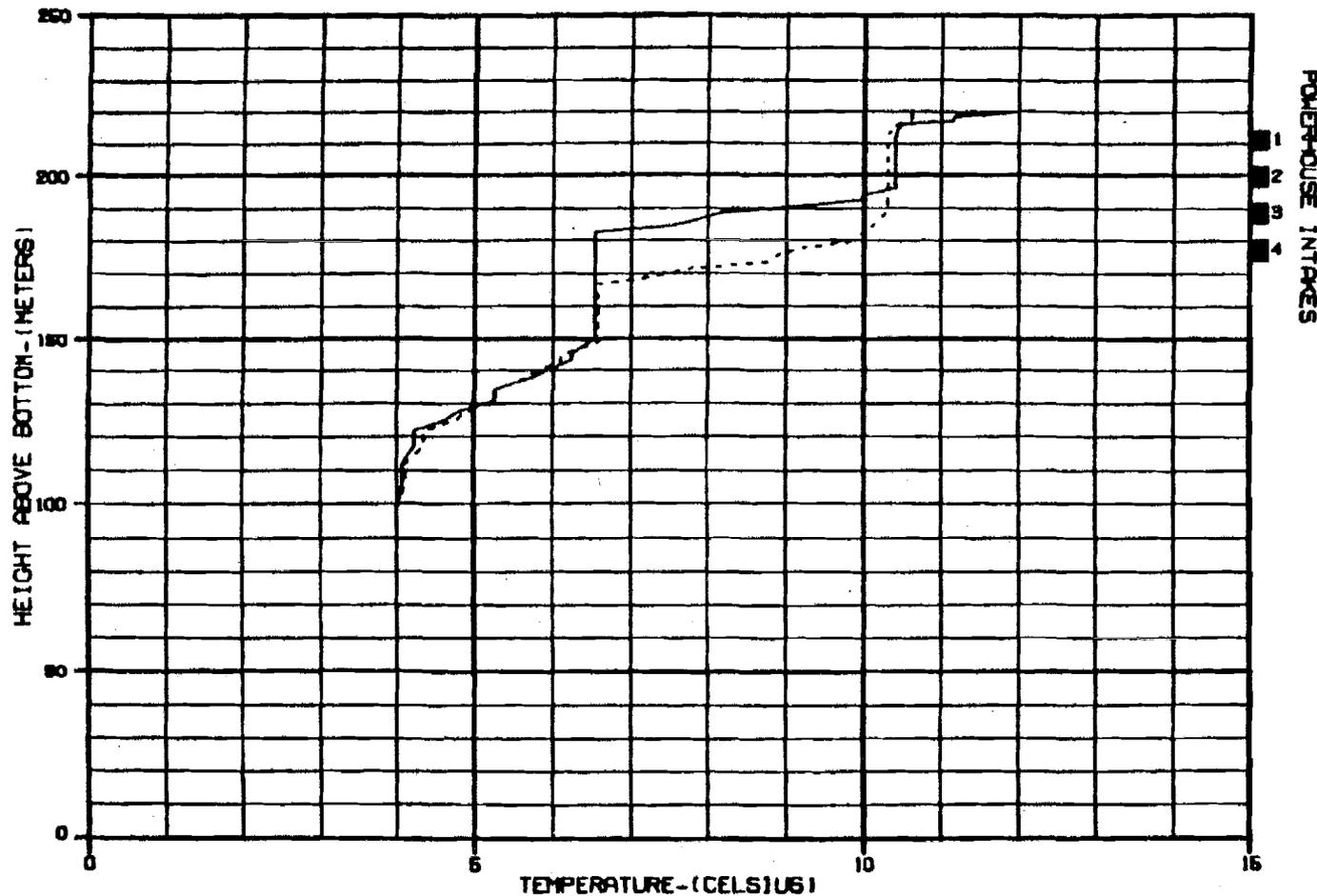
WATANA RESERVOIR
TEMPERATURE PROFILES

WARZA-EBR600 JOINT VENTURE

OWNER - ALASKA

7 JAN 84

©-010-04

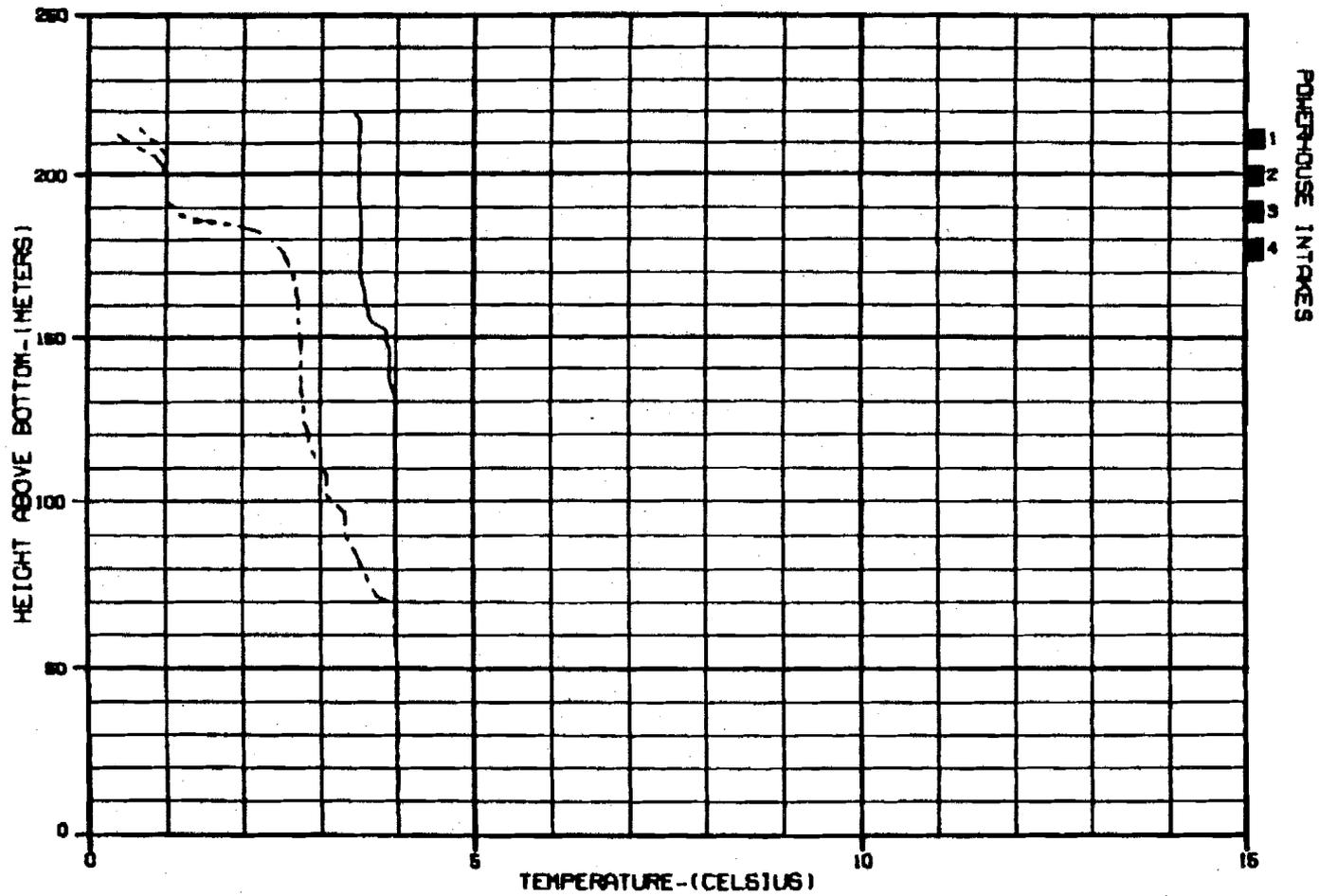


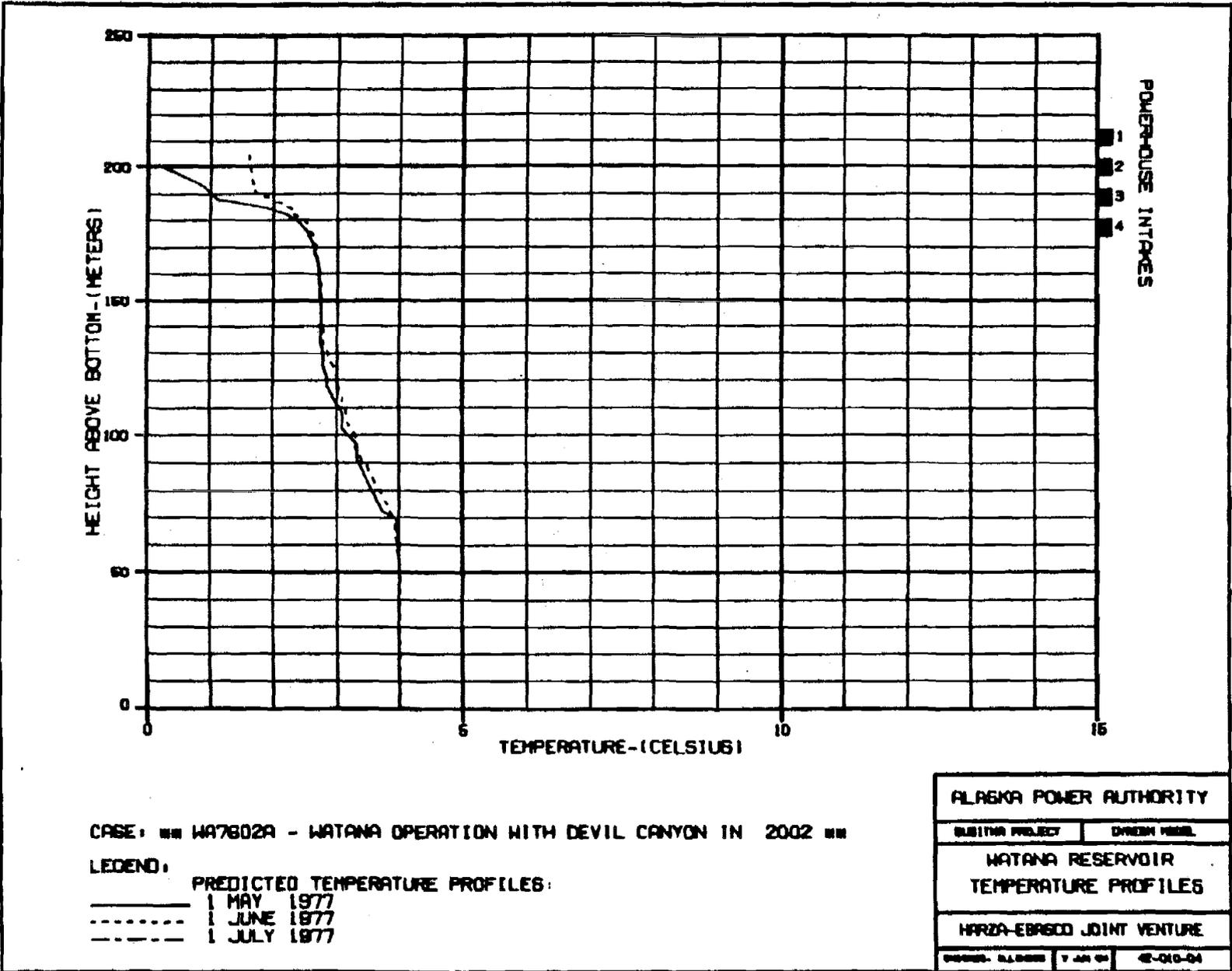
POWERHOUSE INTAKES

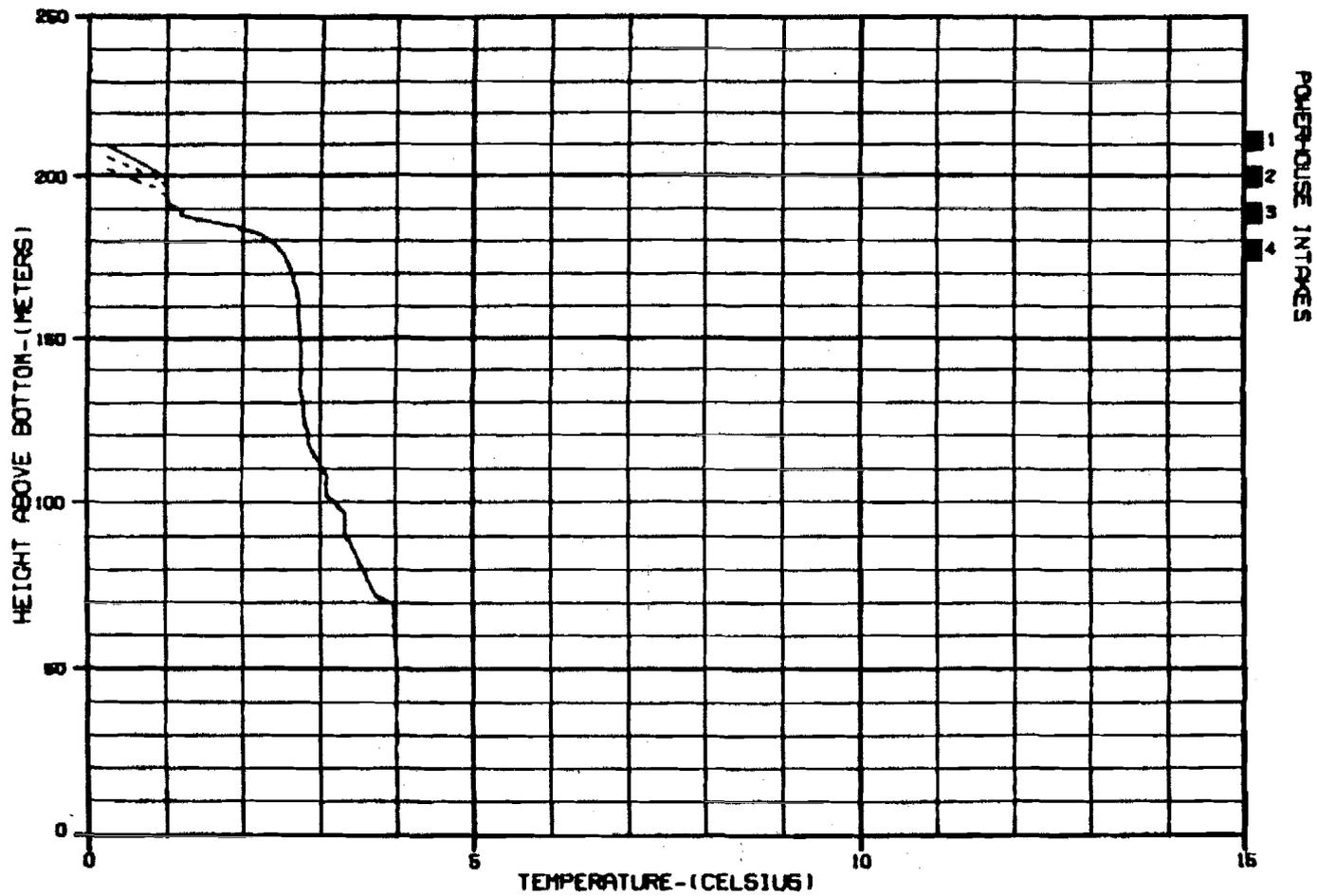
CASE: WA7602A - WATANA OPERATION WITH DEVIL CANYON IN 2002

LEGEND:
 PREDICTED TEMPERATURE PROFILES:
 ———— | AUGUST 1976
 | SEPTEMBER 1976
 - - - - | OCTOBER 1976

ALASKA POWER AUTHORITY		
SUBMITTER PROJECT	OWNER MODEL	
WATANA RESERVOIR		
TEMPERATURE PROFILES		
WARZA-EBASCO JOINT VENTURE		
DESIGNED BY	DATE	PROJECT NO.
W. J. BROWN	7 JAN 81	42-010-04







CASE: WA7602A - WATANA OPERATION WITH DEVIL CANYON IN 2002

LEGEND:

PREDICTED TEMPERATURE PROFILES:

— 1 FEBRUARY 1977
 - - - 2 MARCH 1977
 . . . 3 APRIL 1977

ALASKA POWER AUTHORITY

WATANA PROJECT

DYKES MODEL

WATANA RESERVOIR
 TEMPERATURE PROFILES

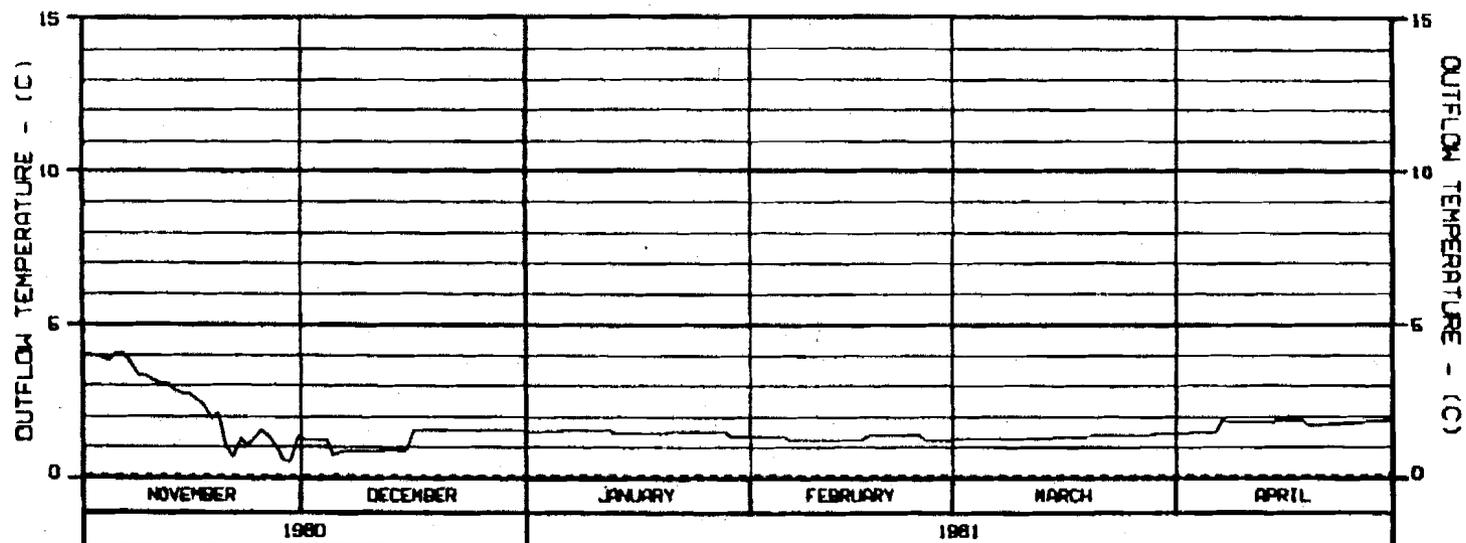
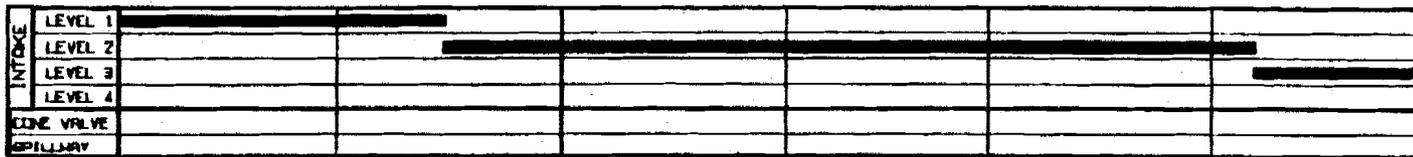
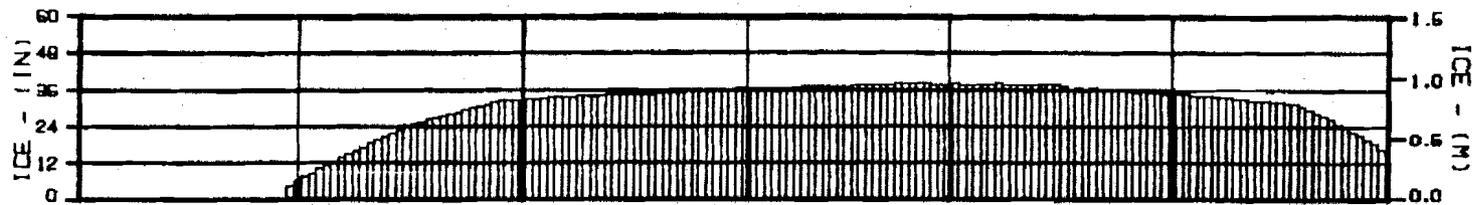
HARZA-EBASCO JOINT VENTURE

DESIGN: S.L. BROWN

7 JAN 81

42-010-04

EXHIBIT AC



LEGEND: CASE: #4 WAB182102B - WATANA OPERATION WITH DEVIL CANYON IN 2002 #44

———— PREDICTED OUTFLOW TEMPERATURE
 - - - - - INFLOW TEMPERATURE

- NOTES:
1. INTAKE PORT LEVEL 1 AT ELEVATION 2161 FT (656.6 M)
 2. INTAKE PORT LEVEL 2 AT ELEVATION 2114 FT (644.3 M)
 3. INTAKE PORT LEVEL 3 AT ELEVATION 2077 FT (633.1 M)
 4. INTAKE PORT LEVEL 4 AT ELEVATION 2040 FT (621.8 M)
 5. CONE VALVE AT ELEVATION 2040 FT (621.8 M)
 6. SPILLWAY CREST AT ELEVATION 2149 FT (654.7 M)

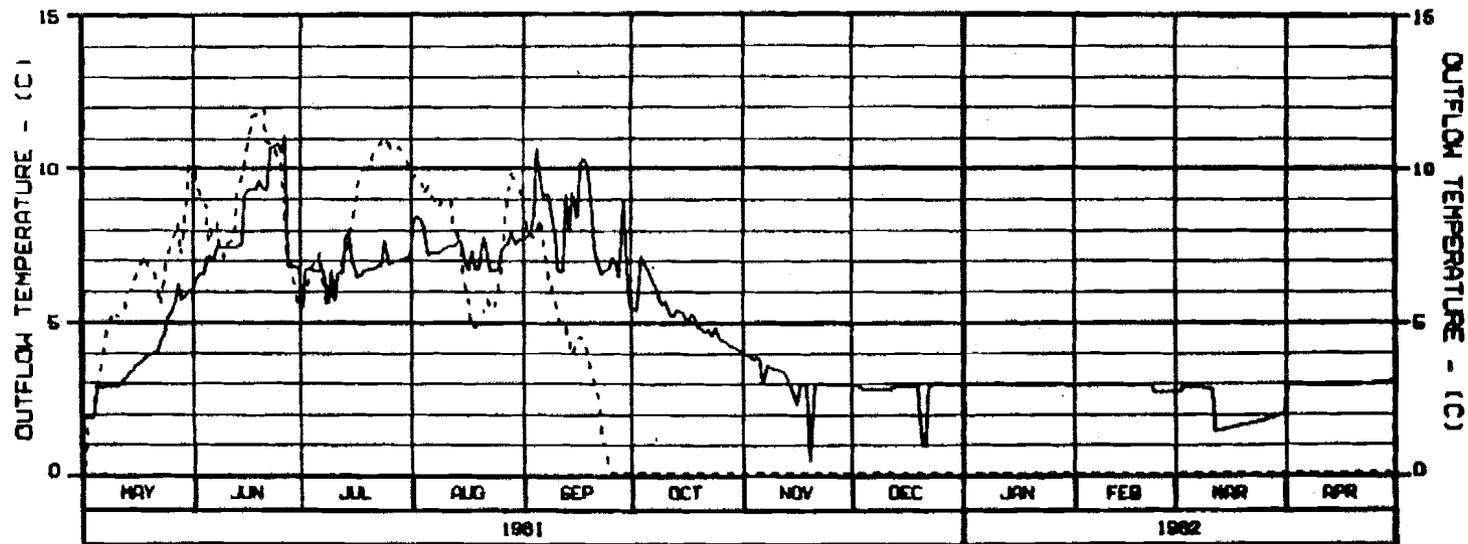
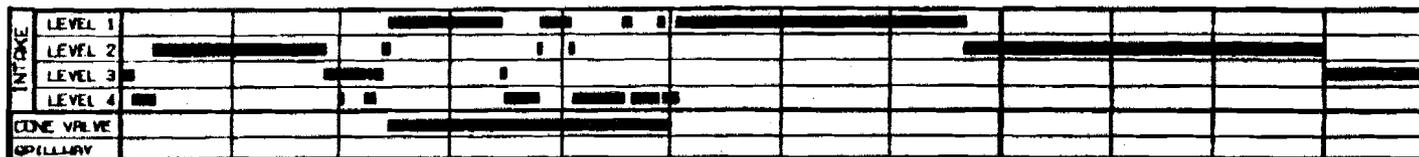
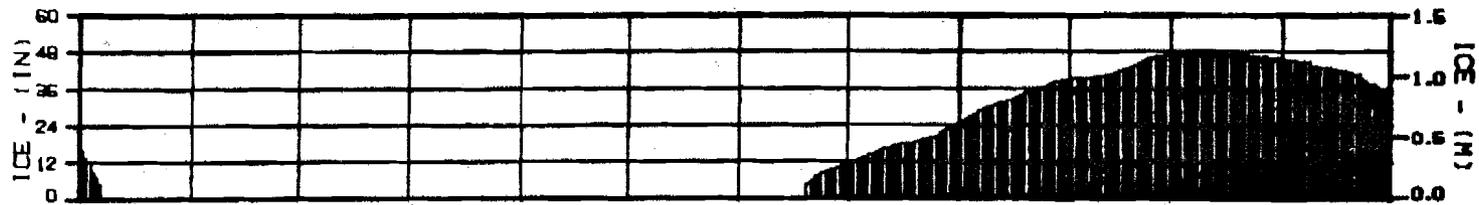
ALASKA POWER AUTHORITY

SUBMITTA PROJECT DYRESM MODEL

WATANA RESERVOIR
 OUTFLOW TEMPERATURE
 AND ICE GROWTH

HARZA-EBASCO JOINT VENTURE

CHARGE: 8.1.1981 1 JAN 81 8-100-81



LEGEND: CASE: WAB1102102B - WATANA OPERATION WITH DEVIL CANYON IN 2002

— PREDICTED OUTFLOW TEMPERATURE
 - - - INFLOW TEMPERATURE

- NOTES:
1. INTAKE PORT LEVEL 1 AT ELEVATION 2151 FT (655.6 M)
 2. INTAKE PORT LEVEL 2 AT ELEVATION 2114 FT (644.3 M)
 3. INTAKE PORT LEVEL 3 AT ELEVATION 2077 FT (633.1 M)
 4. INTAKE PORT LEVEL 4 AT ELEVATION 2040 FT (621.9 M)
 5. CONE VALVE AT ELEVATION 2040 FT (621.9 M)
 6. SPILLWAY CREST AT ELEVATION 2149 FT (654.7 M)

ALASKA POWER AUTHORITY

OUTFLOW PROJECT DAMPEN MODEL

WATANA RESERVOIR
 OUTFLOW TEMPERATURE
 AND ICE GROWTH

HARZA-EBASCO JOINT VENTURE

ISSUED: 11/19/81 1 JAN 82 45-000-01



CASE: WAB1182102B - WATANA OPERATION WITH DEVIL CANYON IN 2002

LEGEND:

PREDICTED TEMPERATURE PROFILES:
 | NOVEMBER 1980
 | DECEMBER 1980
 | JANUARY 1981

ALASKA POWER AUTHORITY

WATANA PROJECT

OWNER MODEL

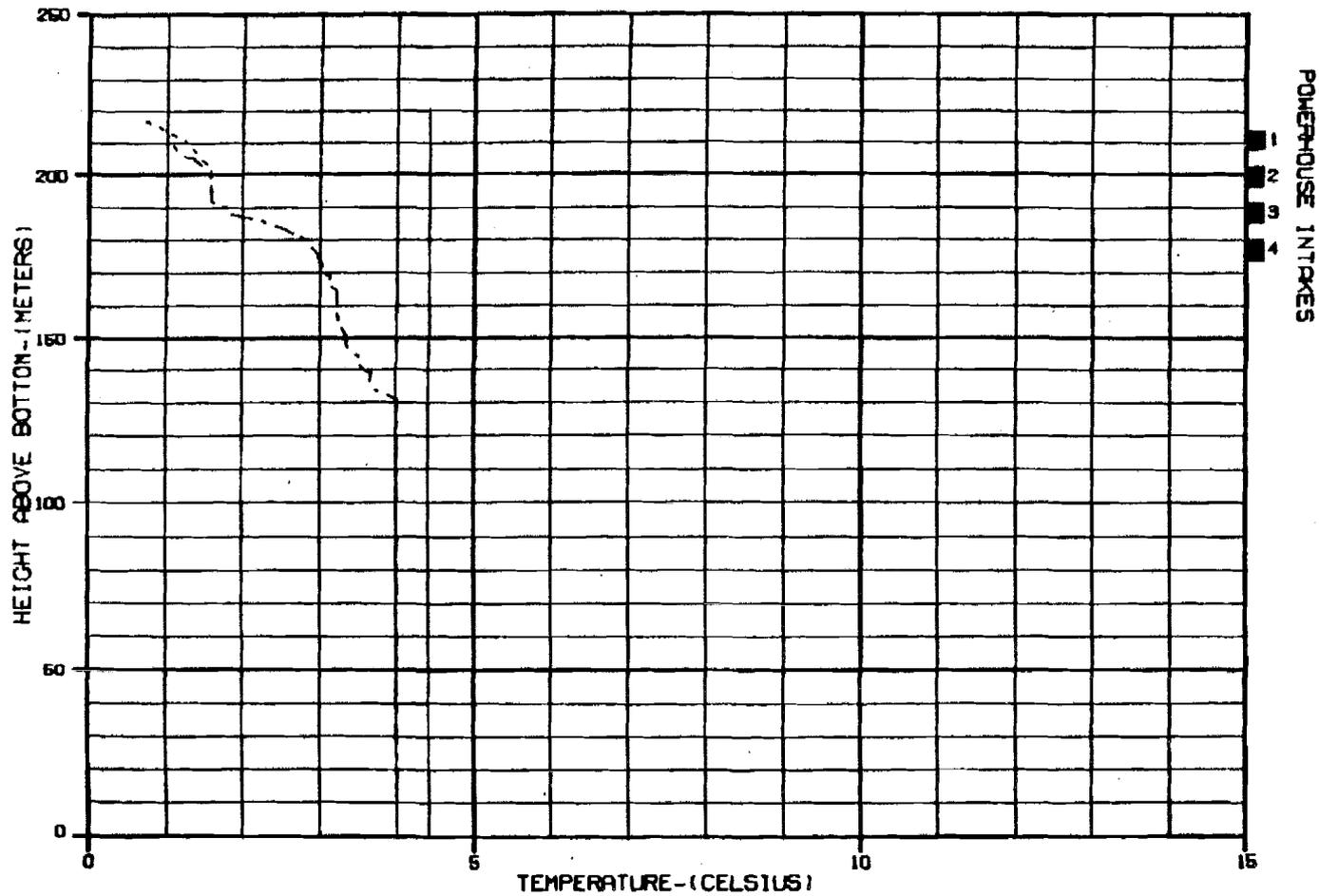
WATANA RESERVOIR
 TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

OWNER: ALP/BJV

1 JAN 81

42-010-04



CASE: WAB1182102B - WATANA OPERATION WITH DEVIL CANYON IN 2002

LEGEND: PREDICTED TEMPERATURE PROFILES:
 ——— 1 NOVEMBER 1980
 1 DECEMBER 1980
 - - - - 1 JANUARY 1981

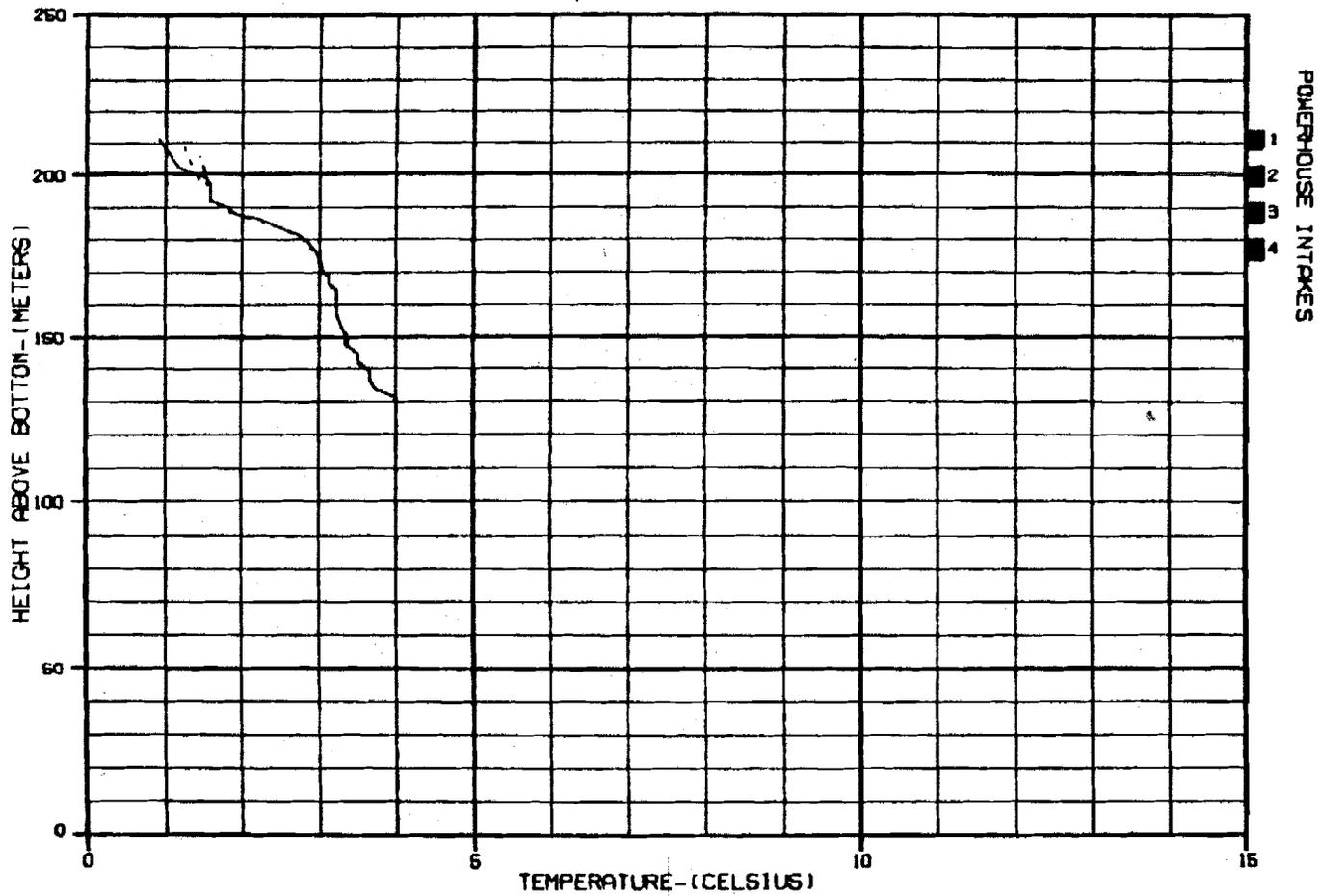
ALASKA POWER AUTHORITY

SUBMITTA PROJECT | OPENSH MODEL

WATANA RESERVOIR
 TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

GEORGE BLANKS | 1 JAN 81 | 47-010-04



CASE: WAB1182102B - WATANA OPERATION WITH DEVIL CANYON IN 2002

LEGEND:

PREDICTED TEMPERATURE PROFILES:

- 1 FEBRUARY 1981
- - - 1 MARCH 1981
- · - · 1 APRIL 1981

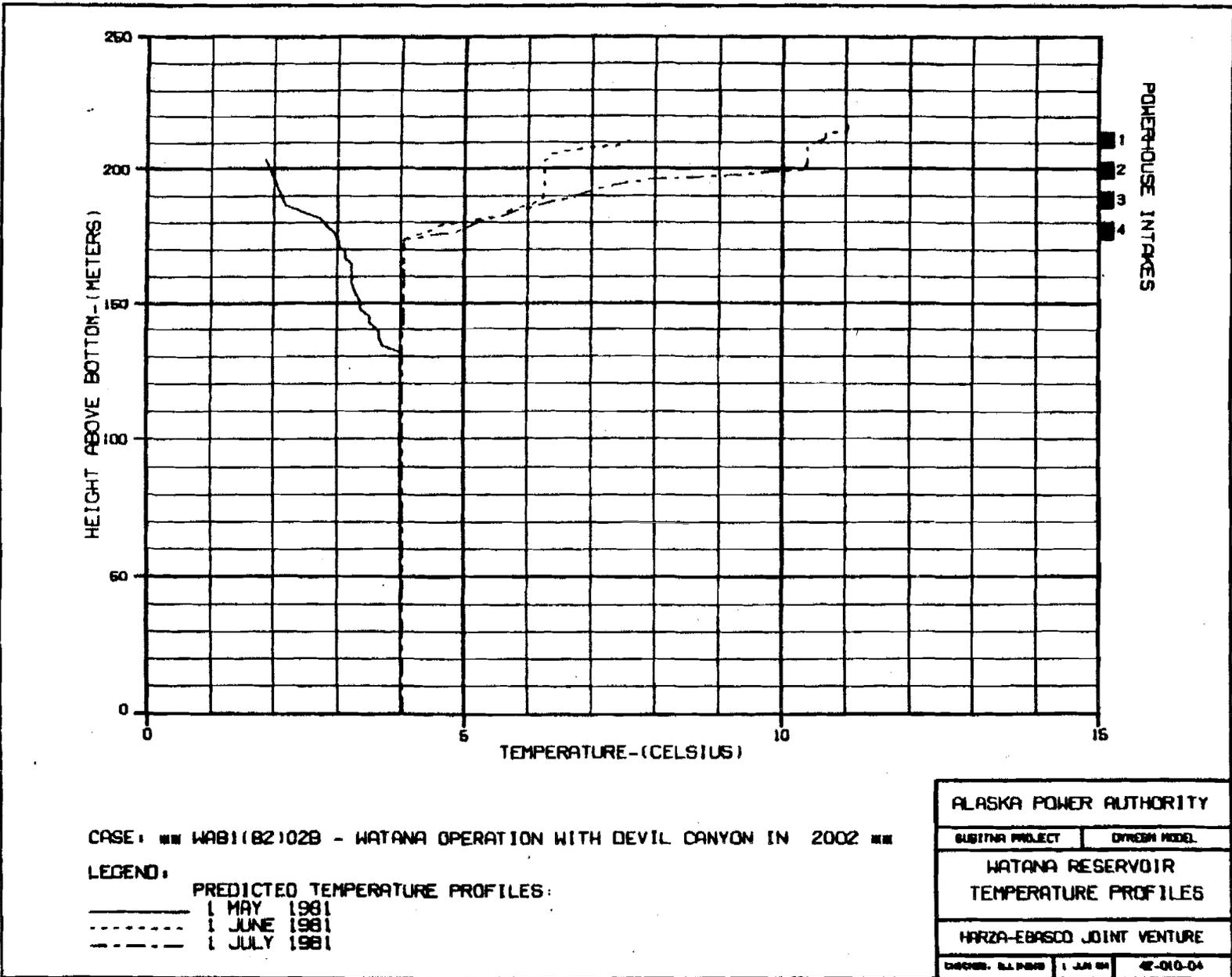
ALASKA POWER AUTHORITY

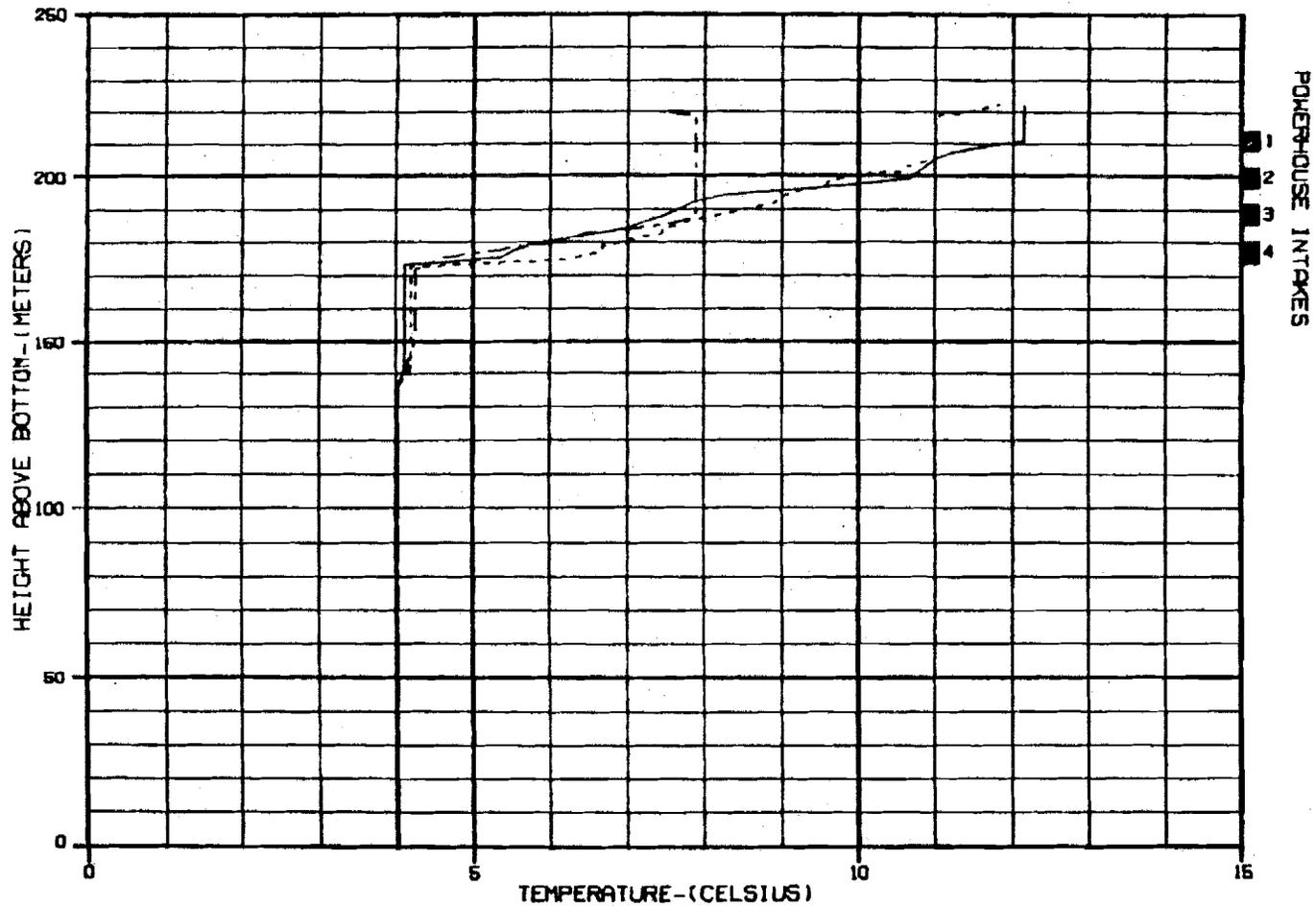
SUBITNA PROJECT DYNEM MODEL

WATANA RESERVOIR
TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

ENCLOSURE - 1 JAN 84 42-010-04





CASE: WAB1182102B - WATANA OPERATION WITH DEVIL CANYON IN 2002

LEGEND:

PREDICTED TEMPERATURE PROFILES:

- | AUGUST 1981
- - - | SEPTEMBER 1981
- · - · | OCTOBER 1981

ALASKA POWER AUTHORITY

DLITNA PROJECT

OWENH MODEL

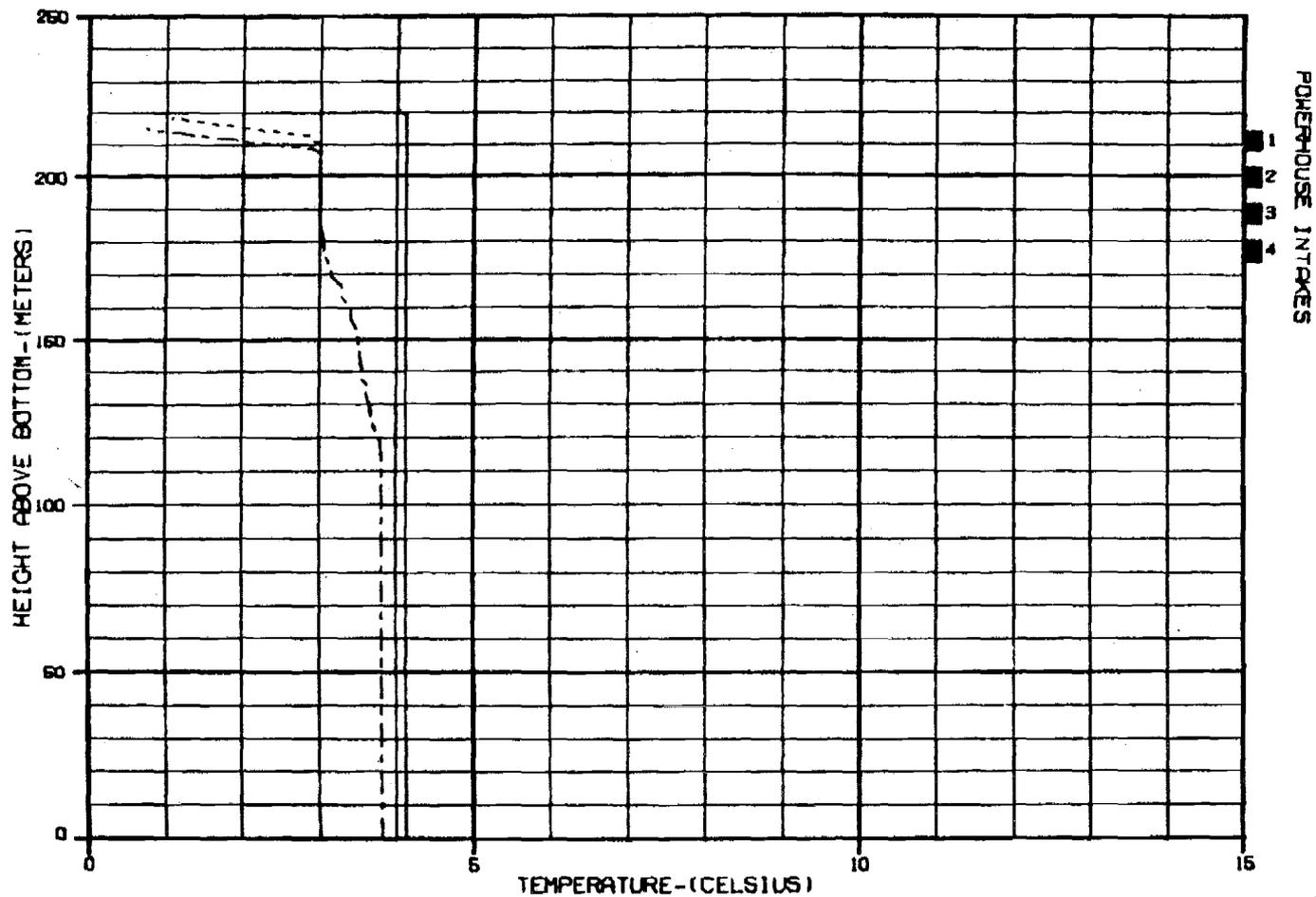
WATANA RESERVOIR
TEMPERATURE PROFILES

HARZA-EBAGCO JOINT VENTURE

CHGDR: ALP/BS

1 JAN 81

EE-010-04



CASE: WATANA WAB1182102B - WATANA OPERATION WITH DEVIL CANYON IN 2002

LEGEND:

PREDICTED TEMPERATURE PROFILES:

- 1 NOVEMBER 1981
- - - 1 DECEMBER 1981
- · - · 1 JANUARY 1982

ALASKA POWER AUTHORITY

WATANA PROJECT

OVERSEAS MODEL

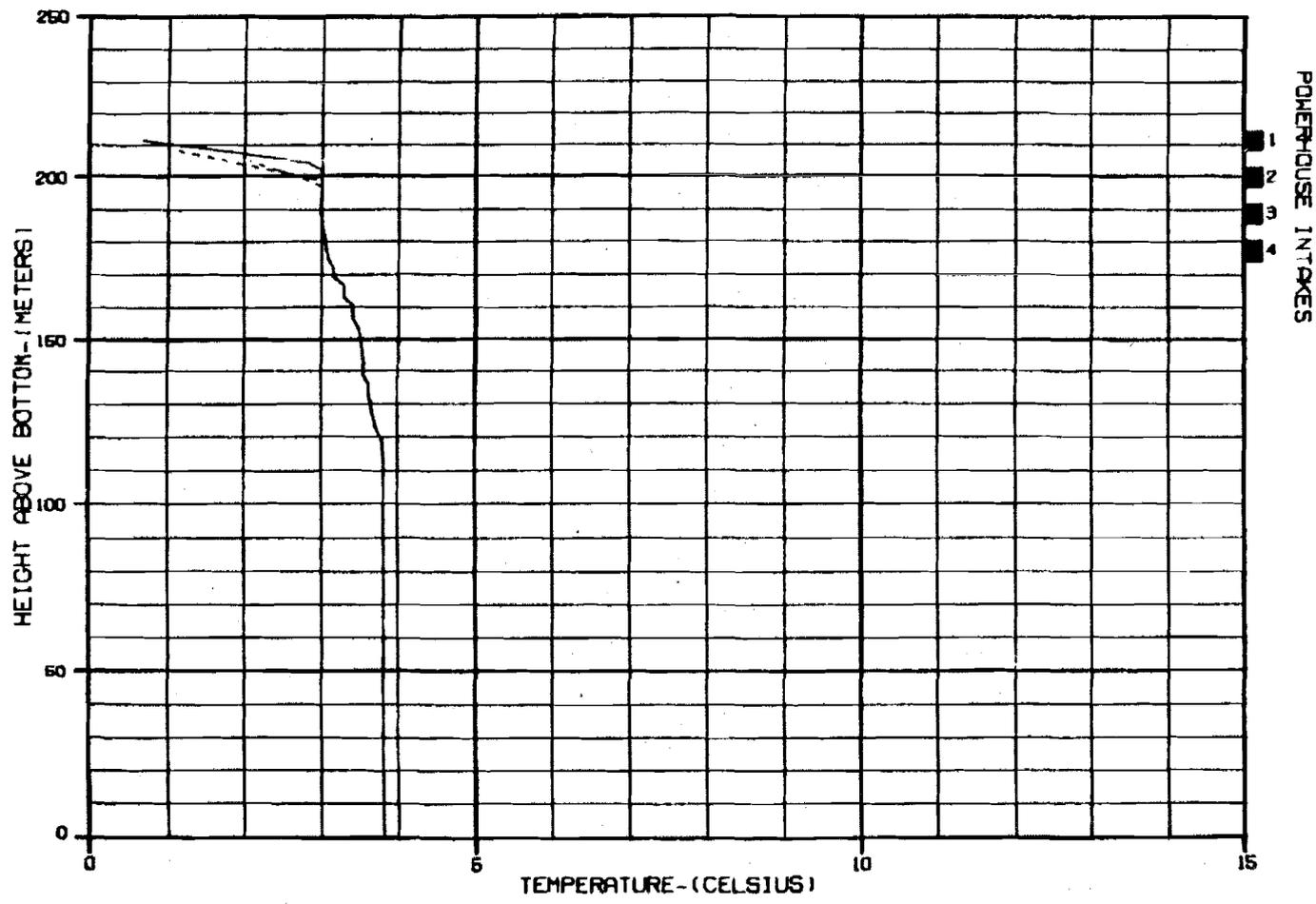
WATANA RESERVOIR
TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

ENGINEER: B.L. PETER

1 JUN 84

42-010-04



CASE: ■■ WAB1182102B - WATANA OPERATION WITH DEVIL CANYON IN 2002 ■■

LEGEND: PREDICTED TEMPERATURE PROFILES

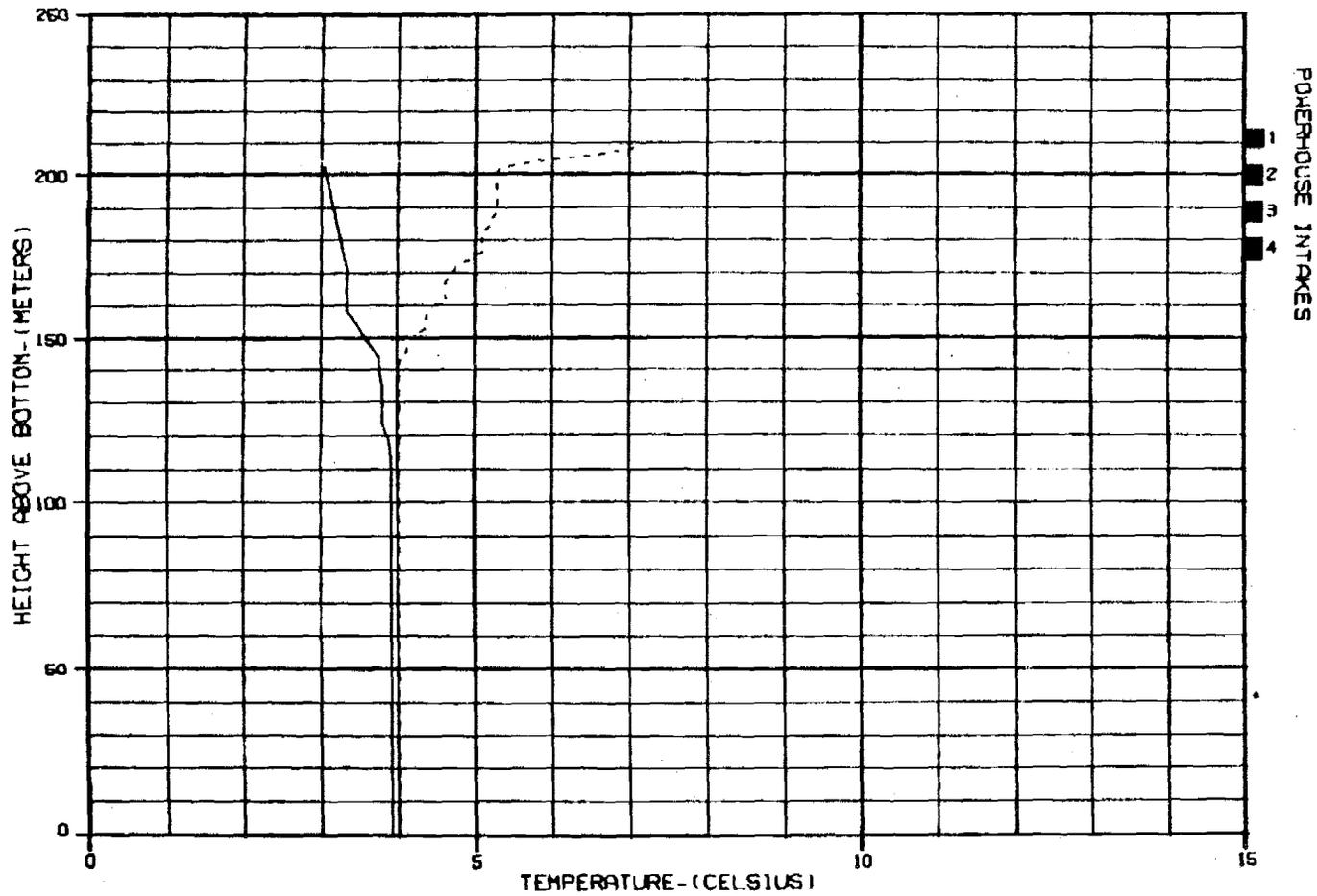
————— | FEBRUARY 1982

----- | MARCH 1982

- · - · - | APRIL 1982

ALASKA POWER AUTHORITY		
SLBITHA PROJECT	DYWIDOP MODEL	
WATANA RESERVOIR TEMPERATURE PROFILES		
WARZA-EBAGCO JOINT VENTURE		
CHARGE - 0110010	1 JAN 84	42-010-04

EXHIBIT AD



CASE: ■■■ WAB1182102B - WATANA OPERATION WITH DEVIL CANYON IN 2002 ■■■

LEGEND:

PREDICTED TEMPERATURE PROFILES

——— | MAY 1983
 - - - - | JUNE 1983

ALASKA POWER AUTHORITY

SUBITNA PROJECT

DYKEMA MODEL

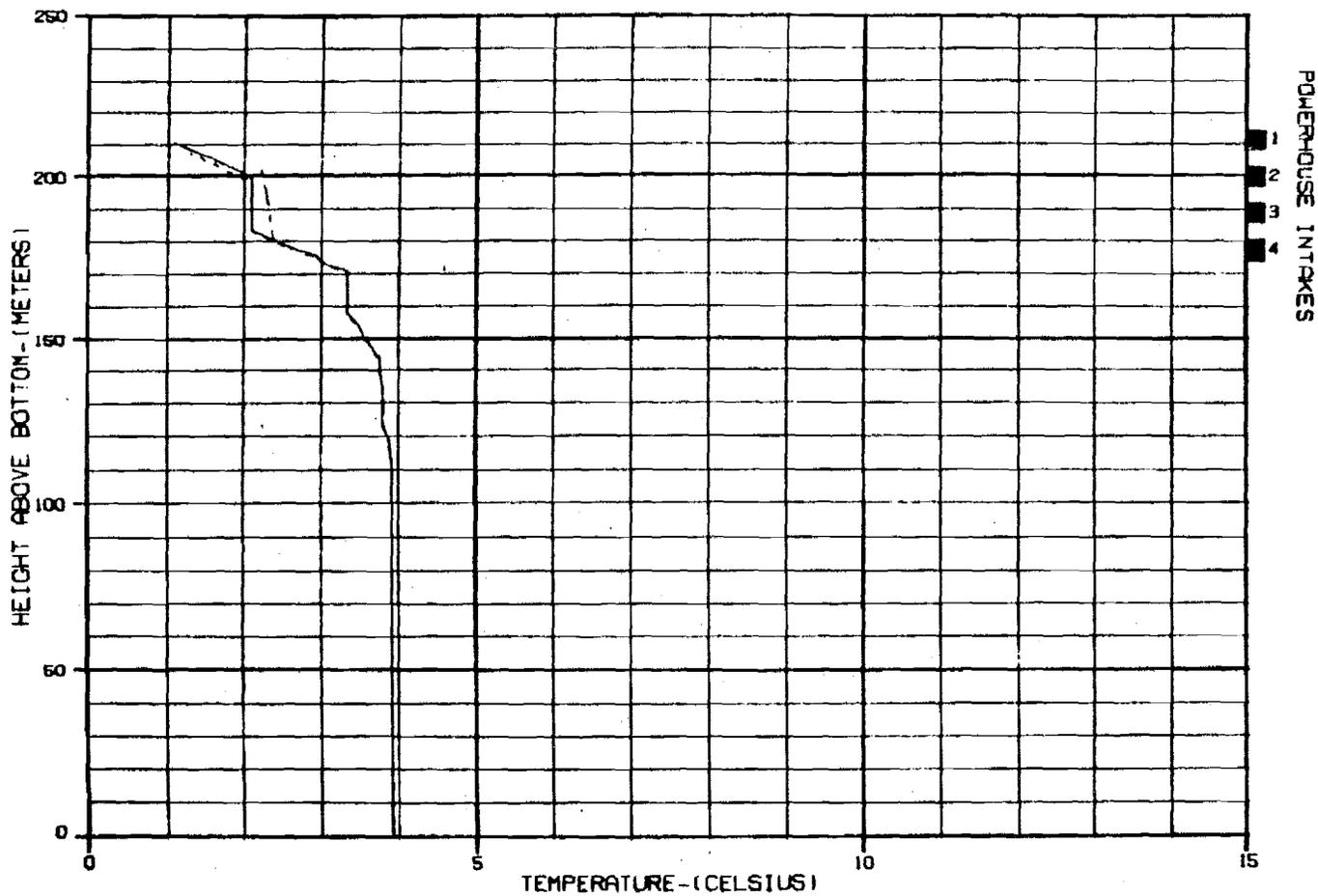
WATANA RESERVOIR
 TEMPERATURE PROFILES

HARZA-EBAGCO JOINT VENTURE

ENGINEER: D.L. HARRIS

1 JUN 83

42-010-04



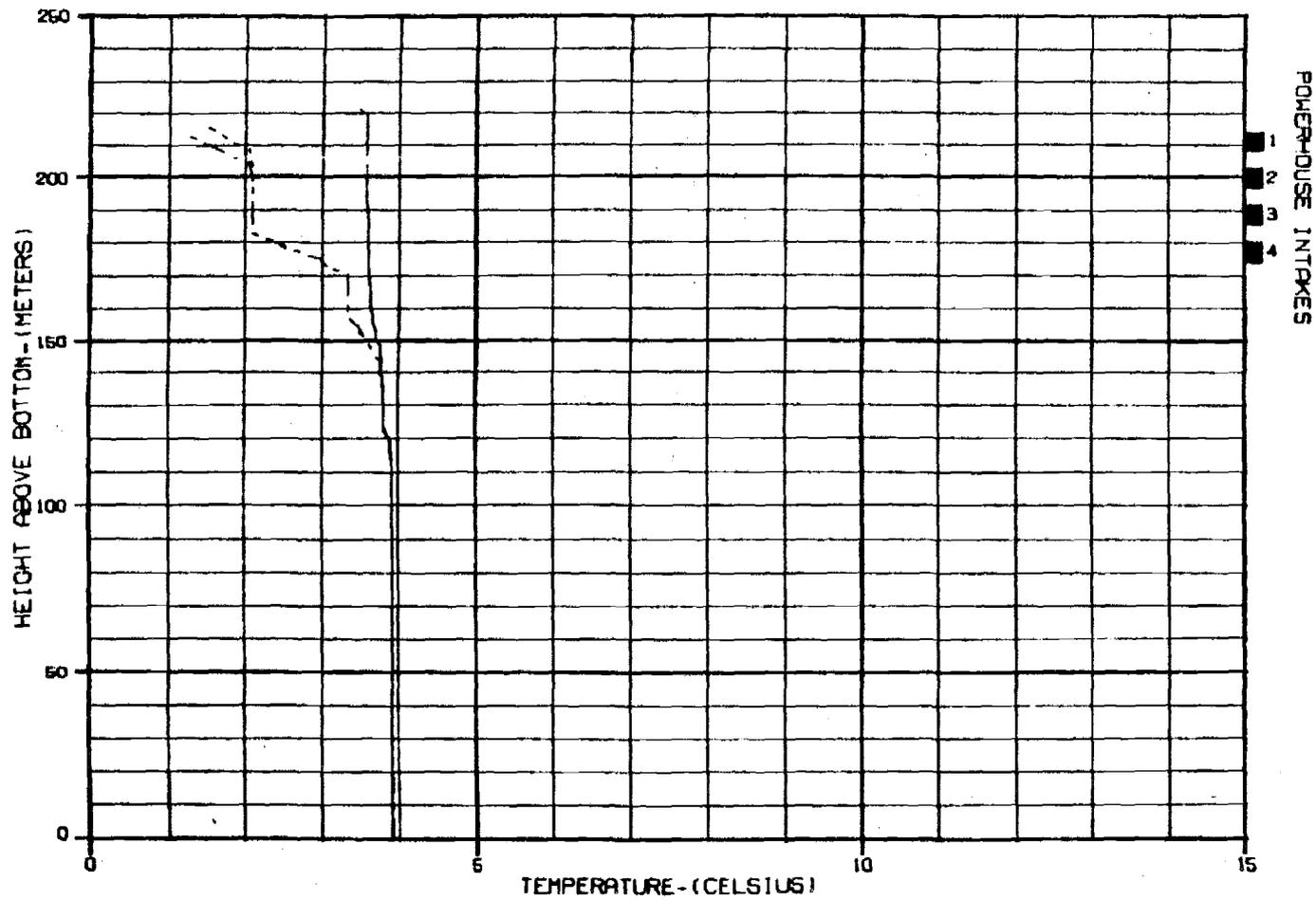
CASE: WAB1(82)02B - WATANA OPERATION WITH DEVIL CANYON IN 2002

LEGEND:

PREDICTED TEMPERATURE PROFILES:

- 1 FEBRUARY 1983
- - - 1 MARCH 1983
- · - · 1 APRIL 1983

ALASKA POWER AUTHORITY	
SUBITNA PROJECT	DYRESM MODEL
WATANA RESERVOIR TEMPERATURE PROFILES	
WARZA-EBASCO JOINT VENTURE	
ENGINEER - (ILLINOIS)	1 JAN 84 42-010-04

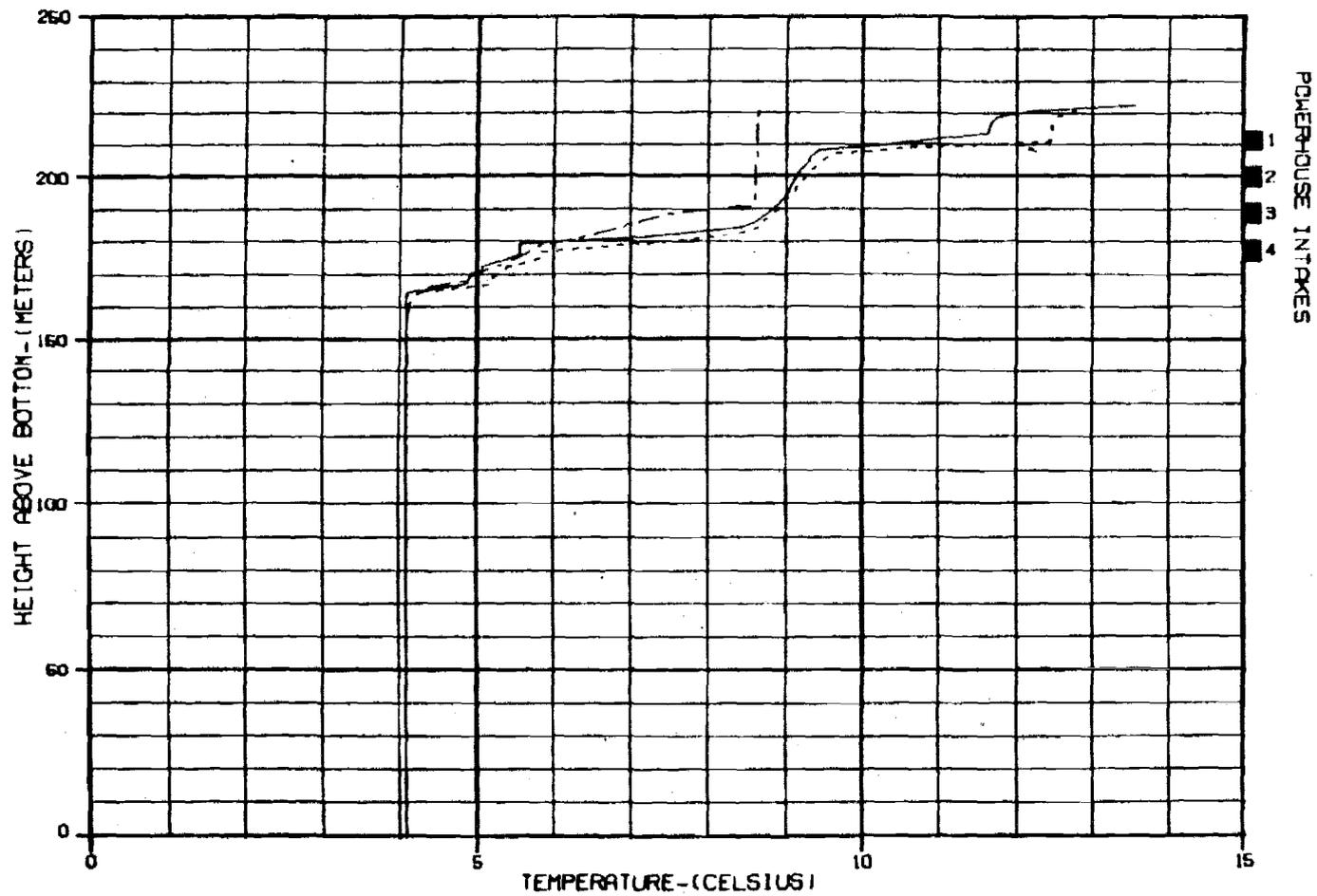


POWERHOUSE INTAKES
1
2
3
4

CASE: WAB1182102B - WATANA OPERATION WITH DEVIL CANYON IN 2002

LEGEND: PREDICTED TEMPERATURE PROFILES:
 ——— 1 NOVEMBER 1982
 - - - - 1 DECEMBER 1982
 - · - · 1 JANUARY 1983

ALASKA POWER AUTHORITY	
SUBMITTA PROJECT	DTRESM MODEL
WATANA RESERVOIR TEMPERATURE PROFILES	
HARZA-EBASCO JOINT VENTURE	
DATE: 01/01/83	42-010-04



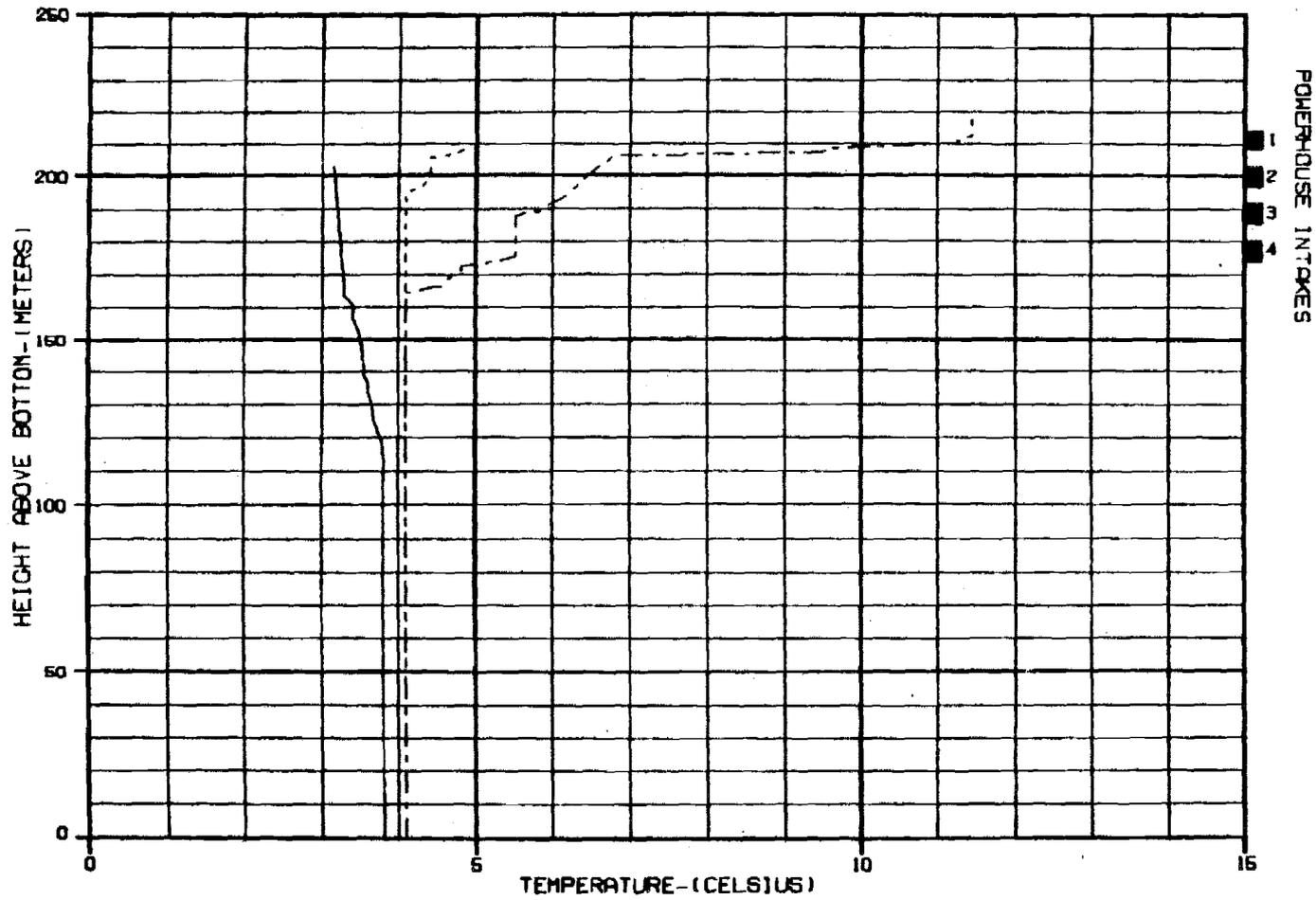
CASE: WAB11821028 - WATANA OPERATION WITH DEVIL CANYON IN 2002 MW

LEGEND:

PREDICTED TEMPERATURE PROFILES:

- 1 AUGUST 1982
- - - 1 SEPTEMBER 1982
- · - · 1 OCTOBER 1982

ALASKA POWER AUTHORITY		
SUBMITTA PROJECT	DYREDAH MODEL	
WATANA RESERVOIR		
TEMPERATURE PROFILES		
MARZA-EBASCO JOINT VENTURE		
CHICAGO, ILLINOIS	1 JAN 84	42-010-04



CASE: WAB1182102B - WATANA OPERATION WITH DEVIL CANYON IN 2002

LEGEND:

PREDICTED TEMPERATURE PROFILES:

——— MAY 1982
 - - - - - JUNE 1982
 - · - · - JULY 1982

ALASKA POWER AUTHORITY

SUBSTRA PROJECT

DEVESH MODEL

WATANA RESERVOIR
TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

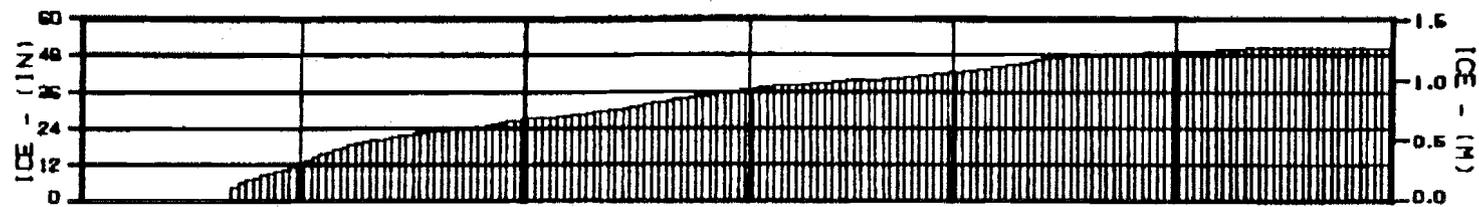
CHORR. BARNIS

1 JAN 84

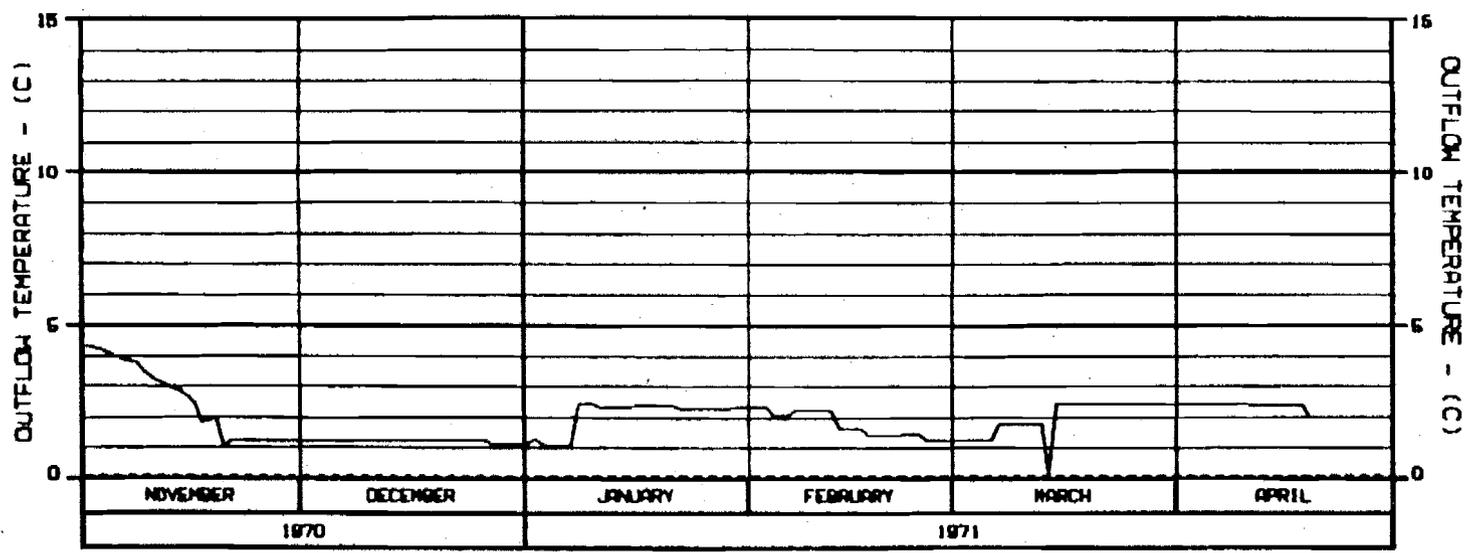
42-010-04

WATANA AND DEVIL CANYON OPERATING
2020 Energy Demands
Watana Reservoir Temperatures

EXHIBIT AE



INTAKE	LEVEL 1					
	LEVEL 2	██████████				
	LEVEL 3		██████████			
	LEVEL 4			██████████	██████████	██████████
	CONE VALVE					
	SPILLWAY					

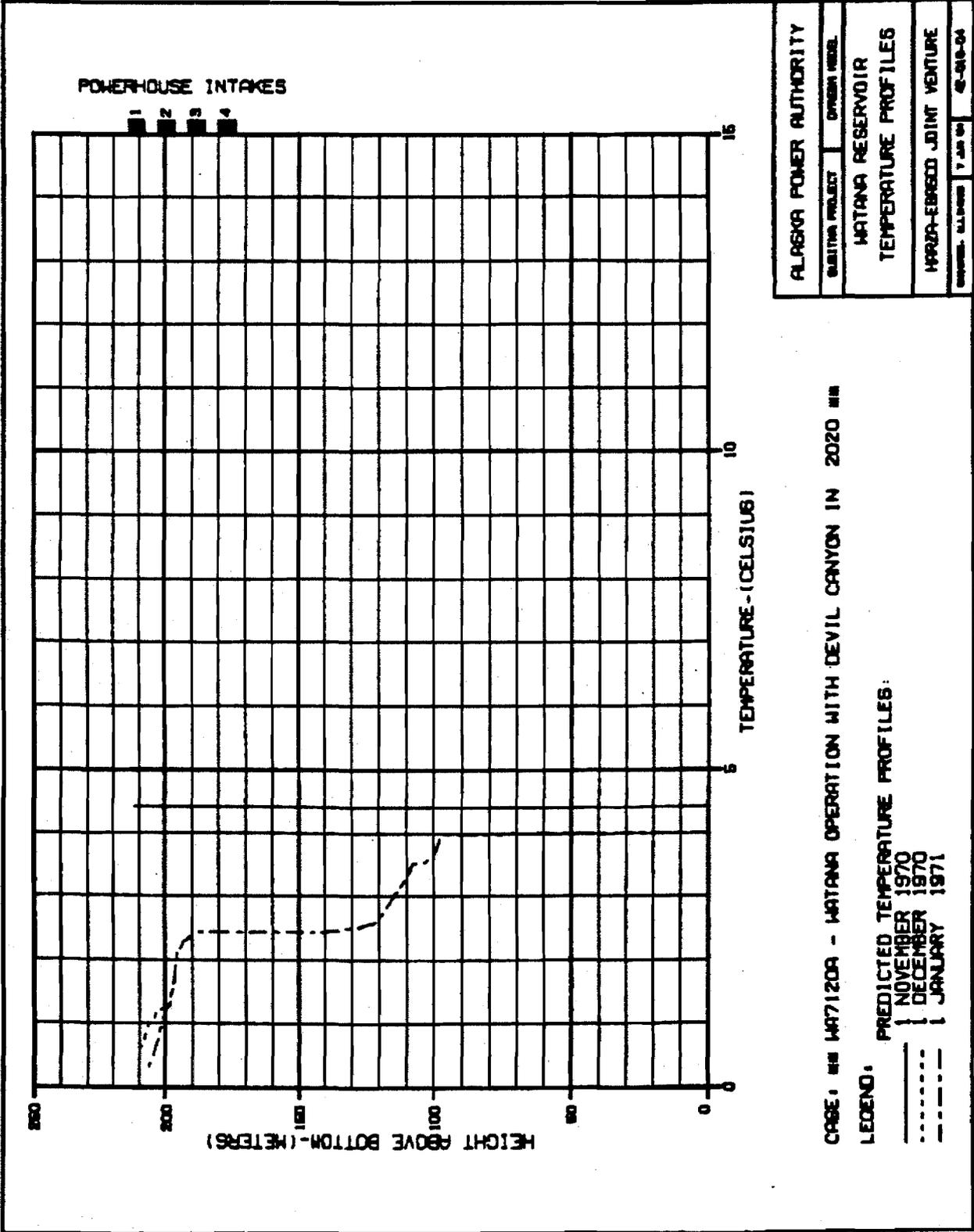


LEGEND: CASE: 000 MA7120A - NATANA OPERATION WITH DEVIL CANYON IN 2020 000

———— PREDICTED OUTFLOW TEMPERATURE
 - - - - - INFLOW TEMPERATURE

- NOTES:
1. INTAKE PORT LEVEL 1 AT ELEVATION 2161 FT (655.6 M)
 2. INTAKE PORT LEVEL 2 AT ELEVATION 2114 FT (644.3 M)
 3. INTAKE PORT LEVEL 3 AT ELEVATION 2077 FT (633.1 M)
 4. INTAKE PORT LEVEL 4 AT ELEVATION 2040 FT (621.0 M)
 5. CONE VALVE AT ELEVATION 2040 FT (621.0 M)
 6. SPILLWAY CREST AT ELEVATION 2140 FT (654.7 M)

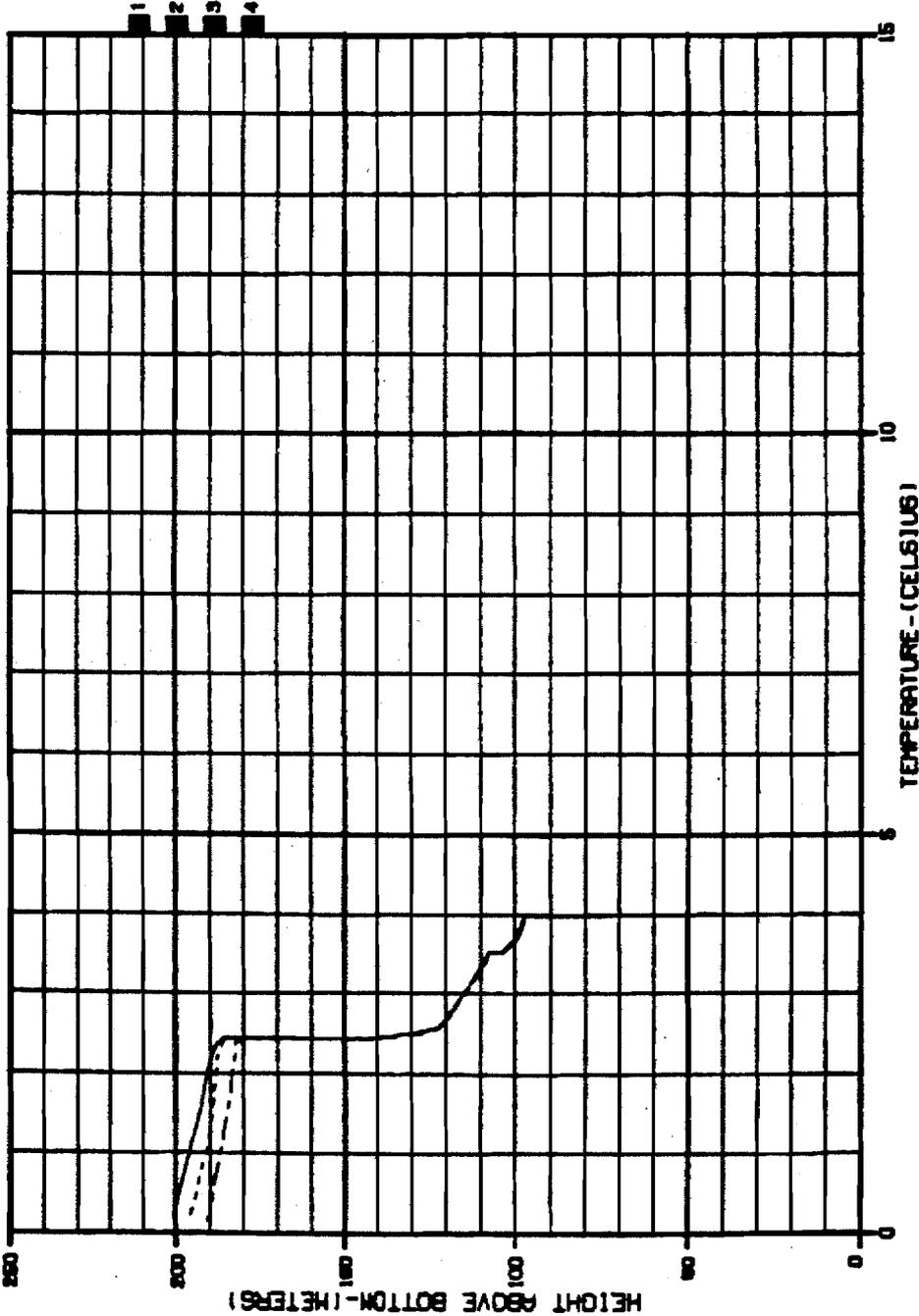
ALASKA POWER AUTHORITY		
WATANA PROJECT	DANESH MODEL	
WATANA RESERVOIR OUTFLOW TEMPERATURE AND ICE GROWTH		
HARZA-EBASCO JOINT VENTURE		
DATE: 11-20-80	7 JAN 81	42-000-01



ALASKA POWER AUTHORITY
 QUALITY PROJECT DIVISION HEAD
 HATANA RESERVOIR
 TEMPERATURE PROFILES
 HARZA-ERBACD JOINT VENTURE
 DRAWING: 44-1000 7 JAN 70 42-010-04

CASE: #147120A - HATANA OPERATION WITH DEVIL CANYON IN 2020 MIN
 LEGEND: PREDICTED TEMPERATURE PROFILES:
 | NOVEMBER 1970
 | DECEMBER 1970
 | JANUARY 1971

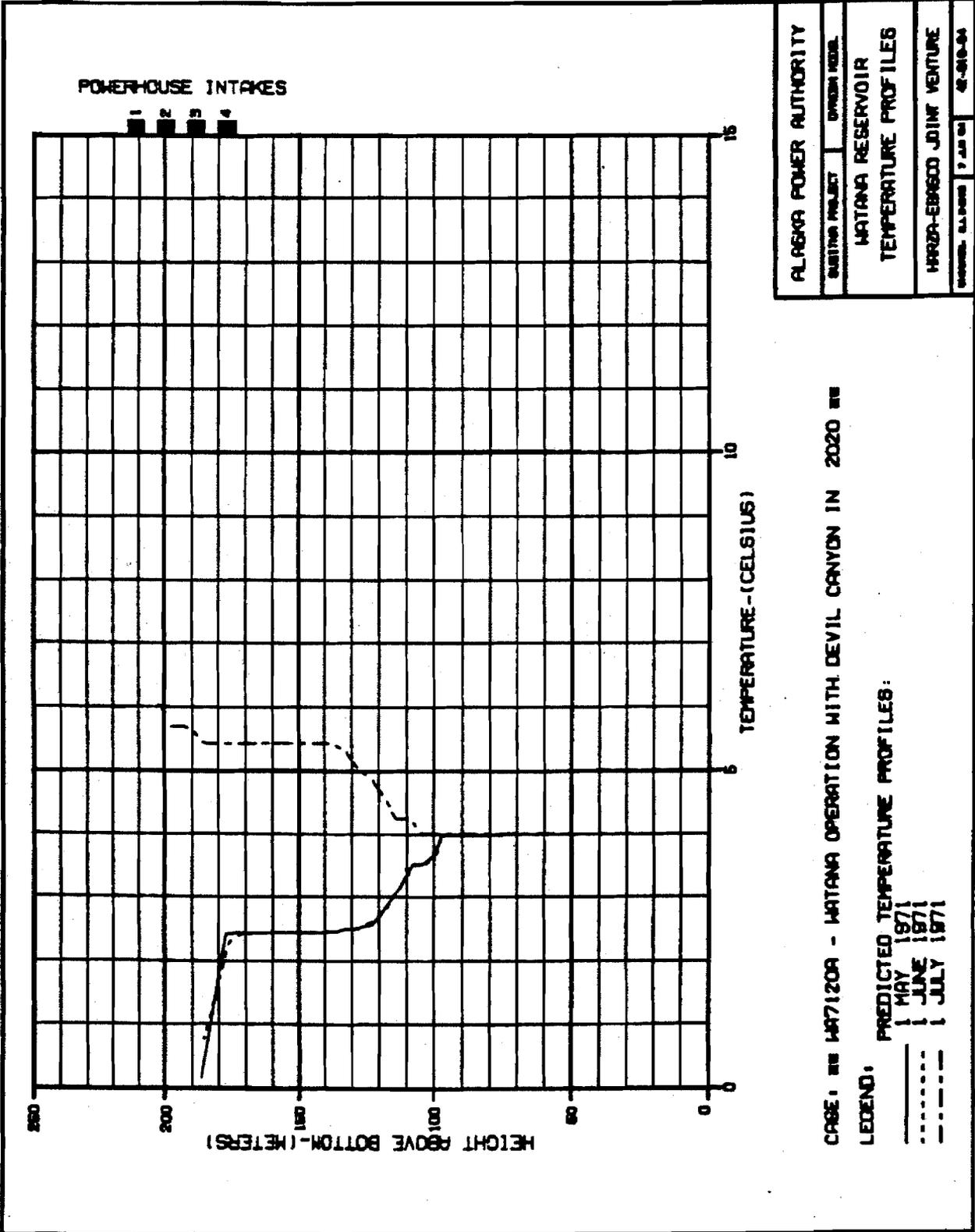
POWERHOUSE INTAKES



ALASKA POWER AUTHORITY	
SUBJECT PROJECT	DEVIL CANYON
WATANA RESERVOIR	
TEMPERATURE PROFILES	
HARZA-EBERCO JOINT VENTURE	
DATE	4-20-71

CASE: WAT120A - WATANA OPERATION WITH DEVIL CANYON IN 2020

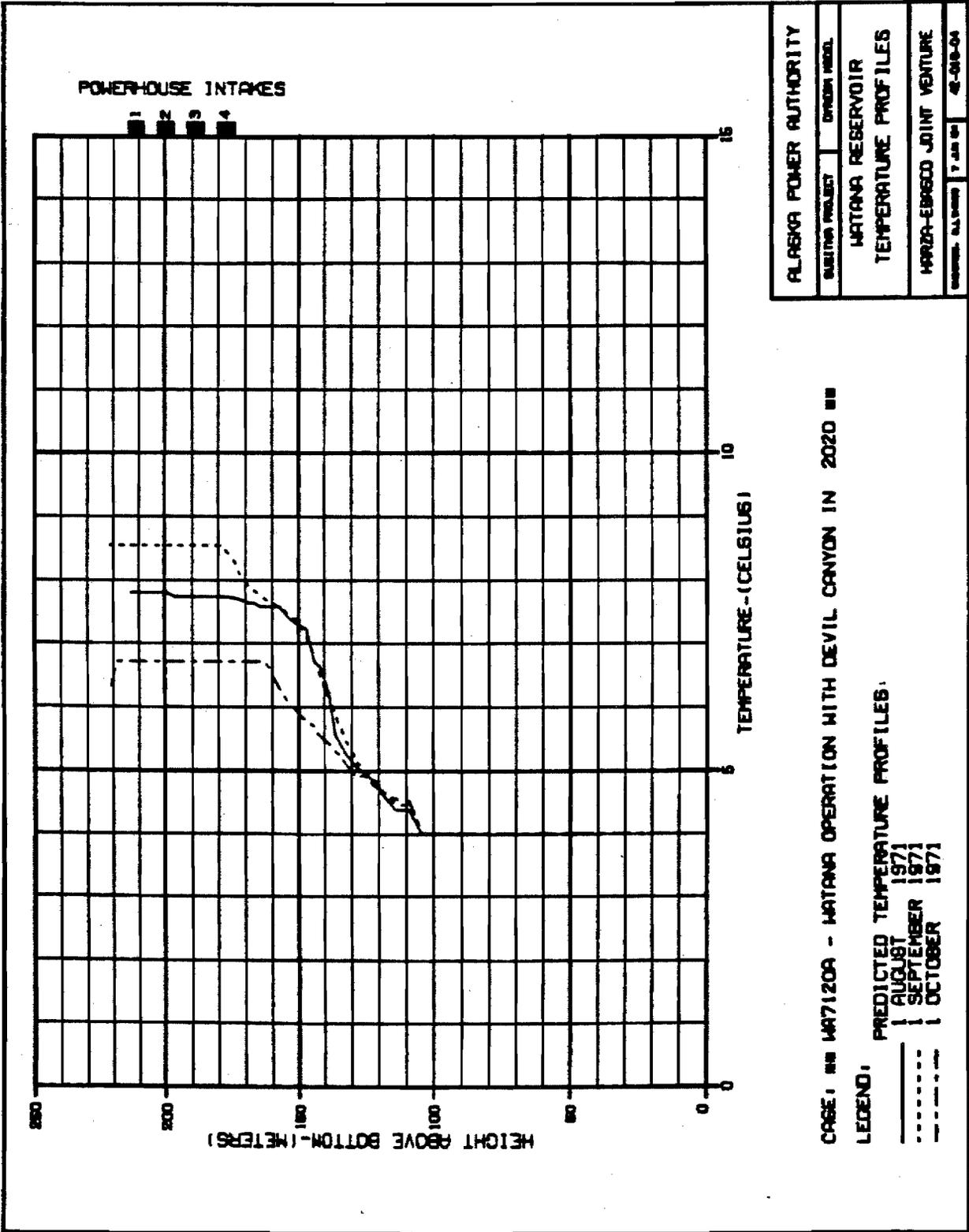
LEGEND:
 — PREDICTED TEMPERATURE PROFILES:
 - - - FEBRUARY 1971
 - - - MARCH 1971
 - - - APRIL 1971

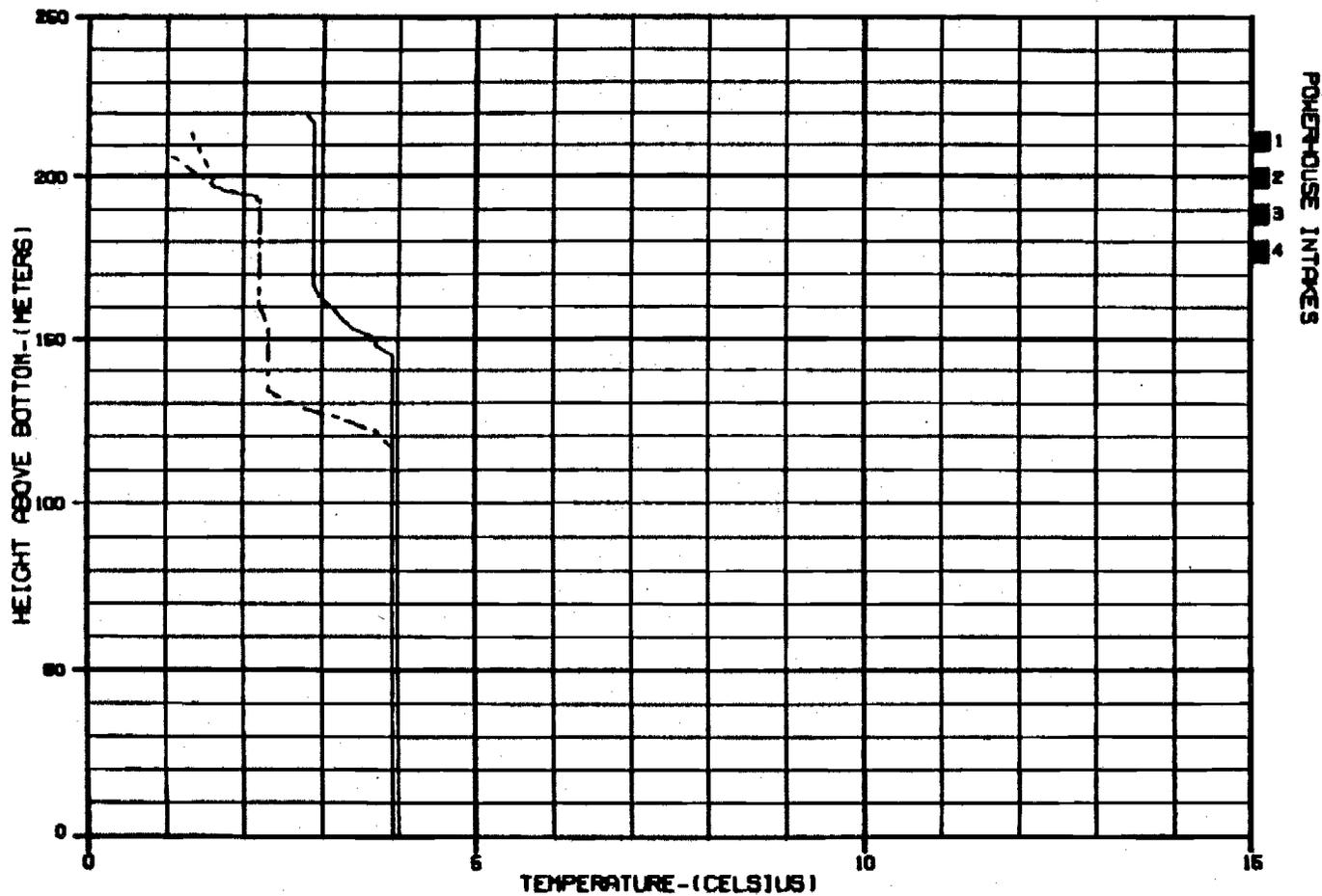


ALASKA POWER AUTHORITY
 SUBMITTER PROJECT DIVISION NO. 1
 WATANA RESERVOIR
 TEMPERATURE PROFILES
 HARZA-ERBACCO JOINT VENTURE
 DRAWING: S.A. 1000 7 JAN 74 42-210-04

CASE: # 147120A - WATANA OPERATION WITH DEVIL CANYON IN 2020

LEGEND:
 ——— MAY 1971
 - - - - - JUNE 1971
 JULY 1971





CASE: WA7120A - WATANA OPERATION WITH DEVIL CANYON IN 2020

LEGEND:

PREDICTED TEMPERATURE PROFILES:

— | NOVEMBER 1971
 - - - | DECEMBER 1971
 - · - · | JANUARY 1972

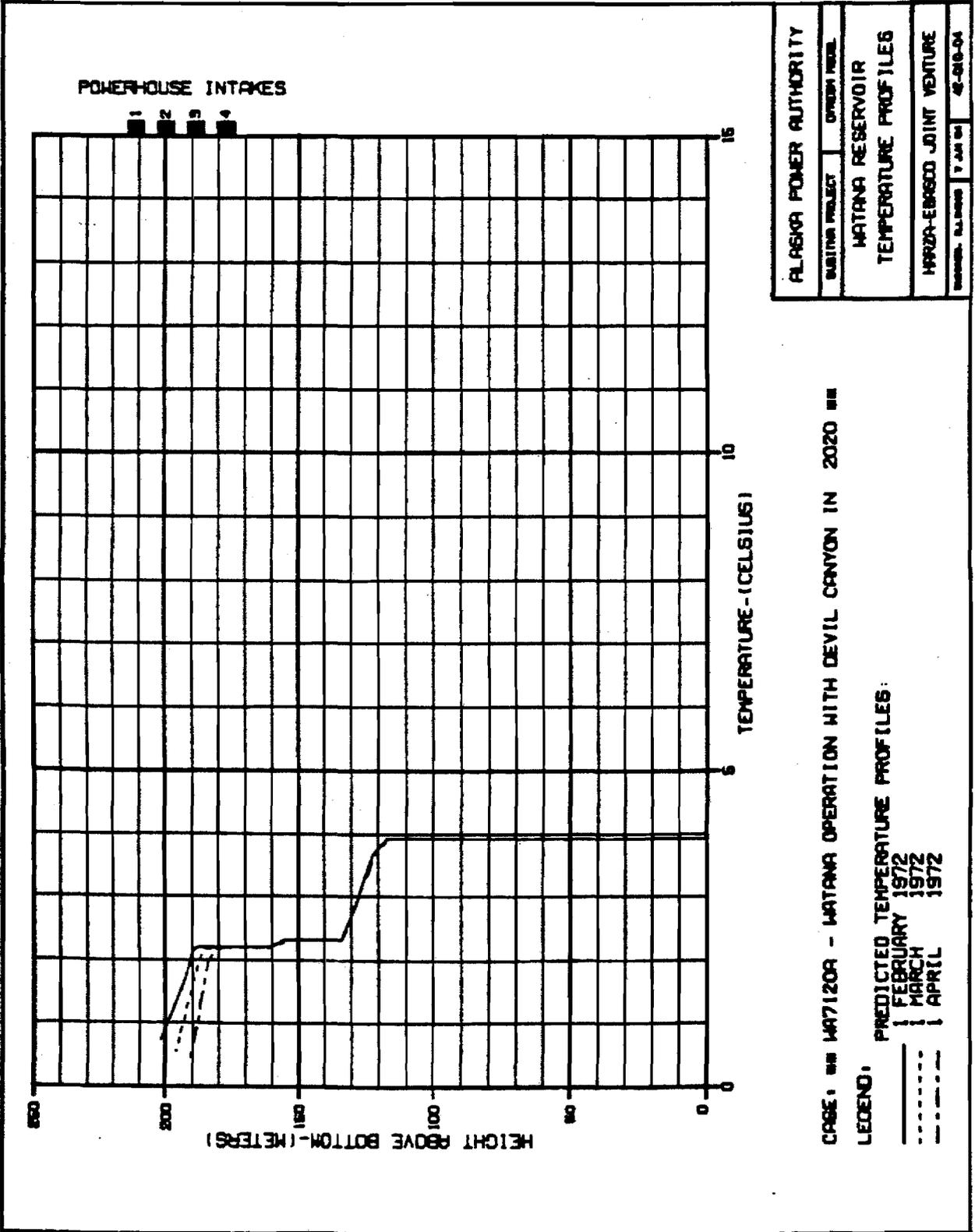
ALASKA POWER AUTHORITY

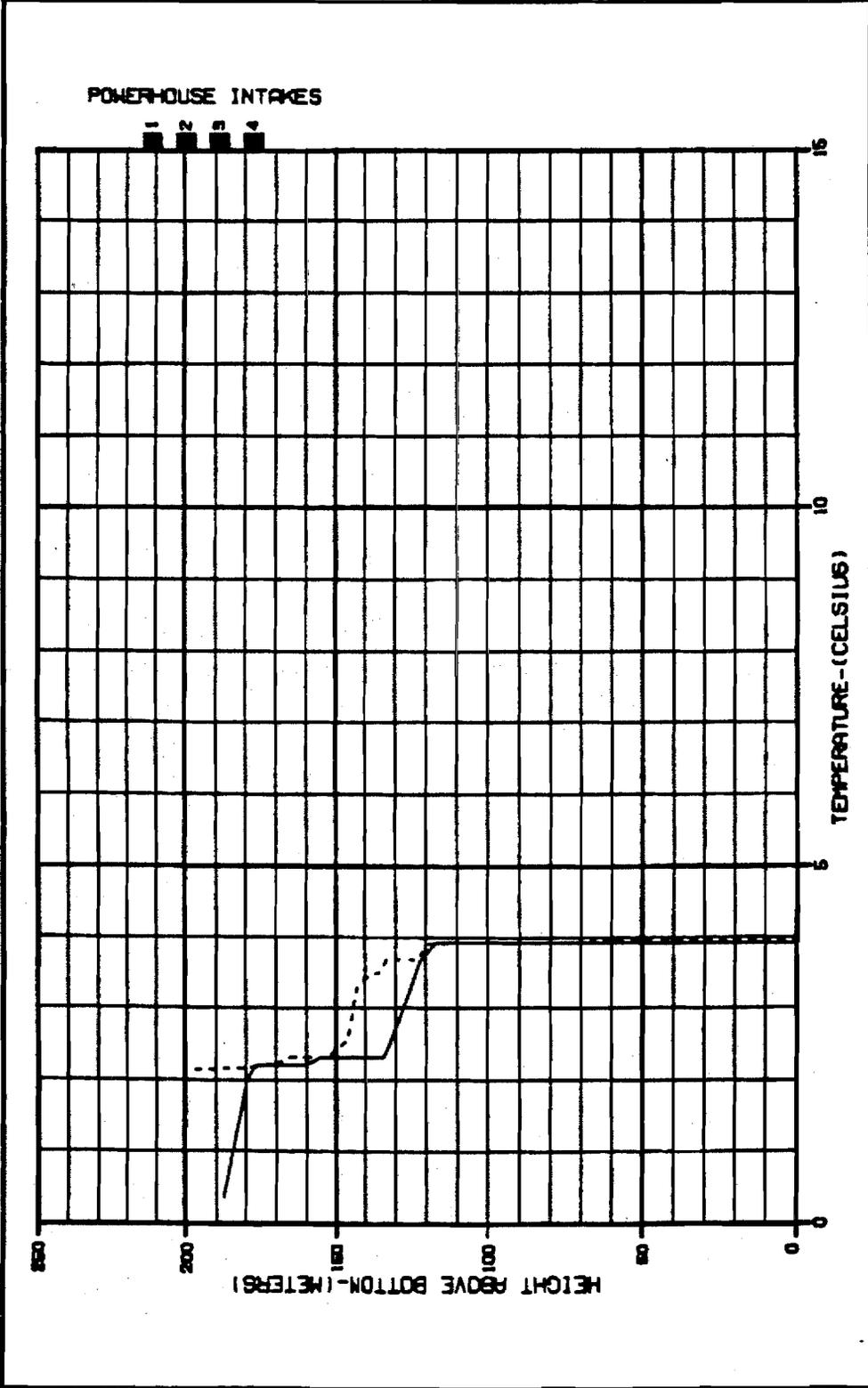
SLITNA PROJECT | DYKIN AREA

WATANA RESERVOIR
 TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

WORKSHEET 7 JAN 81 | 42-010-04



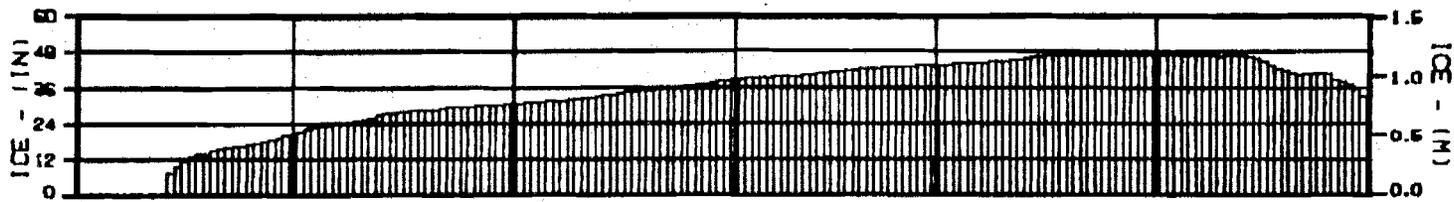


ALASKA POWER AUTHORITY	
EXISTING PROJECT	OPERATION PROFILE
MATANA RESERVOIR	
TEMPERATURE PROFILES	
WARZA-EDGECO JOINT VENTURE	
DATE: 8.1.1972	BY: J.A.S. 82-210-04

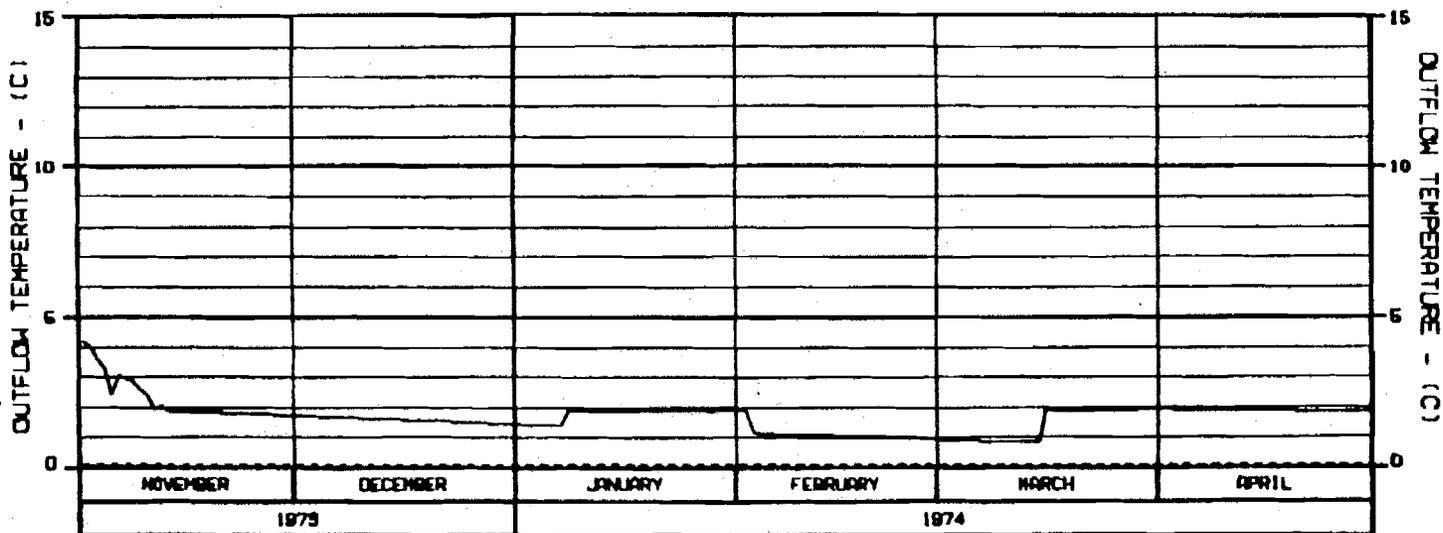
CASE: # 147120A - MATANA OPERATION WITH DEVIL CANYON IN 2020

LEGEND: PREDICTED TEMPERATURE PROFILES:
 ——— MAY 1972
 - - - - - JUNE 1972
 - - - - - JULY 1972

EXHIBIT AF



INTAKE	LEVEL 1					
	LEVEL 2					
	LEVEL 3					
	LEVEL 4					
	CONE VALVE					
	SPILLWAY					



LEGEND: CASE: WA7420A - WATANA OPERATION WITH DEVIL CANYON IN 2020

———— PREDICTED OUTFLOW TEMPERATURE
 - - - - - INFLOW TEMPERATURE

- NOTES:
1. INTAKE PORT LEVEL 1 AT ELEVATION 2161 FT (656.6 M)
 2. INTAKE PORT LEVEL 2 AT ELEVATION 2114 FT (644.3 M)
 3. INTAKE PORT LEVEL 3 AT ELEVATION 2077 FT (633.1 M)
 4. INTAKE PORT LEVEL 4 AT ELEVATION 2040 FT (621.9 M)
 5. CONE VALVE AT ELEVATION 2040 FT (621.9 M)
 6. SPILLWAY CREST AT ELEVATION 2149 FT (654.7 M)

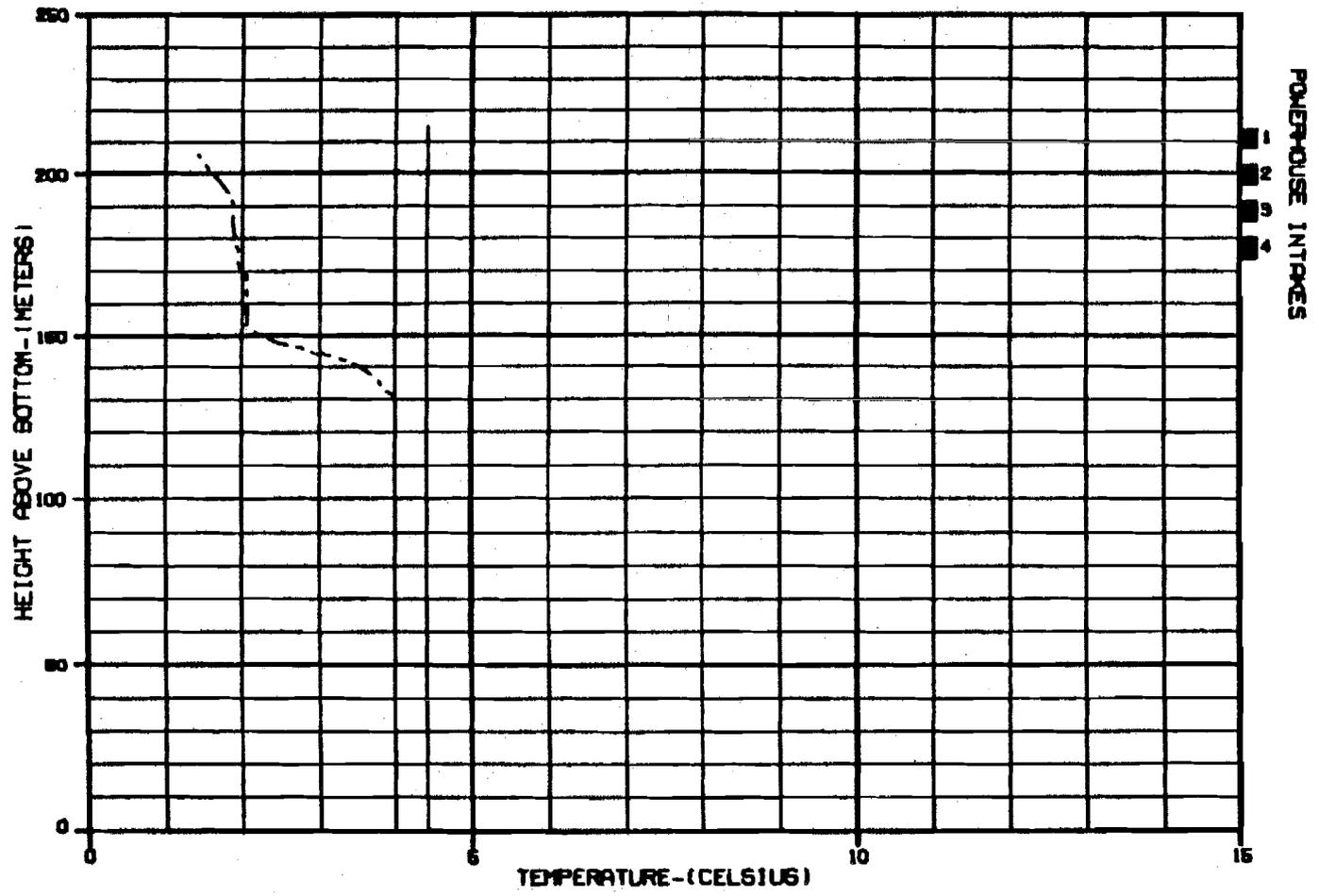
ALASKA POWER AUTHORITY

SUBMITTA PROJECT DESIGN MODEL

WATANA RESERVOIR
 OUTFLOW TEMPERATURE
 AND ICE GROWTH

HARZA-EBASCO JOINT VENTURE

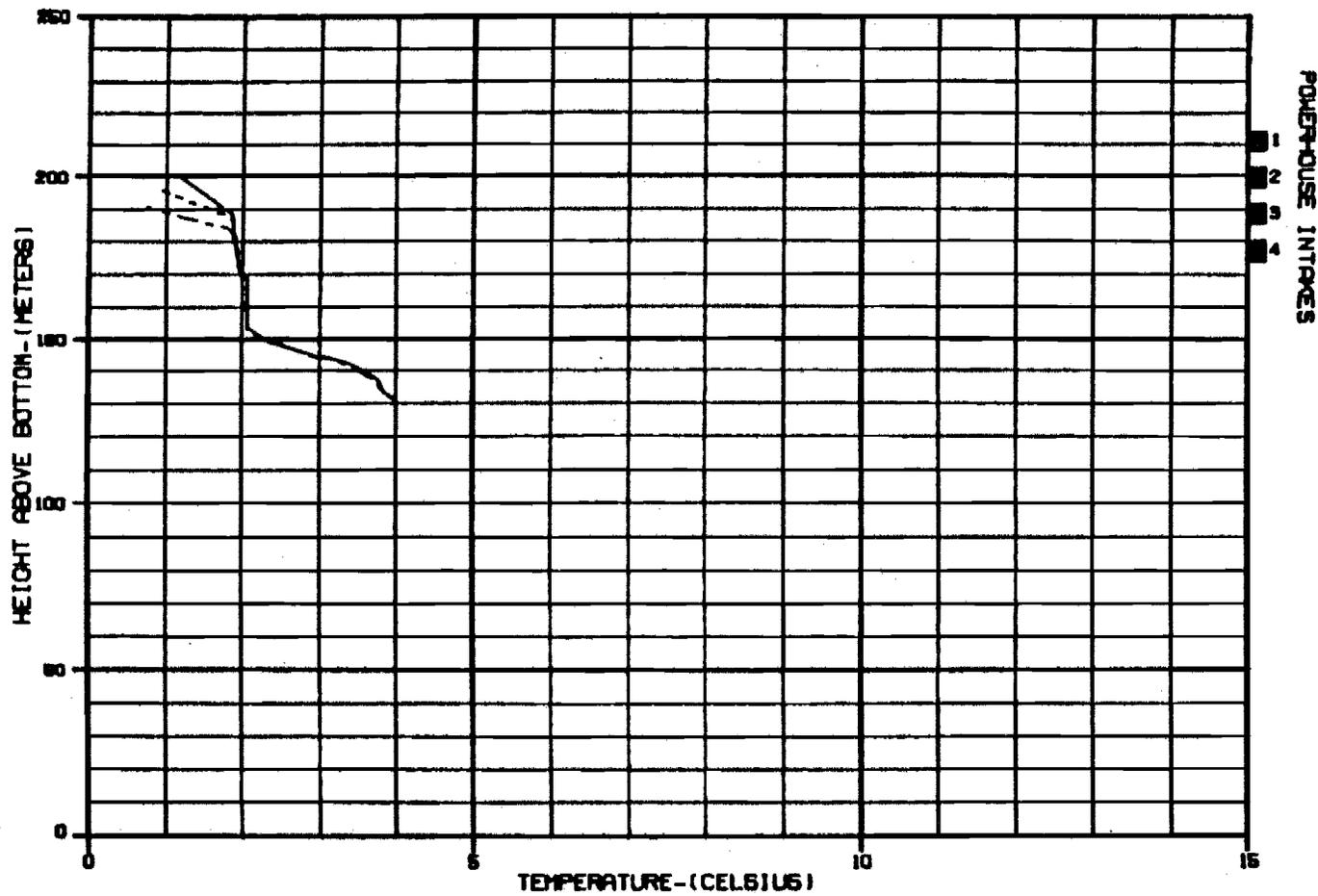
DESIGN: EL-2000 7 JAN 84 48-048-04



CASE: WA7420A - WATANA OPERATION WITH DEVIL CANYON IN 2020

LEGEND: PREDICTED TEMPERATURE PROFILES:
 ———— | NOVEMBER 1973
 | DECEMBER 1973
 - - - - | JANUARY 1974

ALASKA POWER AUTHORITY		
DESIGN PROJECT	DESIGN NUMBER	
WATANA RESERVOIR		
TEMPERATURE PROFILES		
WARDA-EBASCO JOINT VENTURE		
DESIGN NUMBER	7 JAN 83	42-010-04



CASE: ■ W97420A - WATANA OPERATION WITH DEVIL CANYON IN 2020 ■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

- 1 FEBRUARY 1974
- 1 MARCH 1974
- · - · - 1 APRIL 1974

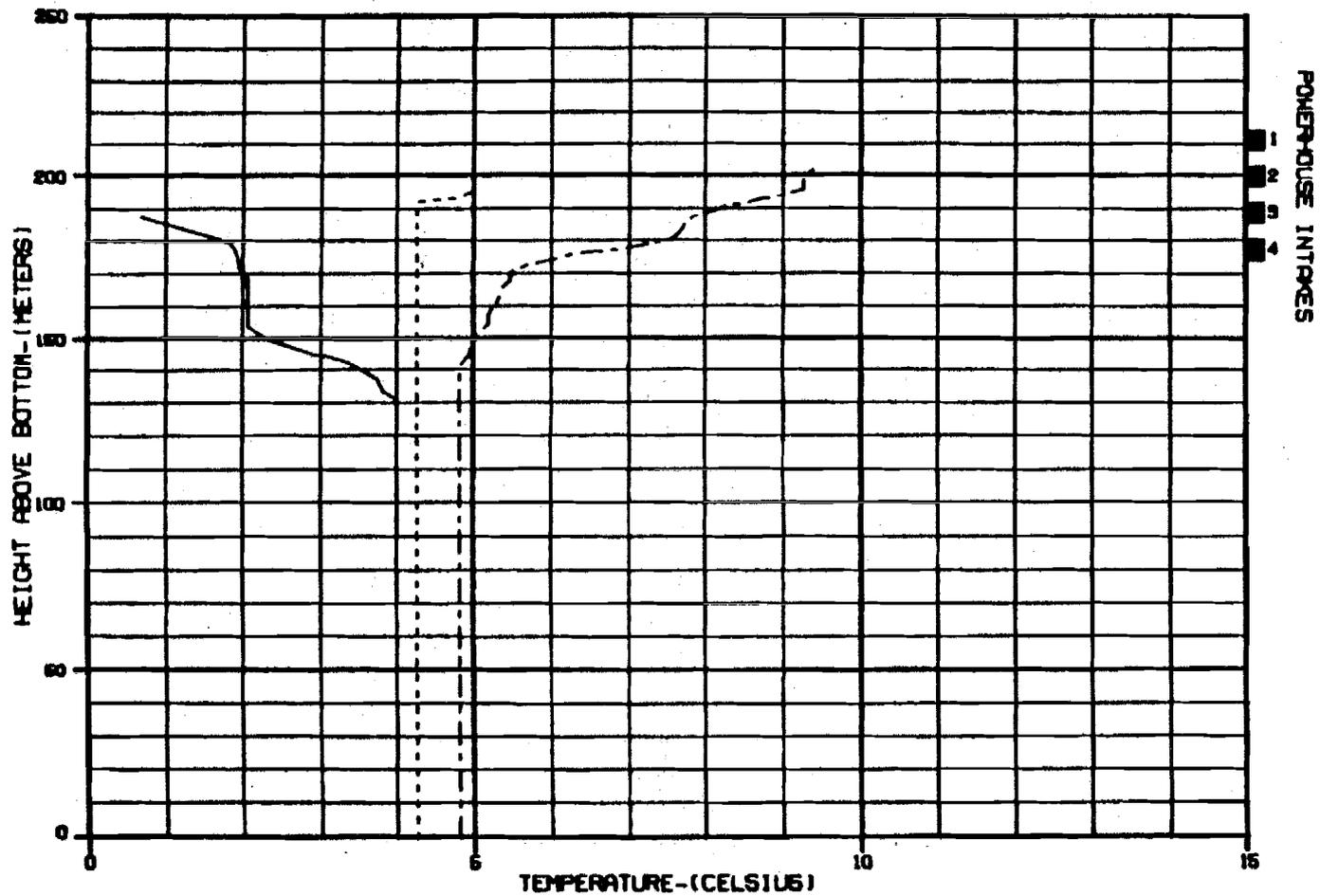
ALASKA POWER AUTHORITY

SUBJECT PROJECT OPERATIONAL

WATANA RESERVOIR
TEMPERATURE PROFILES

HAZDA-EBRSCO JOINT VENTURE

ORDER: 84000 7 JAN 84 42-010-04



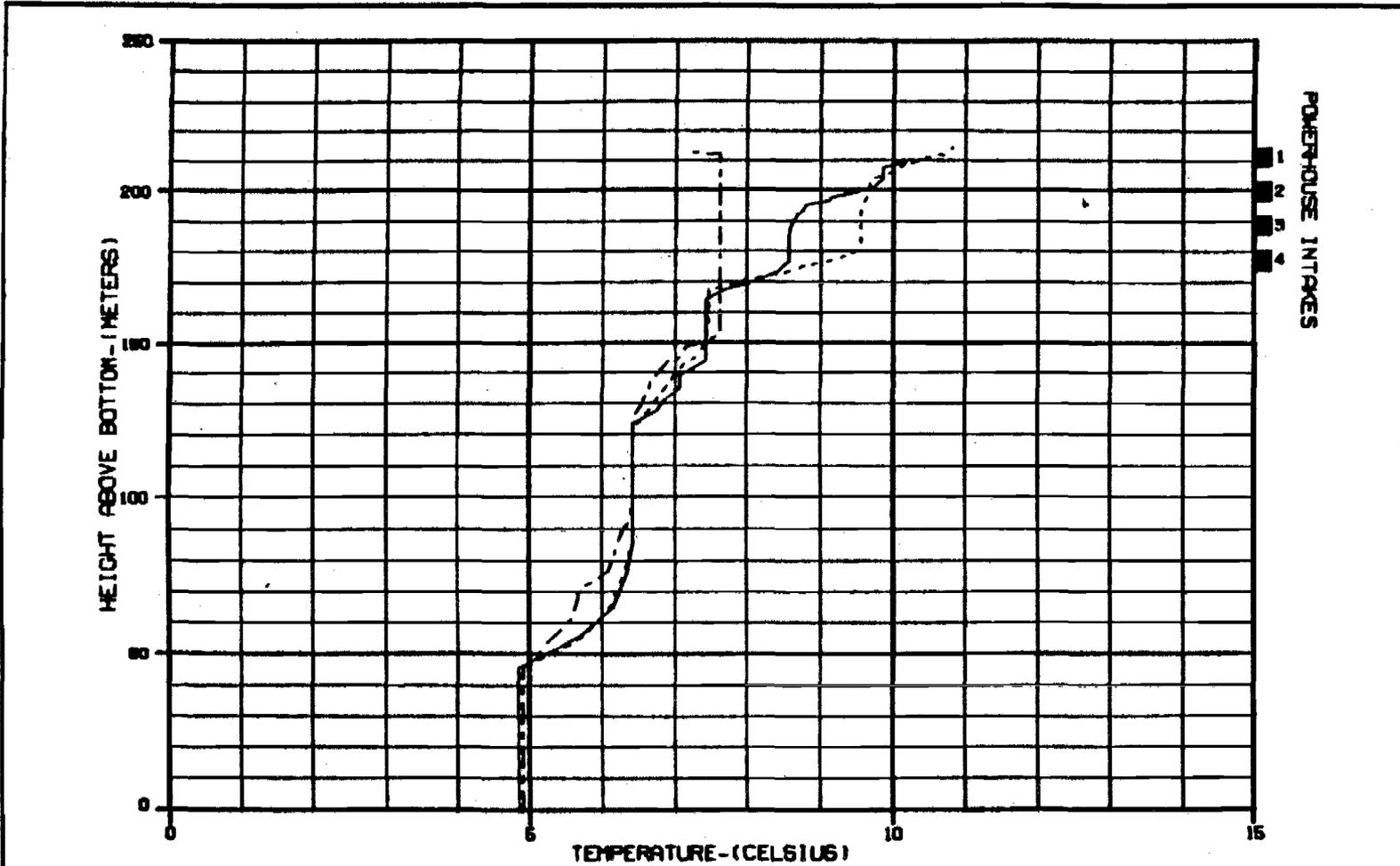
CASE: WA7420A - WATANA OPERATION WITH DEVIL CANYON IN 2020

LEGEND:

PREDICTED TEMPERATURE PROFILES:

- MAY 1974
- - - JUNE 1974
- · - · JULY 1974

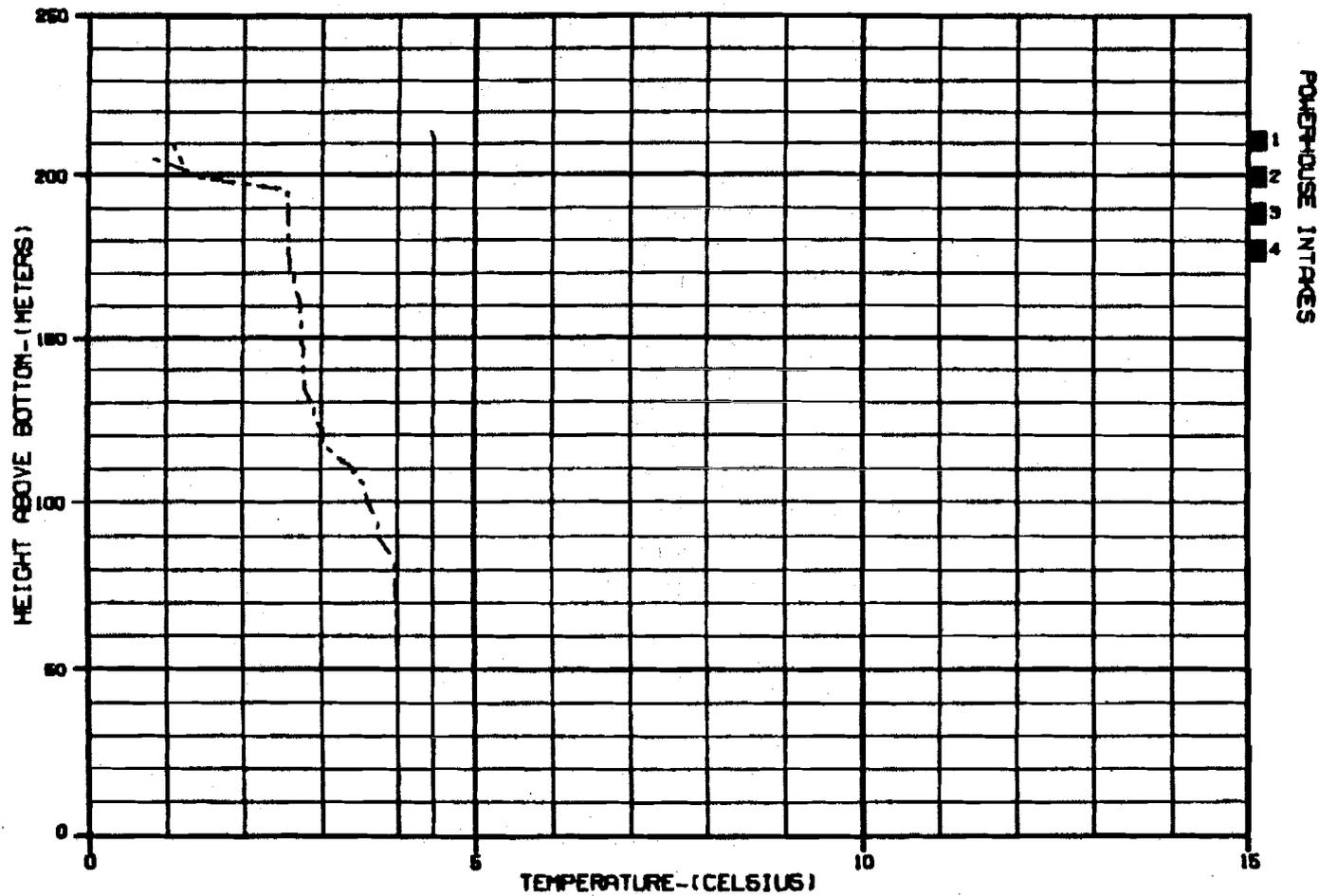
ALASKA POWER AUTHORITY	
SUBMITTER PROJECT	OWNER MODEL
WATANA RESERVOIR TEMPERATURE PROFILES	
WARBA-EBASCO JOINT VENTURE	
OWNER: ALASKA	DATE: 7-22-74
47-010-04	



CASE: WA7420A - WATANA OPERATION WITH DEVIL CANYON IN 2020

LEGEND:
 PREDICTED TEMPERATURE PROFILES:
 _____ | AUGUST 1974
 - - - - - | SEPTEMBER 1974
 - · - · - | OCTOBER 1974

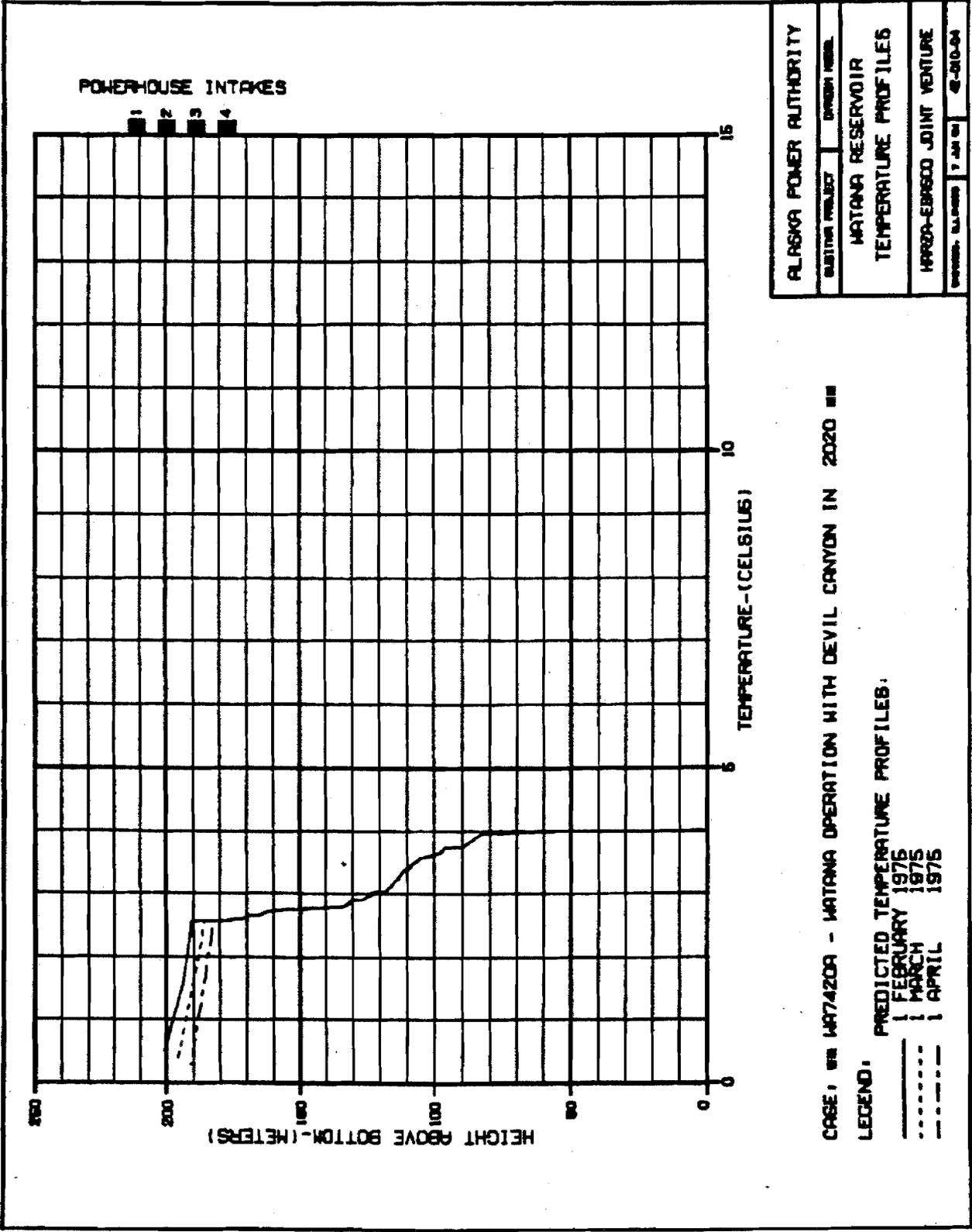
ALASKA POWER AUTHORITY	
DESIGN PROJECT	DESIGN MODEL
WATANA RESERVOIR TEMPERATURE PROFILES	
HAZRA-EBASCO JOINT VENTURE	
DESIGN NUMBER	42-210-04

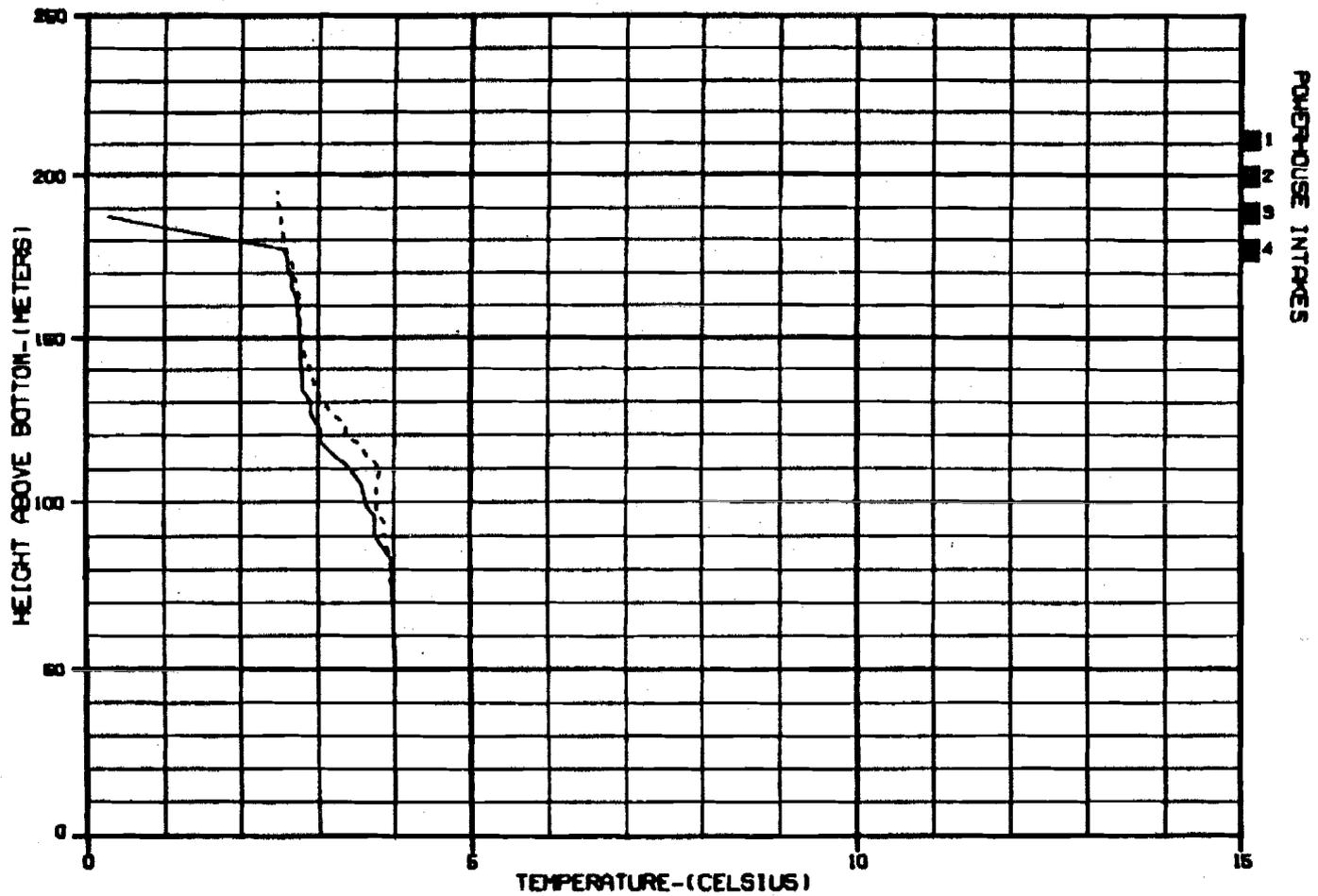


CASE: WA7420A - WATANA OPERATION WITH DEVIL CANYON IN 2020

LEGEND: PREDICTED TEMPERATURE PROFILES:
 ———— 1 NOVEMBER 1974
 - - - - - 1 DECEMBER 1974
 - · - · - 1 JANUARY 1975

ALASKA POWER AUTHORITY	
DESIGN PROJECT	CONCRETE HEAD
WATANA RESERVOIR TEMPERATURE PROFILES	
WARZA-EBASCO JOINT VENTURE	
DESIGN - ALASKA	7 JAN 81
	42-010-04





CASE: ■■ W97420A - WATANA OPERATION WITH DEVIL CANYON IN 2020 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

_____ | MAY 1976
 | JUNE 1975
 - - - - - | JULY 1975

ALASKA POWER AUTHORITY

SUBMITTAL PROJECT

GRAPH MODEL

WATANA RESERVOIR
TEMPERATURE PROFILES

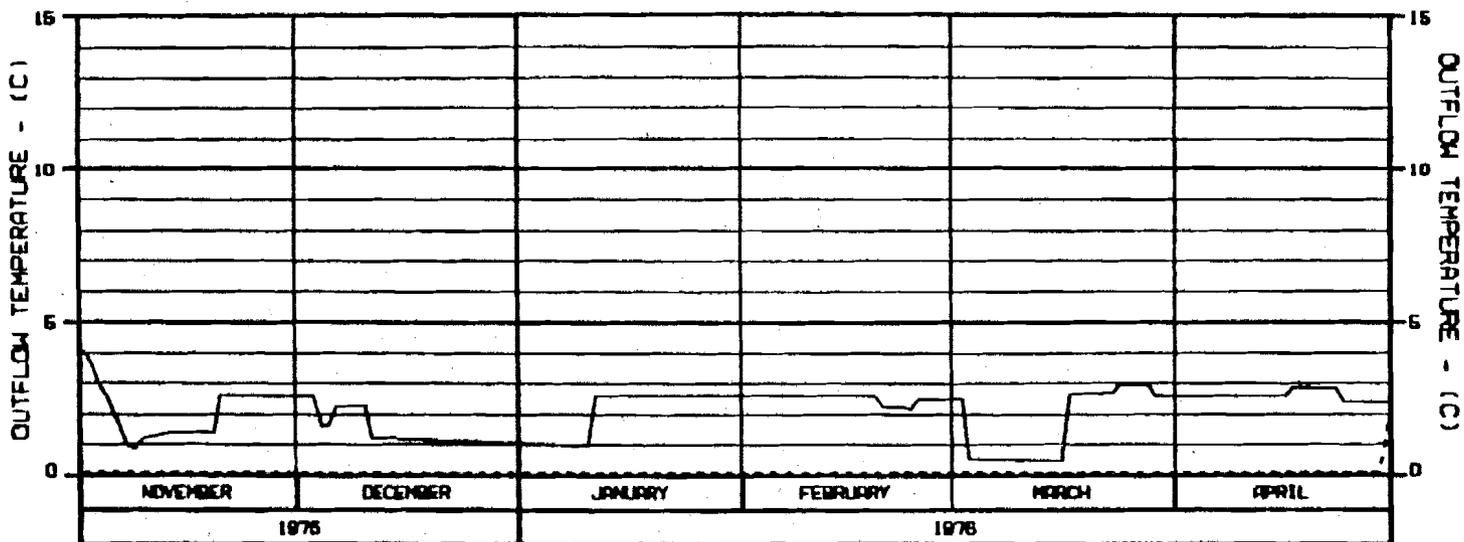
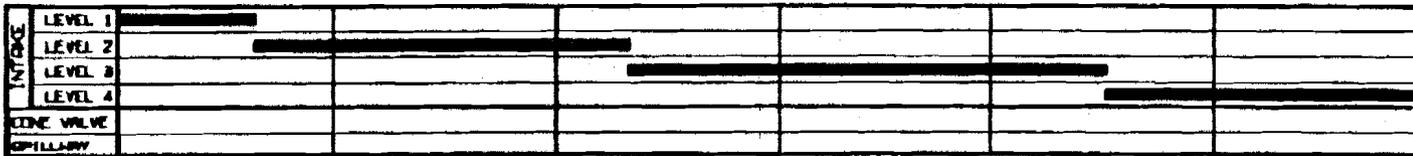
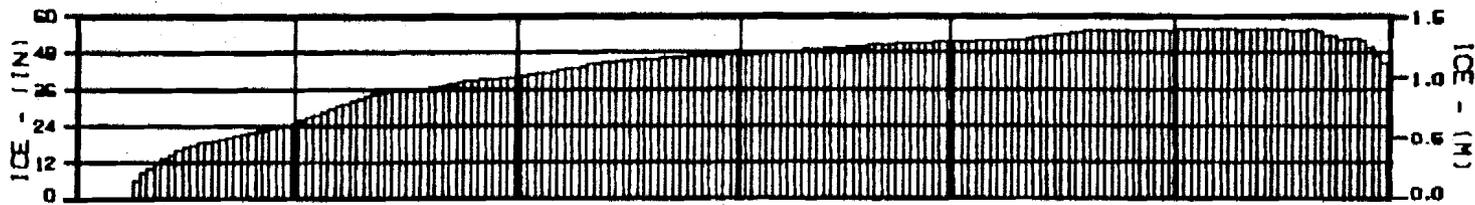
WARDA-EBERD JOINT VENTURE

GRAPH. 8.1.1.1.1.1

7 JAN 81

42-010-04

EXHIBIT AG



LEGEND: CASE: 000 WA7620A - WATANA OPERATION WITH DEVIL CANYON IN 2020 000

———— PREDICTED OUTFLOW TEMPERATURE
 - - - - - INFLOW TEMPERATURE

- NOTES:
1. INTAKE PORT LEVEL 1 AT ELEVATION 2161 FT (656.6 M)
 2. INTAKE PORT LEVEL 2 AT ELEVATION 2114 FT (644.3 M)
 3. INTAKE PORT LEVEL 3 AT ELEVATION 2077 FT (633.1 M)
 4. INTAKE PORT LEVEL 4 AT ELEVATION 2040 FT (621.9 M)
 5. CDNE VALVE AT ELEVATION 2040 FT (621.9 M)
 6. SPILLWAY CREST AT ELEVATION 2149 FT (654.7 M)

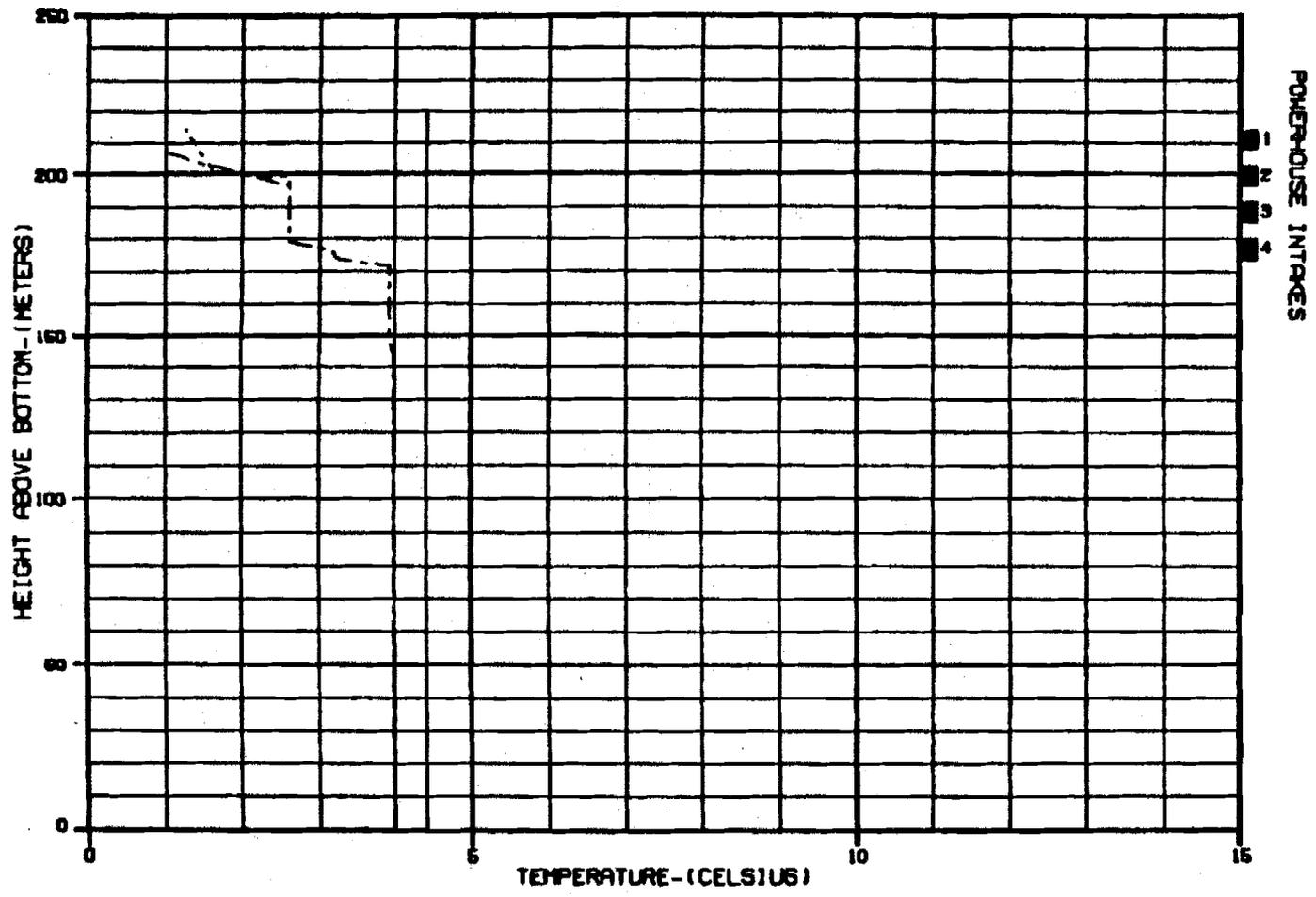
ALASKA POWER AUTHORITY

SUBITMA PROJECT DIVISION MODEL

WATANA RESERVOIR
 OUTFLOW TEMPERATURE
 AND ICE GROWTH

WARZA-EBASCO JOINT VENTURE

DESIGN: S.A. PARR 7 JAN 84 48-008-00

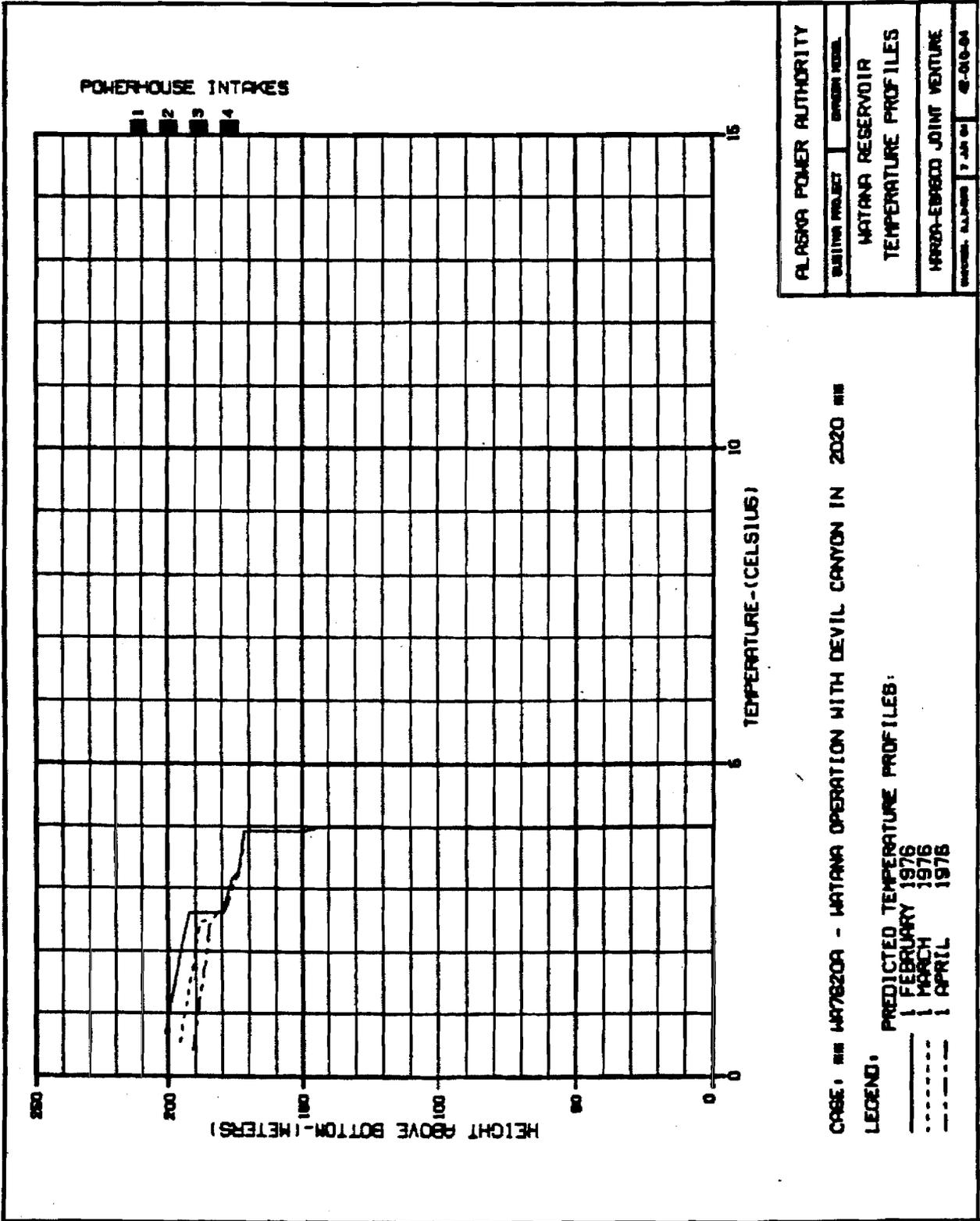


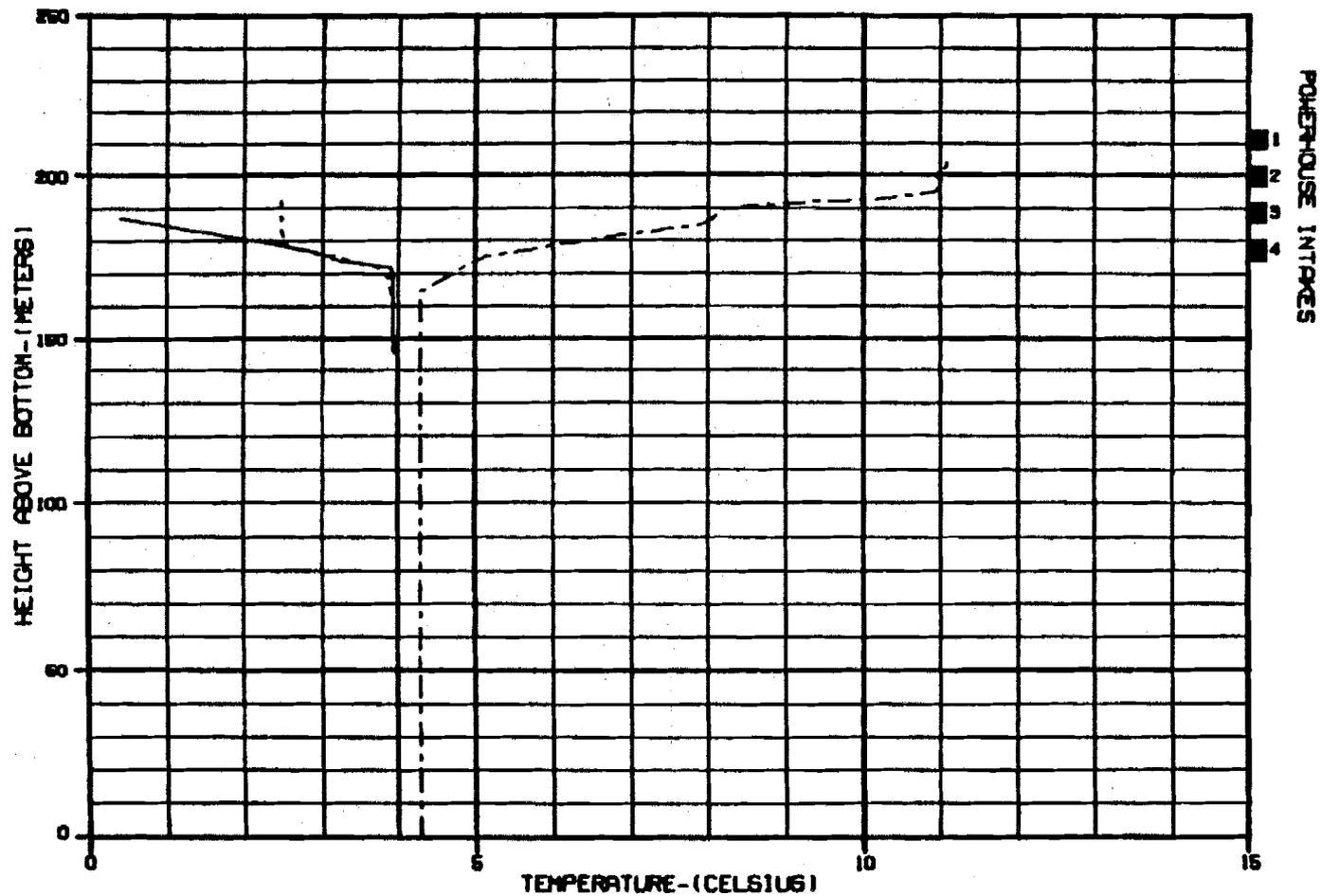
POWERHOUSE INTAKES

CASE: WA7620A - WATANA OPERATION WITH DEVIL CANYON IN 2020

LEGEND: PREDICTED TEMPERATURE PROFILES:
 ——— 1 NOVEMBER 1975
 - - - - 1 DECEMBER 1975
 - · - · 1 JANUARY 1975

ALASKA POWER AUTHORITY	
SLITNA PROJECT	DIVISION NO. 1
WATANA RESERVOIR TEMPERATURE PROFILES	
WARZA-EBASCO JOINT VENTURE	
DESIGN: 2-21-75	42-010-04





CASE: WA7620A - WATANA OPERATION WITH DEVIL CANYON IN 2020

LEGEND:

PREDICTED TEMPERATURE PROFILES:

_____ | MAY 1978
 | JUNE 1978
 - - - - - | JULY 1978

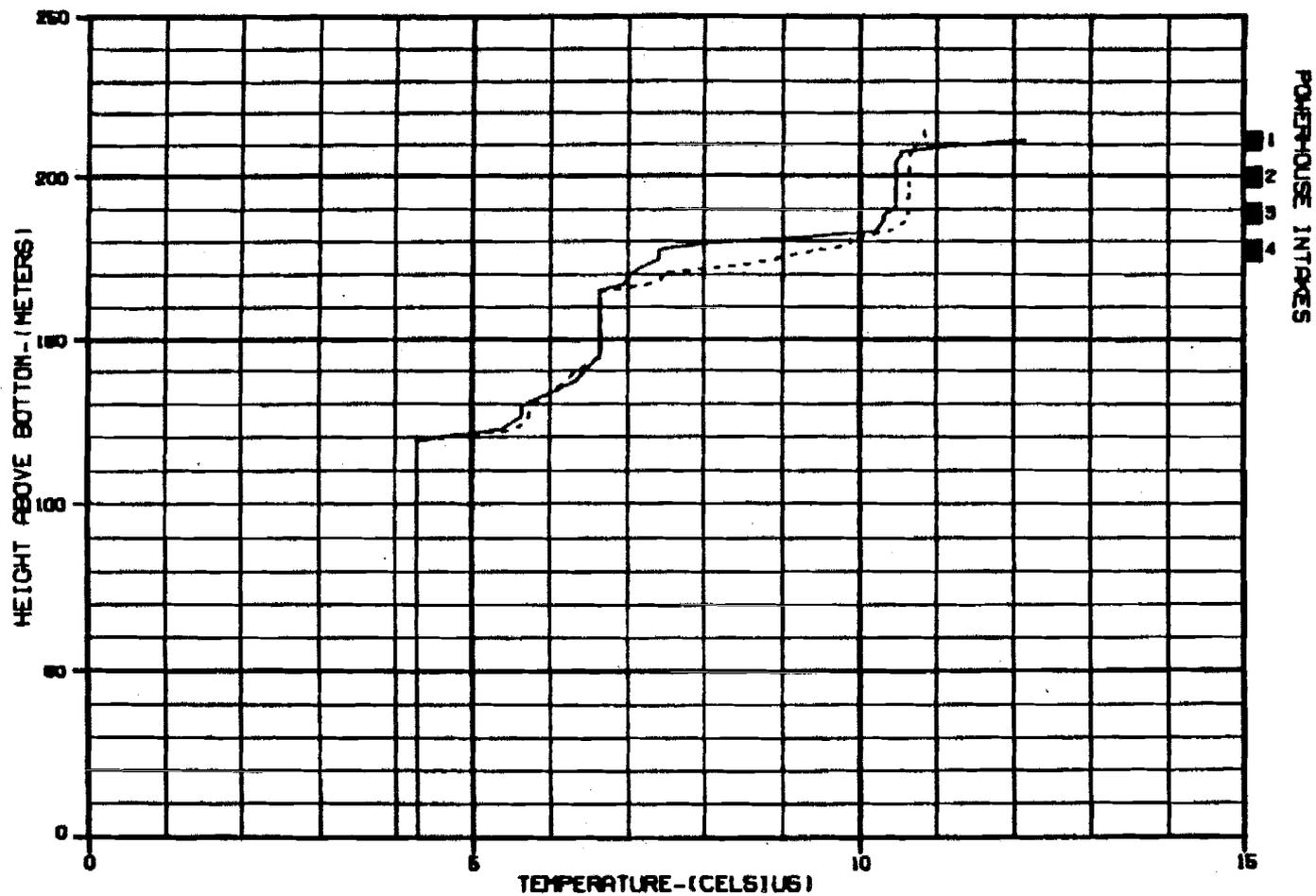
ALASKA POWER AUTHORITY

WATANA PROJECT DAMON REEVE

WATANA RESERVOIR
TEMPERATURE PROFILES

MARZA-EBASCO JOINT VENTURE

DESIGN: B.L.DONN 7 JAN 81 4-016-84



CASE: ■■ WY7620A - WATANA OPERATION WITH DEVIL CANYON IN 2020 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

— | AUGUST 1976
 | SEPTEMBER 1976
 - - - - | OCTOBER 1976

ALASKA POWER AUTHORITY

SUBMITTA PROJECT

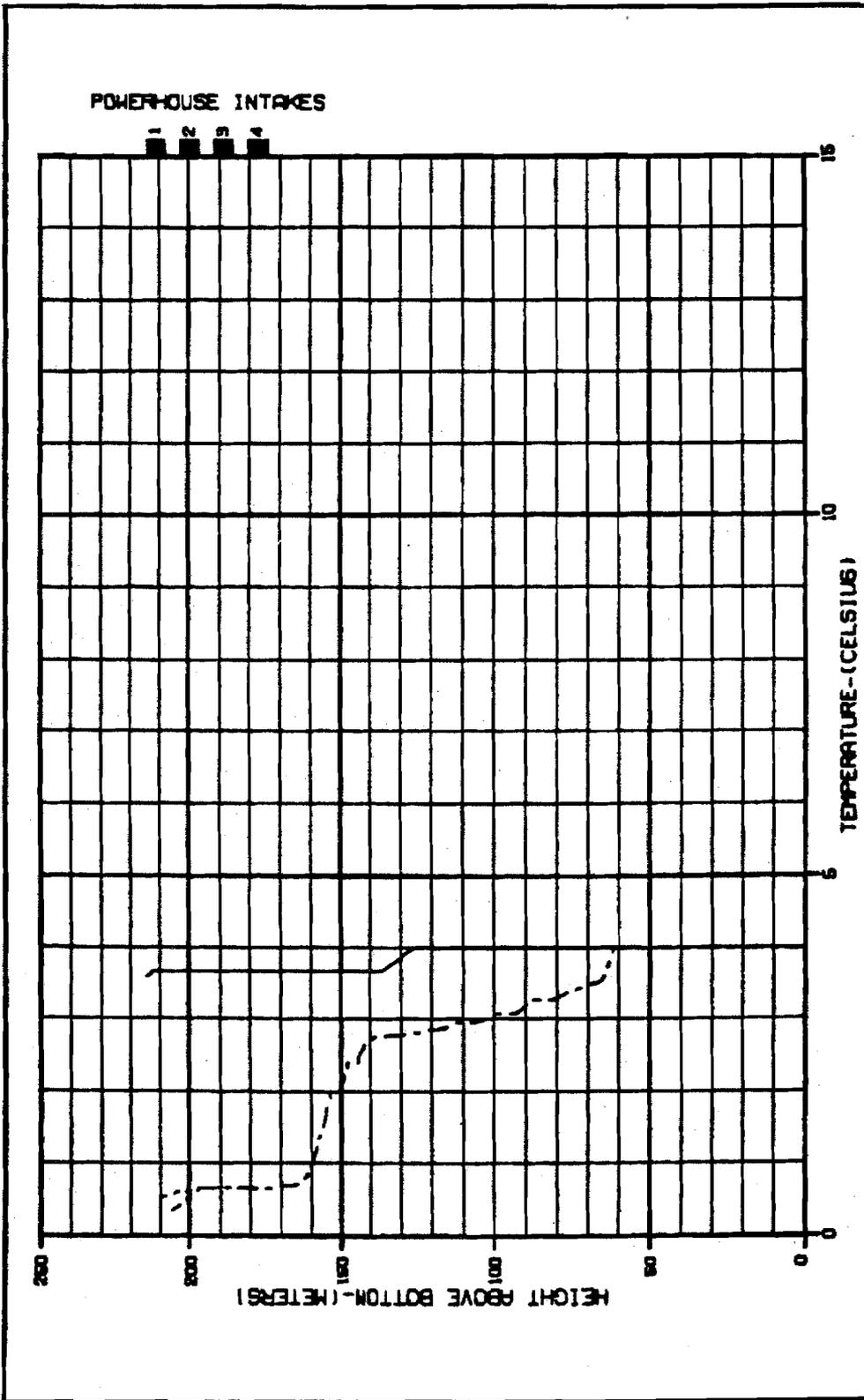
DYKSEN REEGL.

WATANA RESERVOIR
 TEMPERATURE PROFILES

WARSA-EBRACO JOINT VENTURE

POWER PLANT 7 JAN 81

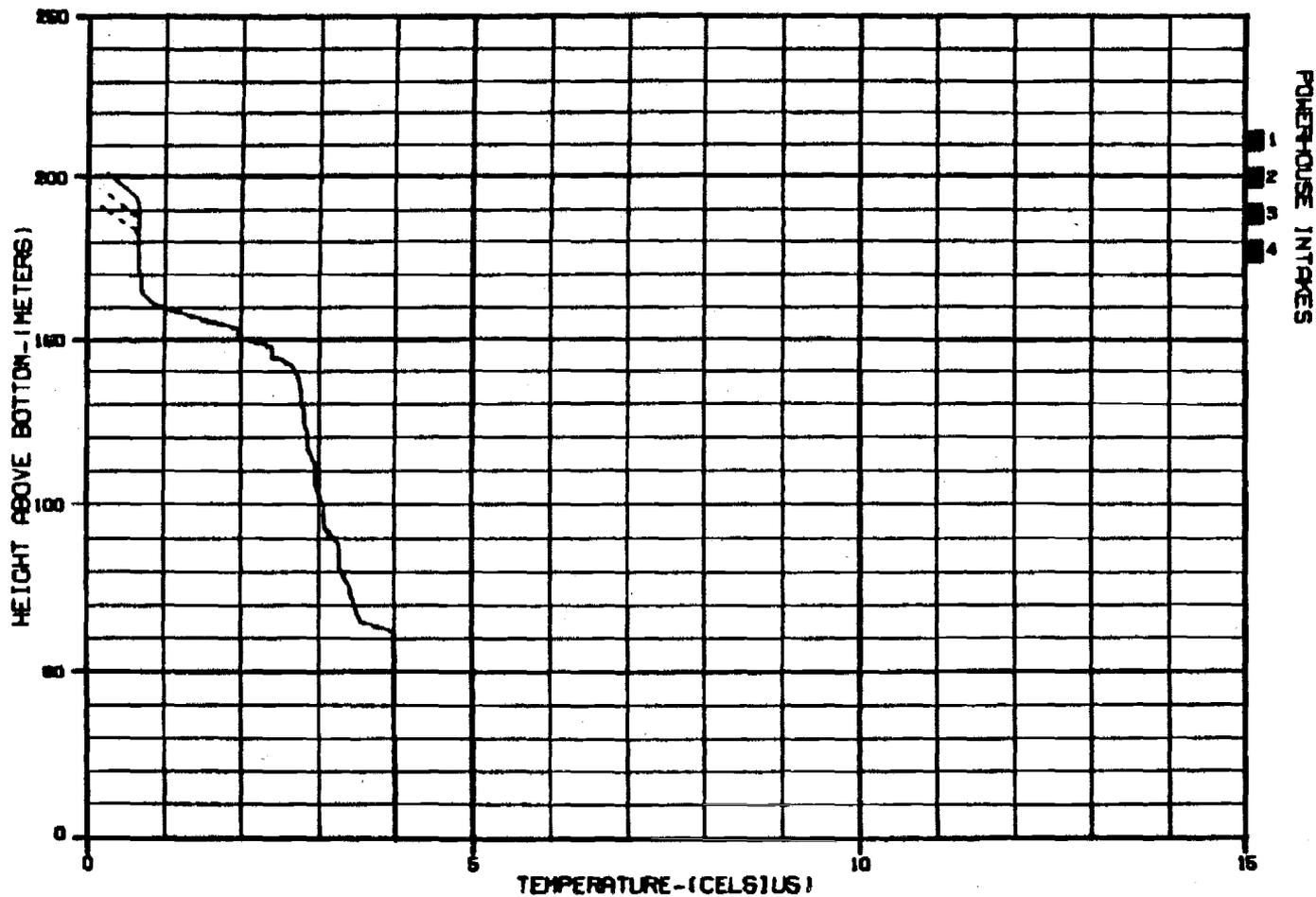
42-010-04



ALASKA POWER AUTHORITY
 SUBMITTER PROJECT: WATANA RESERVOIR
 WATANA RESERVOIR
 TEMPERATURE PROFILES
 HARZA-EMBARCO JOINT VENTURE
 DRAWING: 1-11-76 7 JAN 76 42-010-04

CASE: 111 W47820A - WATANA OPERATION WITH DEVIL CANYON IN 2020 MIN

LEGEND:
 PREDICTED TEMPERATURE PROFILES:
 | NOVEMBER 1976
 | DECEMBER 1976
 | JANUARY 1977



CASE: WA7820A - WATANA OPERATION WITH DEVIL CANYON IN 2020

LEGEND:

PREDICTED TEMPERATURE PROFILES:

———— | FEBRUARY 1977
 - - - - - | MARCH 1977
 - · - · - | APRIL 1977

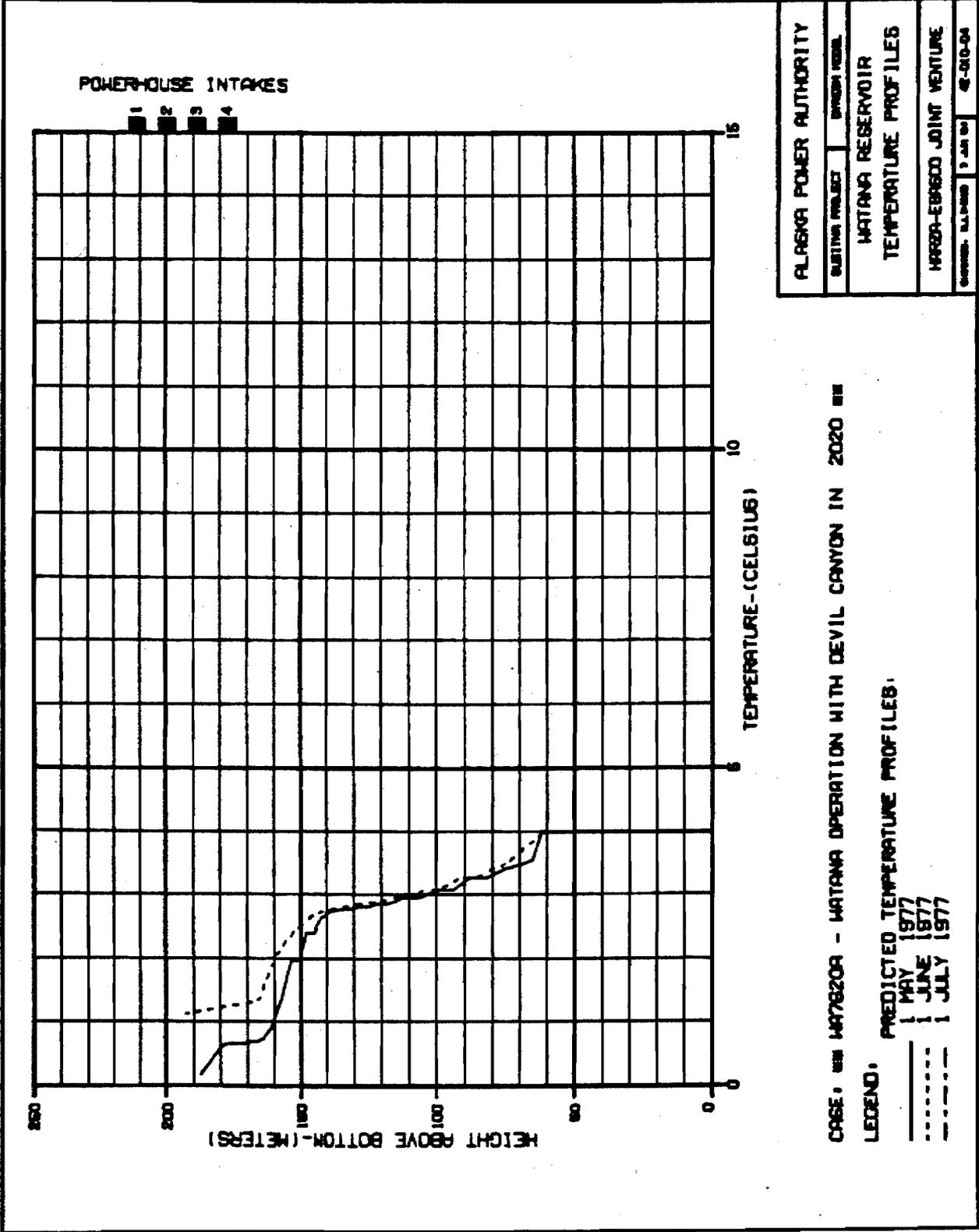
ALASKA POWER AUTHORITY

WATANA PROJECT DEVIL CANYON

WATANA RESERVOIR
TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

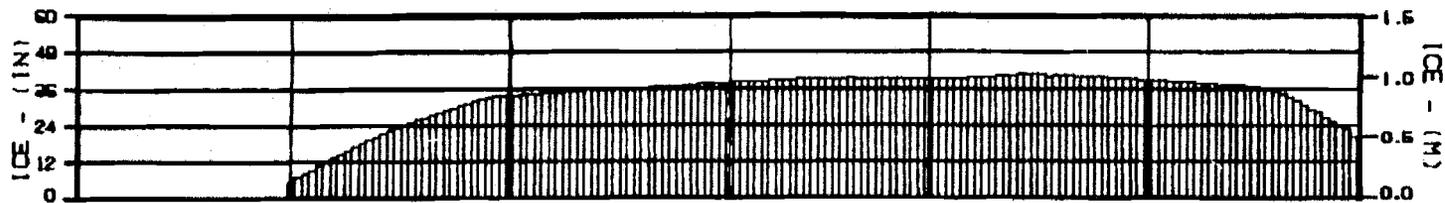
REVISED: 01.09.80 T.J.M. 42-010-04



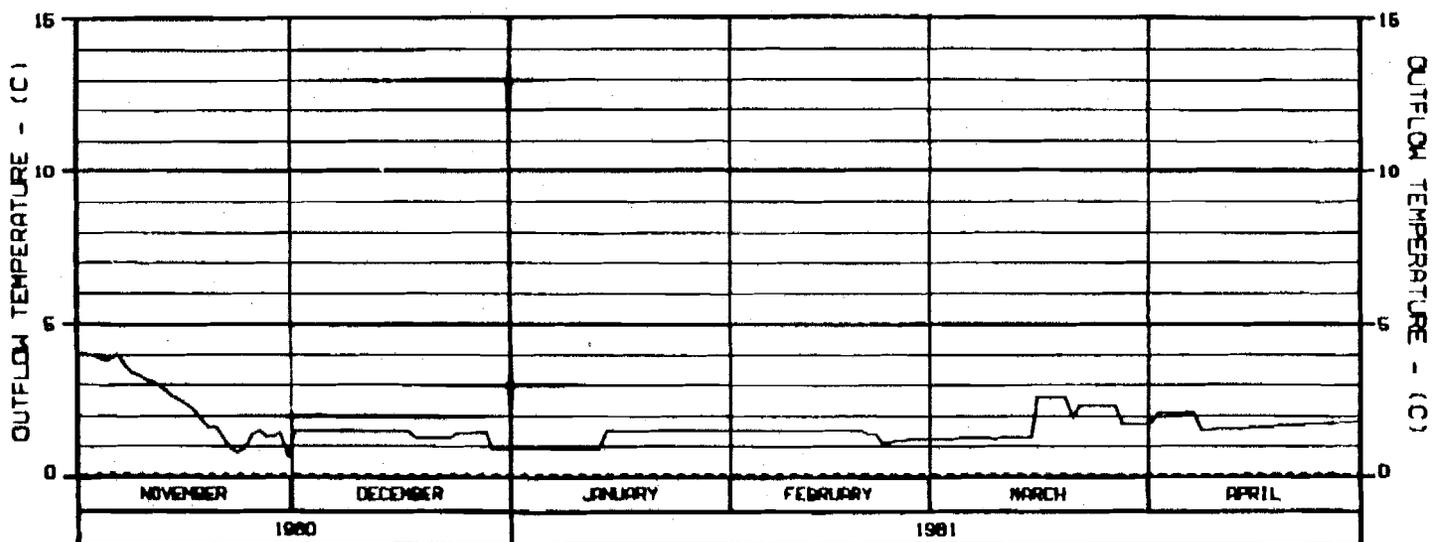
CASE: WAT7820A - MATANA OPERATION WITH DEVIL CANYON IN 2020

ALASKA POWER AUTHORITY
 SUBJECT: MATANA RESERVOIR
 PROJECT: MATANA RESERVOIR
 TEMPERATURE PROFILES
 DATE: 1977
 BY: [Name]
 APP: [Name]

EXHIBIT AH



INTAKE	LEVEL 1				
	LEVEL 2				
	LEVEL 3				
	LEVEL 4				
	CONE VALVE				
	SPILLWAY				



LEGEND: CASE: WAB102120B - WATANA OPERATION WITH DEVIL CANYON IN 2020

— PREDICTED OUTFLOW TEMPERATURE
 - - - INFLOW TEMPERATURE

- NOTES:
1. INTAKE PORT LEVEL 1 AT ELEVATION 2161 FT (656.6 M)
 2. INTAKE PORT LEVEL 2 AT ELEVATION 2114 FT (644.3 M)
 3. INTAKE PORT LEVEL 3 AT ELEVATION 2077 FT (633.1 M)
 4. INTAKE PORT LEVEL 4 AT ELEVATION 2040 FT (621.9 M)
 5. CONE VALVE AT ELEVATION 2040 FT (621.9 M)
 6. SPILLWAY CREST AT ELEVATION 2149 FT (654.7 M)

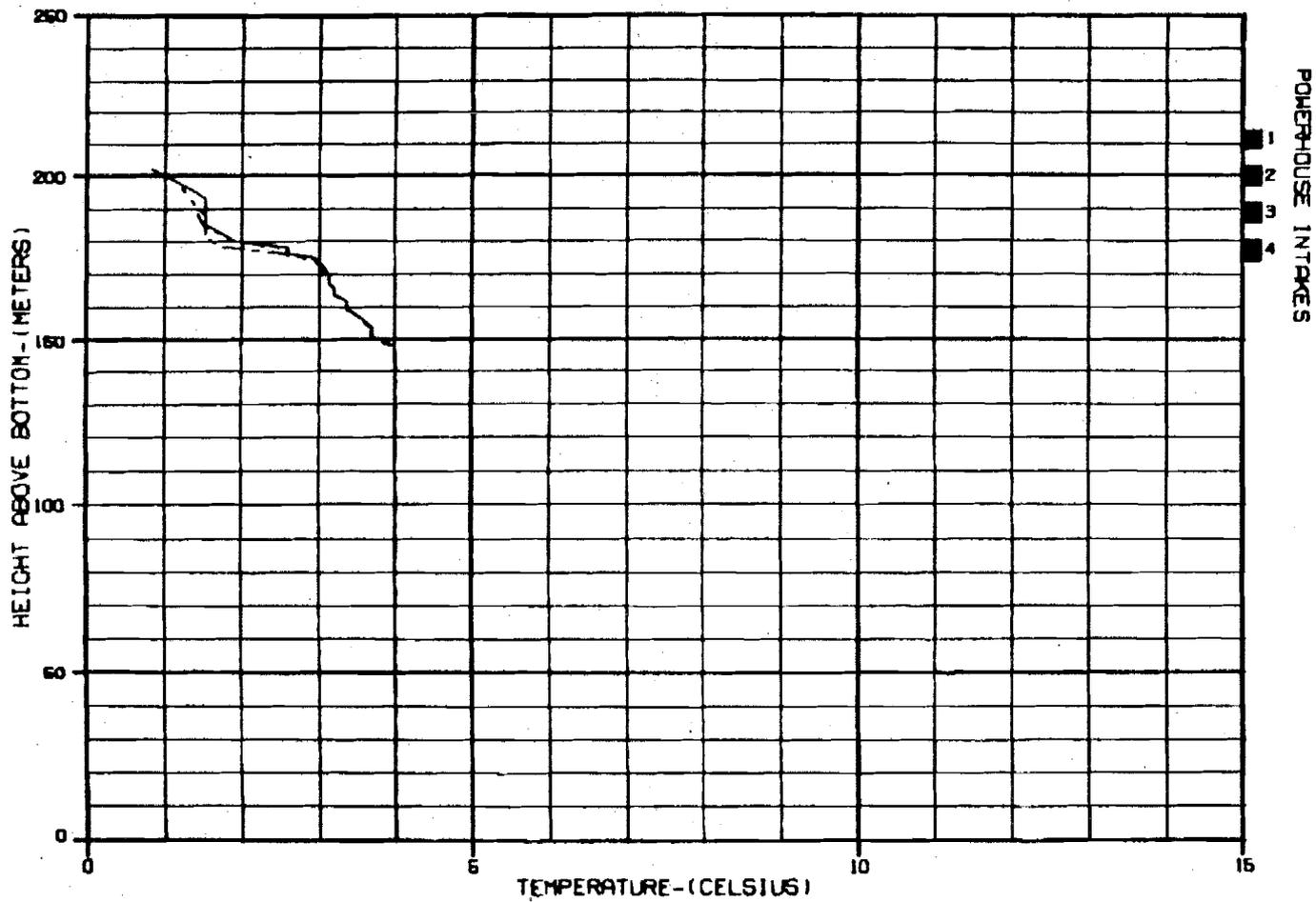
ALASKA POWER AUTHORITY

SUBMITTA PROJECT OPERING MODE

WATANA RESERVOIR
 OUTFLOW TEMPERATURE
 AND ICE GROWTH

HARZA-EBRASC JOINT VENTURE

CHARGE: 01/20/81 9 AM '81 40-000-00



CASE: ■■ WAB11821208 - WATANA OPERATION WITH DEVIL CANYON IN 2020 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

————— | FEBRUARY 1981
 | MARCH 1981
 - - - - - | APRIL 1981

ALASKA POWER AUTHORITY

SUBITNA PROJECT

DYNOM MODEL

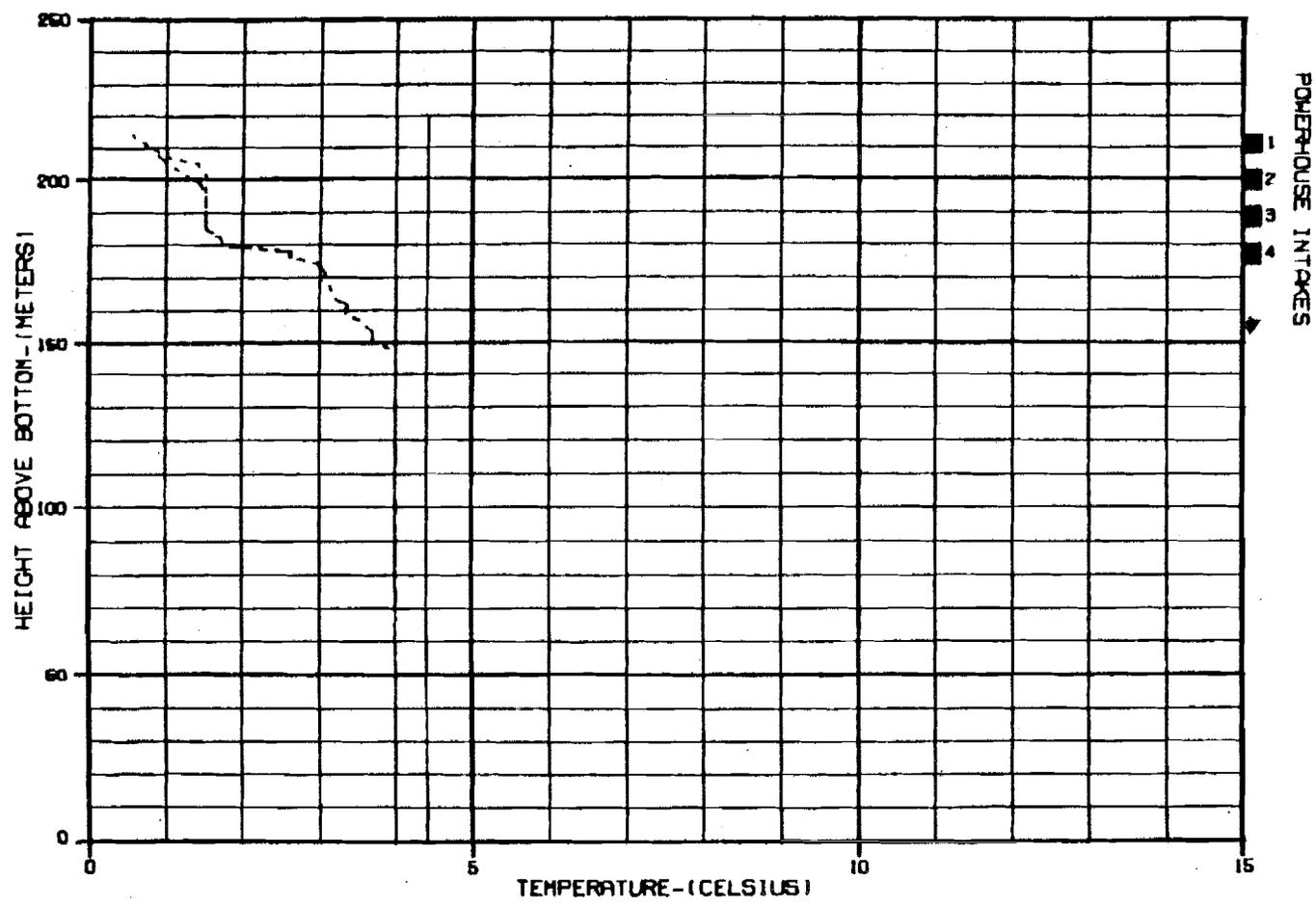
WATANA RESERVOIR
 TEMPERATURE PROFILES

WARZA-EBAGCO JOINT VENTURE

DESIGN: S.L.P. 888

8 JAN 81

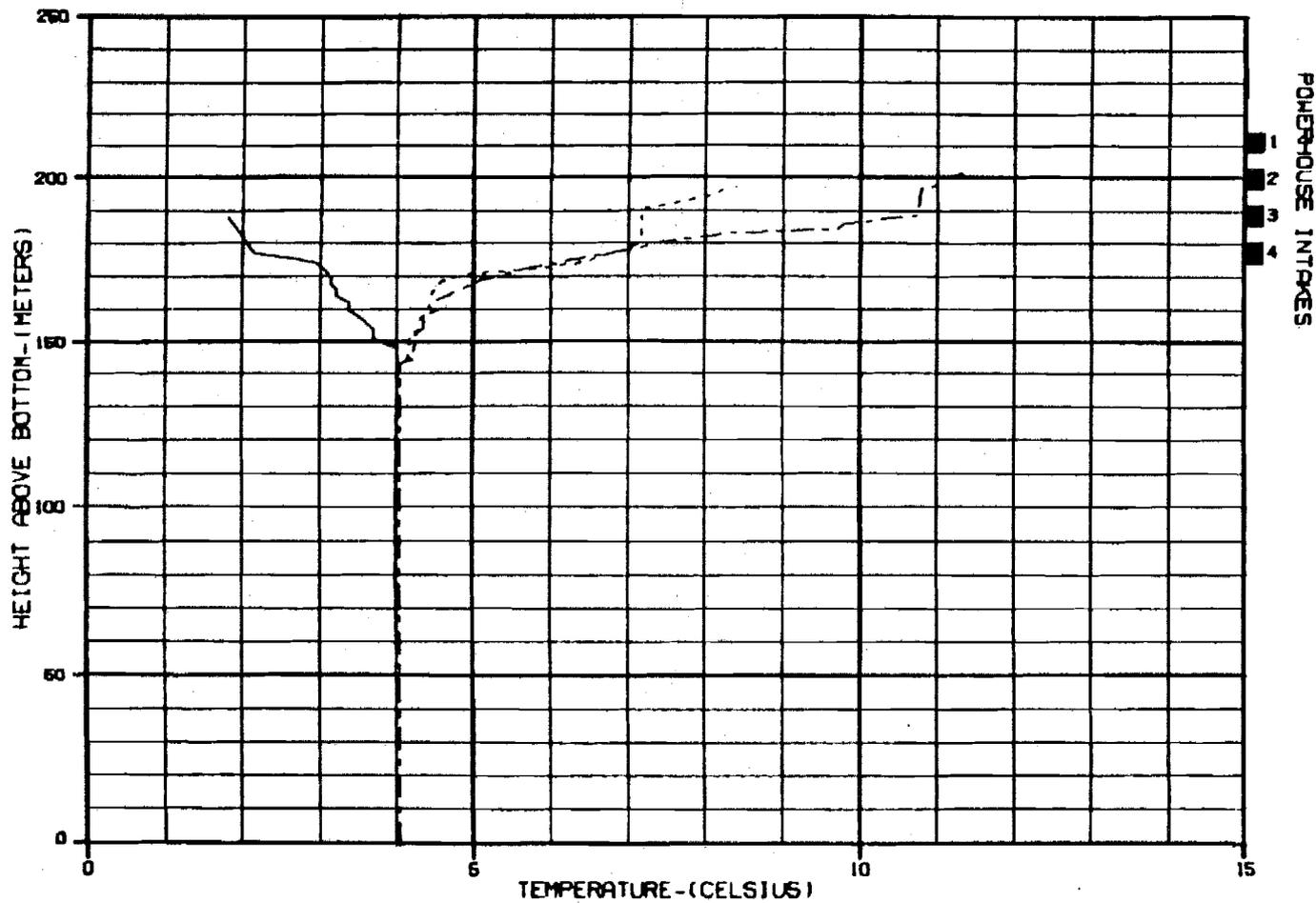
42-010-04



CASE: WAB11B2120B - WATANA OPERATION WITH DEVIL CANYON IN 2020

LEGEND:
 PREDICTED TEMPERATURE PROFILES:
 ——— 1 NOVEMBER 1980
 1 DECEMBER 1980
 - - - - 1 JANUARY 1981

ALASKA POWER AUTHORITY		
WATANA PROJECT	OPEN MODEL	
WATANA RESERVOIR TEMPERATURE PROFILES		
HAZRA-EBASCO JOINT VENTURE		
DESIGN: ELLIOTT	8 JAN 81	42-010-04



CASE: ■■ WAB11B2120B - WATANA OPERATION WITH DEVIL CANYON IN 2020 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES.

——— | MAY 1981
 | JUNE 1981
 - - - - | JULY 1981

ALASKA POWER AUTHORITY

SUBMITTA PROJECT

OPERATION MODEL

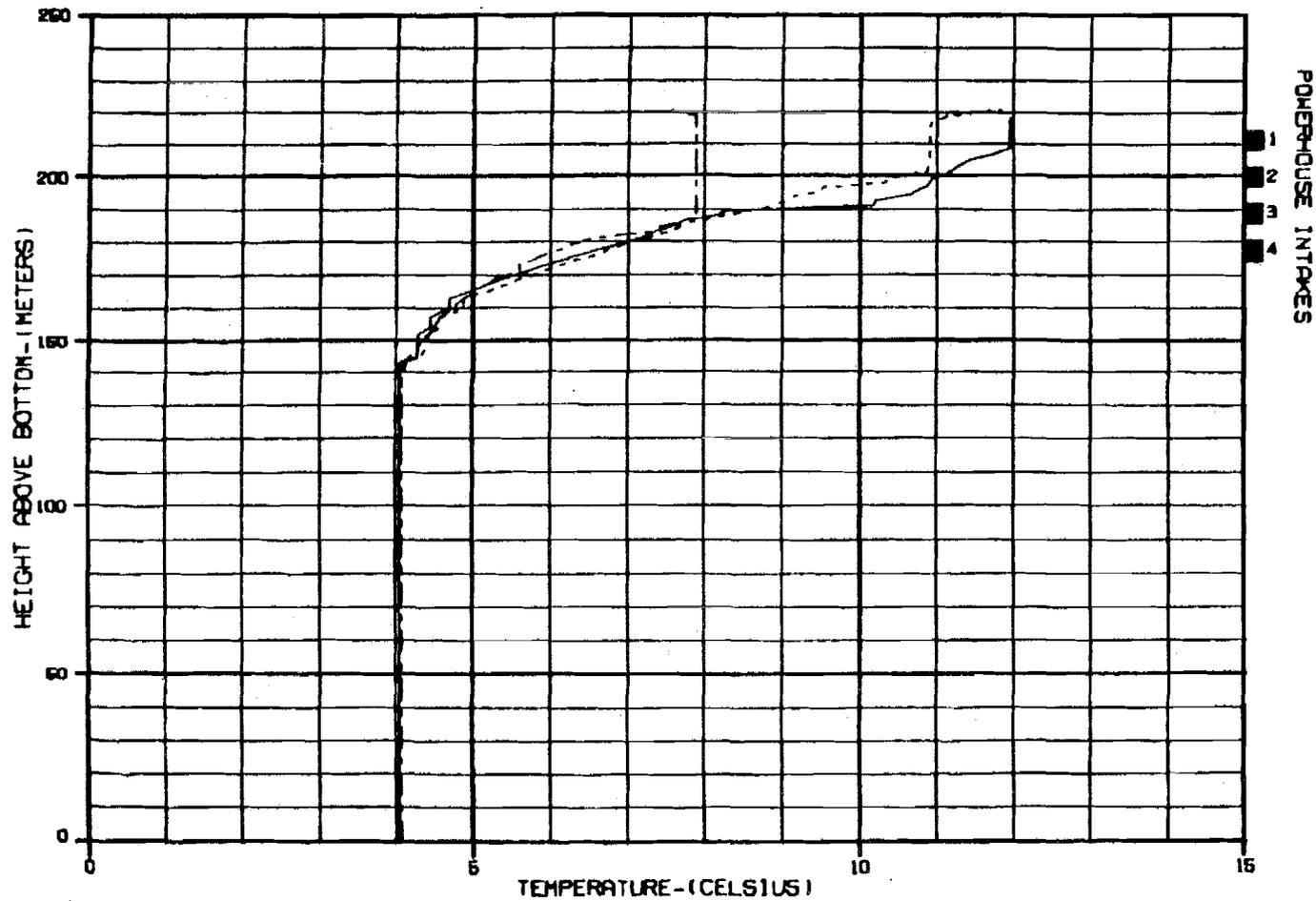
WATANA RESERVOIR
 TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

DATE: 01/01/81

0 JAN 81

42-010-04



CASE: ■■ WAB11821208 - WATANA OPERATION WITH DEVIL CANYON IN 2020. ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

- 1 AUGUST 1981
- 1 SEPTEMBER 1981
- 1 OCTOBER 1981

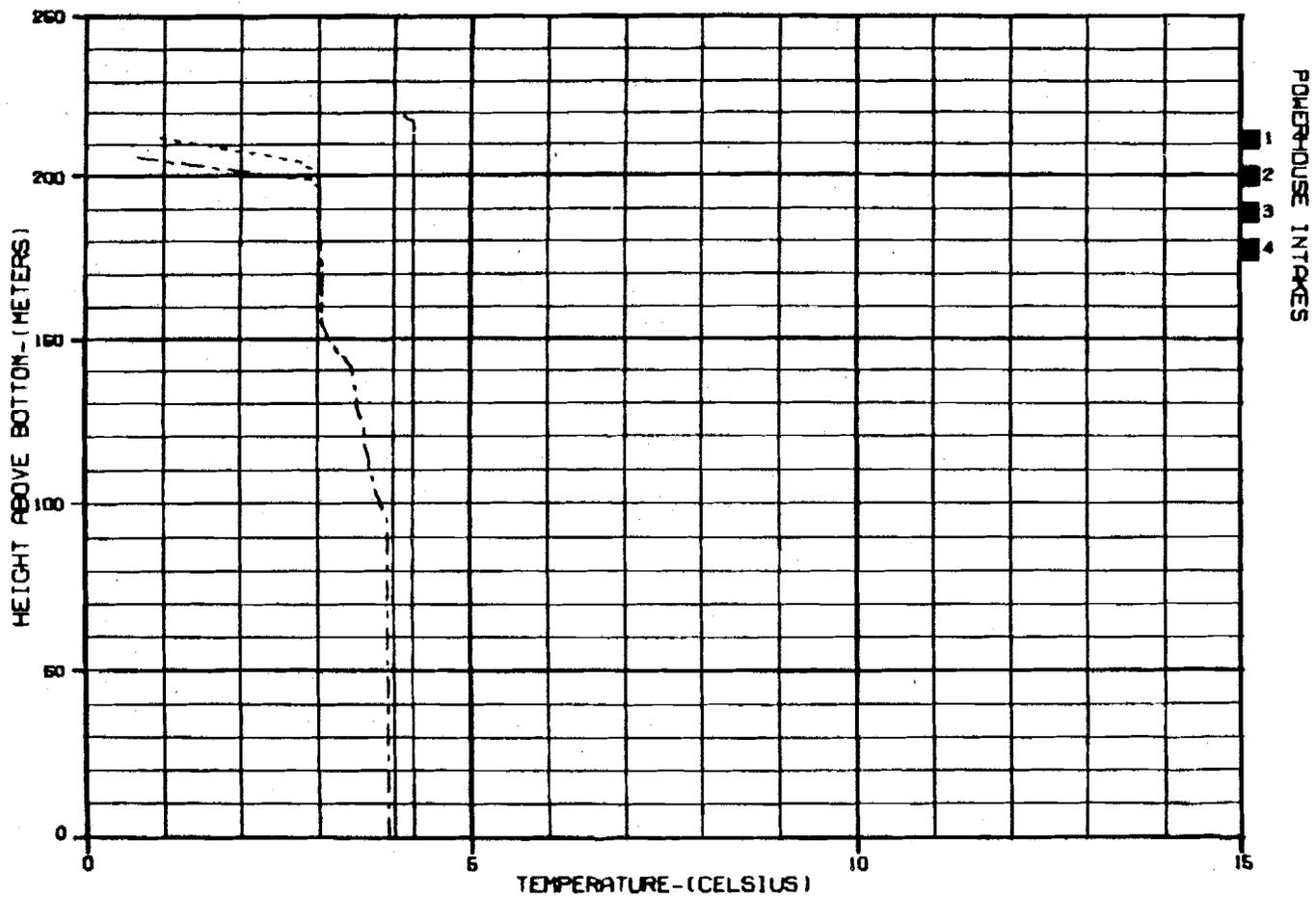
ALASKA POWER AUTHORITY

SUBMITTA PROJECT DIVISION MODEL

WATANA RESERVOIR
TEMPERATURE PROFILES

WARZA-EBASCO JOINT VENTURE

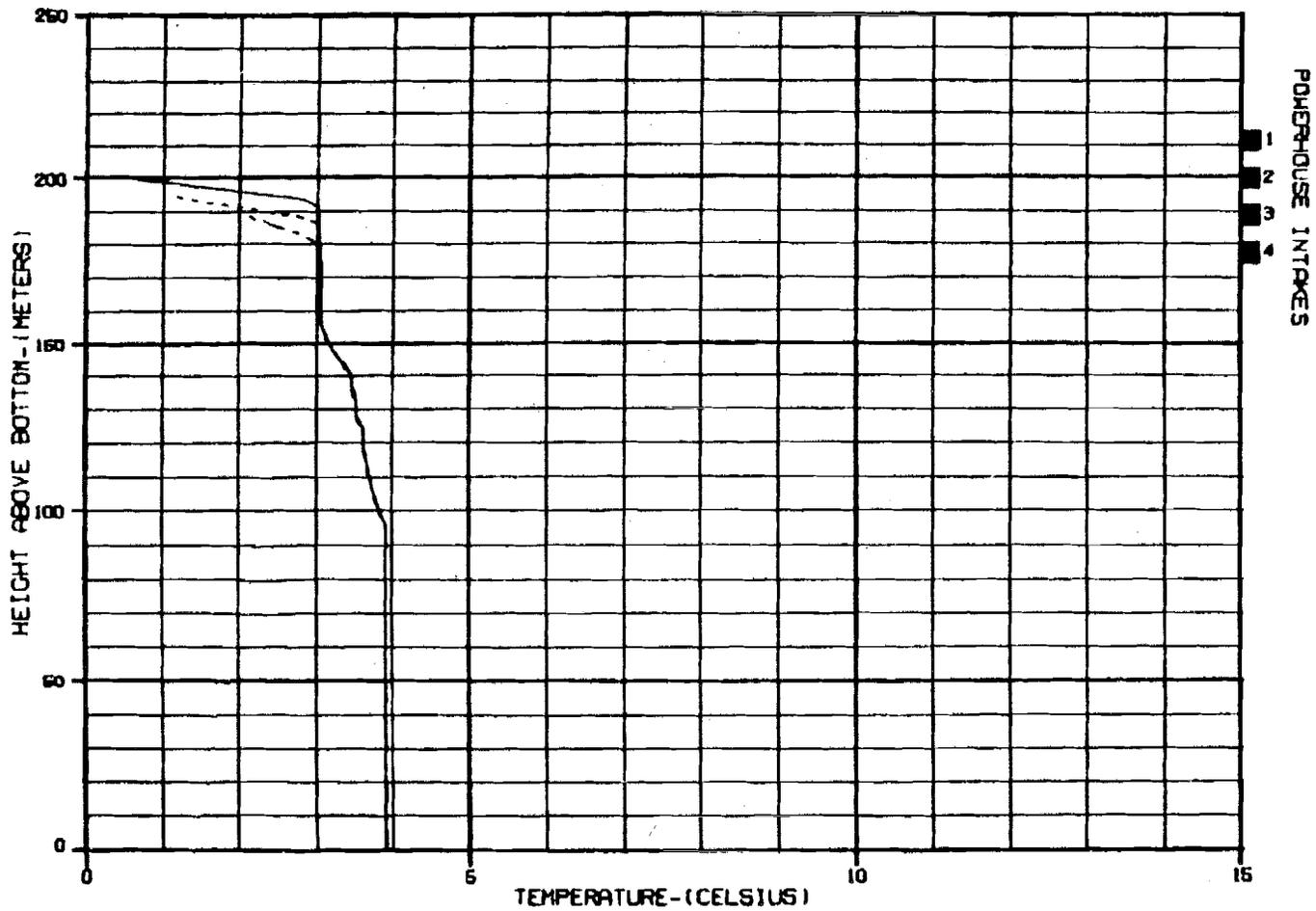
CHUCKLE, BLANKS 8 JAN 84 42-010-04



CASE: ■■ WAB11B2120B - WATANA OPERATION WITH DEVIL CANYON IN 2020 ■■

LEGEND: PREDICTED TEMPERATURE PROFILES.
 _____ | NOVEMBER 1981
 - - - - - | DECEMBER 1981
 - · - · - | JANUARY 1982

ALASKA POWER AUTHORITY		
DESIGN PROJECT	DYNAMIC MODEL	
WATANA RESERVOIR TEMPERATURE PROFILES		
HARZA-EBRACO JOINT VENTURE		
DATE: 11/1982	8 JAN 83	42-010-04



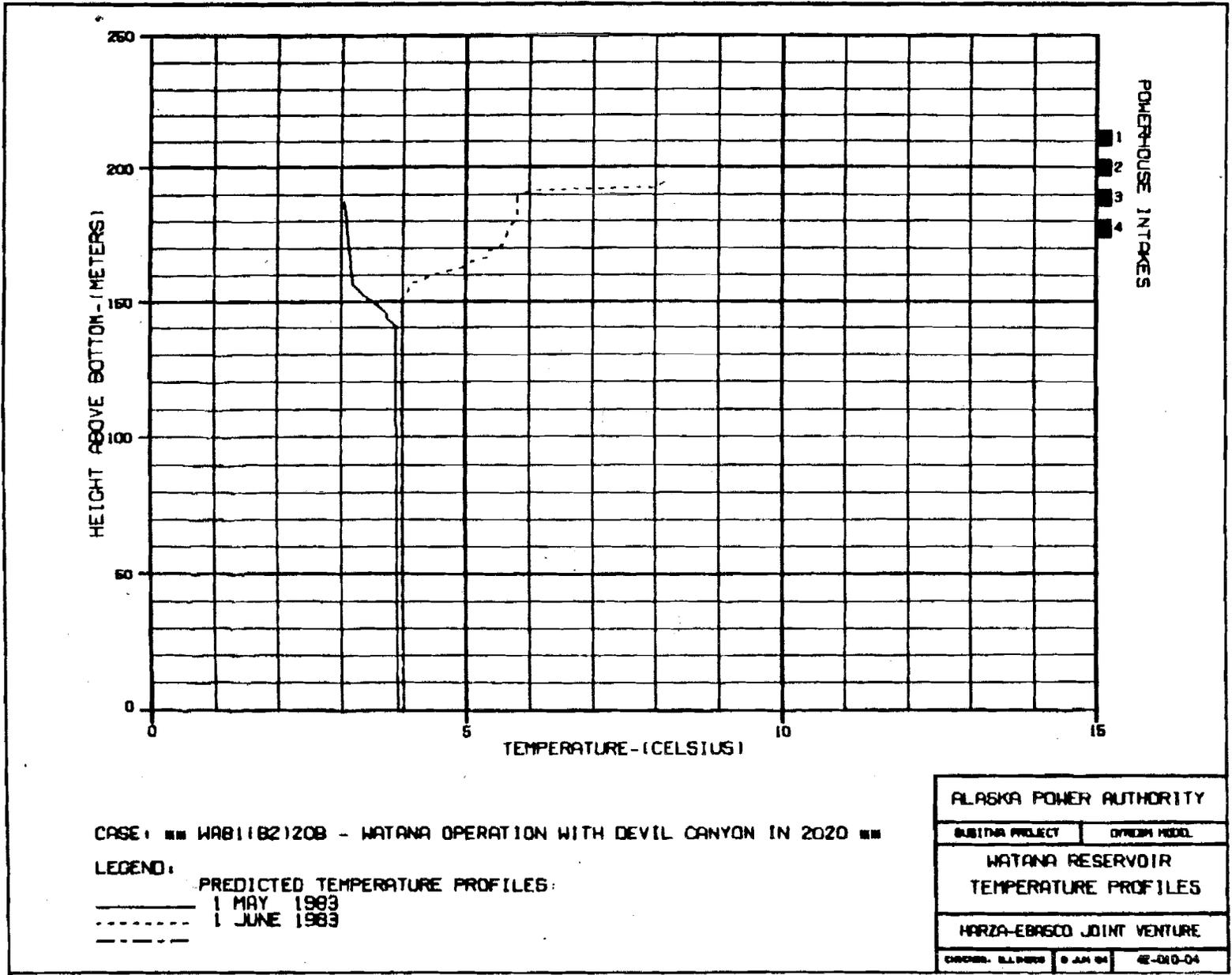
POWERHOUSE INTAKES

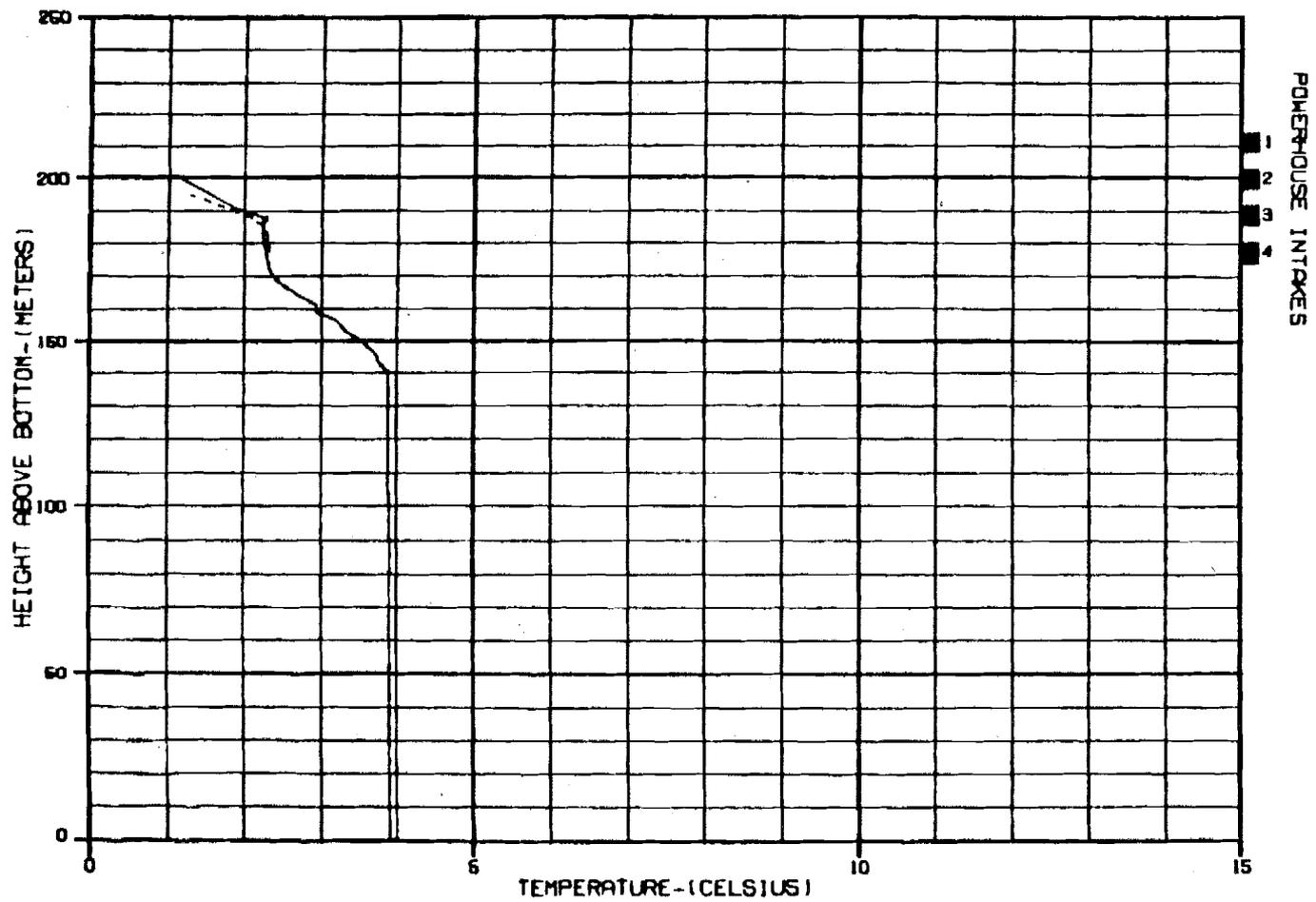
CASE: WAB11821208 - WATANA OPERATION WITH DEVIL CANYON IN 2020

LEGEND: PREDICTED TEMPERATURE PROFILES:
 ———— 1 FEBRUARY 1982
 - - - - - 1 MARCH 1982
 1 APRIL 1982

ALASKA POWER AUTHORITY		
QUALITY PROJECT	DYNEMA MODEL	
WATANA RESERVOIR TEMPERATURE PROFILES		
WARZA-EBRACO JOINT VENTURE		
DATE: 01-11-82	BY: JAM/DA	42-010-04

EXHIBIT AI





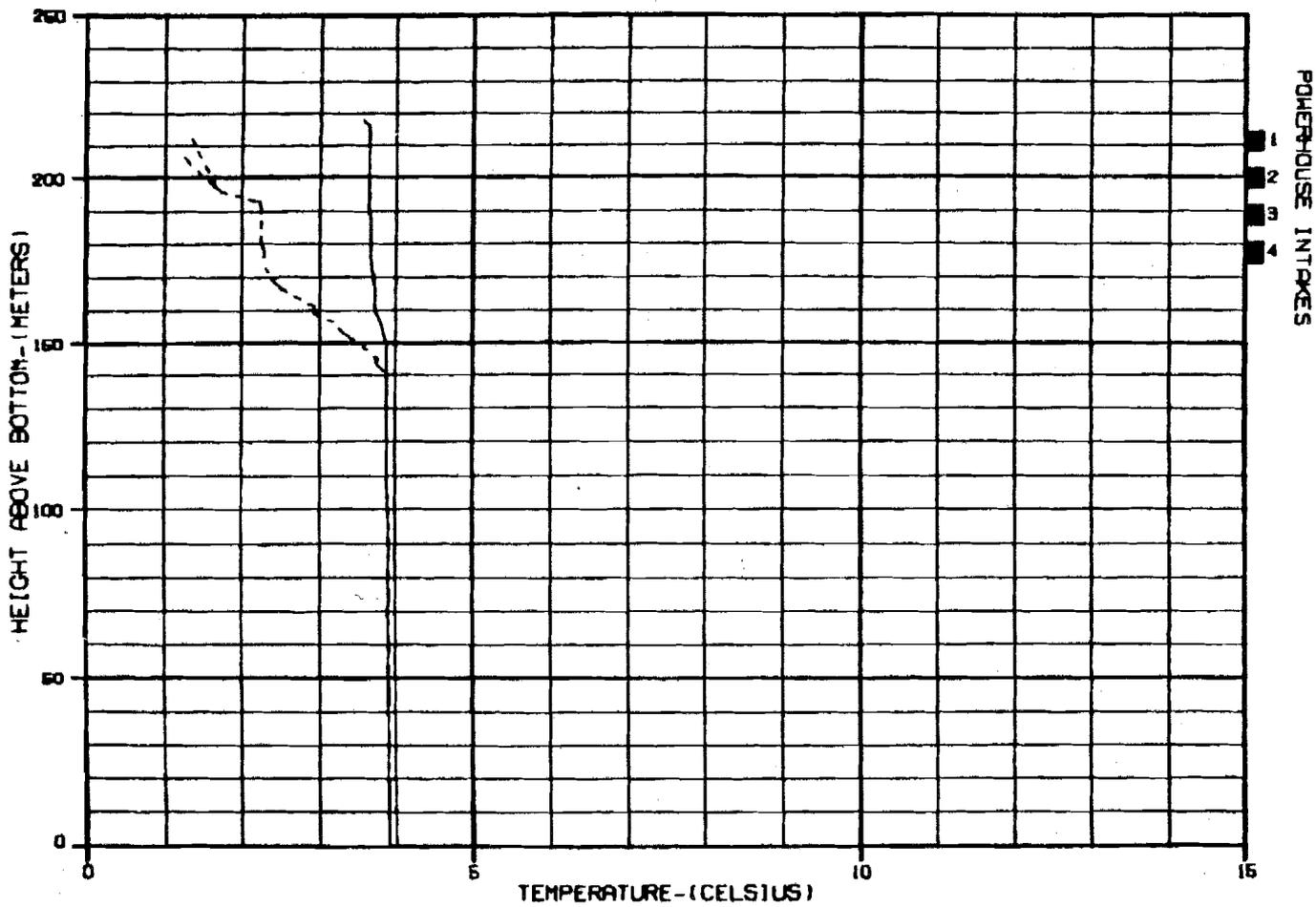
CASE: ■■ WAB11B2120B - WATANA OPERATION WITH DEVIL CANYON IN 2020 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

- 1 FEBRUARY 1983
- 1 MARCH 1983
- 1 APRIL 1983

ALASKA POWER AUTHORITY		
SUBMITTER PROJECT	DRAWING MODEL	
WATANA RESERVOIR		
TEMPERATURE PROFILES		
HARZA-EBASCO JOINT VENTURE		
CHECKED: S.L. DAVIS	8 JAN 84	42-010-04



CASE: WAB11821208 - WATANA OPERATION WITH DEVIL CANYON IN 2020

LEGEND:

PREDICTED TEMPERATURE PROFILES:

- NOVEMBER 1982
- - - DECEMBER 1982
- . - . JANUARY 1983

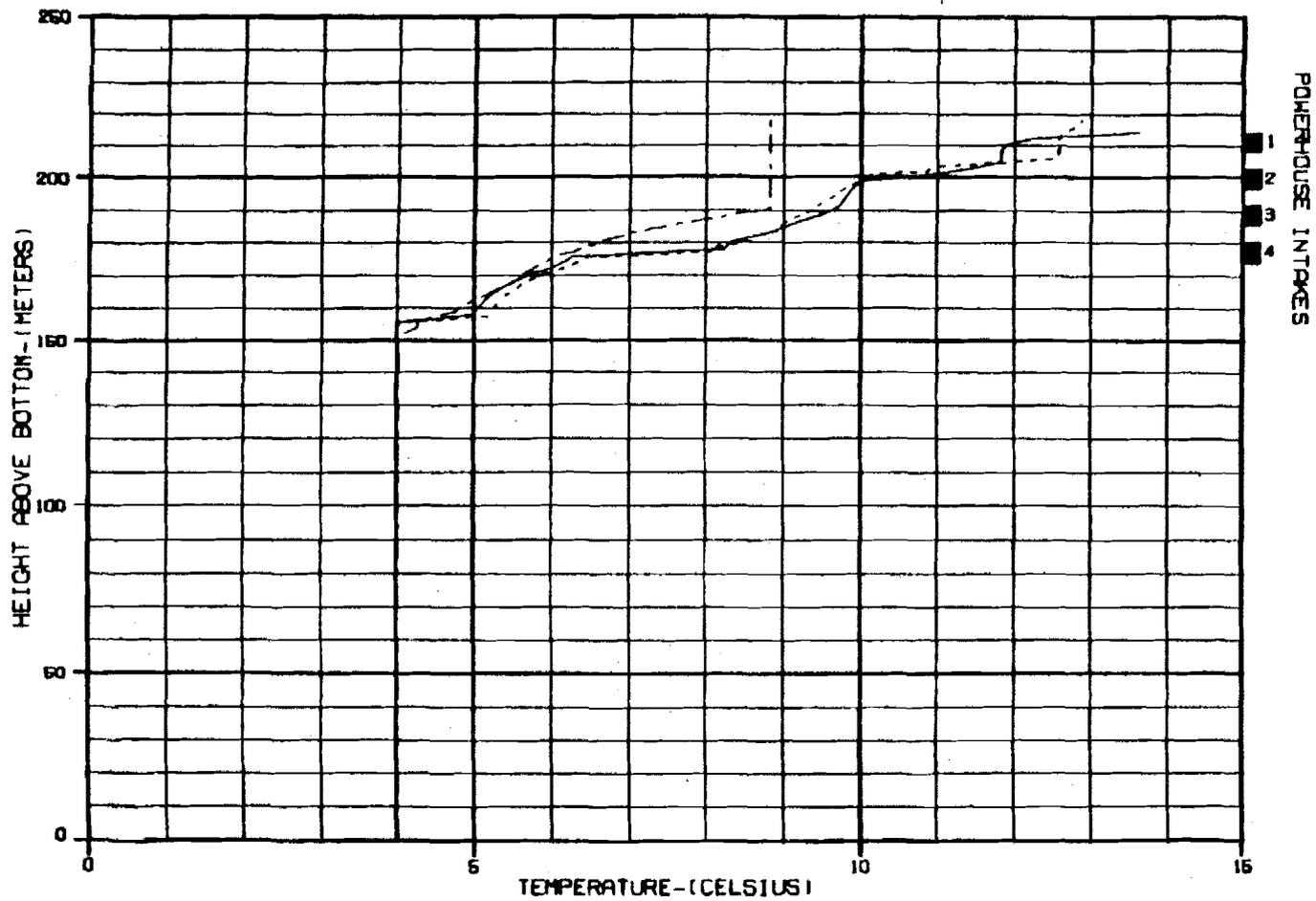
ALASKA POWER AUTHORITY

SUBMITTA PROJECT OPENING MODEL

WATANA RESERVOIR
TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

OWNER: ALASKA POWER AUTHORITY 42-010-04



CASE: WAB11B2120B - WATANA OPERATION WITH DEVIL CANYON IN 2020

LEGEND:

PREDICTED TEMPERATURE PROFILES:

- 1 AUGUST 1982
- - - 1 SEPTEMBER 1982
- . - . 1 OCTOBER 1982

ALASKA POWER AUTHORITY

SUBMITTA PROJECT

DYDSON MODEL

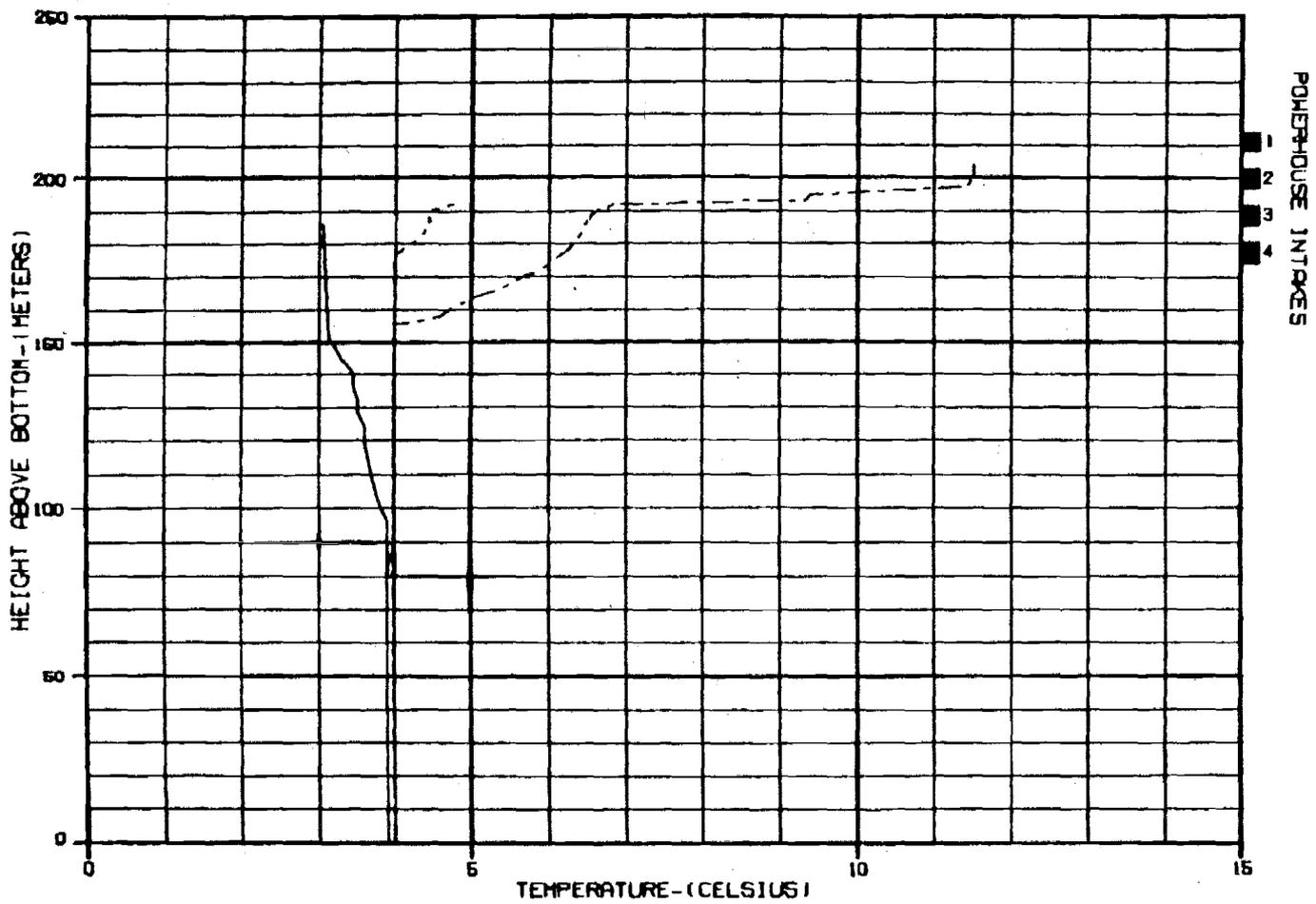
WATANA RESERVOIR
TEMPERATURE PROFILES

WARZA-EBASCO JOINT VENTURE

DESIGN: D.L. BROWN

8 JAN 83

42-010-04



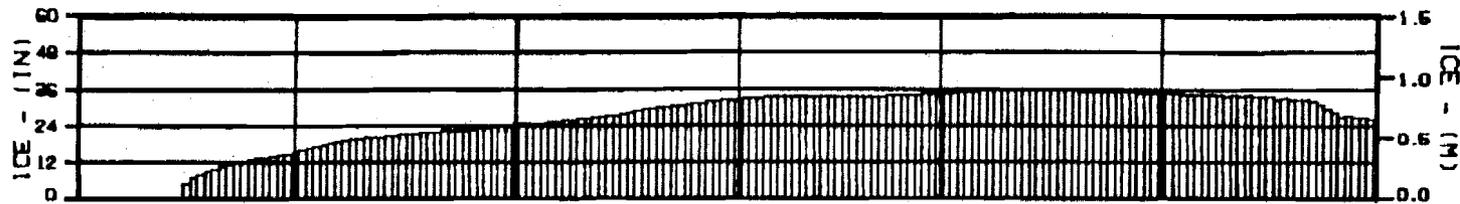
CASE: ■■ WAB1182120B - WATANA OPERATION WITH DEVIL CANYON IN 2020 ■■

LEGEND: PREDICTED TEMPERATURE PROFILES:
 ———— 1 MAY 1982
 - - - - - 1 JUNE 1982
 ······· 1 JULY 1982

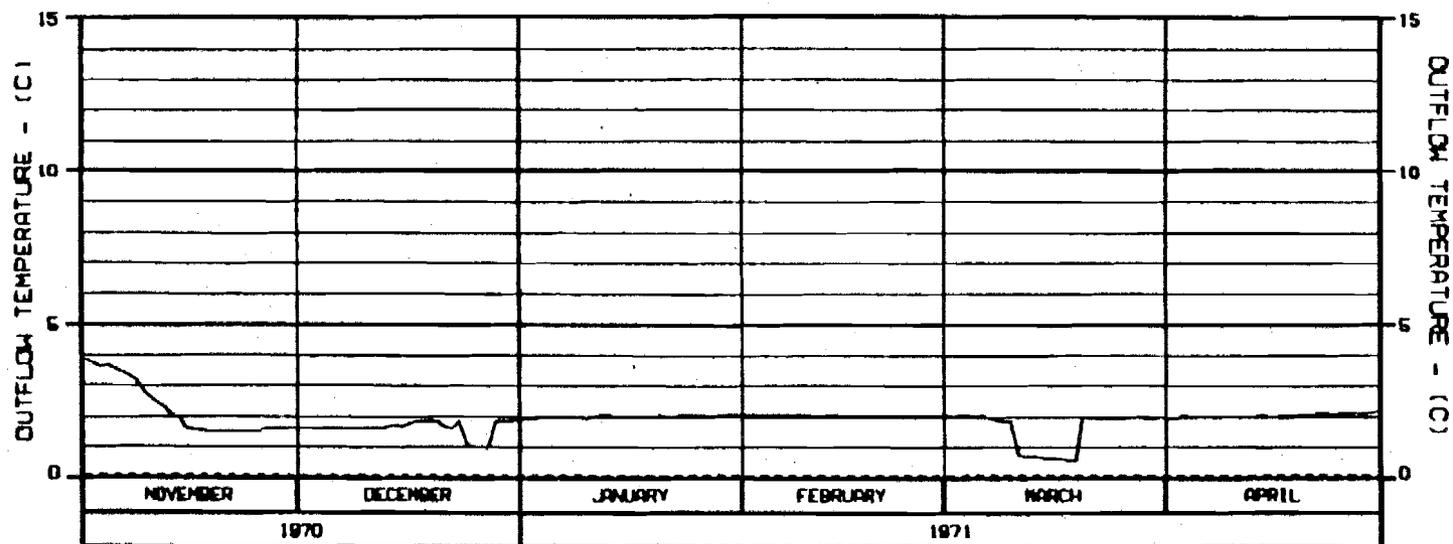
ALASKA POWER AUTHORITY	
SUBTNA PROJECT	DYSDM MODEL
WATANA RESERVOIR TEMPERATURE PROFILES	
WARZA-EBRSCO JOINT VENTURE	
DESIGNED: B.L.D.870	5 JAN 84
42-010-04	

WATANA AND DEVIL CANYON OPERATING
2002 Energy Demands
Devil Canyon Reservoir Temperatures

EXHIBIT AJ



INTAKE	LEVEL 1					
	LEVEL 2					
	CONE VALVE					
	SPILLWAY					



LEGEND: DASH: ■■ DC7102A - DEVIL CANYON OPERATION WITH MATANA IN 2002 ■■

———— PREDICTED OUTFLOW TEMPERATURE FROM DEVIL CANYON RESERVOIR
 - - - - - INFLOW TEMPERATURE TO MATANA RESERVOIR

- NOTES: 1. INTAKE PORT LEVEL 1 AT ELEVATION 1426 FT (434.34 M)
 2. INTAKE PORT LEVEL 2 AT ELEVATION 1376 FT (419.10 M)
 3. CONE VALVE AT ELEVATION 990 FT (301.75 M)
 4. SPILLWAY CREST AT ELEVATION 1404 FT (427.94 M)

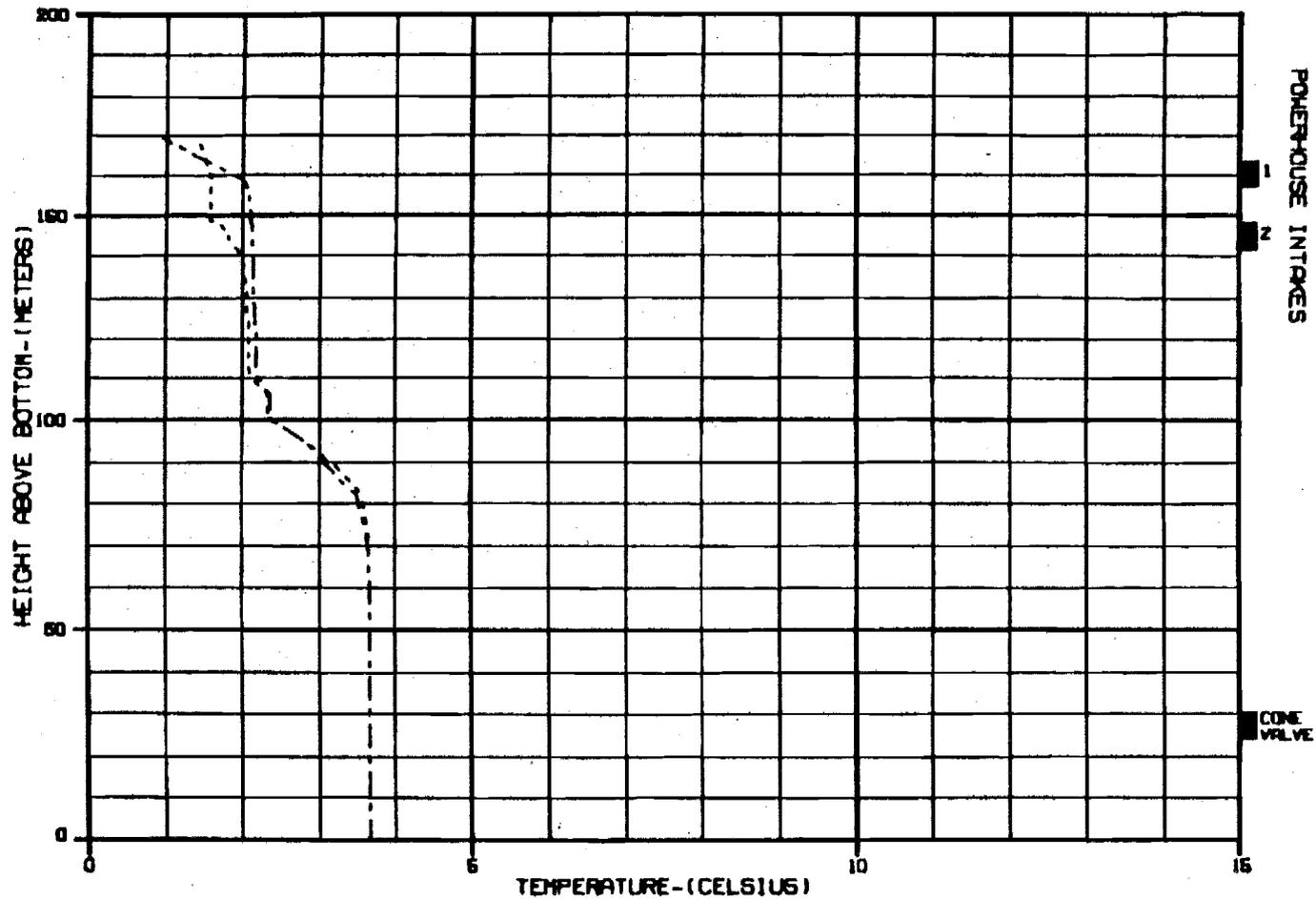
ALASKA POWER AUTHORITY

DEVELOPMENT PROJECT DYNEMO MODEL

DEVIL CANYON RESERVOIR
 OUTFLOW TEMPERATURE
 AND ICE GROWTH

HARZA-EBASCO JOINT VENTURE

ENGINEER - J.L. BROWN 8 JUN 81 MODEL LOG NO. 010-04



CASE: ■■ DC7102A - DEVIL CANYON OPERATION WITH MATANA IN 2002 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

——— | NOVEMBER 1970
 | DECEMBER 1970
 - - - - | JANUARY 1971

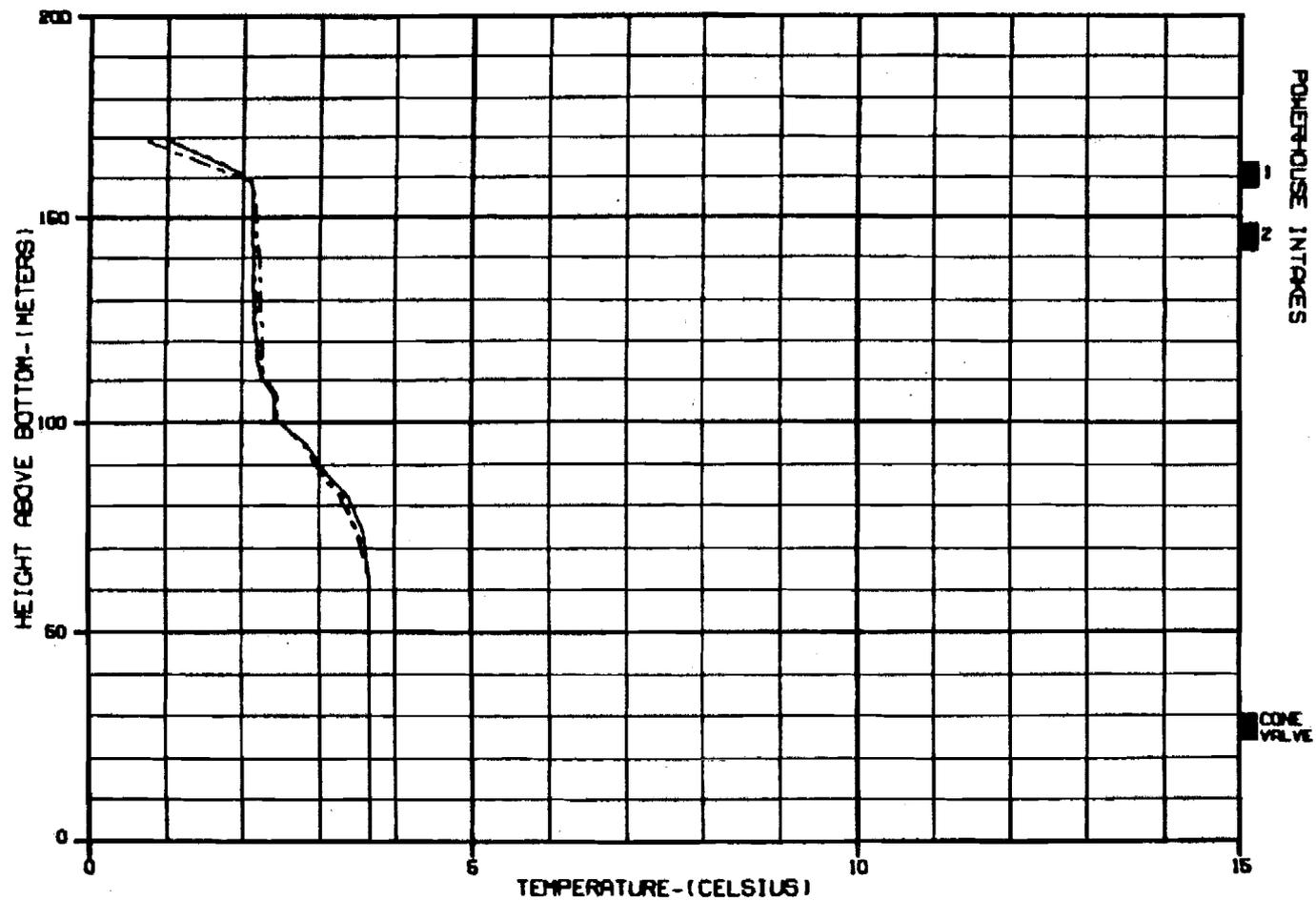
ALASKA POWER AUTHORITY

SUBMITTA PROJECT | OPERA MODEL

DEVIL CANYON RESERVOIR
TEMPERATURE PROFILES

HARZA-EBRACO JOINT VENTURE

ISSUED: 11/18/03 9 JAN 04 42-010-04



CASE: DC7102A - DEVIL CANYON OPERATION WITH WATANA IN 2002

LEGEND:

PREDICTED TEMPERATURE PROFILES:

— | FEBRUARY 1971
 | MARCH 1971
 - - - - | APRIL 1971

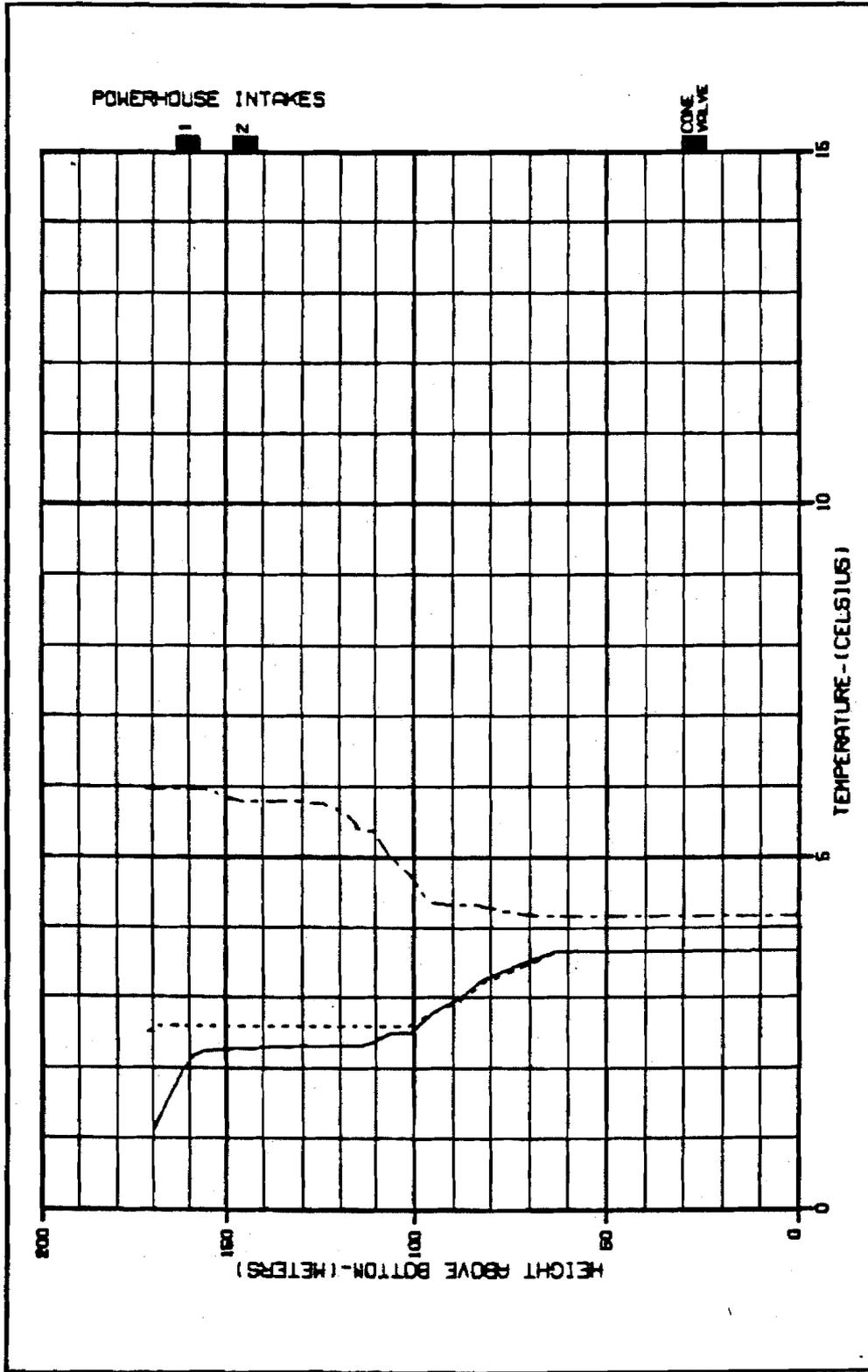
ALASKA POWER AUTHORITY

DEVELOPER PROJECT OPERATOR

DEVIL CANYON RESERVOIR
 TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

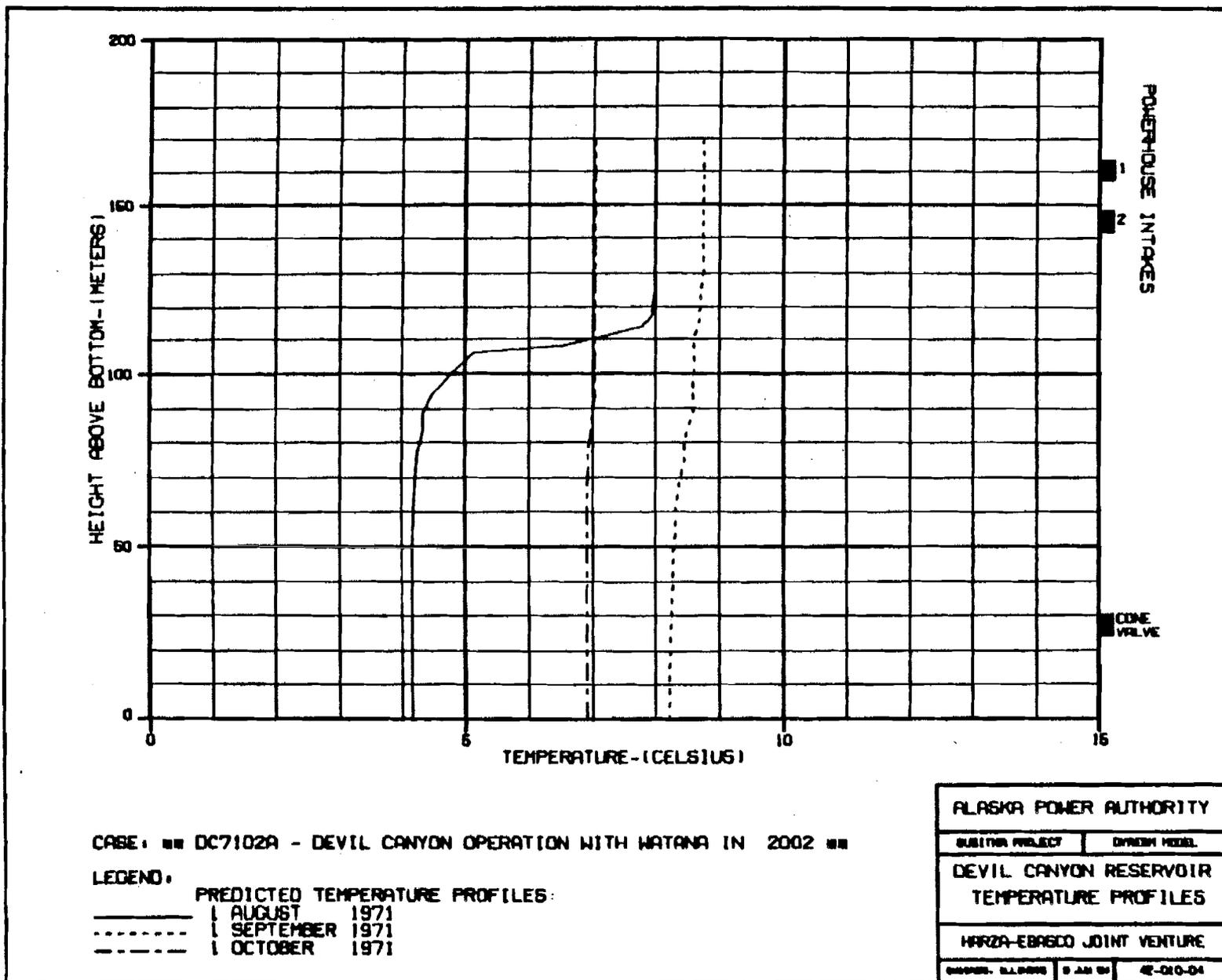
DESIGN: 11/88 9 JAN 89 42-018-04

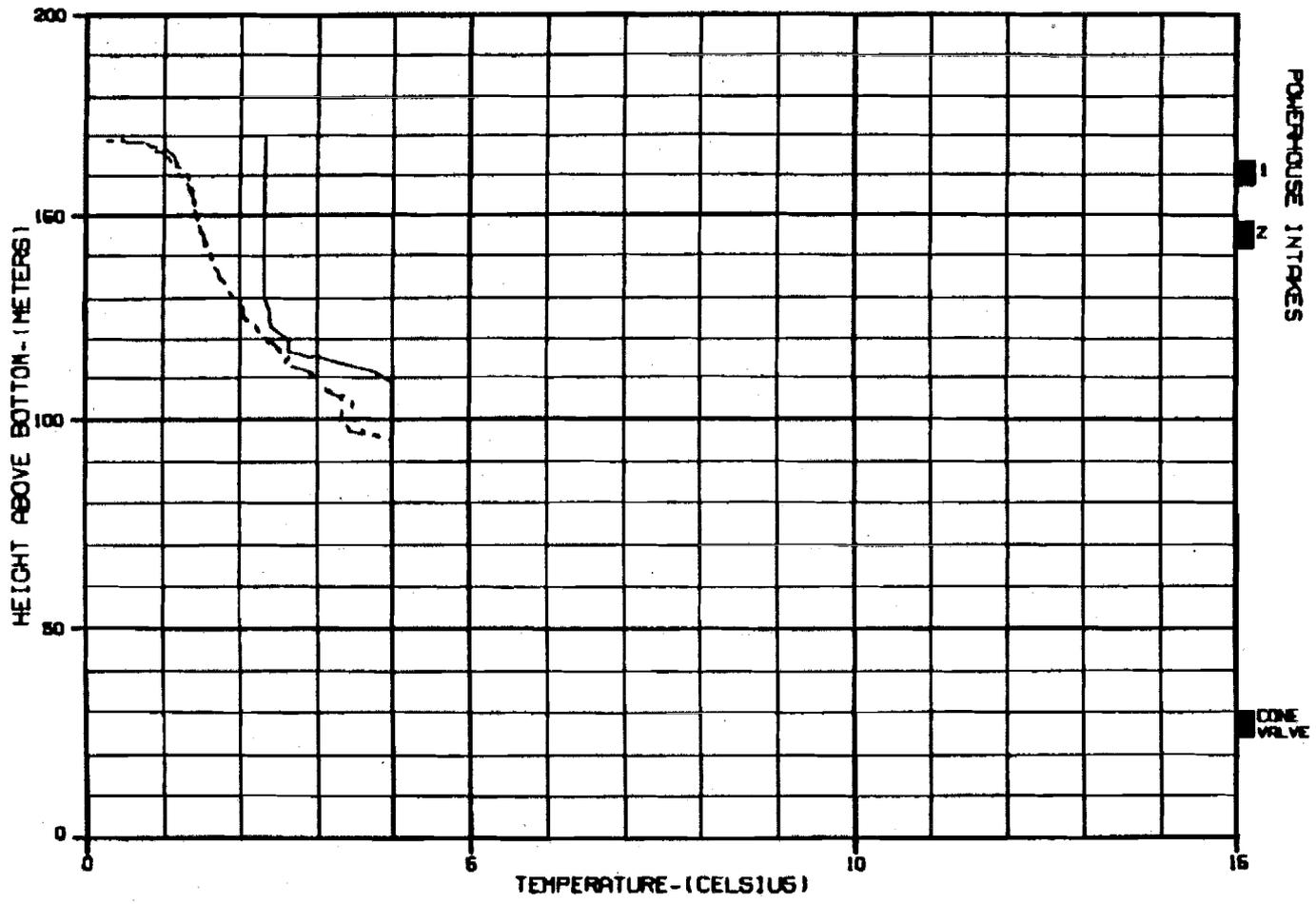


ALASKA POWER AUTHORITY	
SUBJECT	PROJECT
DEVIL CANYON RESERVOIR	
TEMPERATURE PROFILES	
WARDA-EBROD JOINT VENTURE	
DATE	BY
8-01-04	8-01-04

CASE: # DC7102A - DEVIL CANYON OPERATION WITH MATANA IN 2002

LEGEND: PREDICTED TEMPERATURE PROFILES:
 ——— MAY 1971
 - - - - JUNE 1971
 - · - · JULY 1971





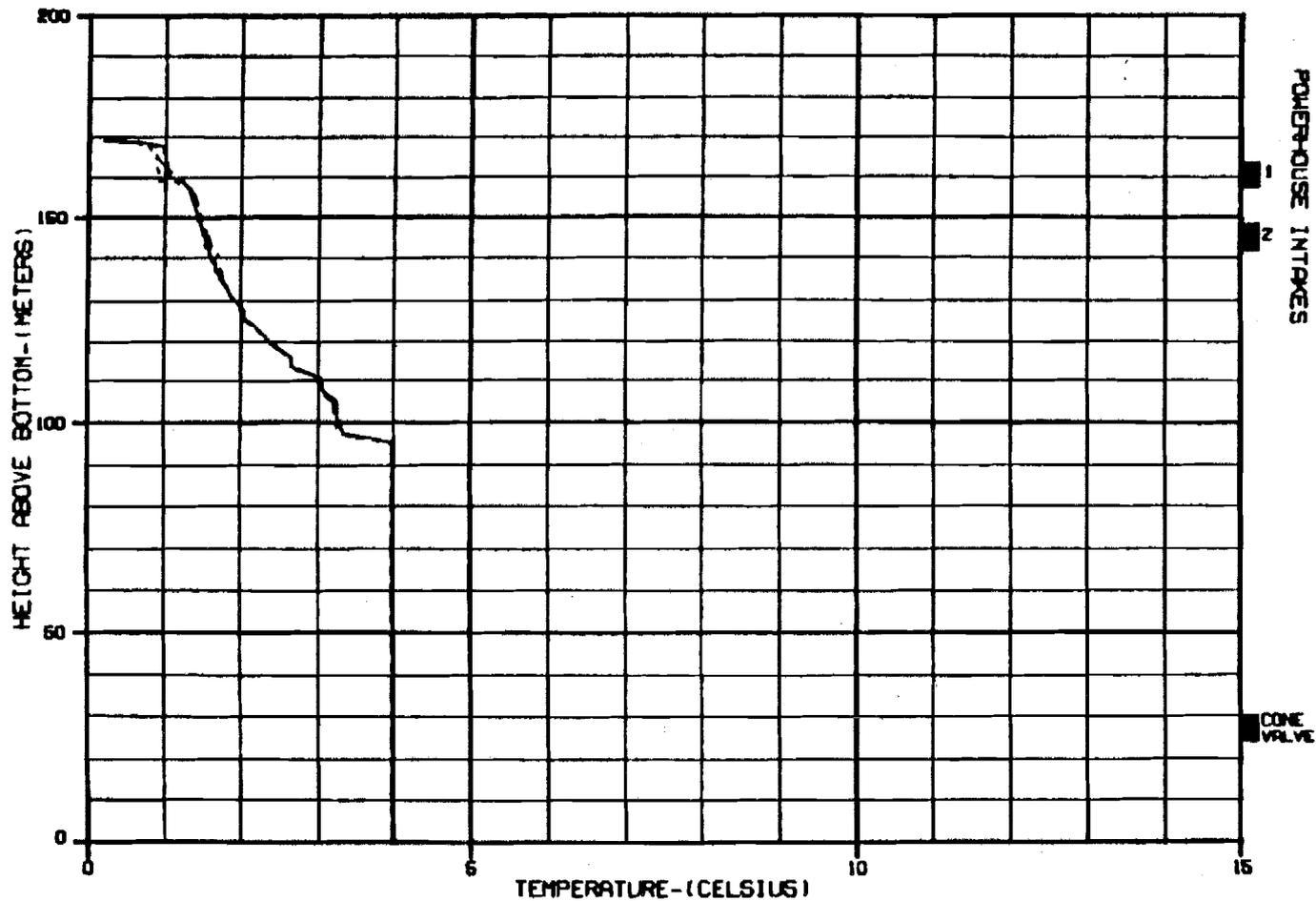
CASE: ■■ DC7102A - DEVIL CANYON OPERATION WITH WATANA IN 2002 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

- | NOVEMBER 1971
- | DECEMBER 1971
- · - · - · | JANUARY 1972

ALASKA POWER AUTHORITY		
BASELINE PROJECT	DWARREN MODEL	
DEVIL CANYON RESERVOIR TEMPERATURE PROFILES		
WARZA-EBASCO JOINT VENTURE		
DESIGNED: A.L. DAVIS	8 JAN 84	42-DIG-04



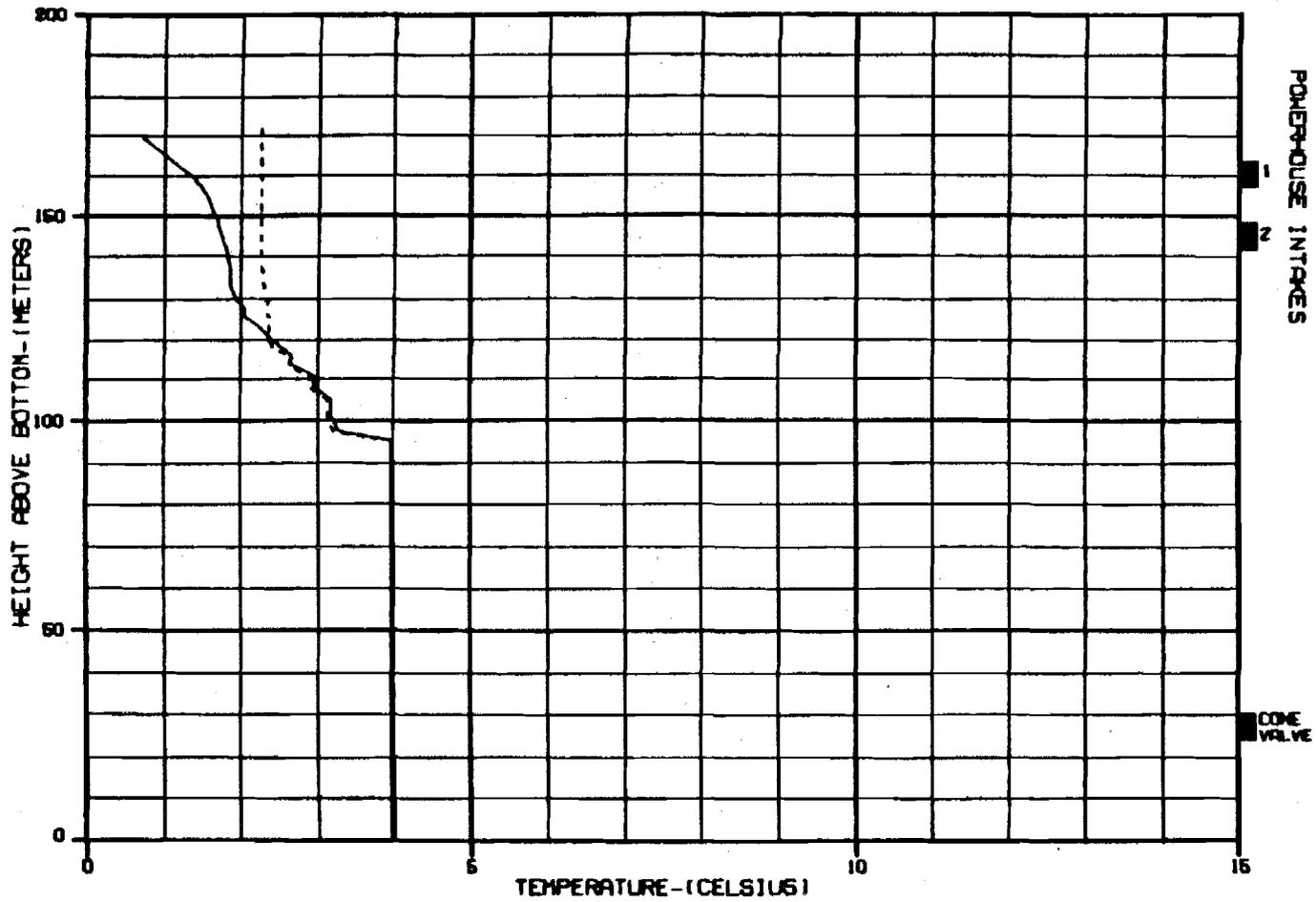
CASE: ■ DC7102A - DEVIL CANYON OPERATION WITH WATANA IN 2002 ■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

- 1 FEBRUARY 1972
- - - 1 MARCH 1972
- · - 1 APRIL 1972

ALASKA POWER AUTHORITY	
SUBMITTER PROJECT	DATE/REV. MOD.
DEVIL CANYON RESERVOIR TEMPERATURE PROFILES	
HARZA-EBASCO JOINT VENTURE	
DRAWN: S.L. PERRY	8 JAN 84
	42-010-04



CASE: # DC7102A - DEVIL CANYON OPERATION WITH WATANA IN 2002 #

LEGEND:

PREDICTED TEMPERATURE PROFILES:

——— MAY 1972
 - - - - - JUNE 1972
 JULY 1972

ALASKA POWER AUTHORITY

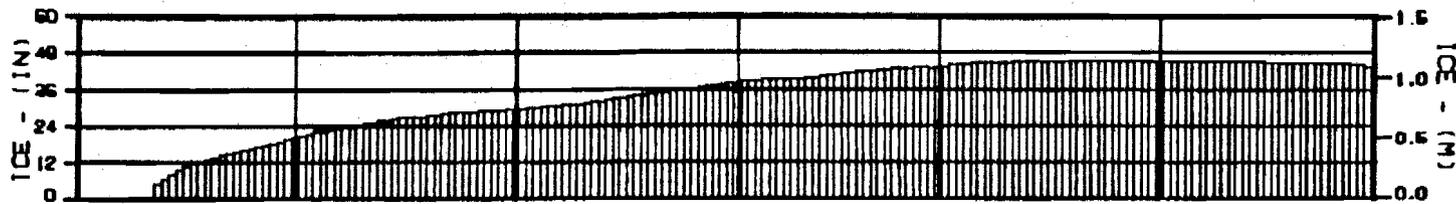
DEVIL CANYON RESERVOIR

TEMPERATURE PROFILES

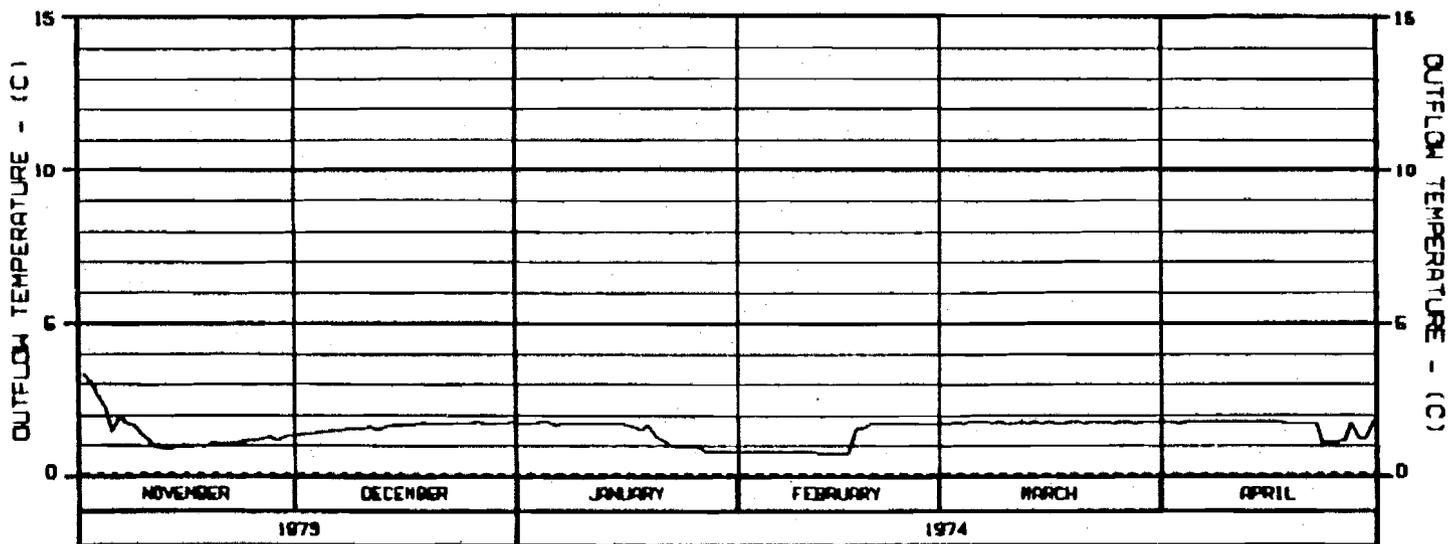
HARZA-EBASCO JOINT VENTURE

DATE: 11/10/04 8 AM '04 42-010-04

EXHIBIT AK



INTAKE	LEVEL 1					
	LEVEL 2					
	CONE VALVE					
	SPILLWAY					



LEGEND: CASE: ■ DC7402A - DEVIL CANYON OPERATION WITH NATANA IN 2002 ■■

— PREDICTED OUTFLOW TEMPERATURE FROM DEVIL CANYON RESERVOIR
 - - - - - INFLOW TEMPERATURE TO NATANA RESERVOIR

- NOTES: 1. INTAKE PORT LEVEL 1 AT ELEVATION 1425 FT (434.24 M)
 2. INTAKE PORT LEVEL 2 AT ELEVATION 1376 FT (419.10 M)
 3. CONE VALVE AT ELEVATION 930 FT (283.15 M)
 4. SPILLWAY CREST AT ELEVATION 1404 FT (427.84 M)

ALASKA POWER AUTHORITY

BUILDING PROJECT DESIGN NO.

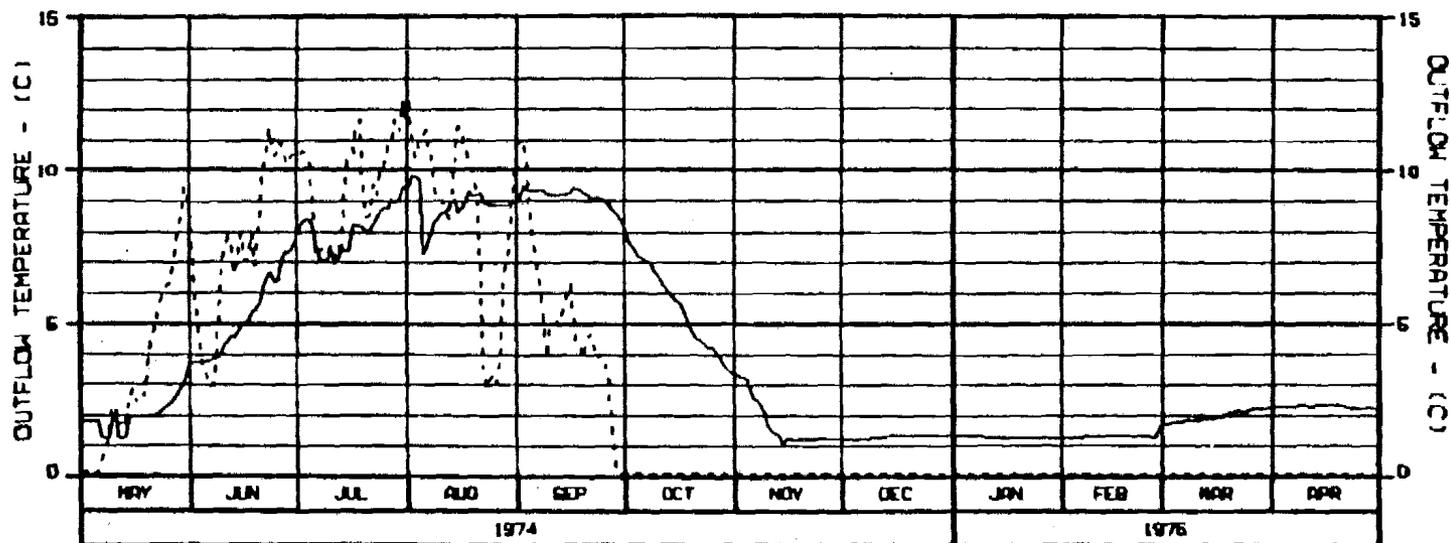
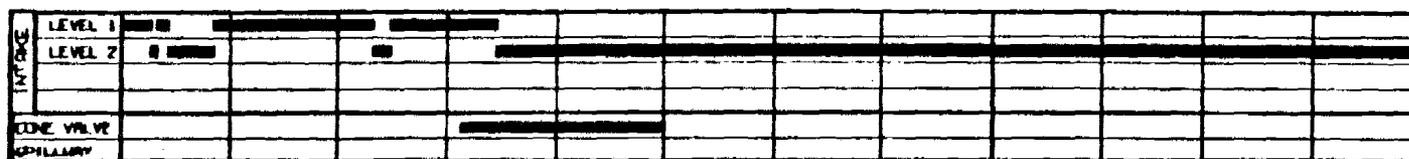
DEVIL CANYON RESERVOIR

OUTFLOW TEMPERATURE

AND ICE GROWTH

HARZA-EBRACO JOINT VENTURE

UNIVERSITY MICROFILMS 8 JAN 84 SERIALS ACQUISITION



LEGEND: CASE: ■ DC7402A - DEVIL CANYON OPERATION WITH NATANA IN 2002 ■■

———— PREDICTED OUTFLOW TEMPERATURE FROM DEVIL CANYON RESERVOIR
 - - - - - INFLOW TEMPERATURE TO NATANA RESERVOIR

- NOTES: 1. INTAKE PORT LEVEL 1 AT ELEVATION 1425 FT (434.24 M)
 2. INTAKE PORT LEVEL 2 AT ELEVATION 1275 FT (419.10 M)
 3. CONE VALVE AT ELEVATION 990 FT (301.75 M)
 4. SPILLWAY CREST AT ELEVATION 1404 FT (427.94 M)

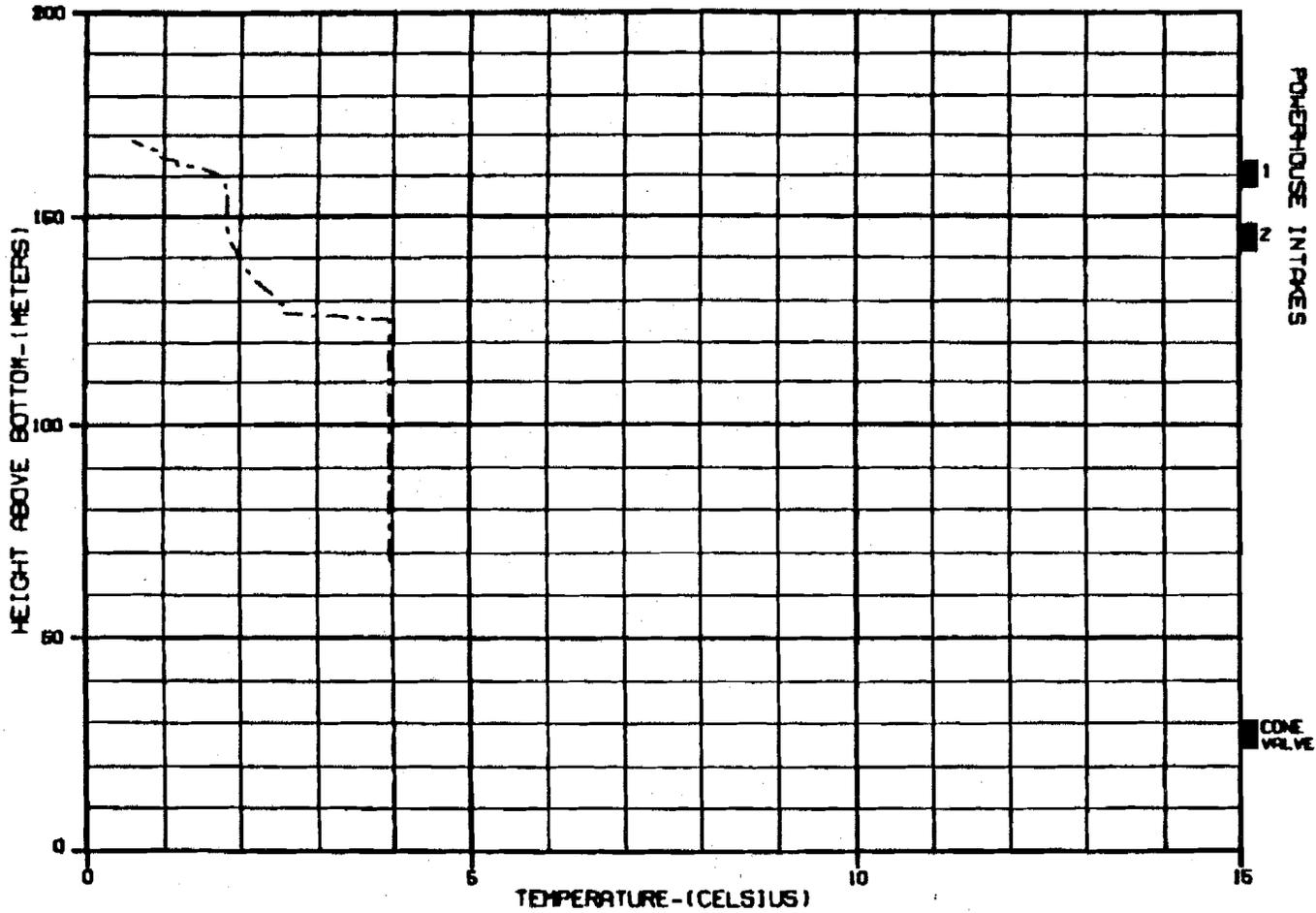
ALASKA POWER AUTHORITY

SUBTERRANEAN PROJECT DIVISION HEAD

DEVIL CANYON RESERVOIR
 OUTFLOW TEMPERATURE
 AND ICE GROWTH

HARZA-EBASCO JOINT VENTURE

CHANGES: ALL PAGES 8 JAN 84 8888.149 48-9908-04



CASE: ■■ DC7402A - DEVIL CANYON OPERATION WITH WATANA IN 2002 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

_____ | NOVEMBER 1973
 | DECEMBER 1973
 - - - - - | JANUARY 1974

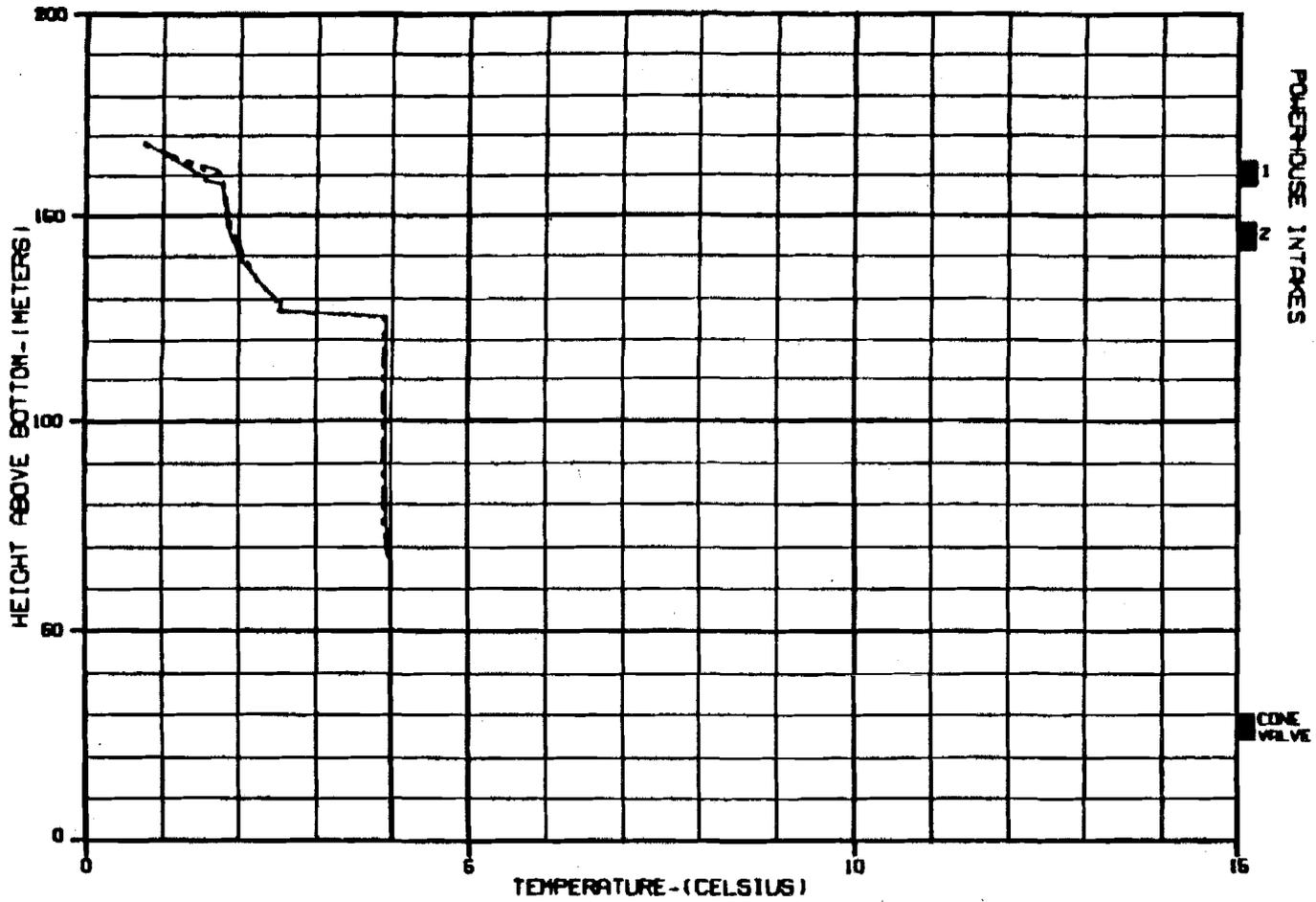
ALASKA POWER AUTHORITY

DISTRIBUTION PROJECT | DYNAMIC MODEL

DEVIL CANYON RESERVOIR
TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

DATE: 11/10/83 9 AM '83 42-010-04



CASE: WDC7402A - DEVIL CANYON OPERATION WITH WATANA IN 2002

LEGEND:

PREDICTED TEMPERATURE PROFILES:

— FEBRUARY 1974
 - - - MARCH 1974
 . . . APRIL 1974

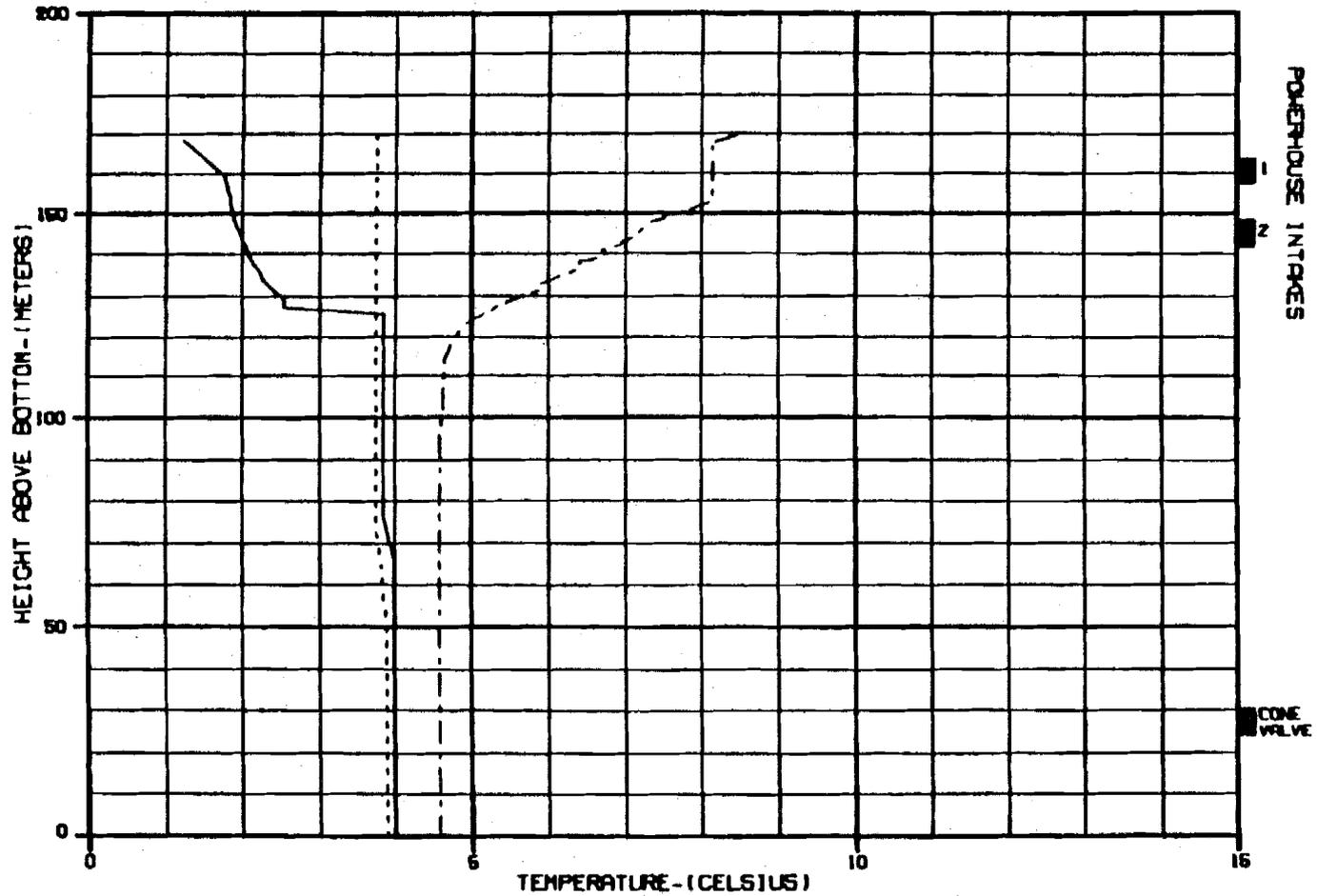
ALASKA POWER AUTHORITY

DEVELOPMENT PROJECT OPERATIONAL MODEL

DEVIL CANYON RESERVOIR
 TEMPERATURE PROFILES

HARZA-EBRACED JOINT VENTURE

OWNER: ALASKA POWER AUTHORITY 9 JAN 84 47-010-04



CASE: ■■ DC7402A - DEVIL CANYON OPERATION WITH WATANA IN 2002 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

- | MAY 1974
- | JUNE 1974
- - - - | JULY 1974

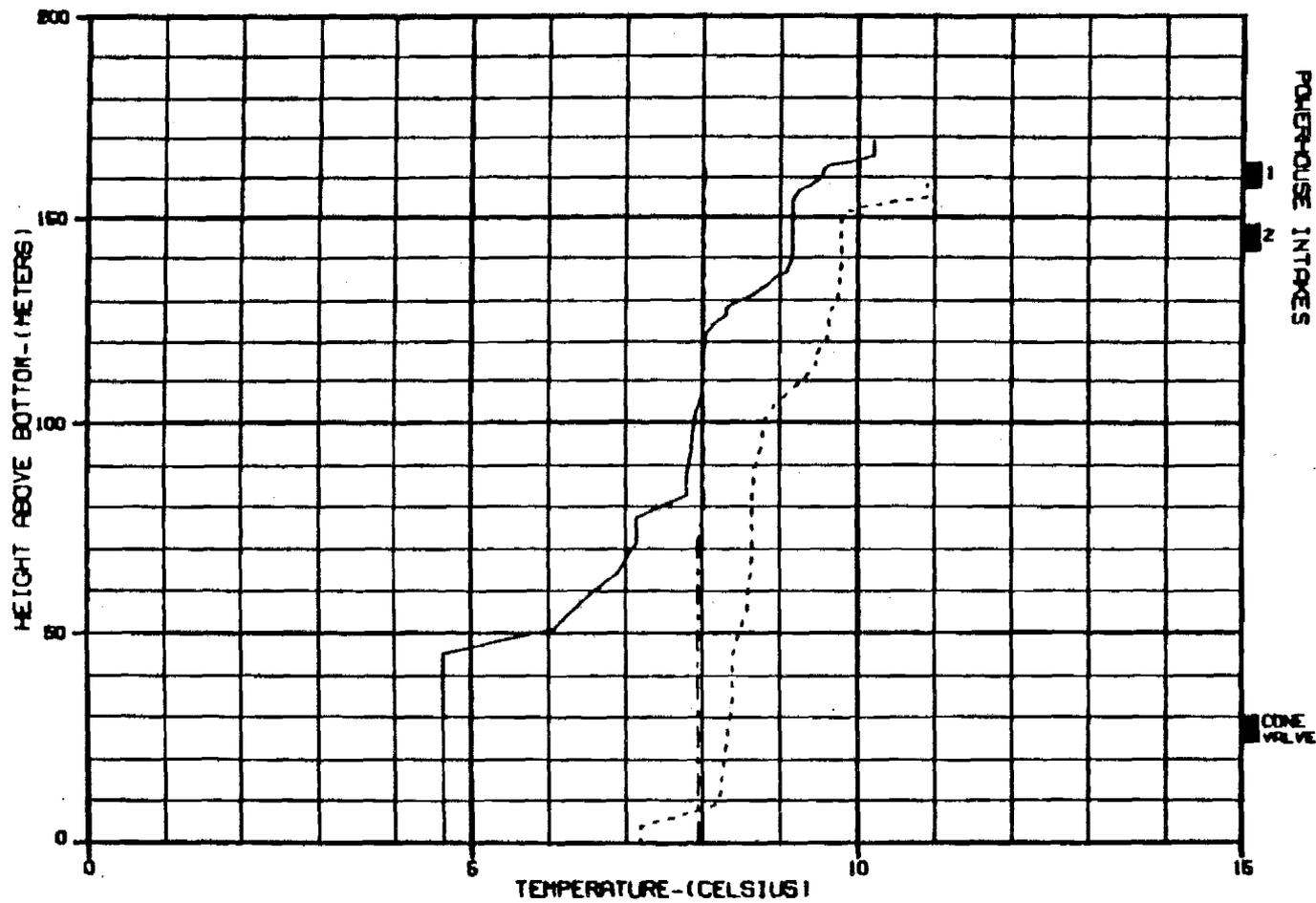
ALASKA POWER AUTHORITY

SUBMITTER PROJECT | OTHER PROJECT

DEVIL CANYON RESERVOIR
TEMPERATURE PROFILES

WARZA-EBRARD JOINT VENTURE

DESIGN NUMBER | DATE | REVISION



CASE: ■ DC7402A - DEVIL CANYON OPERATION WITH WATANA IN 2002 ■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

_____ | AUGUST 1974
 | SEPTEMBER 1974
 - - - - - | OCTOBER 1974

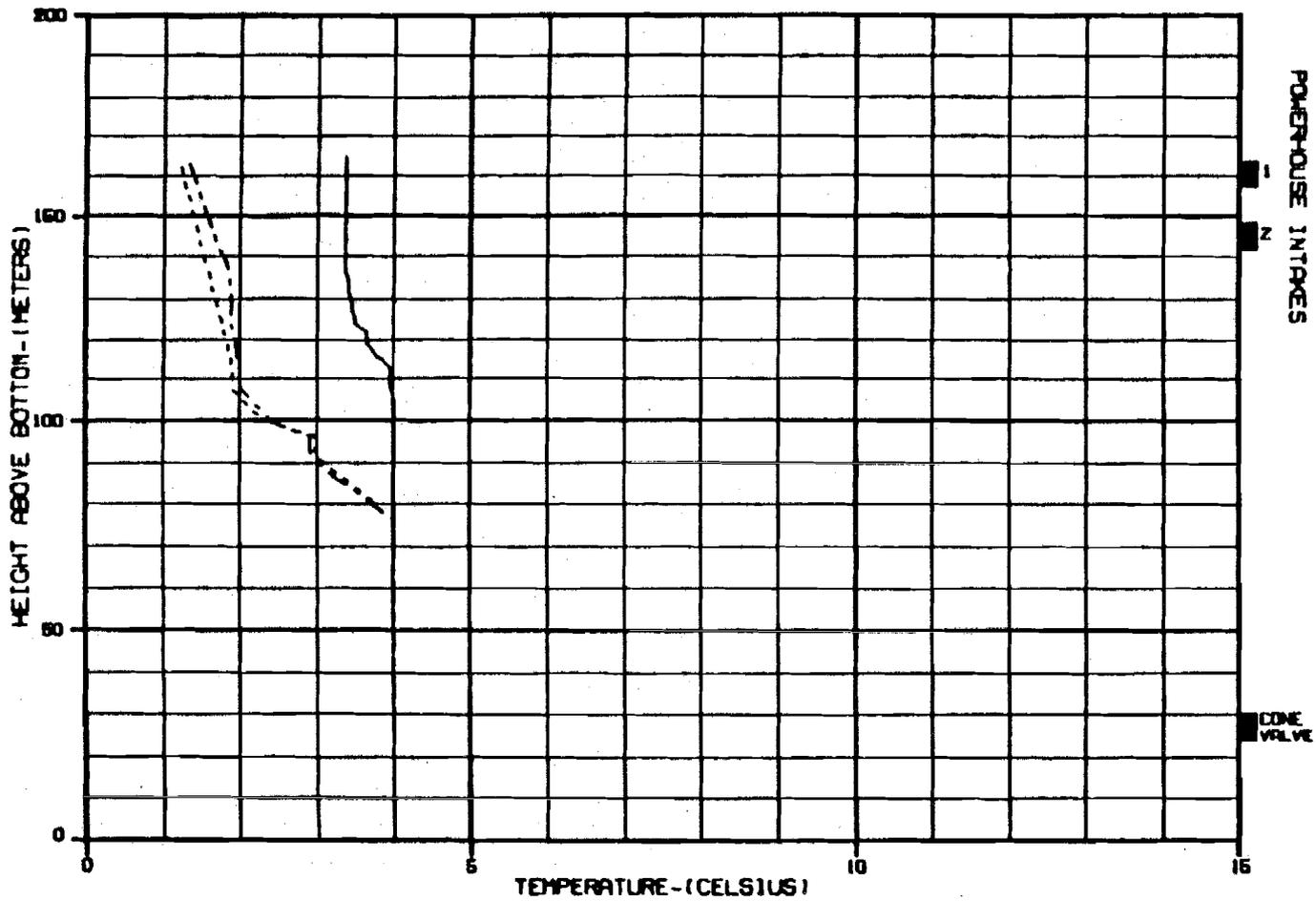
ALASKA POWER AUTHORITY

SUBMITTA PROJECT | DRAWING NO. 42

DEVIL CANYON RESERVOIR
TEMPERATURE PROFILES

HARZA-EBRARD JOINT VENTURE

PROJECT: DC7402A | DATE: 01-01-74 | 42-010-04



CASE: ■ DC7402A - DEVIL CANYON OPERATION WITH WATANA IN 2002 ■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

———— | NOVEMBER 1974
 - - - - - | DECEMBER 1974
 - · - · - | JANUARY 1975

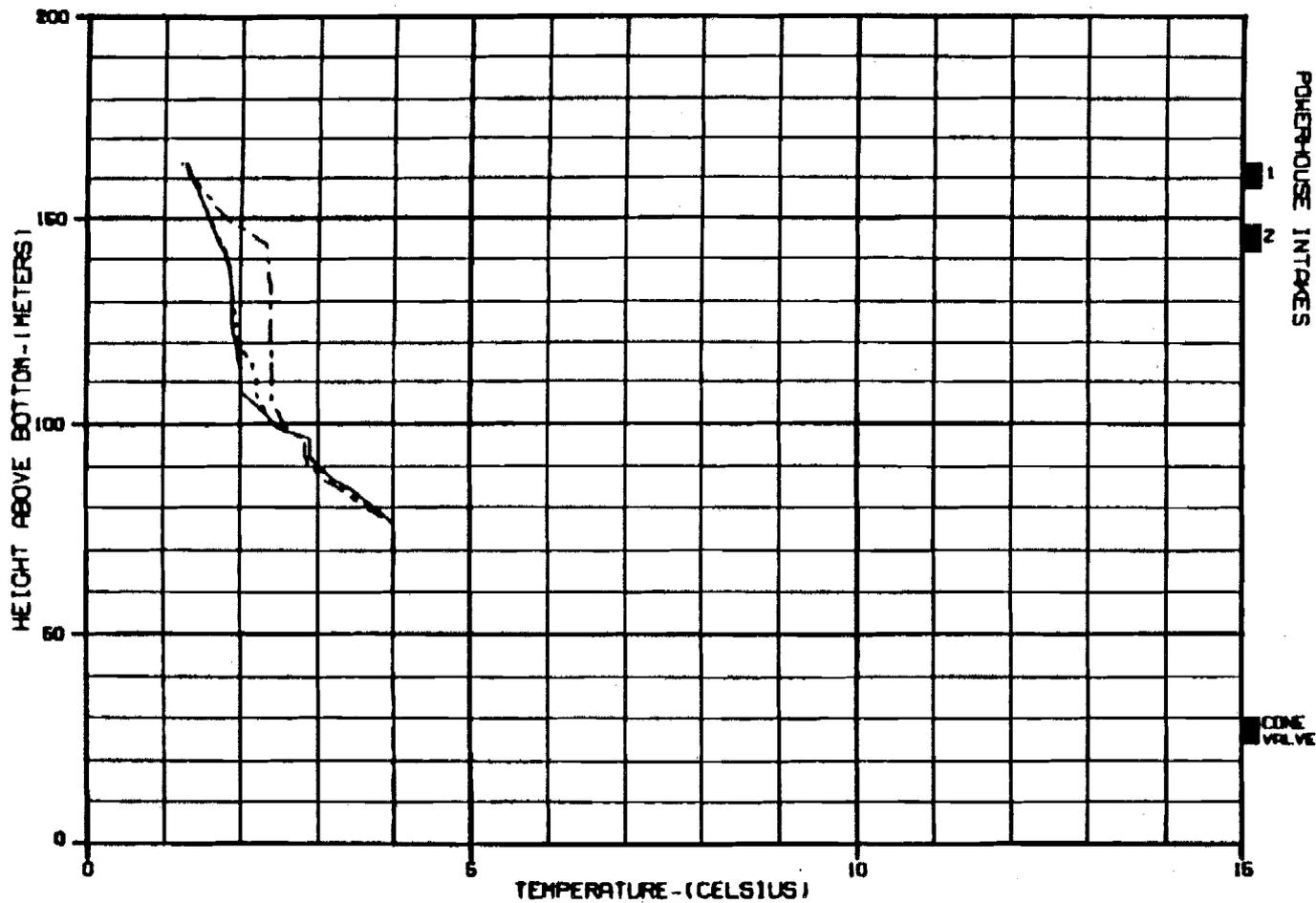
ALASKA POWER AUTHORITY

SUBMITTAL PROJECT OPERATIONAL

DEVIL CANYON RESERVOIR
TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

DESIGNED: S.L. PERRY 8 JAN 84 42-010-04



CASE: ■■ DC7402A - DEVIL CANYON OPERATION WITH WATANA IN 2002 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

———— 1 FEBRUARY 1975
 - - - - - 1 MARCH 1975
 - · - · - 1 APRIL 1975

ALASKA POWER AUTHORITY

DESIGN PROJECT DESIGN MODEL

DEVIL CANYON RESERVOIR
 TEMPERATURE PROFILES

WARZA-EBRACO JOINT VENTURE

CHANGES: 01-0000 8 JAN 84 02-010-04

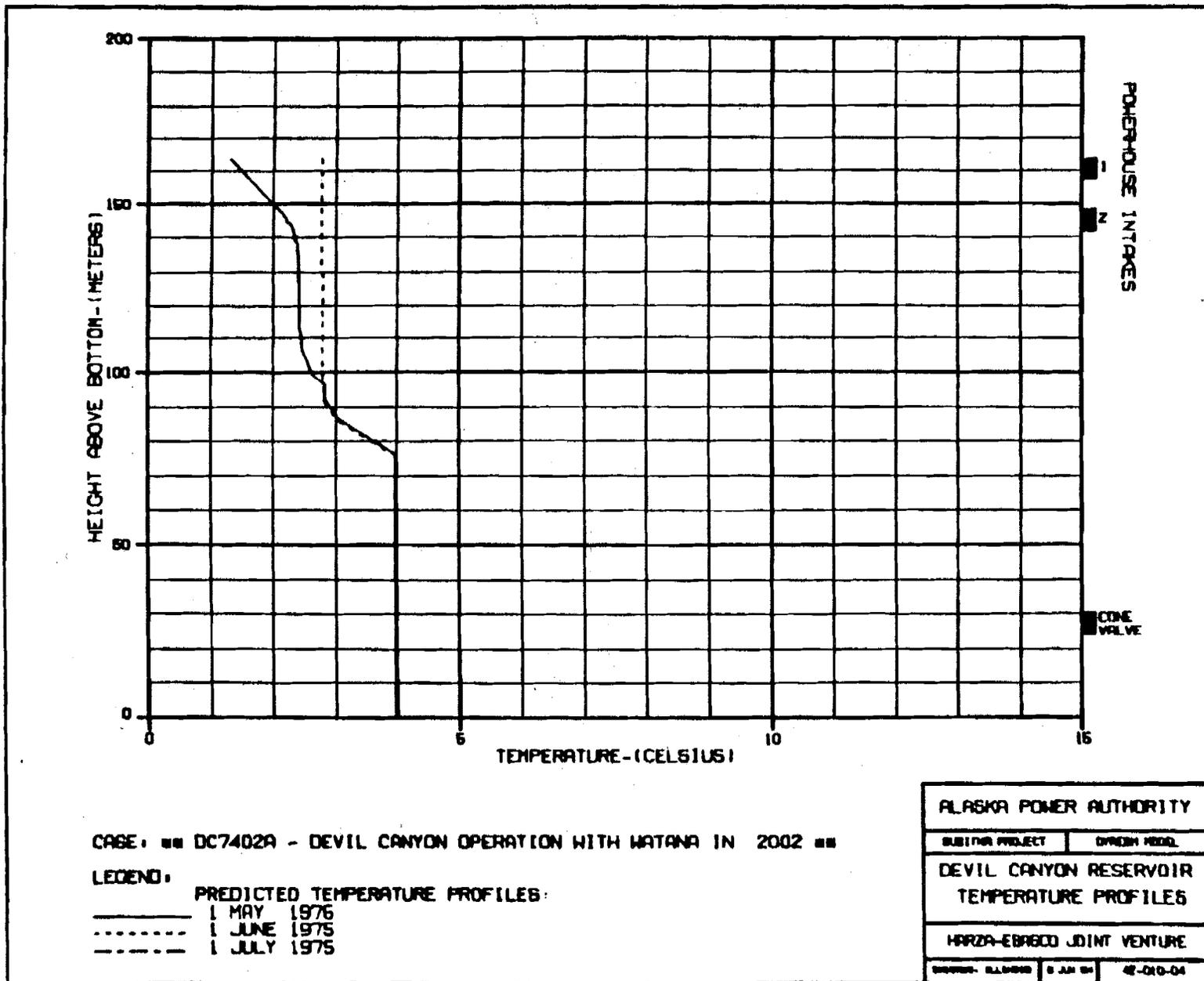
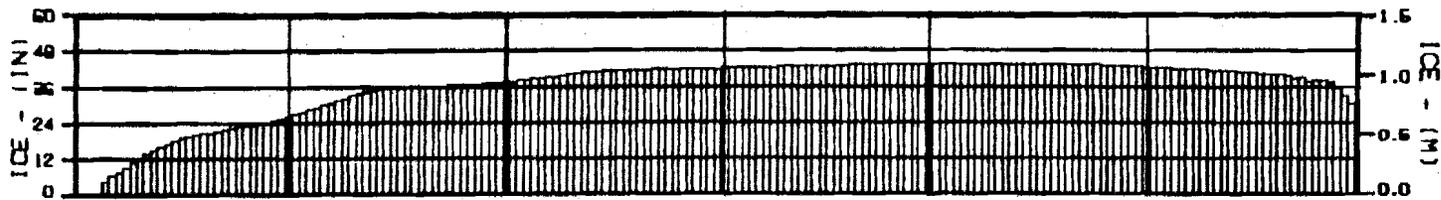
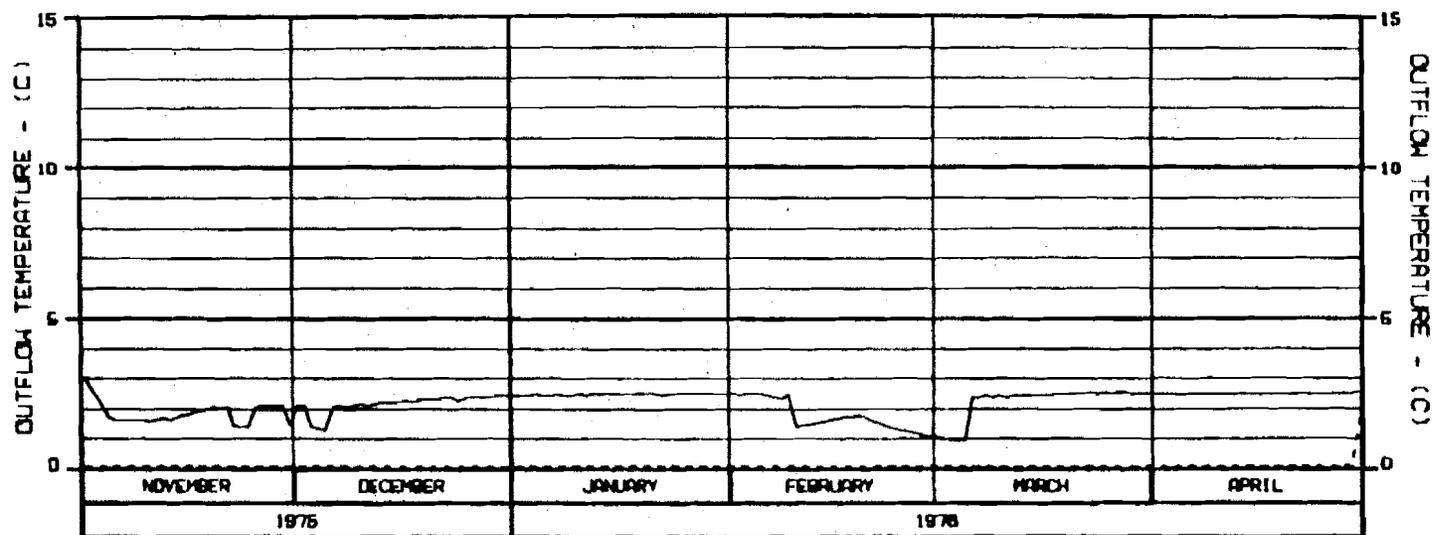


EXHIBIT AL



INTAKE	LEVEL 1					
	LEVEL 2					
CONE VALVE						
SPILLWAY						



LEGEND: CASE: ■ DC7602A - DEVIL CANYON OPERATION WITH MATANA IN 2002 ■■

— PREDICTED OUTFLOW TEMPERATURE FROM DEVIL CANYON RESERVOIR
 - - - - - INFLOW TEMPERATURE TO MATANA RESERVOIR

- NOTES: 1. INTAKE PORT LEVEL 1 AT ELEVATION 1426 FT (434.84 M)
 2. INTAKE PORT LEVEL 2 AT ELEVATION 1376 FT (419.10 M)
 3. CONE VALVE AT ELEVATION 990 FT (301.76 M)
 4. SPILLWAY CREST AT ELEVATION 1404 FT (427.94 M)

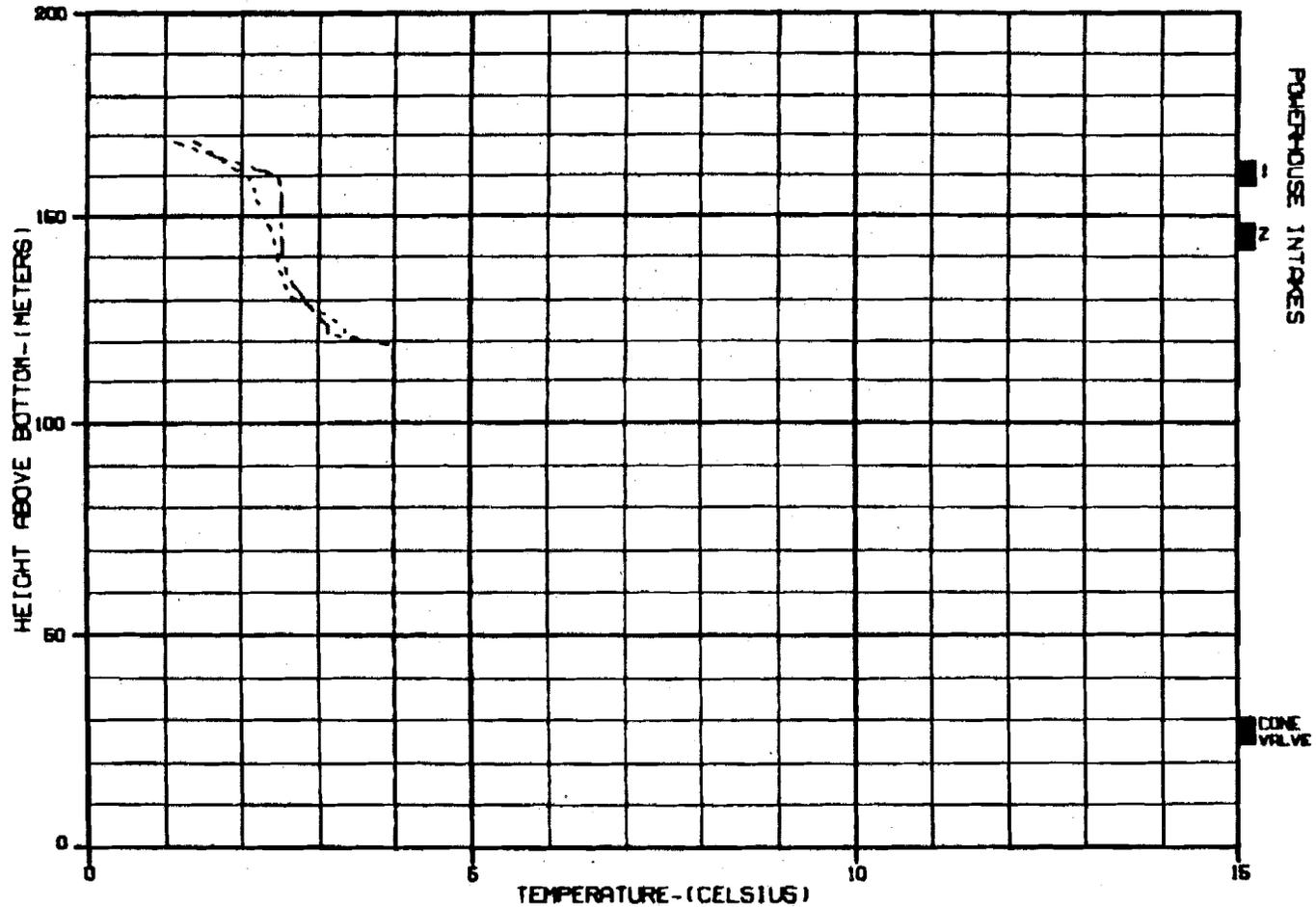
ALASKA POWER AUTHORITY

BUILDING PROJECT DYNOM MODEL

DEVIL CANYON RESERVOIR
 OUTFLOW TEMPERATURE
 AND ICE GROWTH

HARZA-EBASCO JOINT VENTURE

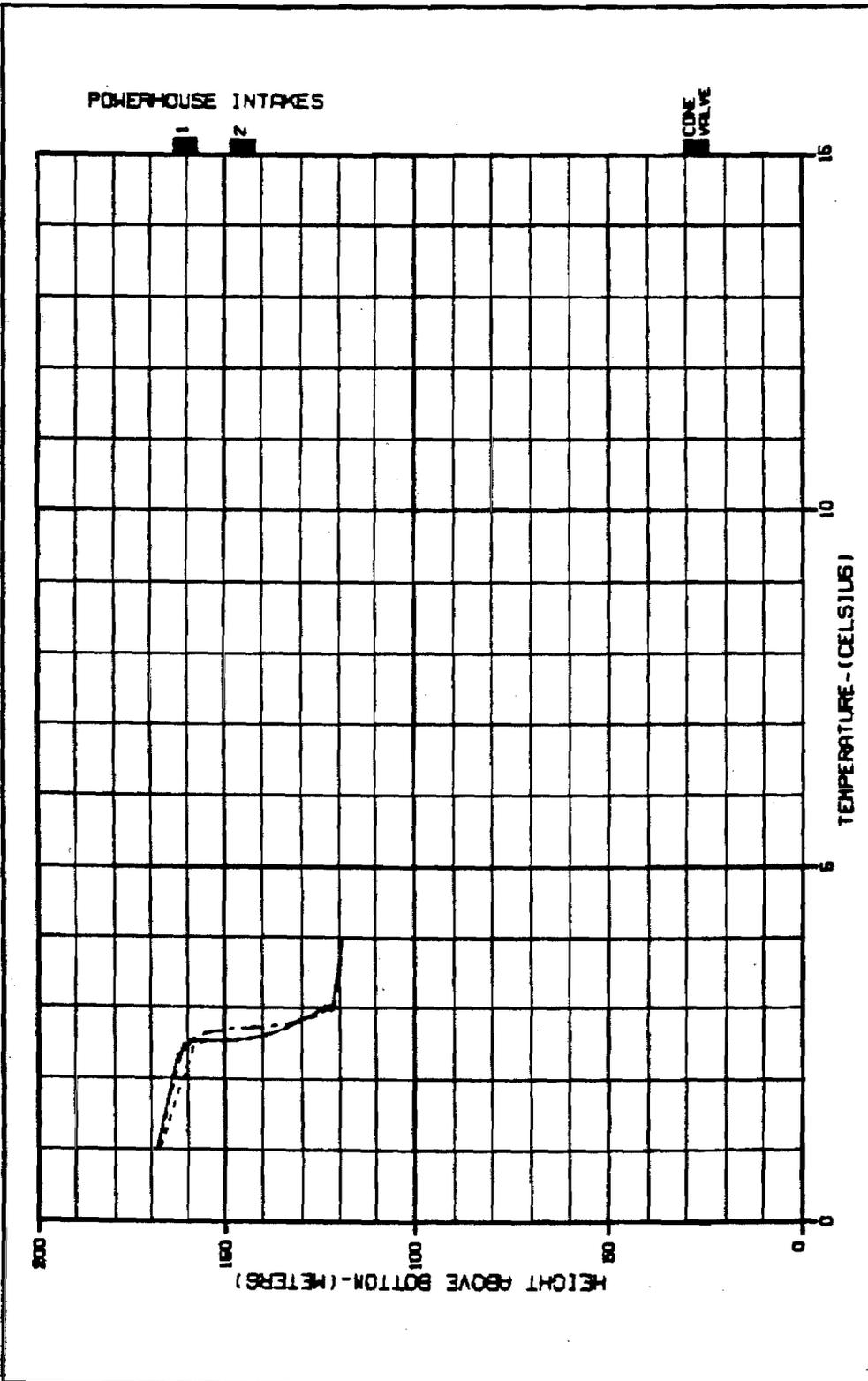
CHARTED: 04.09.02 9 JUN 04 1000.107.04.010-04



CASE: ■■■ DC7602A - DEVIL CANYON OPERATION WITH WATANA IN 2002 ■■■

LEGEND: PREDICTED TEMPERATURE PROFILES:
 ———— | NOVEMBER 1976
 - - - - - | DECEMBER 1976
 - · - · - | JANUARY 1976

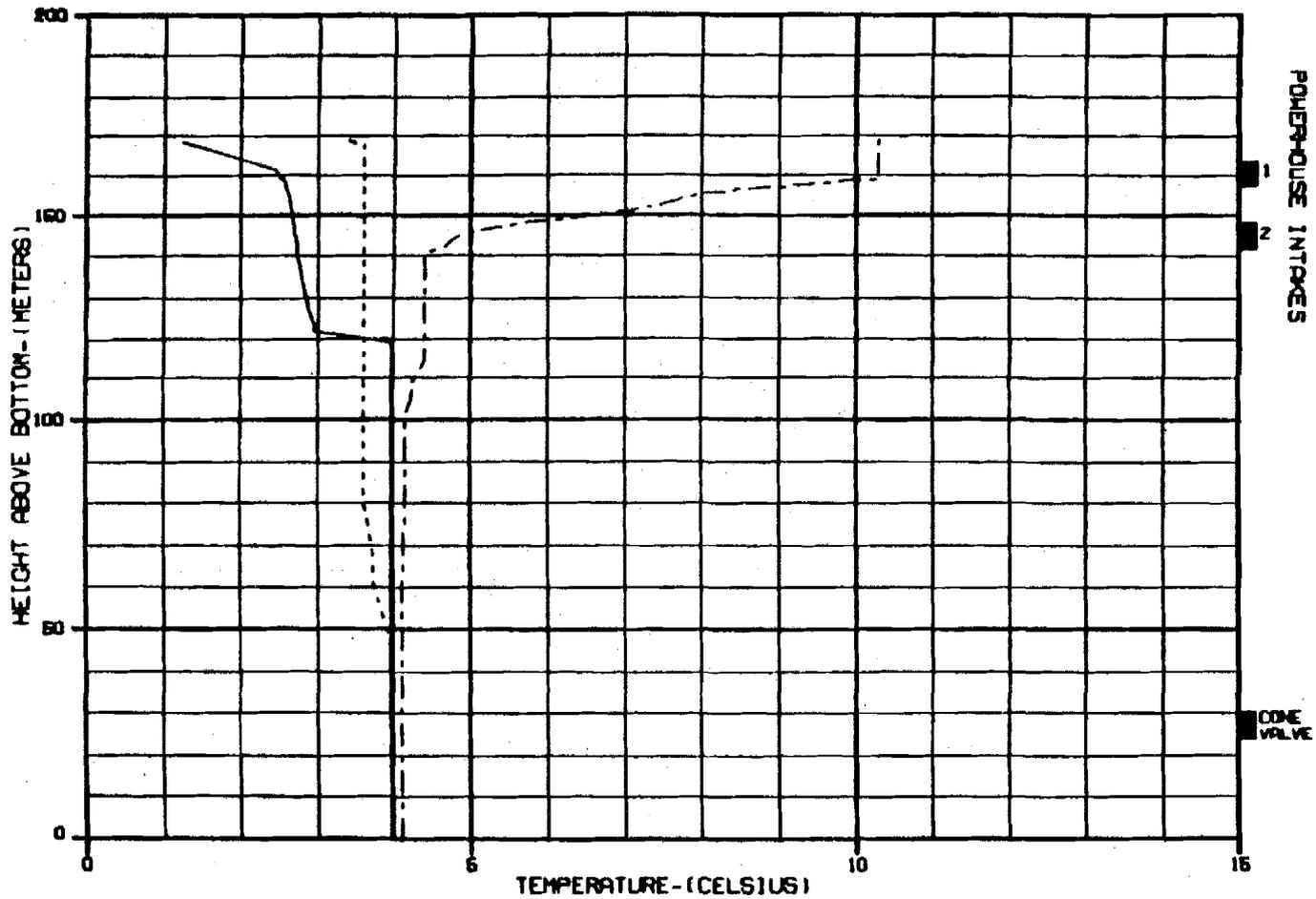
ALASKA POWER AUTHORITY		
SUBMITTA PROJECT	OPERATION MANUAL	
DEVIL CANYON RESERVOIR TEMPERATURE PROFILES		
HARZA-EBRACO JOINT VENTURE		
OWNER: ALPACOR	DATE: JAN 84	REV: 010-04



ALASKA POWER AUTHORITY	
RELATION PROJECT	DESIGN MODEL
DEVIL CANYON RESERVOIR	
TEMPERATURE PROFILES	
HARZA-EMESCO JOINT VENTURE	
DATE	BY
02-01-04	02-01-04

CASE: ■■ DC7602A - DEVIL CANYON OPERATION WITH WATANA IN 2002 ■■

LEGEND:
 — PREDICTED TEMPERATURE PROFILES:
 - - - - - 1 FEBRUARY 1976
 - - - - - 1 MARCH 1976
 - - - - - 1 APRIL 1976



CASE: ■■ DC7802A - DEVIL CANYON OPERATION WITH WATANA IN 2002 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

- MAY 1976
- - - JUNE 1976
- · - · JULY 1976

ALASKA POWER AUTHORITY

DEVELOPMENT PROJECT

DYNDRA MODEL

DEVIL CANYON RESERVOIR
TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

ISSUED: 01-08-88

0 JAN 88

42-010-04



CASE: ■■■ DC7602A - DEVIL CANYON OPERATION WITH WATANA IN 2002 ■■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

——— 1 AUGUST 1976
 1 SEPTEMBER 1976
 - - - - 1 OCTOBER 1976

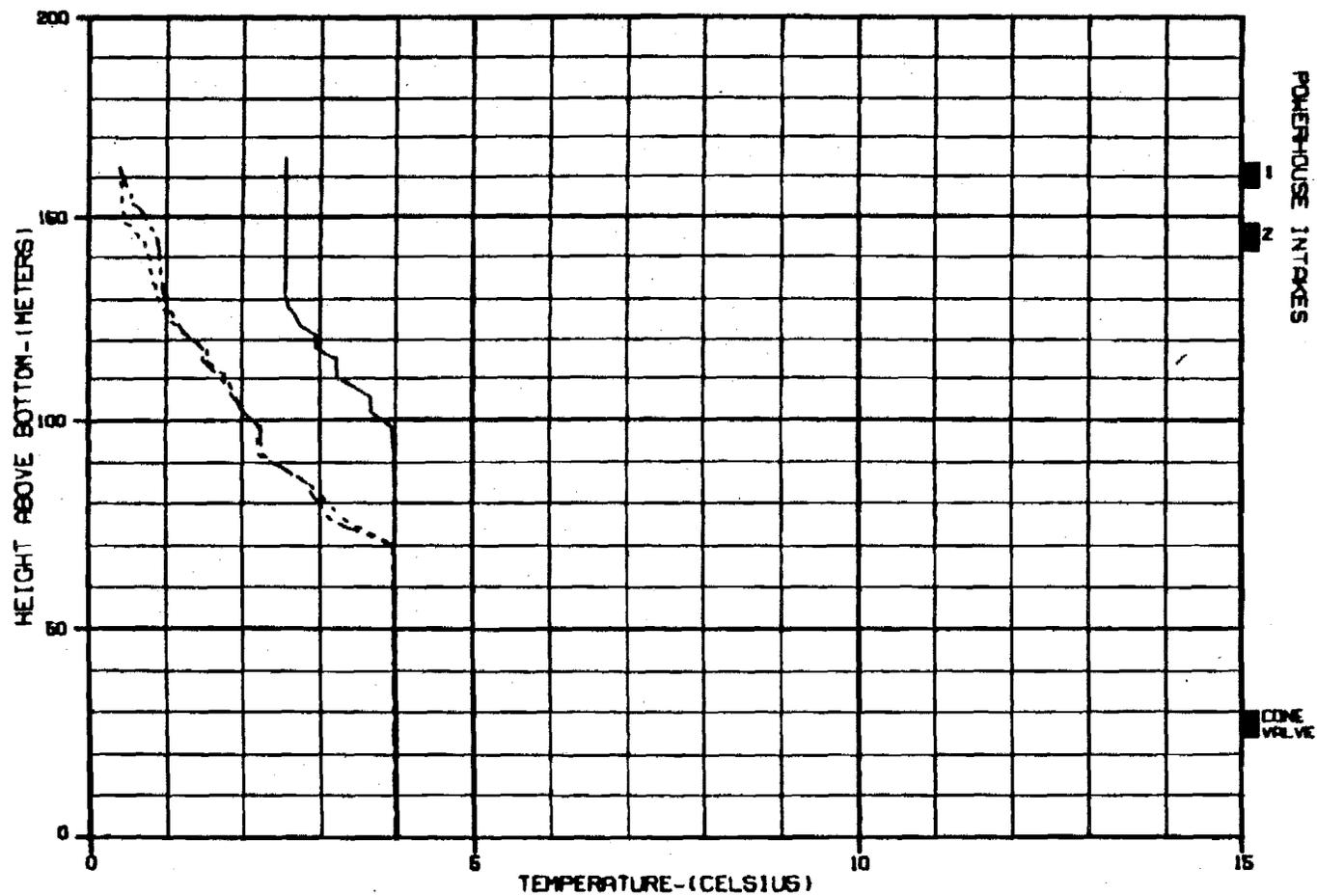
ALASKA POWER AUTHORITY

DEVELOPER PROJECT OPERATOR

DEVIL CANYON RESERVOIR
TEMPERATURE PROFILES

WARZA-EBASCO JOINT VENTURE

DATE: 11/19/88 8:41 AM 42-010-04



CASE: ■■ DC7802A - DEVIL CANYON OPERATION WITH WATANA IN 2002 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

— 1 NOVEMBER 1976
 - - - 1 DECEMBER 1976
 - · - 1 JANUARY 1977

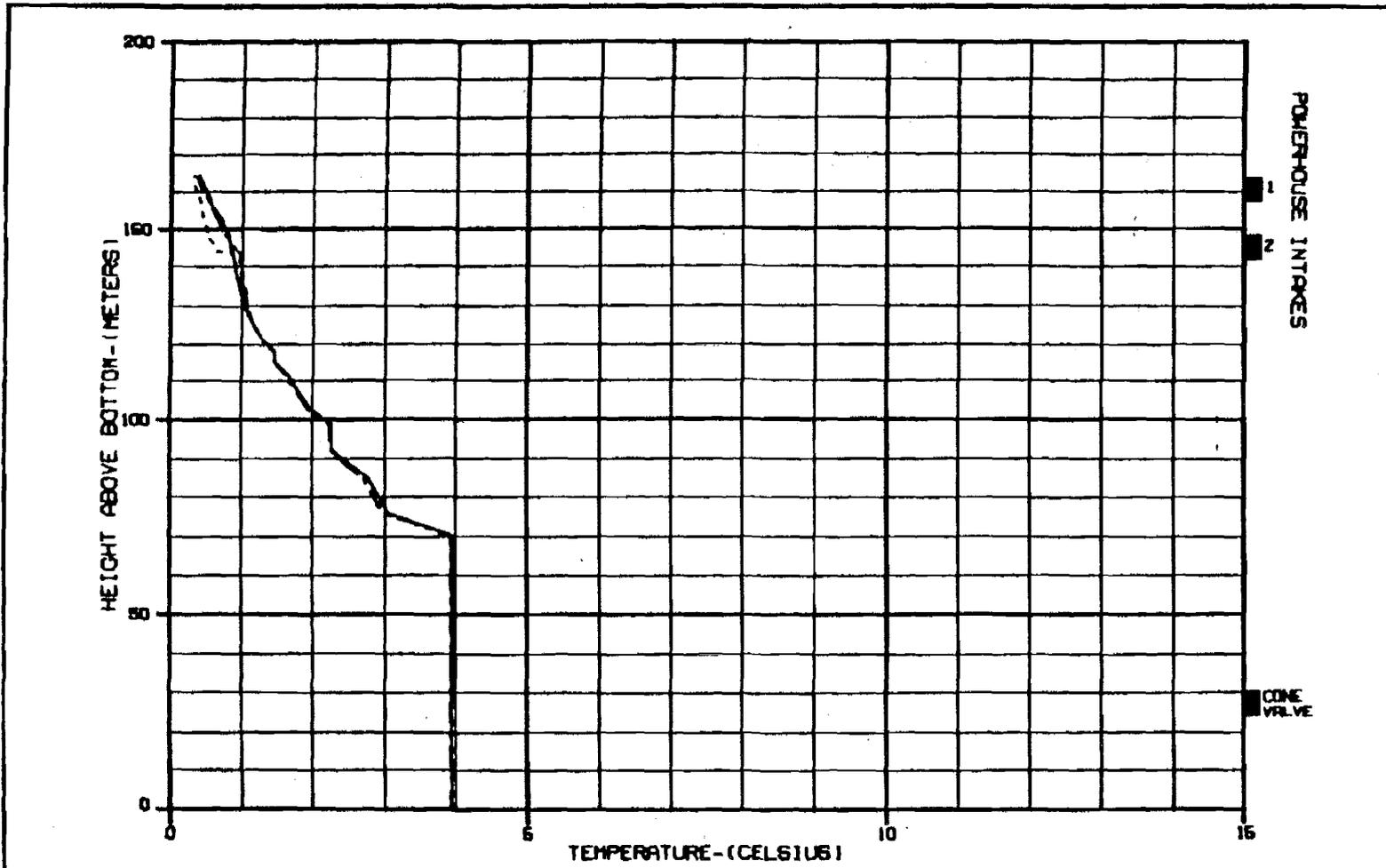
ALASKA POWER AUTHORITY

QUESTA PROJECT OPERA REGR.

DEVIL CANYON RESERVOIR
 TEMPERATURE PROFILES

WARZA-EBRACO JOINT VENTURE

DRAWN: J.L.P. 8 JAN 84 42-010-04

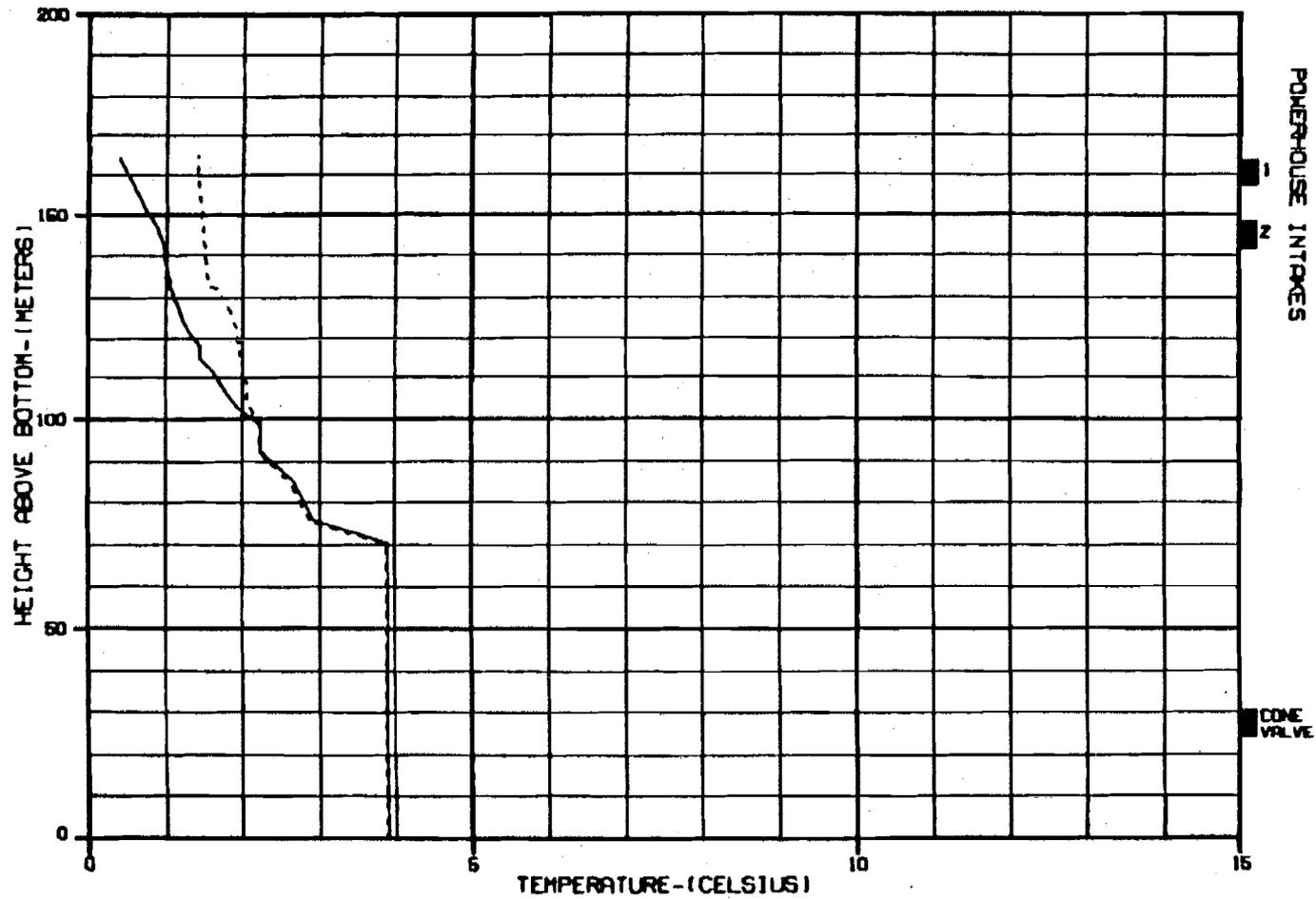


CASE: ■■ DC7802A - DEVIL CANYON OPERATION WITH WATANA IN 2002 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:
 ———— | FEBRUARY 1977
 - - - - - | MARCH 1977
 - - - - - | APRIL 1977

ALASKA POWER AUTHORITY	
SUBMITTER PROJECT	DIVISION MODEL
DEVIL CANYON RESERVOIR TEMPERATURE PROFILES	
WARZA-EBASCO JOINT VENTURE	
UNIFIED: ALL DATA	8 JUN 84 42-010-04

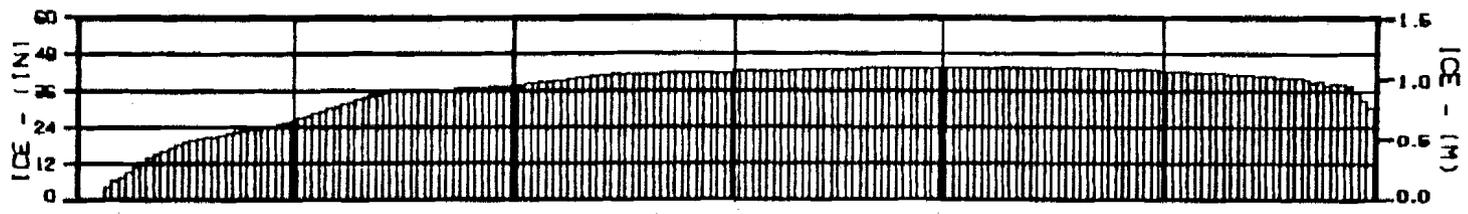


CASE: ■■ DC7602A - DEVIL CANYON OPERATION WITH WATANA IN 2002 ■■

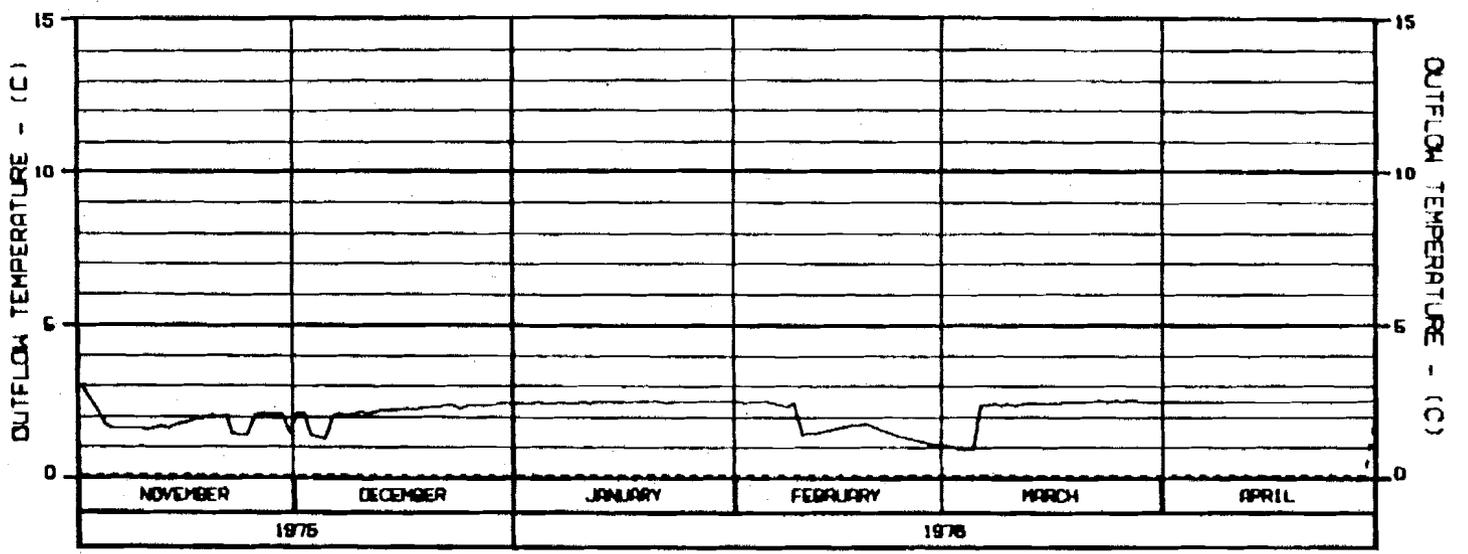
LEGEND: PREDICTED TEMPERATURE PROFILES:
 ———— | MAY 1977
 - - - - - | JUNE 1977
 - · - · - | JULY 1977

ALASKA POWER AUTHORITY	
DISTRICT PROJECT	SYSTEM NEED
DEVIL CANYON RESERVOIR TEMPERATURE PROFILES	
WARZA-EBRACO JOINT VENTURE	
DESIGNED: B.L. GIBSON	8 JUN 78
	47-010-04

EXHIBIT AL



INTAKE	LEVEL 1				
	LEVEL 2				
CONE VALVE					
SPILLWAY					



LEGEND: CASE: DC7602A - DEVIL CANYON OPERATION WITH MATANA IN 2002

———— PREDICTED OUTFLOW TEMPERATURE FROM DEVIL CANYON RESERVOIR
 - - - - - INFLOW TEMPERATURE TO MATANA RESERVOIR

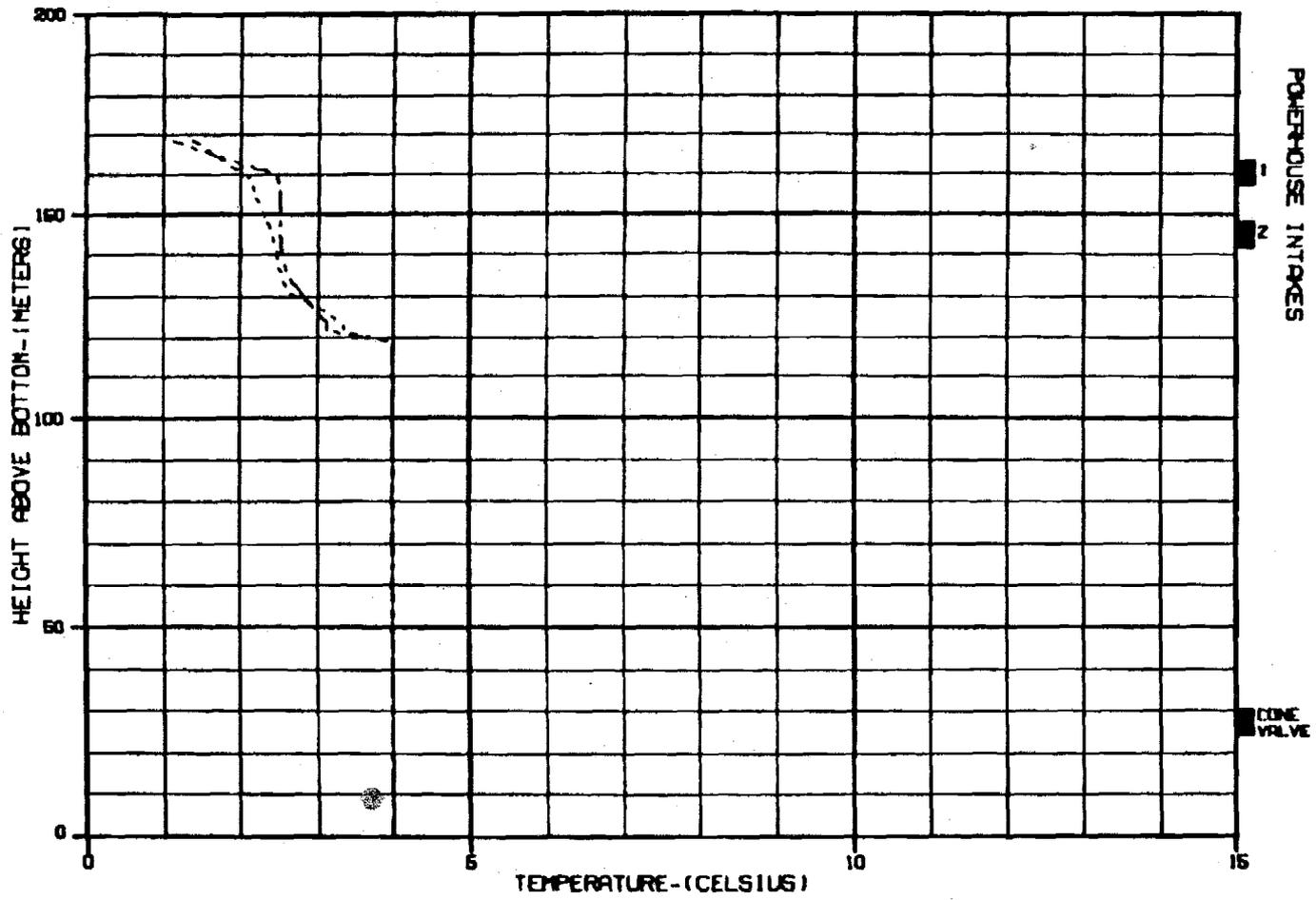
- NOTES:
1. INTAKE PORT LEVEL 1 AT ELEVATION 1426 FT (434.24 M)
 2. INTAKE PORT LEVEL 2 AT ELEVATION 1276 FT (419.10 M)
 3. CONE VALVE AT ELEVATION 990 FT (301.75 M)
 4. SPILLWAY CREST AT ELEVATION 1404 FT (427.94 M)

ALASKA POWER AUTHORITY

SUBMITTA PROJECT DYNEM MODEL
 DEVIL CANYON RESERVOIR
 OUTFLOW TEMPERATURE
 AND ICE GROWTH

HARZA-EBASCO JOINT VENTURE

DESIGNED BY: J. J. ... 8 JAN 84 ...



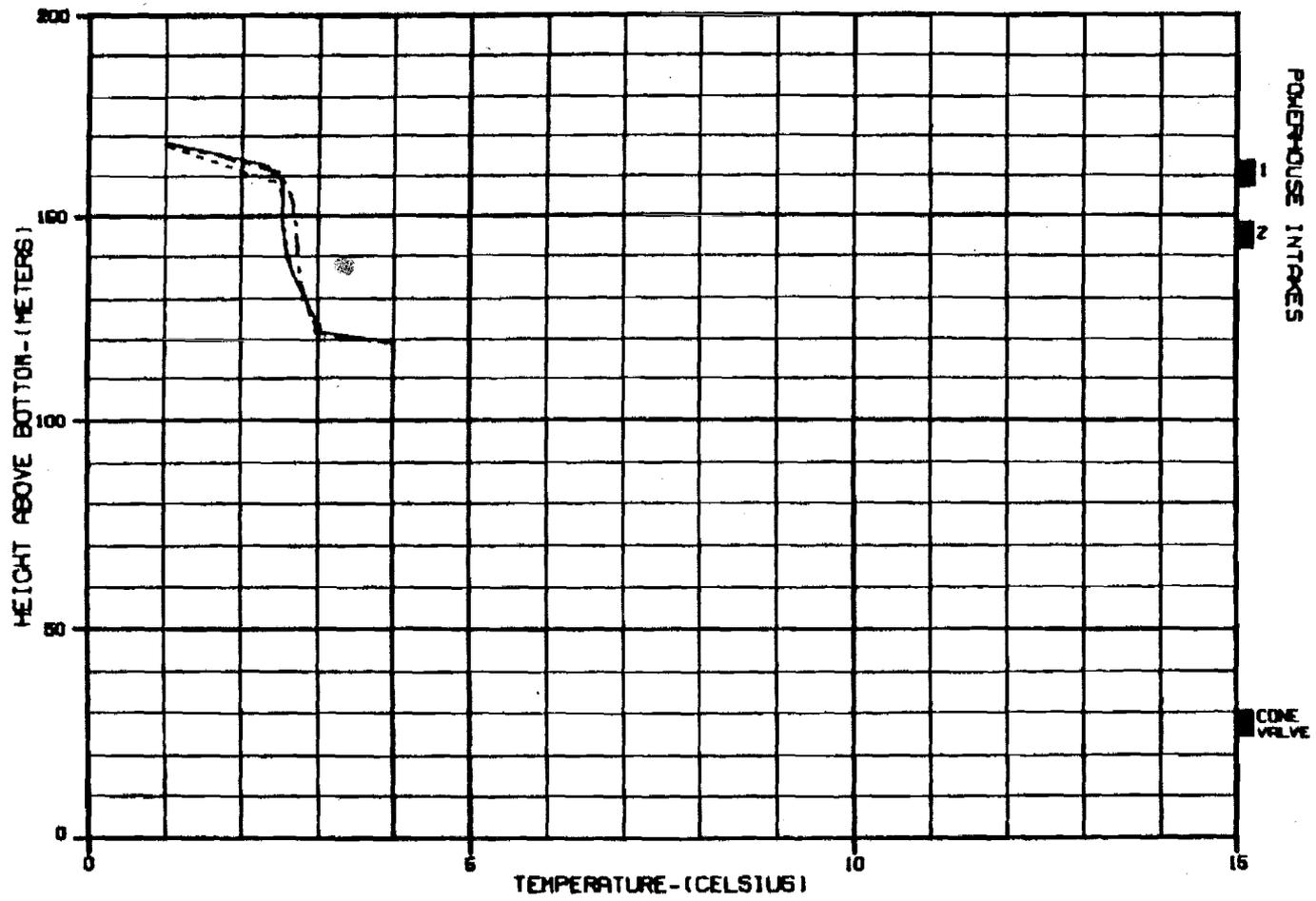
CASE: ■■ DC7602A - DEVIL CANYON OPERATION WITH MATANA IN 2002 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

- | NOVEMBER 1975
- | DECEMBER 1975
- · - · - · | JANUARY 1975

ALASKA POWER AUTHORITY		
SUBMITTER PROJECT	OPERATION MODEL	
DEVIL CANYON RESERVOIR TEMPERATURE PROFILES		
WARZA-EBRISCO JOINT VENTURE		
DESIGNER: B.L. BROWN	8 JAN 84	42-010-04

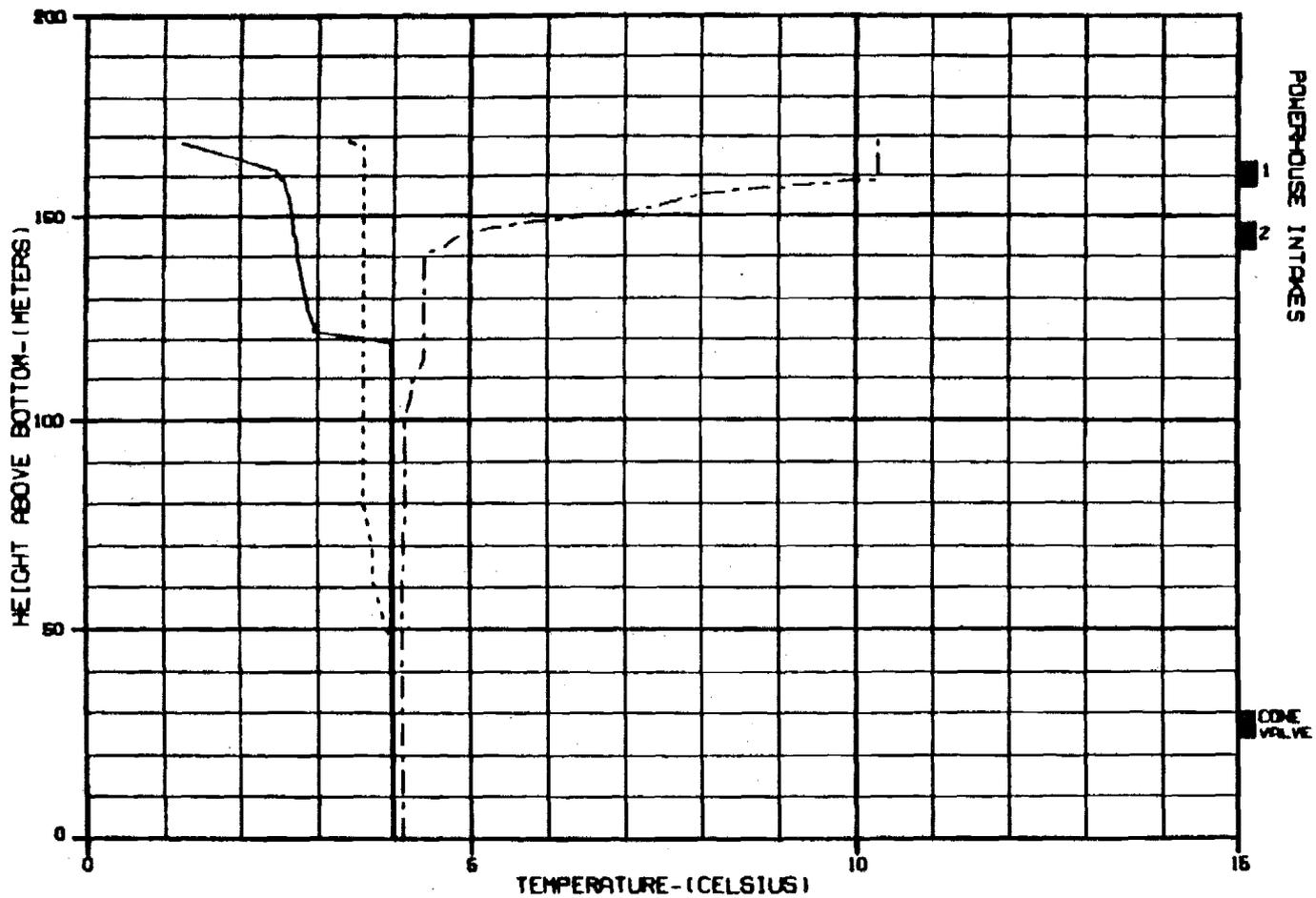


CASE: ■■ DC7602A - DEVIL CANYON OPERATION WITH WATANA IN 2002 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:
 ———— | FEBRUARY 1976
 - - - - - | MARCH 1976
 ········ | APRIL 1976

ALASKA POWER AUTHORITY	
SUBMITTER PROJECT	DESIGN NO.
DEVIL CANYON RESERVOIR TEMPERATURE PROFILES	
WARZA-EBR600 JOINT VENTURE	
ISSUED: 11/28/88	42-010-04



CASE: ■■ DC7602A - DEVIL CANYON OPERATION WITH WATANA IN 2002 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

— MAY 1976
 JUNE 1976
 - - - - JULY 1976

ALASKA POWER AUTHORITY

DEVELOPER PROJECT DIVISION MODEL

DEVIL CANYON RESERVOIR
 TEMPERATURE PROFILES

HARZA-EBRISCO JOINT VENTURE

DESIGNER: J.L. BROWN DRAWN BY: J.M. SMITH DATE: 02-01-04



CASE: DC7602A - DEVIL CANYON OPERATION WITH HATANA IN 2002

LEGEND:

PREDICTED TEMPERATURE PROFILES:

——— AUGUST 1976
 - - - - - SEPTEMBER 1976
 OCTOBER 1976

ALASKA POWER AUTHORITY

SUBMITTA PROJECT

DRAWING NO.

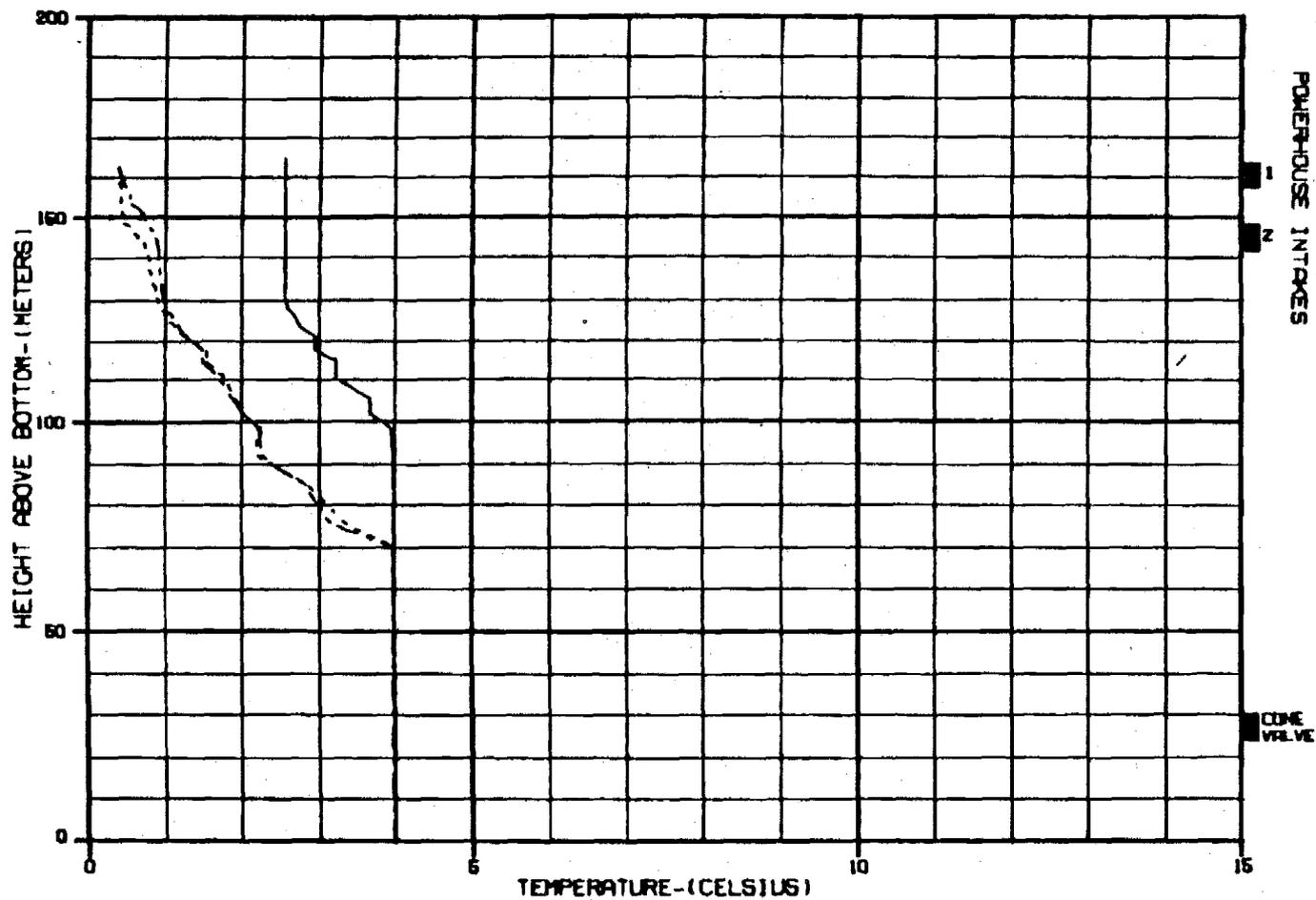
DEVIL CANYON RESERVOIR
TEMPERATURE PROFILES

WARZA-EBRISCO JOINT VENTURE

DESIGNED BY: J. J. POSE

DATE: JAN 84

42-010-04



CASE: ■■ DC7802A - DEVIL CANYON OPERATION WITH WATANA IN 2002 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

———— | NOVEMBER 1976
 | DECEMBER 1976
 - - - - | JANUARY 1977

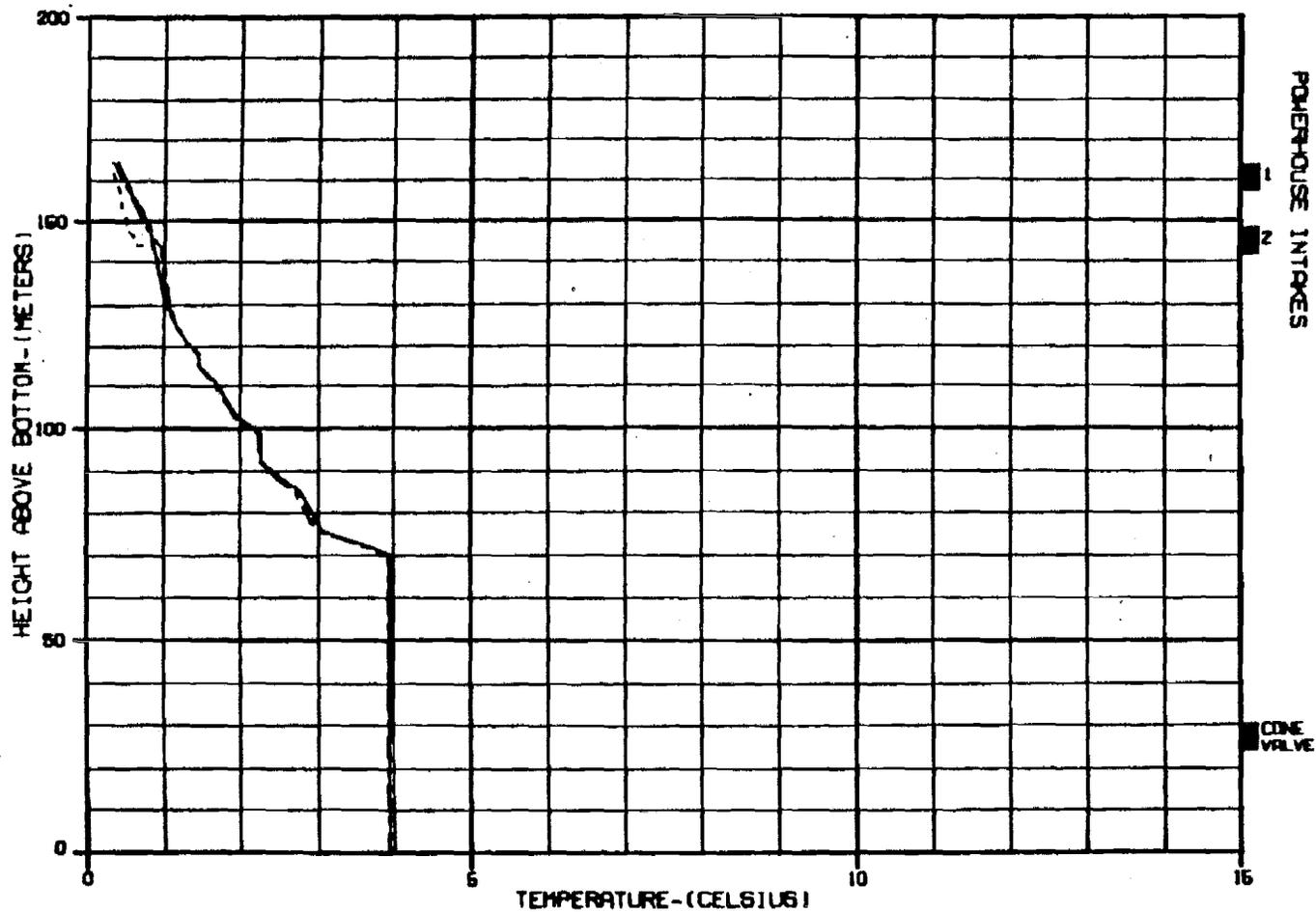
ALASKA POWER AUTHORITY

SUBMITTA PROJECT | OPENING HEAD

DEVIL CANYON RESERVOIR
TEMPERATURE PROFILES

HARZA-EBRACCO JOINT VENTURE

DATE: 11/20/88 8 JAN 89 42-018-04



CASE: ■■ DC7602A - DEVIL CANYON OPERATION WITH MATANA IN 2002 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

— 1 FEBRUARY 1977
 1 MARCH 1977
 - - - - 1 APRIL 1977

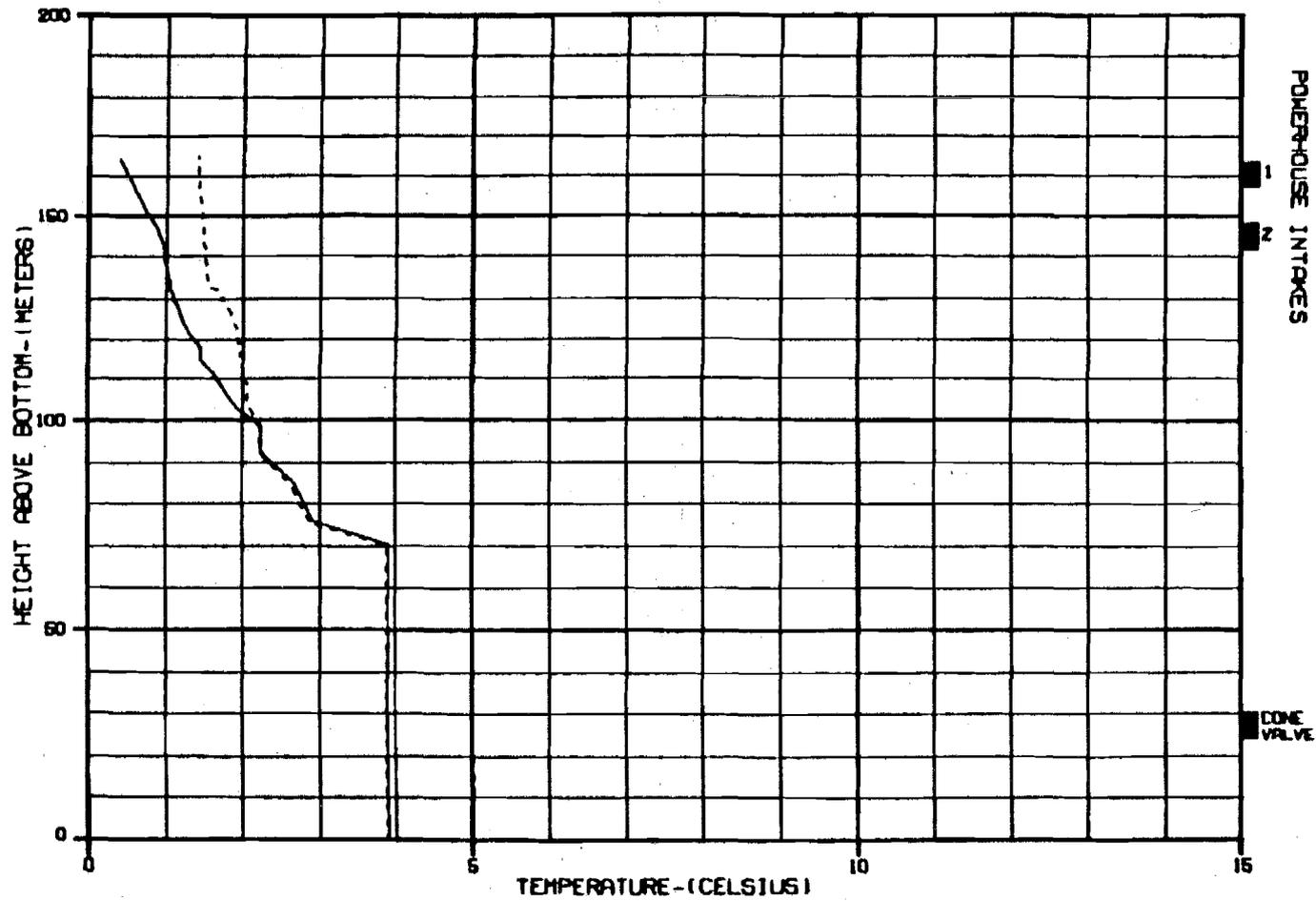
ALASKA POWER AUTHORITY

DEVELOPER PROJECT DESIGN MODEL

DEVIL CANYON RESERVOIR
 TEMPERATURE PROFILES

HARZA-EBAGCO JOINT VENTURE

DESIGNED: ELLIOTT 8 JUN 77 22-010-04



CASE: ■■ DC7802A - DEVIL CANYON OPERATION WITH WATANA IN 2002 ■■

LEGEND: PREDICTED TEMPERATURE PROFILES.
 ——— 1 MAY 1977
 - - - - 1 JUNE 1977
 ······ 1 JULY 1977

ALASKA POWER AUTHORITY

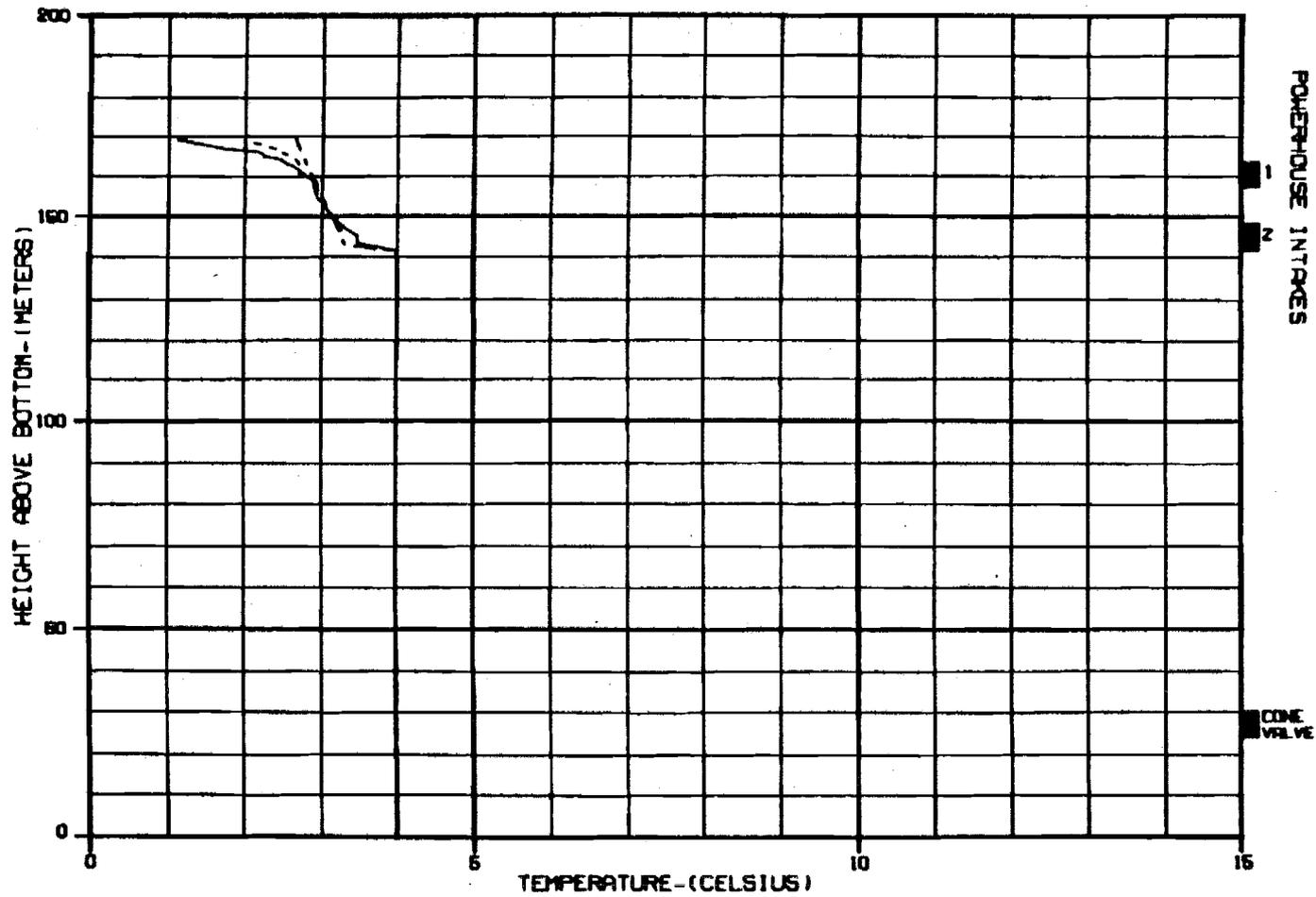
EXISTING PROJECT OPERATING MODEL

DEVIL CANYON RESERVOIR
TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

ENCLOSURE: 5.1.0000 8 JAN 84 42-010-04

EXHIBIT AM



CASE: ■■ DCB1182102D - DEVIL CANYON OPERATION WITH WATANA IN 2002 ■■
 - WATANA WEATHER STATION DATA

LEGEND:

PREDICTED TEMPERATURE PROFILES:

— | FEBRUARY 1982
 - - - | MARCH 1982
 - · - · | APRIL 1982

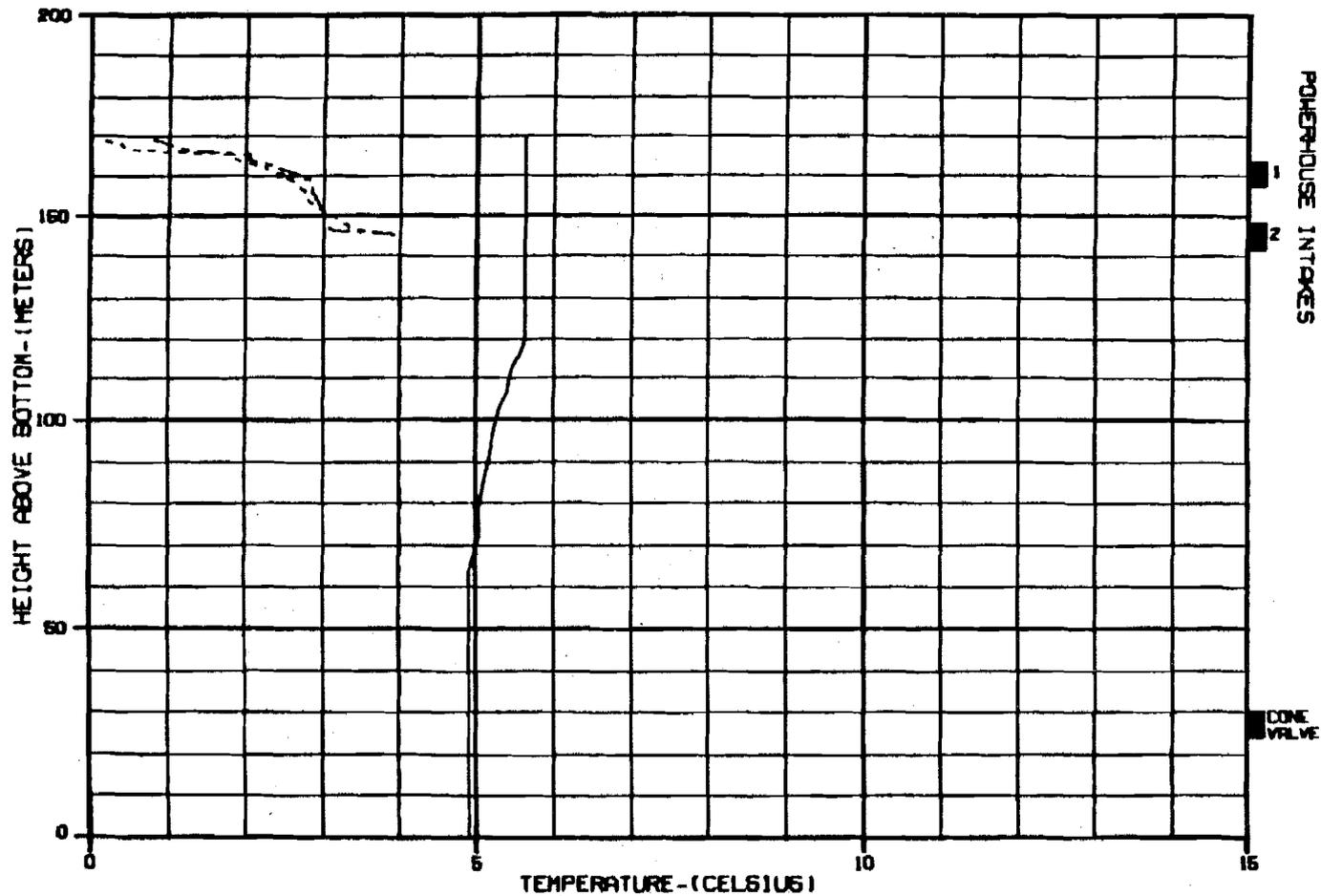
ALASKA POWER AUTHORITY

SUBMITTAL PROJECT DIVISION HEAD

DEVIL CANYON RESERVOIR
 TEMPERATURE PROFILES

HARZA-EBRSCO JOINT VENTURE

WORKSHEET: 1 JAN 82 42-010-04



CASE: DCB1182102D - DEVIL CANYON OPERATION WITH WATANA IN 2002
 - WATANA WEATHER STATION DATA

LEGEND:

PREDICTED TEMPERATURE PROFILES:

— 1 NOVEMBER 1981
 - - - 1 DECEMBER 1981
 - · - · 1 JANUARY 1982

ALASKA POWER AUTHORITY

DISTRIBUTION PROJECT

DIVISION MODEL

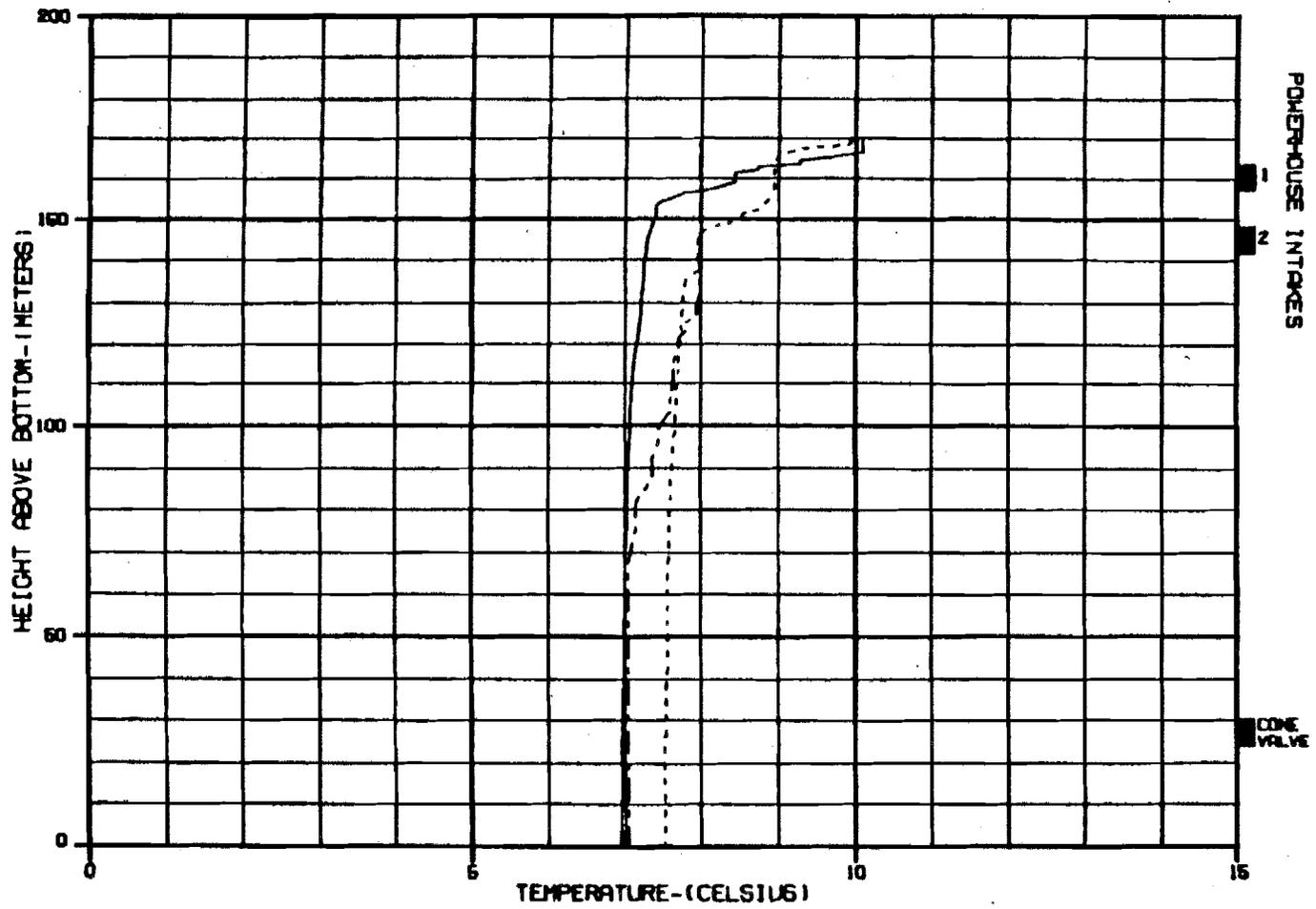
DEVIL CANYON RESERVOIR
 TEMPERATURE PROFILES

MARZA-EBASCO JOINT VENTURE

OWNER: ALASKA

7 JAN 81

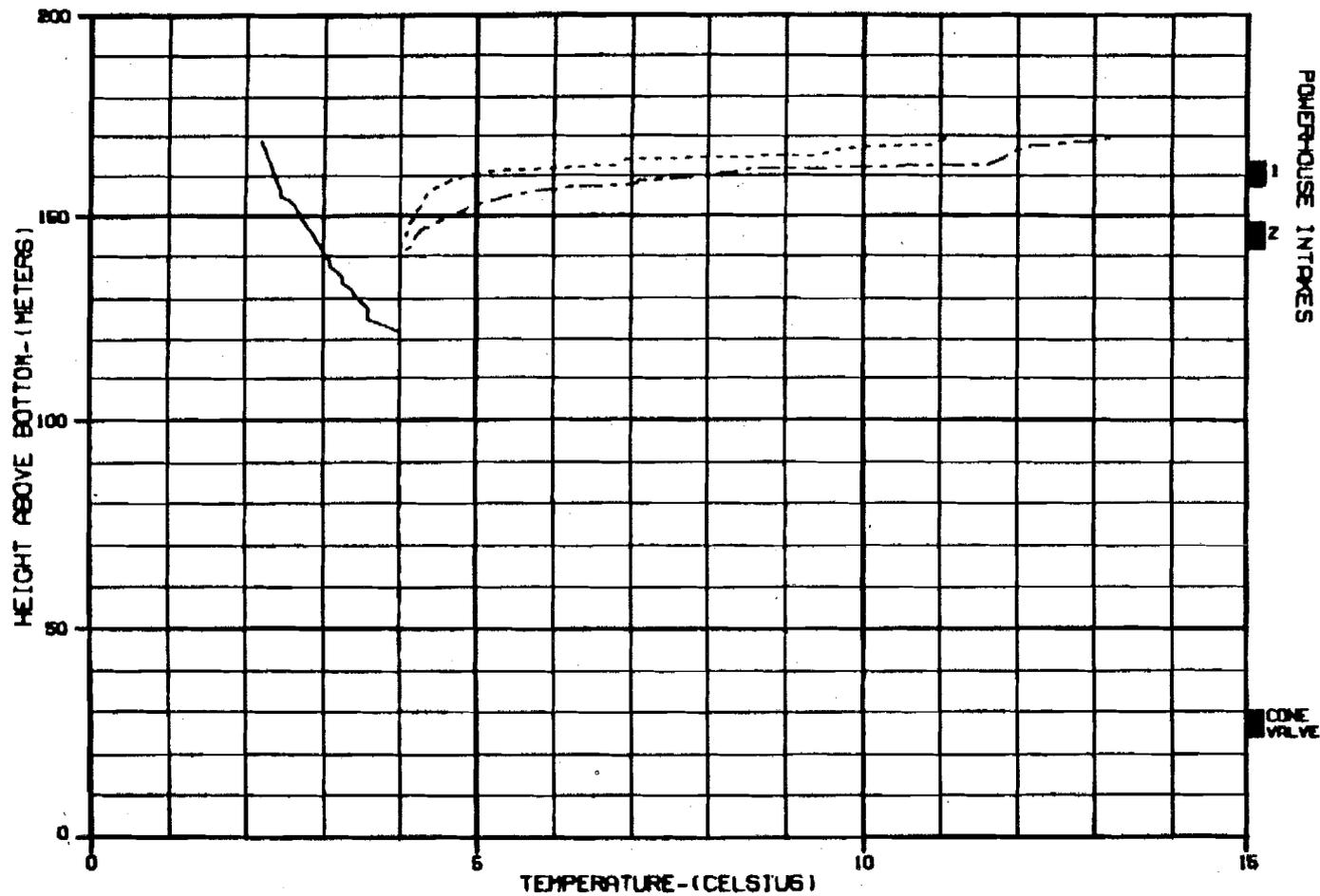
42-010-04



CASE: ■■ DCB1182102D - DEVIL CANYON OPERATION WITH NATANA IN 2002 ■■
 - NATANA WEATHER STATION DATA

LEGEND: PREDICTED TEMPERATURE PROFILES:
 ———— | AUGUST 1981
 | SEPTEMBER 1981
 - - - - | OCTOBER 1981

ALASKA POWER AUTHORITY		
SUBMITTA PROJECT	OFFEROR MODEL	
DEVIL CANYON RESERVOIR TEMPERATURE PROFILES		
HARZA-EBASCO JOINT VENTURE		
ISSUES: 54-288	7 JAN 81	4E-010-04



CASE: ■■ DC01182102D - DEVIL CANYON OPERATION WITH WATANA IN 2002 ■■
 - WATANA WEATHER STATION DATA

LEGEND:

PREDICTED TEMPERATURE PROFILES:

———— 1 MAY 1981
 - - - - - 1 JUNE 1981
 - · - · - 1 JULY 1981

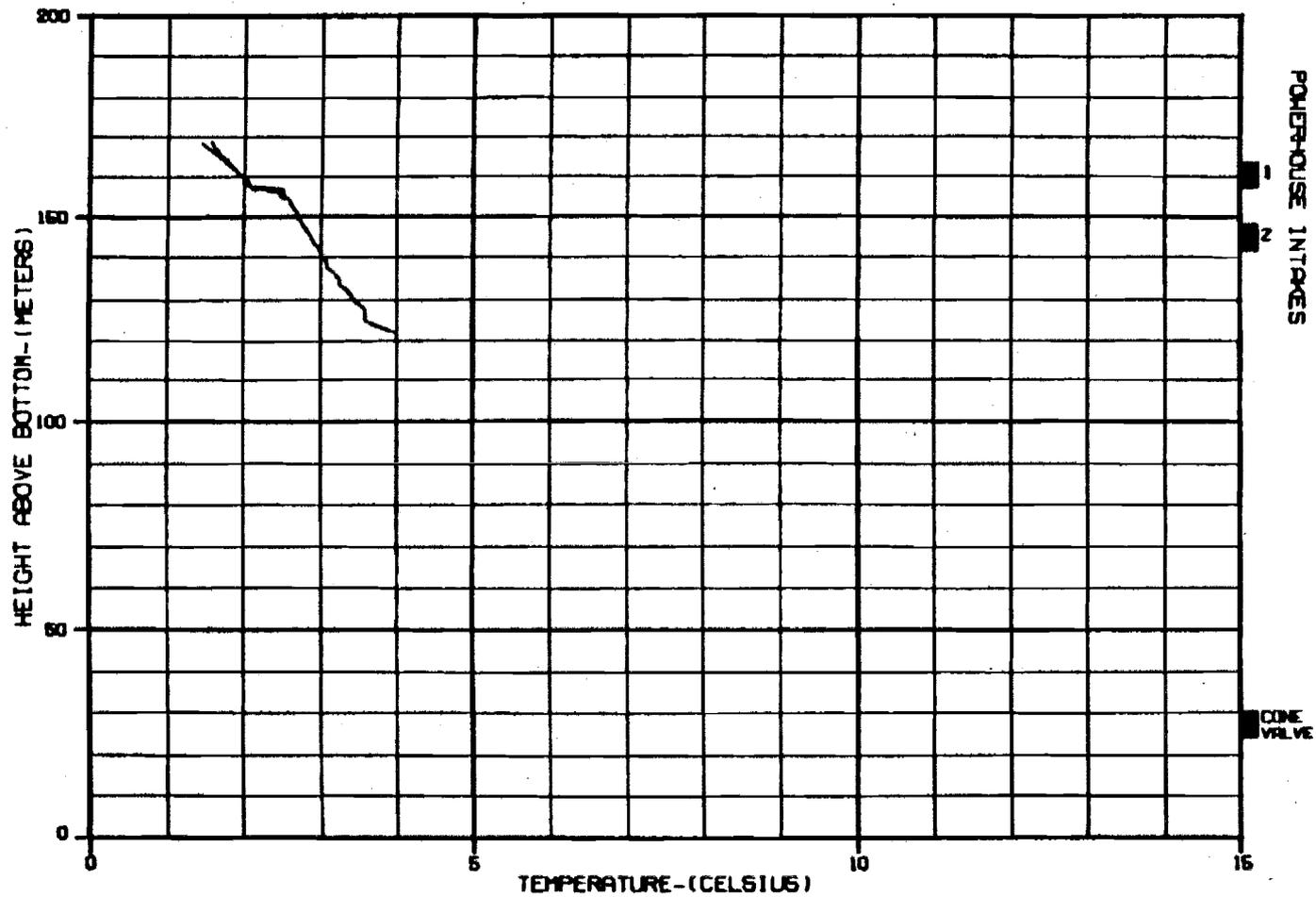
ALASKA POWER AUTHORITY

SUBMITTA PROJECT DYNOM MODEL

DEVIL CANYON RESERVOIR
 TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

MODEL: ALP000 7 JAN 81 4E-010-04



CASE: WDCB1182102D - DEVIL CANYON OPERATION WITH WATANA IN 2002
 - WATANA WEATHER STATION DATA

LEGEND:

PREDICTED TEMPERATURE PROFILES:

- | FEBRUARY 1981
- | MARCH 1981
- · - · - · | APRIL 1981

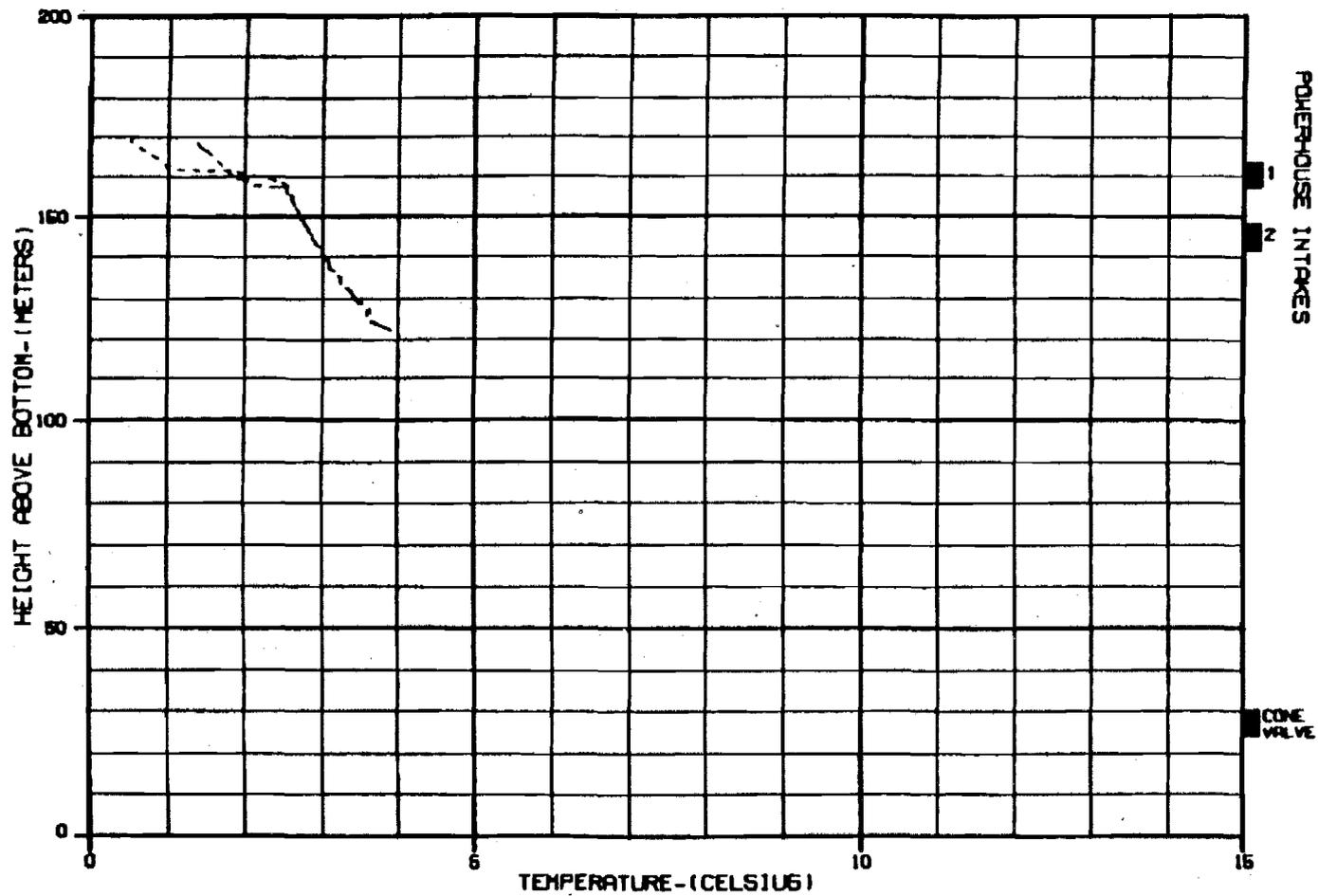
ALASKA POWER AUTHORITY

DEVELOPER PROJECT OPERATOR

DEVIL CANYON RESERVOIR
 TEMPERATURE PROFILES

HARZA-EBRACO JOINT VENTURE

DATE: 11/09/01 7:41 AM 42-010-04



CASE: ■■■ DC81182102D - DEVIL CANYON OPERATION WITH WATANA IN 2002 ■■■
 - WATANA WEATHER STATION DATA

LEGEND: PREDICTED TEMPERATURE PROFILES:
 ———— 1 NOVEMBER 1980
 - - - - - 1 DECEMBER 1980
 - · - · - 1 JANUARY 1981

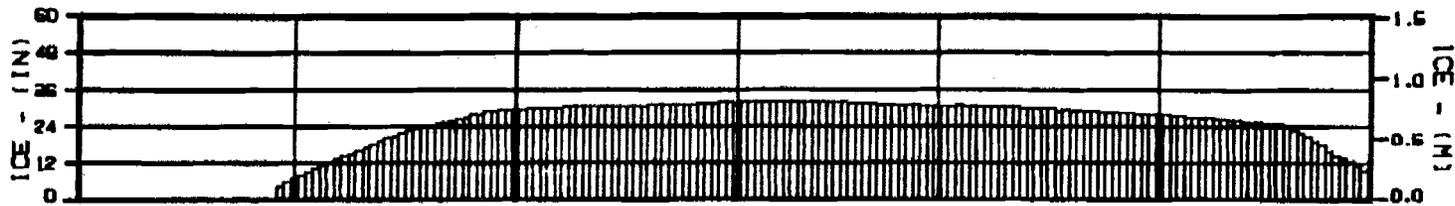
ALASKA POWER AUTHORITY

SUBMITTA PROJECT DYPESH PHEED

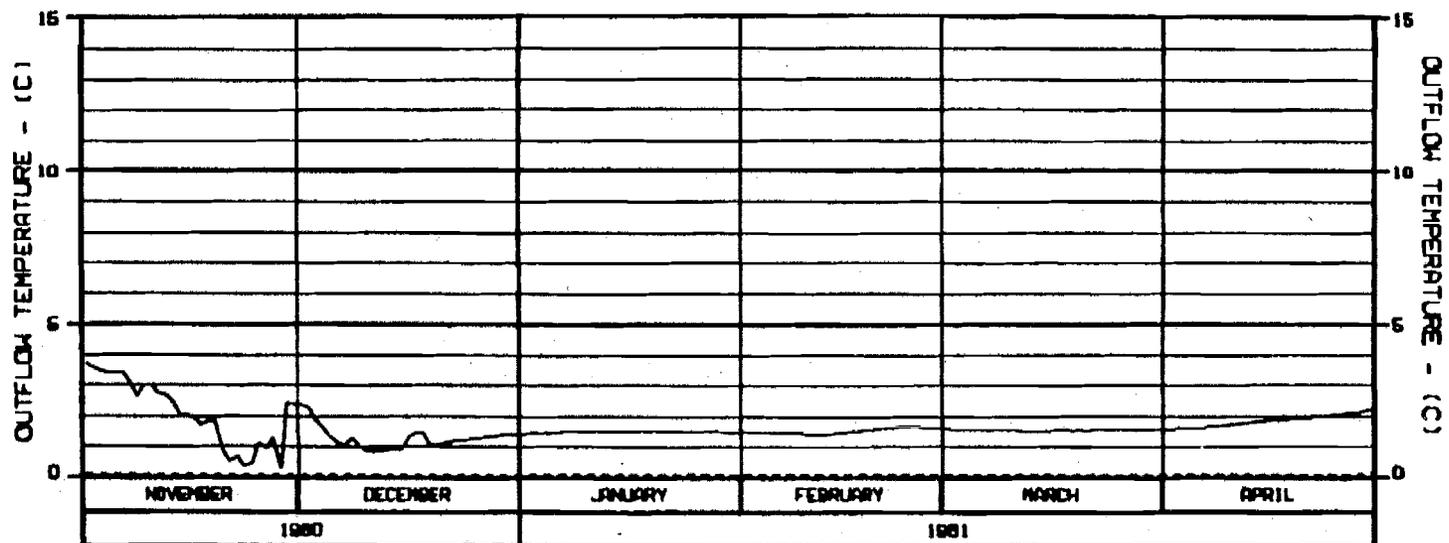
DEVIL CANYON RESERVOIR
 TEMPERATURE PROFILES

HARZA-EBRACOD JOINT VENTURE

DRAWN: BLADEN 7 JAN 81 4E-010-04



INTAKE	LEVEL 1				
	LEVEL 2				
CONE VALVE					
SPILLWAY					



LEGEND: CASE: # DC01182102D - DEVIL CANYON OPERATION WITH MATANA IN 2002 #
 - MATANA WEATHER STATION DATA
 ——— PREDICTED OUTFLOW TEMPERATURE FROM DEVIL CANYON RESERVOIR
 - - - - - INFLOW TEMPERATURE TO MATANA RESERVOIR

NOTES: 1. INTAKE PORT LEVEL 1 AT ELEVATION 1426 FT (434.94 M)
 2. INTAKE PORT LEVEL 2 AT ELEVATION 1376 FT (419.10 M)
 3. CONE VALVE AT ELEVATION 990 FT (301.75 M)
 4. SPILLWAY CREST AT ELEVATION 1404 FT (427.94 M)

ALASKA POWER AUTHORITY

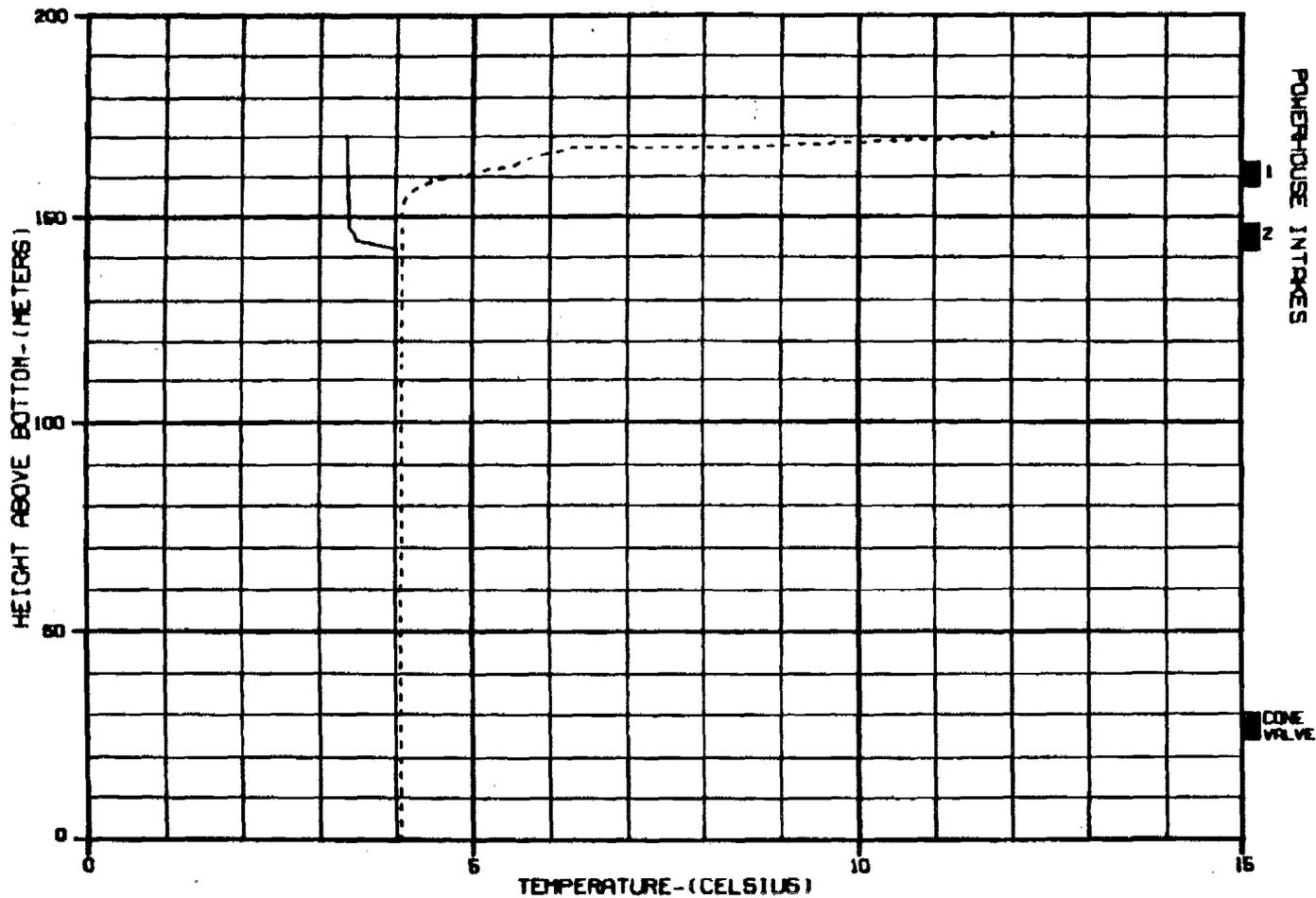
SUBMITTER PROJECT OPERATOR

DEVIL CANYON RESERVOIR
 OUTFLOW TEMPERATURE
 AND ICE GROWTH

HARZA-EBR6CO JOINT VENTURE

ORDER: 811900 1 JAN 81 2000.147.48-010-04

EXHIBIT AN



CASE: DC81182102D - DEVIL CANYON OPERATION WITH WATANA IN 2002
 - WATANA WEATHER STATION DATA

LEGEND:

PREDICTED TEMPERATURE PROFILES:

— 1 MAY 1993
 - - - 1 JUNE 1993

ALASKA POWER AUTHORITY

DISTRICT PROJECT

DYKESIN NEEDS

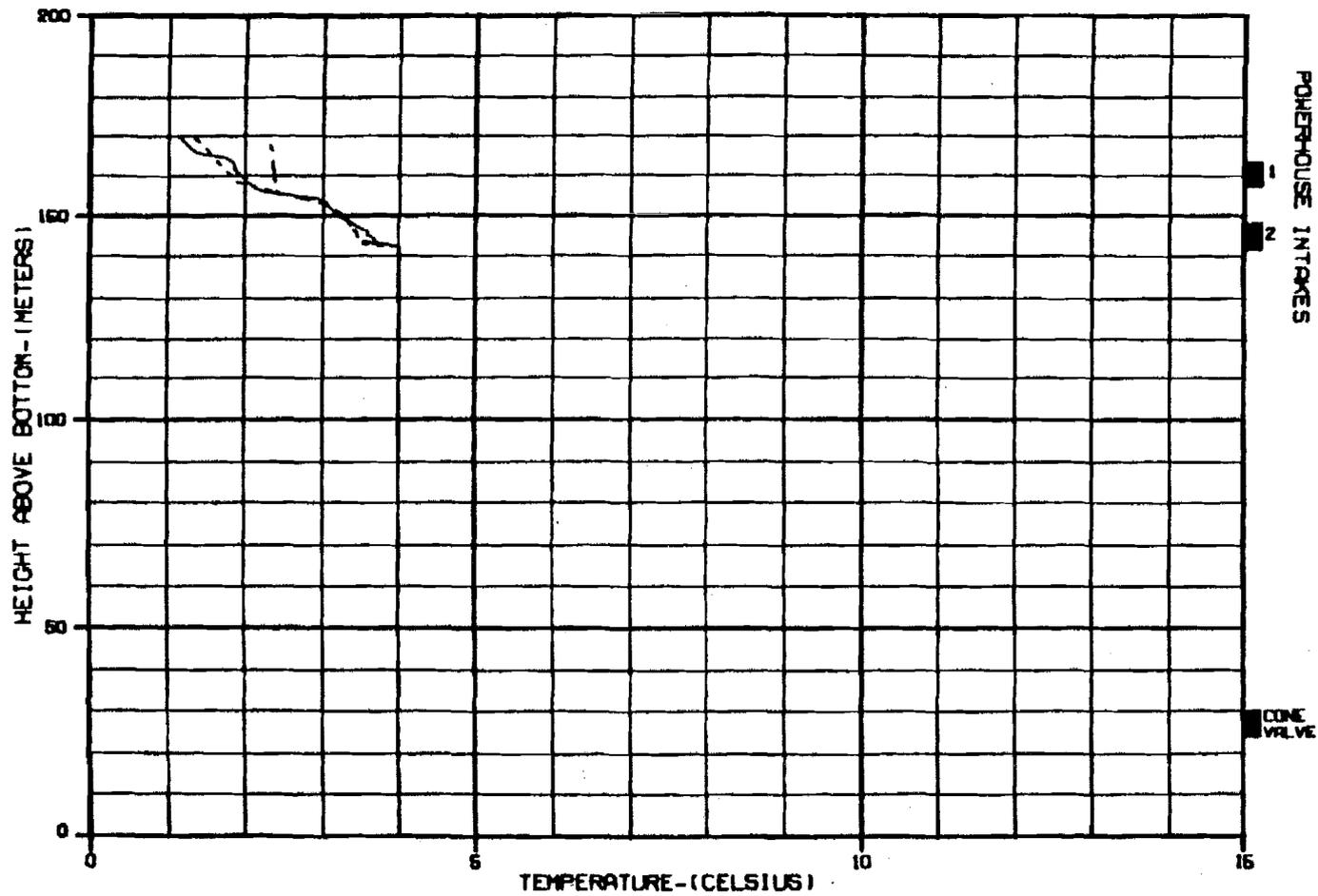
DEVIL CANYON RESERVOIR
 TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

DESIGN: E.A. BROWN

7 JAN 84

42-310-04



CASE: ■■ DCB1182102D - DEVIL CANYON OPERATION WITH WATANA IN 2002 ■■
 - WATANA WEATHER STATION DATA

LEGEND:

PREDICTED TEMPERATURE PROFILES:

————— 1 FEBRUARY 1983
 - - - - - 1 MARCH 1983
 - · - · - 1 APRIL 1983

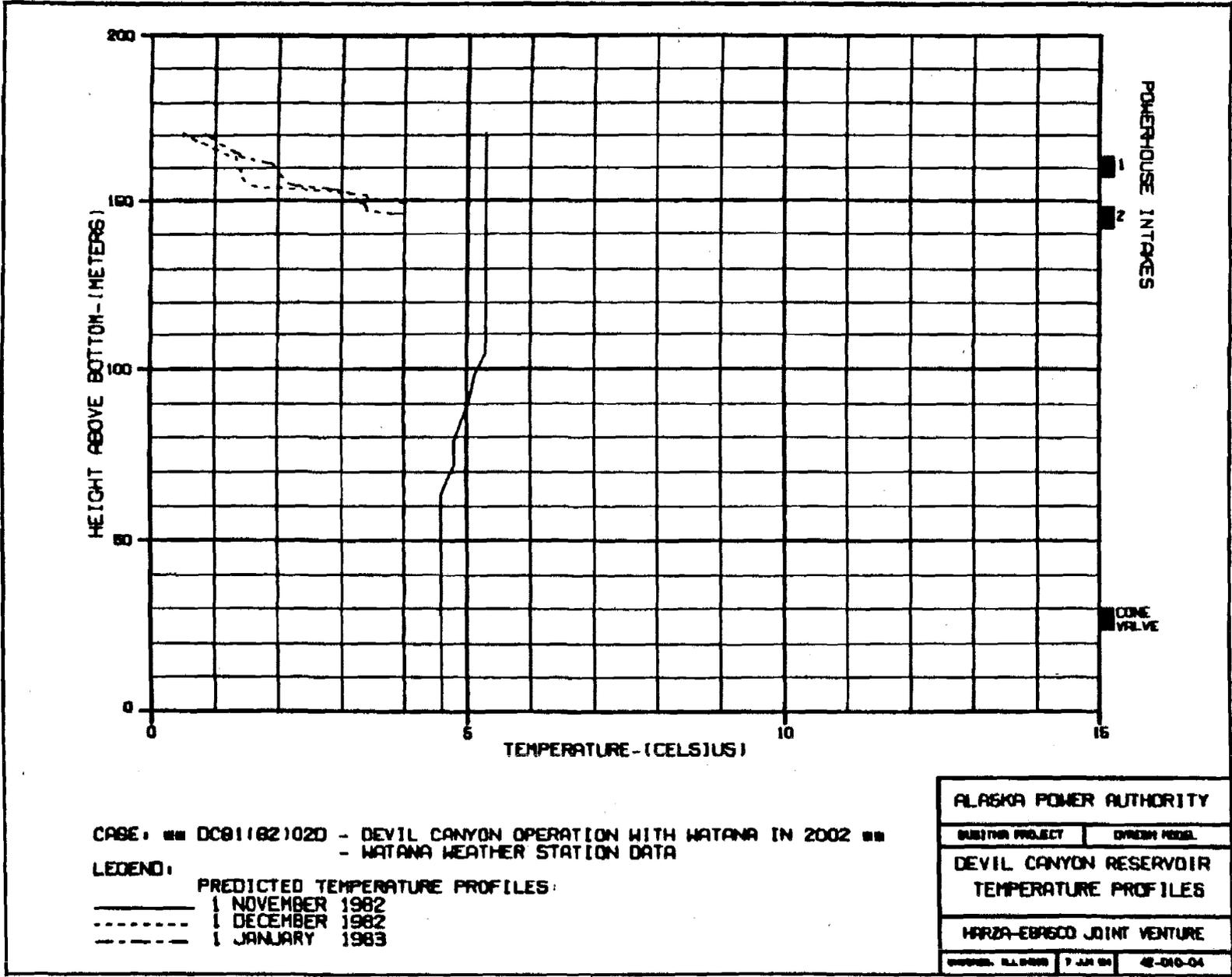
ALASKA POWER AUTHORITY

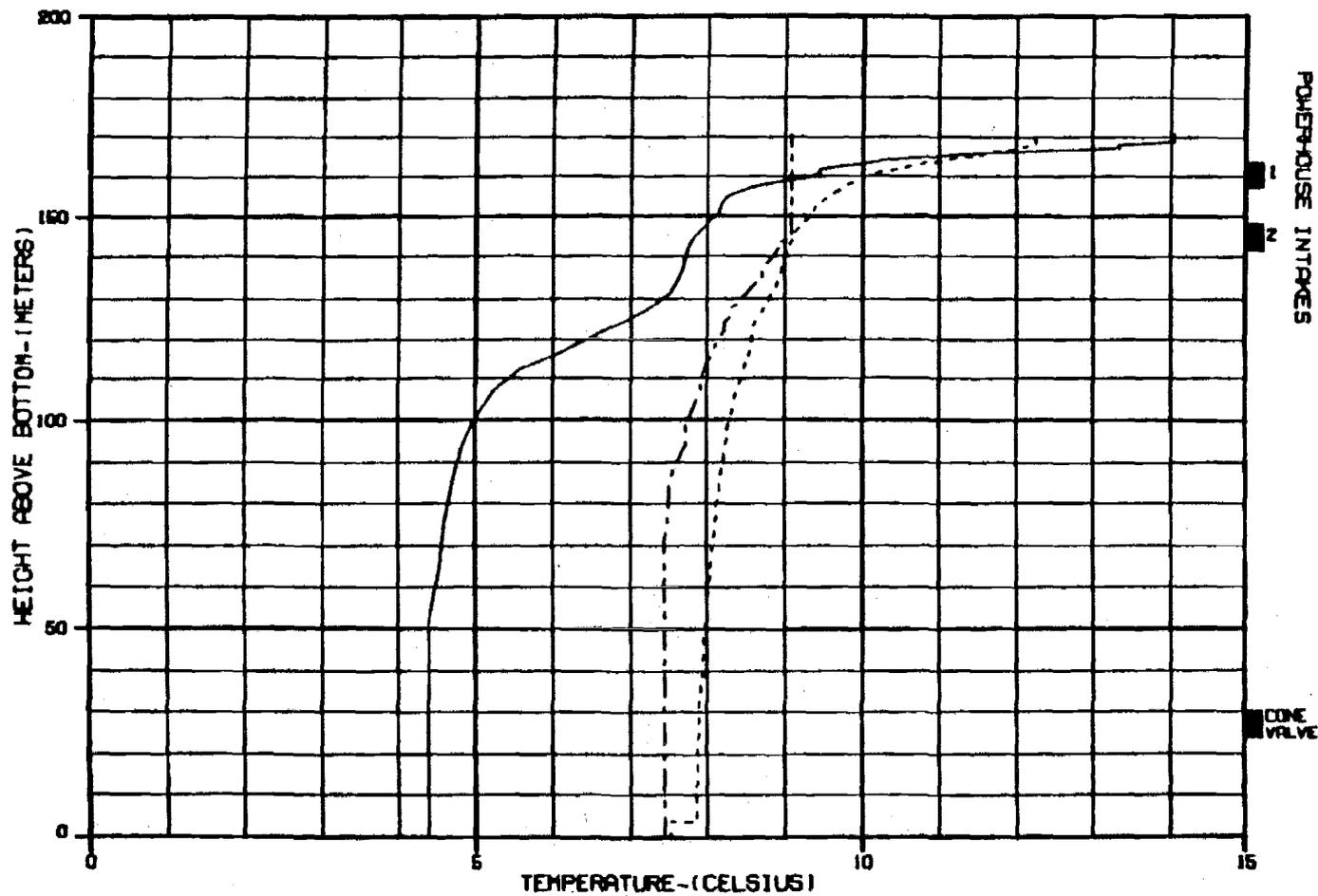
SUBSTATION PROJECT DIVISION MODEL

DEVIL CANYON RESERVOIR
 TEMPERATURE PROFILES

HARZA-EBR600 JOINT VENTURE

DESIGN: ELLIOTT T. JAMES 02-010-04

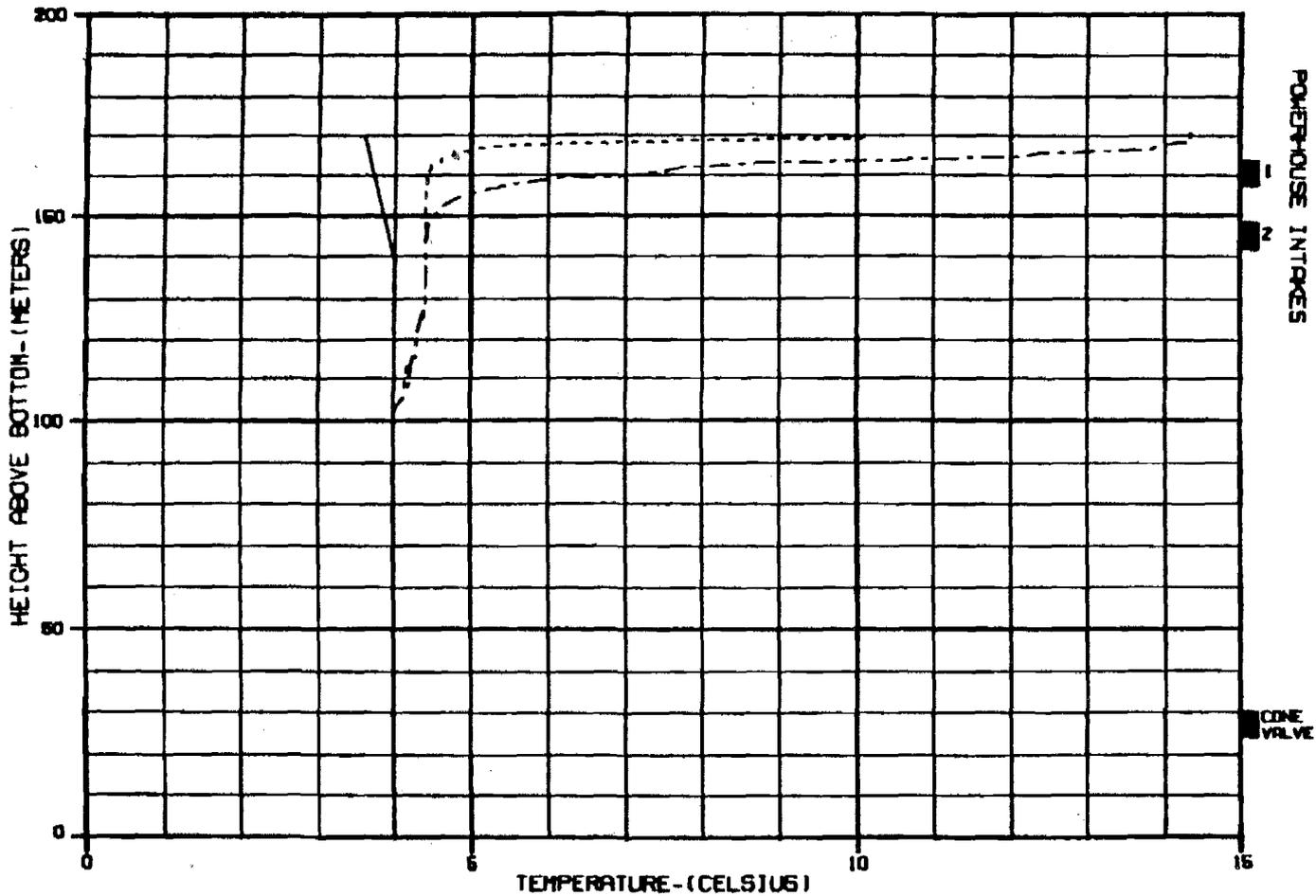




CASE: ■■ DC91182102D - DEVIL CANYON OPERATION WITH WATANA IN 2002 ■■
 - WATANA WEATHER STATION DATA

LEGEND: PREDICTED TEMPERATURE PROFILES:
 ———— | AUGUST 1982
 - - - - - | SEPTEMBER 1982
 - · - · - | OCTOBER 1982

ALASKA POWER AUTHORITY	
UNITED PROJECT	DESIGN MODEL
DEVIL CANYON RESERVOIR TEMPERATURE PROFILES	
WARZA-BASED JOINT VENTURE	
ISSUED: 11/28/82	42-018-04



CASE: ■■ DCB1182102D - DEVIL CANYON OPERATION WITH WATANA IN 2002 ■■
 - WATANA WEATHER STATION DATA

LEGEND:

PREDICTED TEMPERATURE PROFILES:

——— | MAY 1982
 - - - - | JUNE 1982
 - · - · - | JULY 1982

ALASKA POWER AUTHORITY

DEVELOPER PROJECT OWNER MODEL

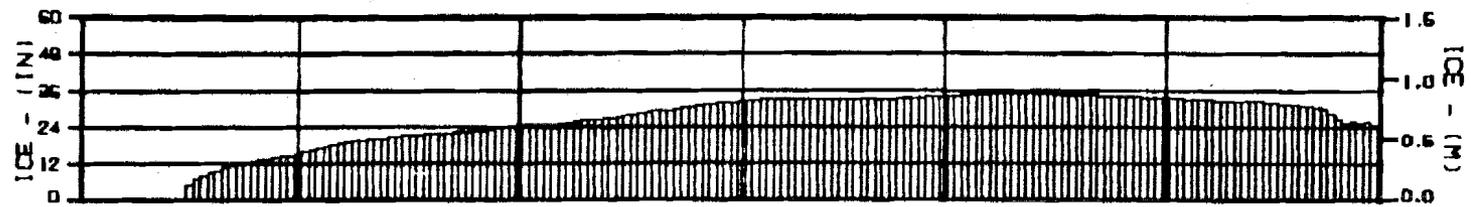
DEVIL CANYON RESERVOIR
 TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

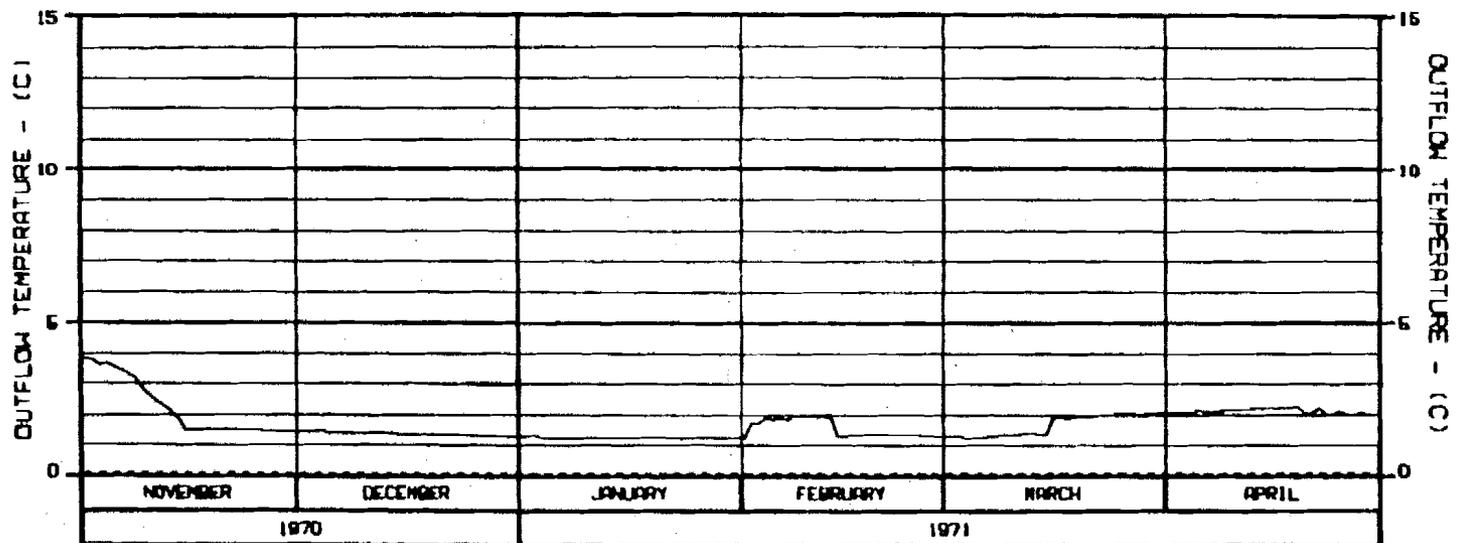
DESIGNED BY: P. J. ... 7 JAN 84 42-010-04

WATANA AND DEVIL CANYON OPERATING
2020 Energy Demands
Devil Canyon Reservoir Temperatures

EXHIBIT AO



INTAKE	LEVEL 1					
	LEVEL 2					
	CONE VALVE					
	SPILLWAY					



LEGEND: CASE: ■ DC7120A - DEVIL CANYON OPERATION WITH MATANA IN 2020 ■

———— PREDICTED OUTFLOW TEMPERATURE FROM DEVIL CANYON RESERVOIR
 - - - - - INFLOW TEMPERATURE TO MATANA RESERVOIR

- NOTES: 1. INTAKE PORT LEVEL 1 AT ELEVATION 1426 FT (434.24 M)
 2. INTAKE PORT LEVEL 2 AT ELEVATION 1376 FT (419.10 M)
 3. CONE VALVE AT ELEVATION 990 FT (301.76 M)
 4. SPILLWAY CREST AT ELEVATION 1404 FT (427.84 M)

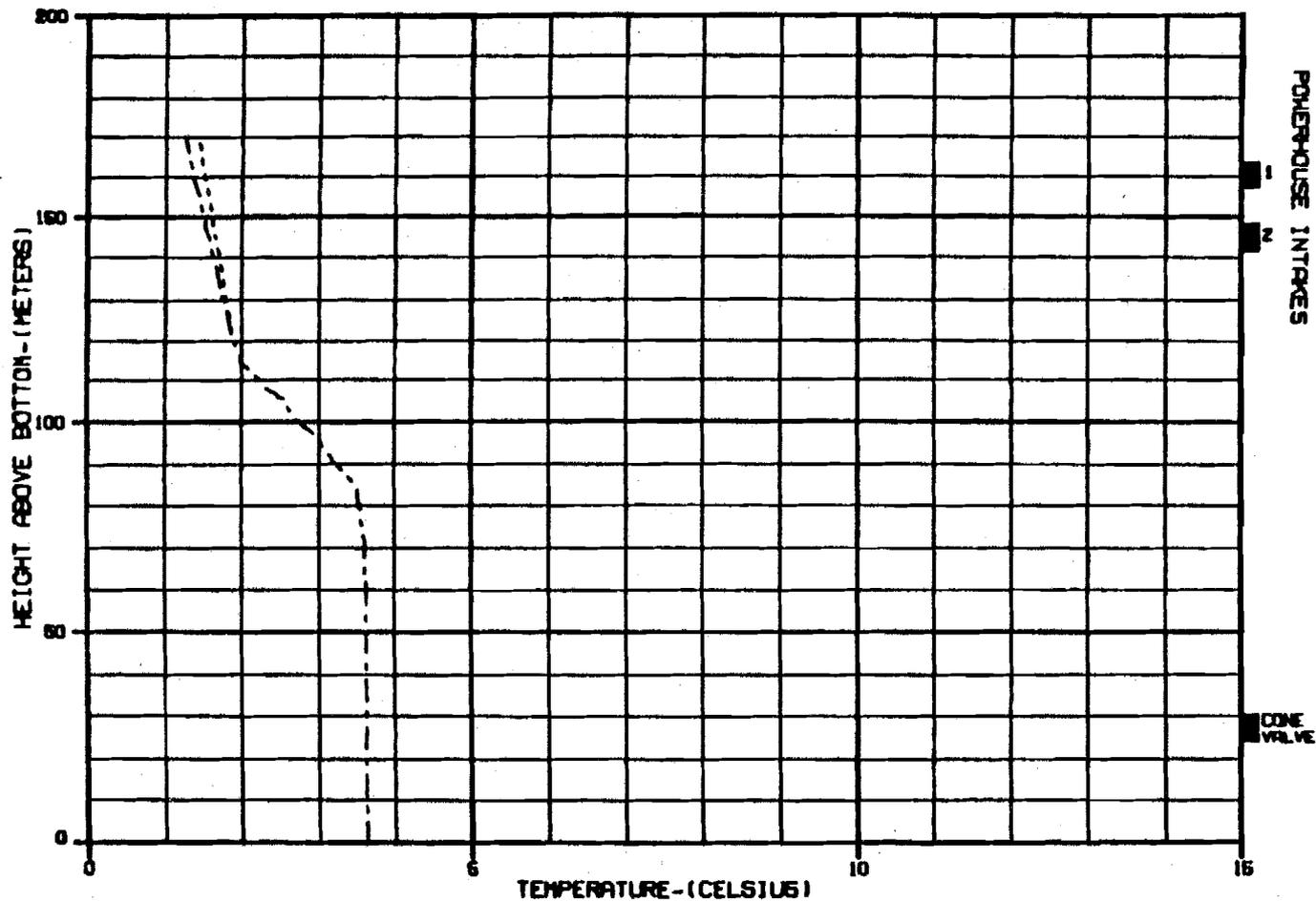
ALASKA POWER AUTHORITY

BUILTIMA PROJECT OPENIN MODEL

DEVIL CANYON RESERVOIR
 OUTFLOW TEMPERATURE
 AND ICE GROWTH

HARZA-EBRACO JOINT VENTURE

DESIGN: BLDG08 9 JAN 84 DRAWING NO. 48-010-04



CASE: ■■ DC712DA - DEVIL CANYON OPERATION WITH WATANA IN 2020 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

_____ | NOVEMBER 1970
 - - - - - | DECEMBER 1970
 - · - · - | JANUARY 1971

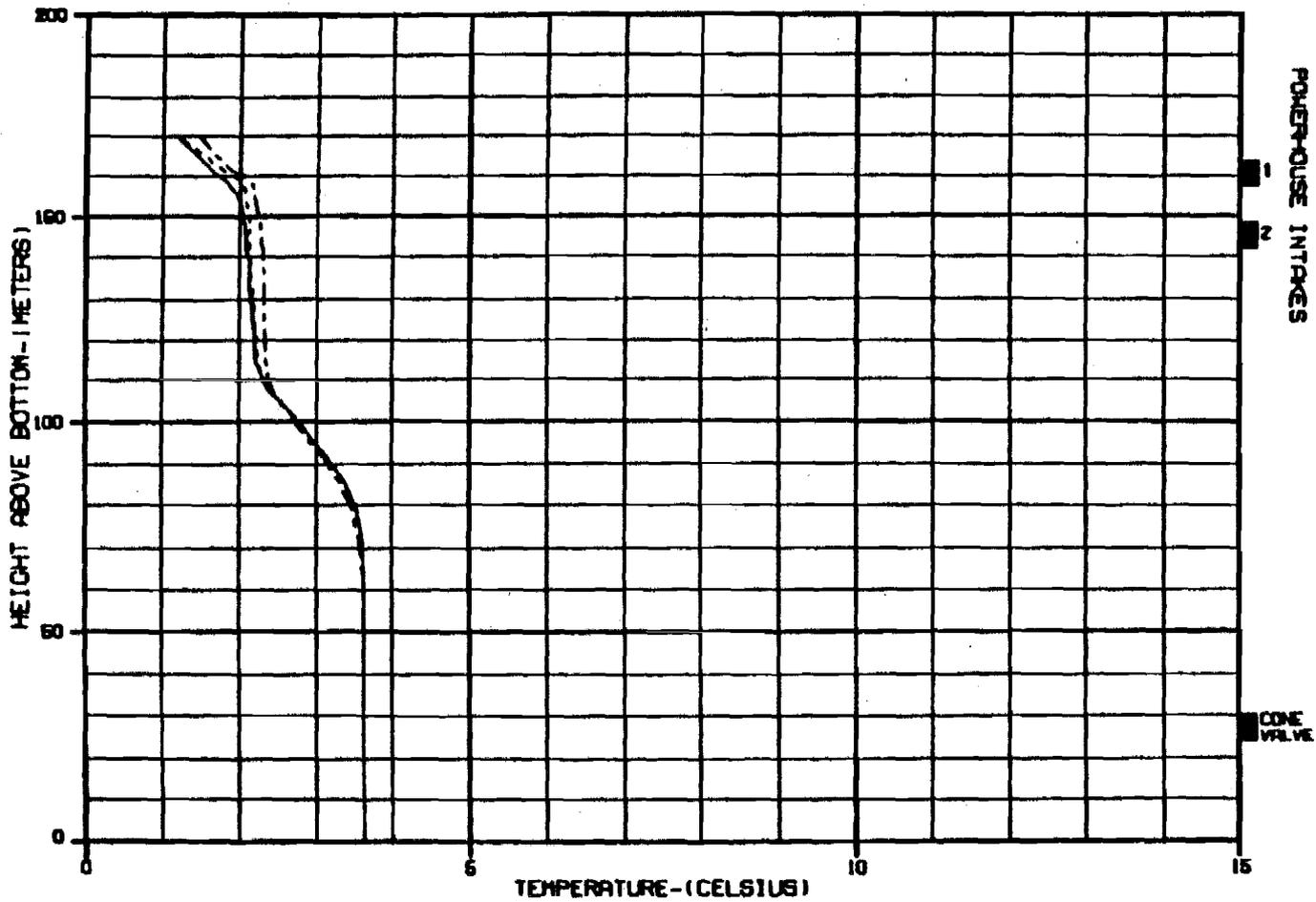
ALASKA POWER AUTHORITY

WATANA PROJECT | DEVIL CANYON

DEVIL CANYON RESERVOIR
TEMPERATURE PROFILES

HARZA-EBRACO JOINT VENTURE

WATANA - EBRACO | 2 JAN 81 | 42-010-04



CASE: ■ DC7120A - DEVIL CANYON OPERATION WITH MATANA IN 2020 ■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

— FEBRUARY 1971
 - - - MARCH 1971
 - · - · - APRIL 1971

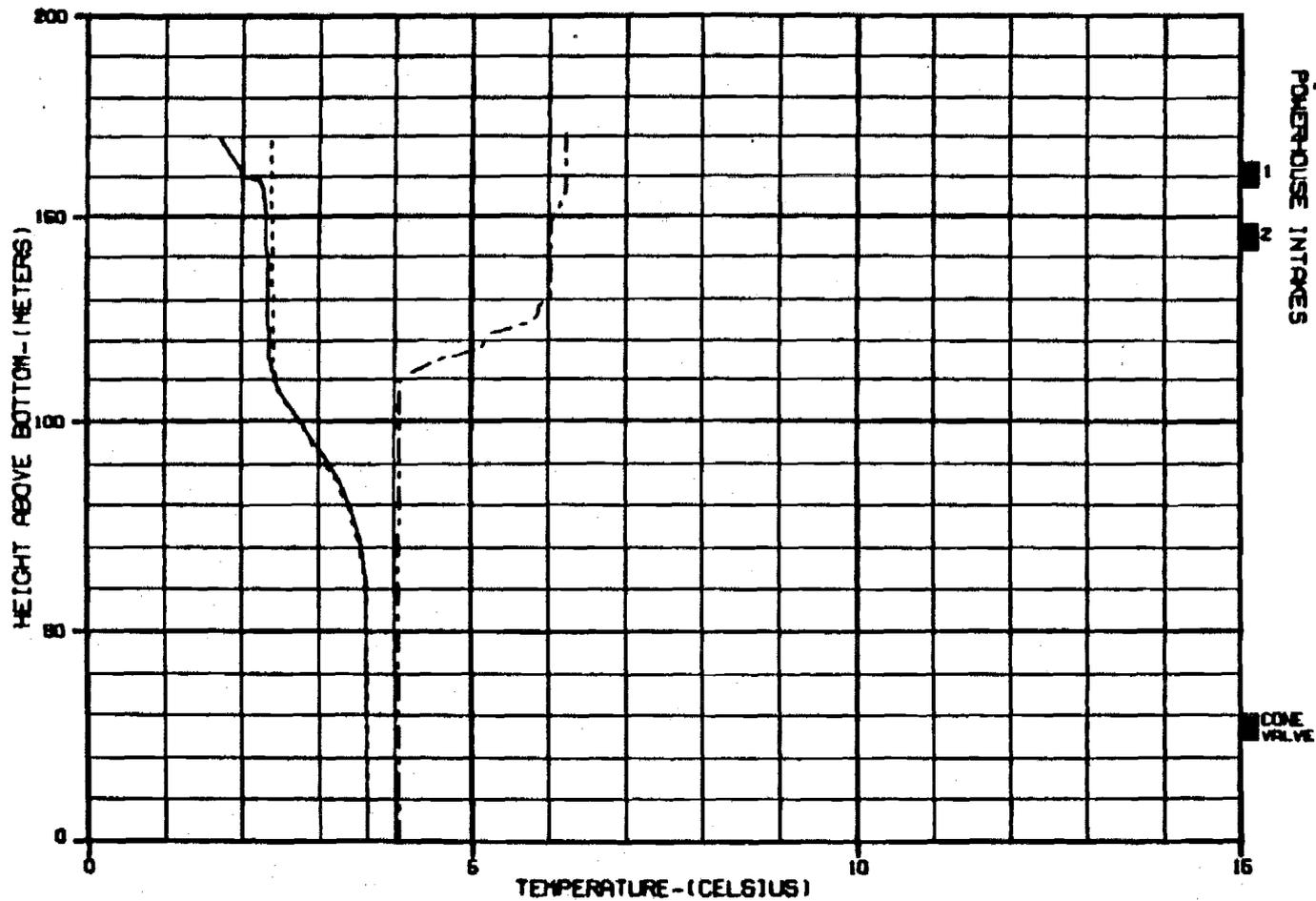
ALASKA POWER AUTHORITY

UNITED PROJECT DRYDEN MODEL

DEVIL CANYON RESERVOIR
TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

ORDER: 44-000 5 JAN 81 42-010-04



CASE: DC7120A - DEVIL CANYON OPERATION WITH WATANA IN 2020

LEGEND:

PREDICTED TEMPERATURE PROFILES:

——— MAY 1971
 - - - - - JUNE 1971
 - - - - - JULY 1971

ALASKA POWER AUTHORITY

SUBMITTAL PROJECT

OPERATION PERIOD

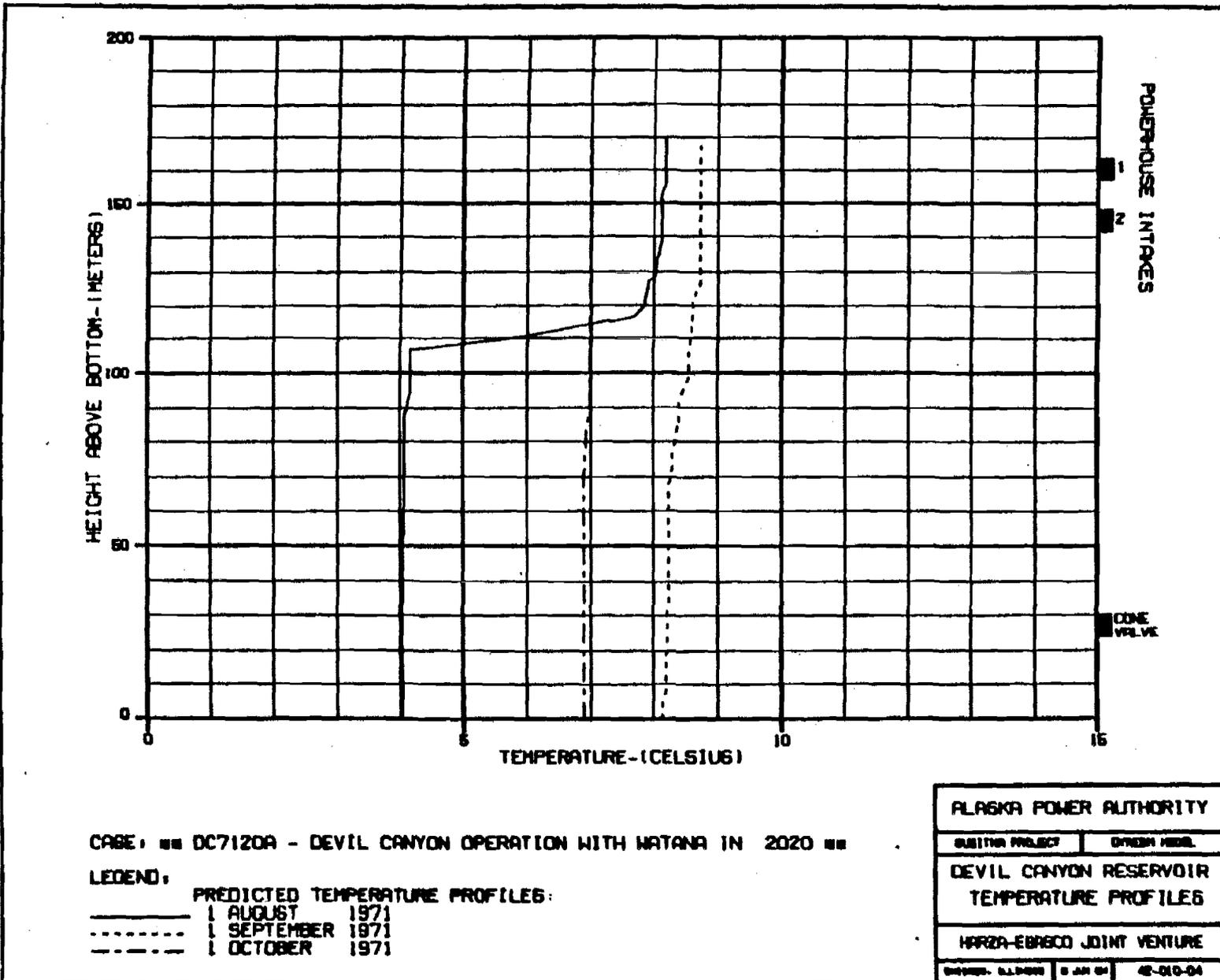
DEVIL CANYON RESERVOIR
TEMPERATURE PROFILES

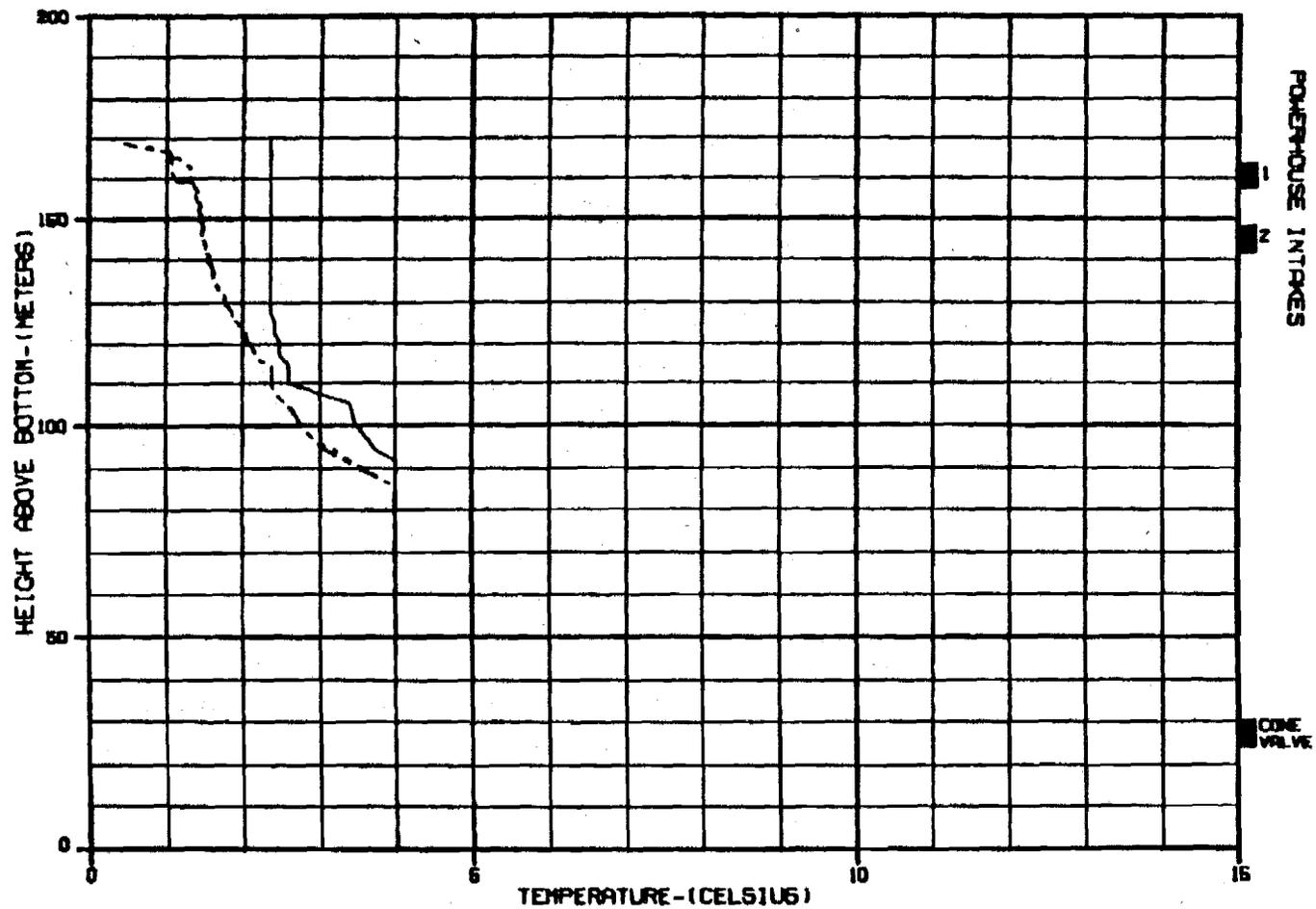
WARZA-EBRACO JOINT VENTURE

DESIGN: 8/1/71

DATE: 8/1/71

45-010-04





CASE: ■■ DC7120A - DEVIL CANYON OPERATION WITH WATANA IN 2020 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

_____ | NOVEMBER 1971
 - - - - - | DECEMBER 1971
 - · - · - | JANUARY 1972

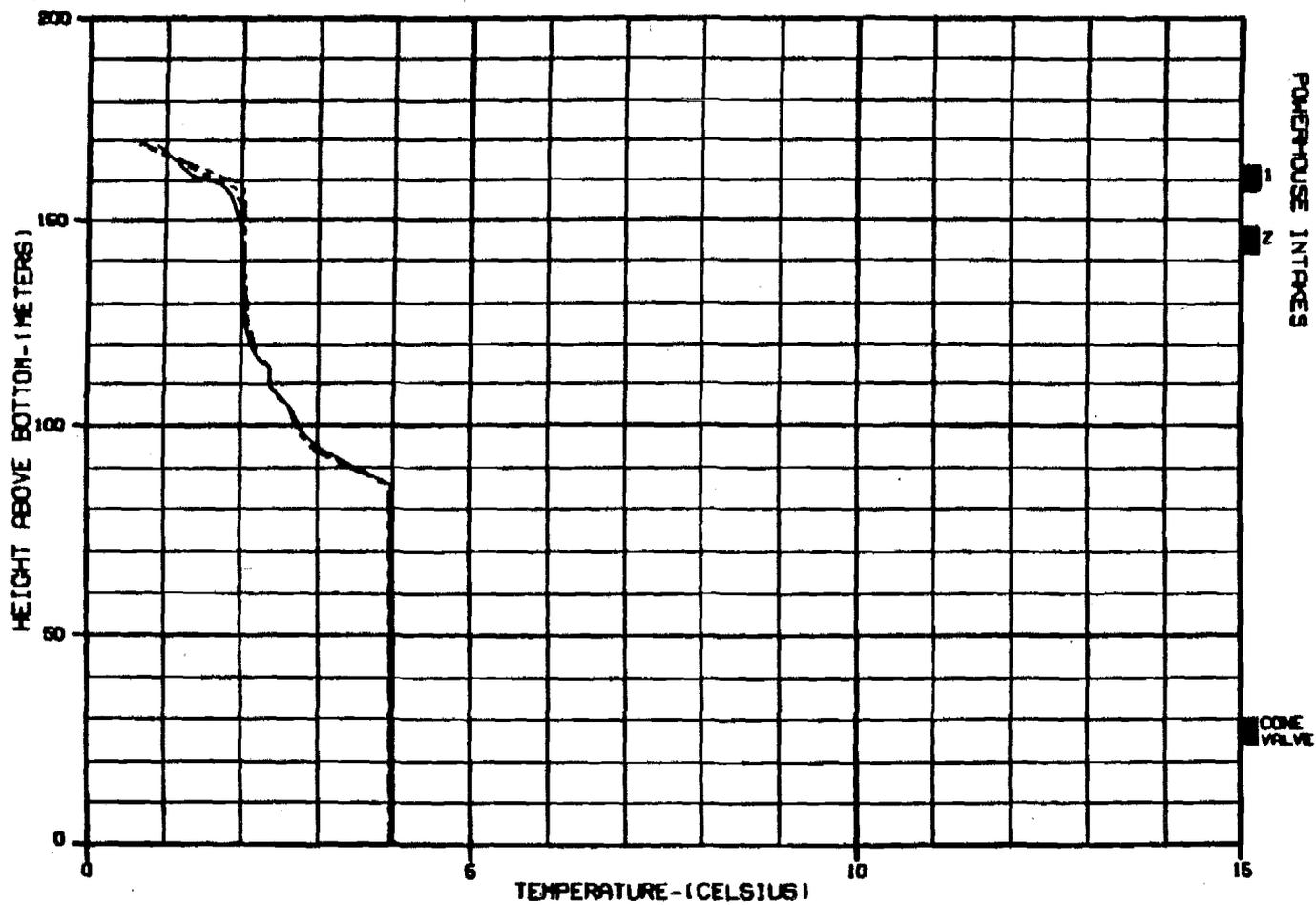
ALASKA POWER AUTHORITY

EXISTING PROJECT | GREEN HILL

DEVIL CANYON RESERVOIR
TEMPERATURE PROFILES

HARZA-EBRACCO JOINT VENTURE

DATE: 11-10-71 9 AM '71 42-010-04



CASE: ■■ DC7120A - DEVIL CANYON OPERATION WITH WATANA IN 2020 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

_____ 1 FEBRUARY 1972
 - - - - - 1 MARCH 1972
 - · - · - 1 APRIL 1972

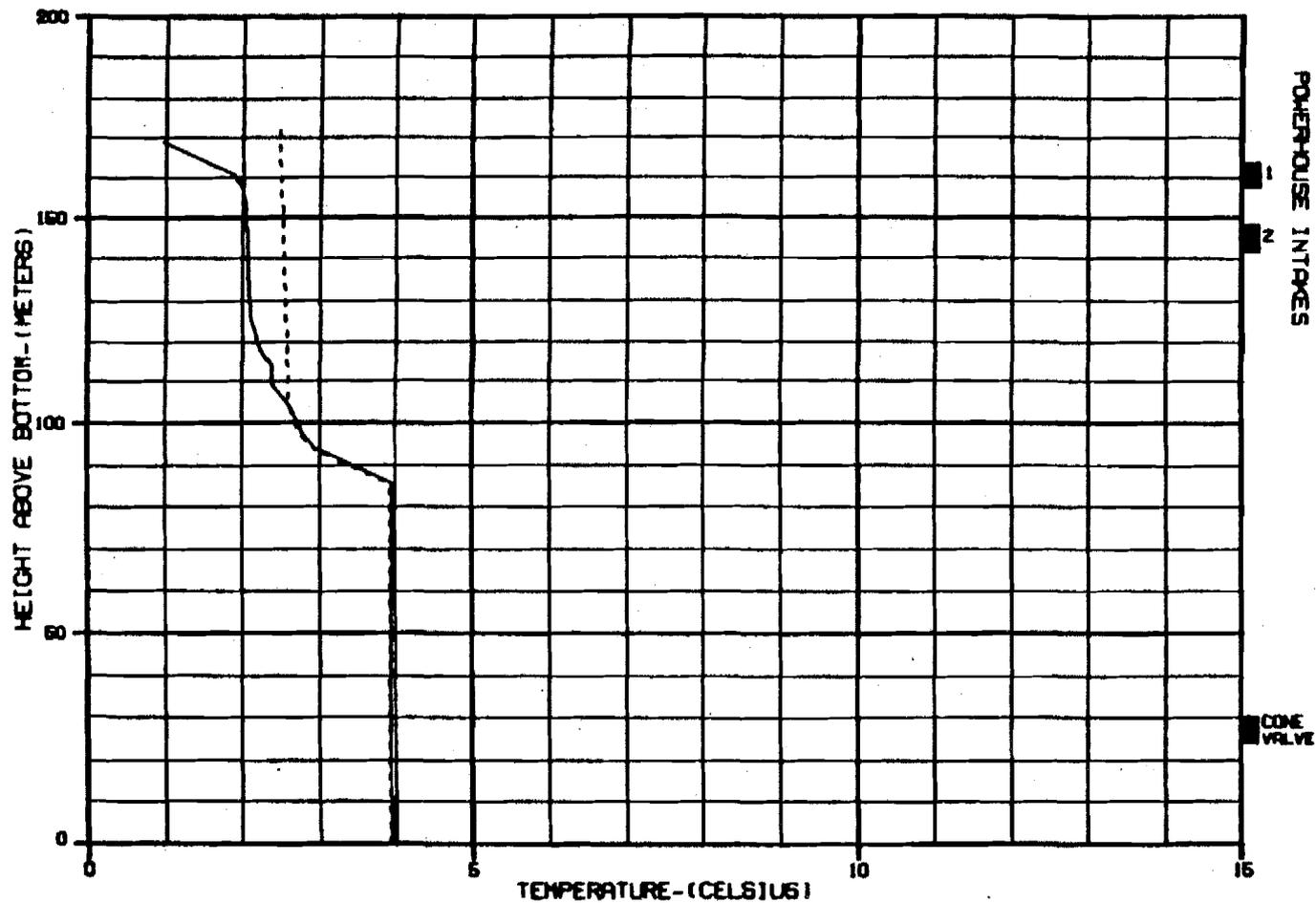
ALASKA POWER AUTHORITY

SUBMITTAL PROJECT CROWN HEDD

DEVIL CANYON RESERVOIR
TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

DATE: 11/20/82 5 JAN 83 4-010-04



CASE: ■■ DC7120A - DEVIL CANYON OPERATION WITH WATANA IN 2020 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

———— | MAY 1972
 - - - - - | JUNE 1972
 - · - · - | JULY 1972

ALASKA POWER AUTHORITY

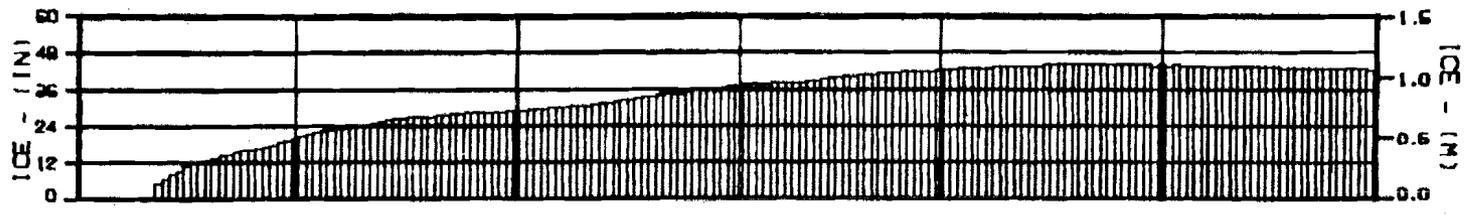
DEVELOPMENT PROJECT | OPERATIONAL MODEL

DEVIL CANYON RESERVOIR
TEMPERATURE PROFILES

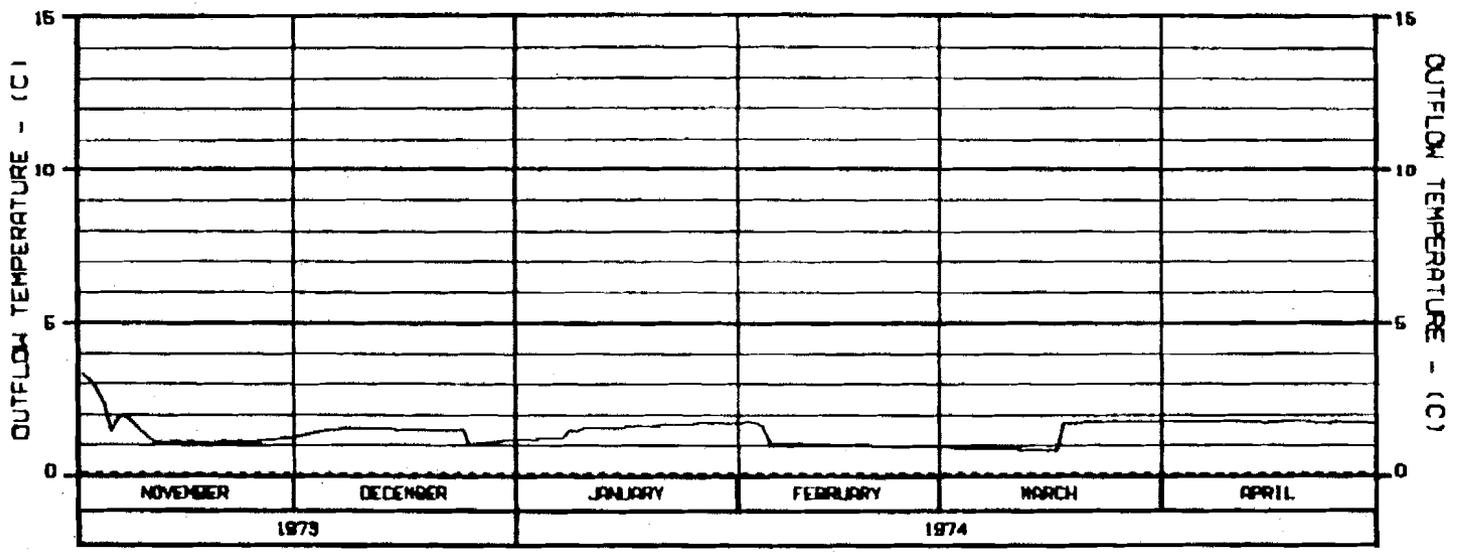
HARZA-EBRARD JOINT VENTURE

DESIGN - 04-0000 | 0 JAN 84 | 42-010-04

EXHIBIT AP



INTAKE	LEVEL 1					
	LEVEL 2					
CONE VALVE						
SPILLWAY						

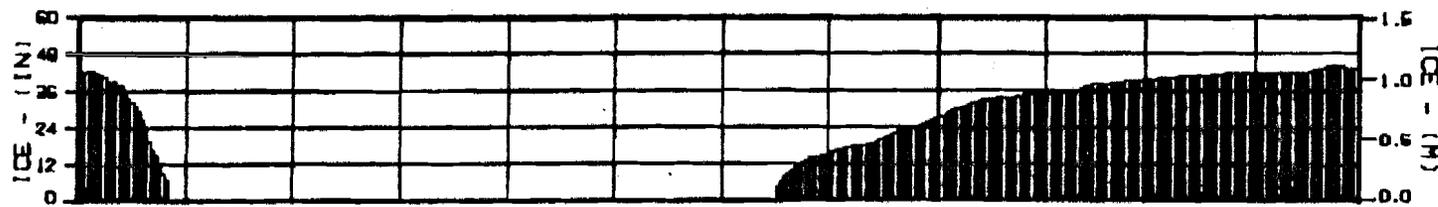


LEGEND: CASE: ■ DC7420A - DEVIL CANYON OPERATION WITH NATANA IN 2020 ■■

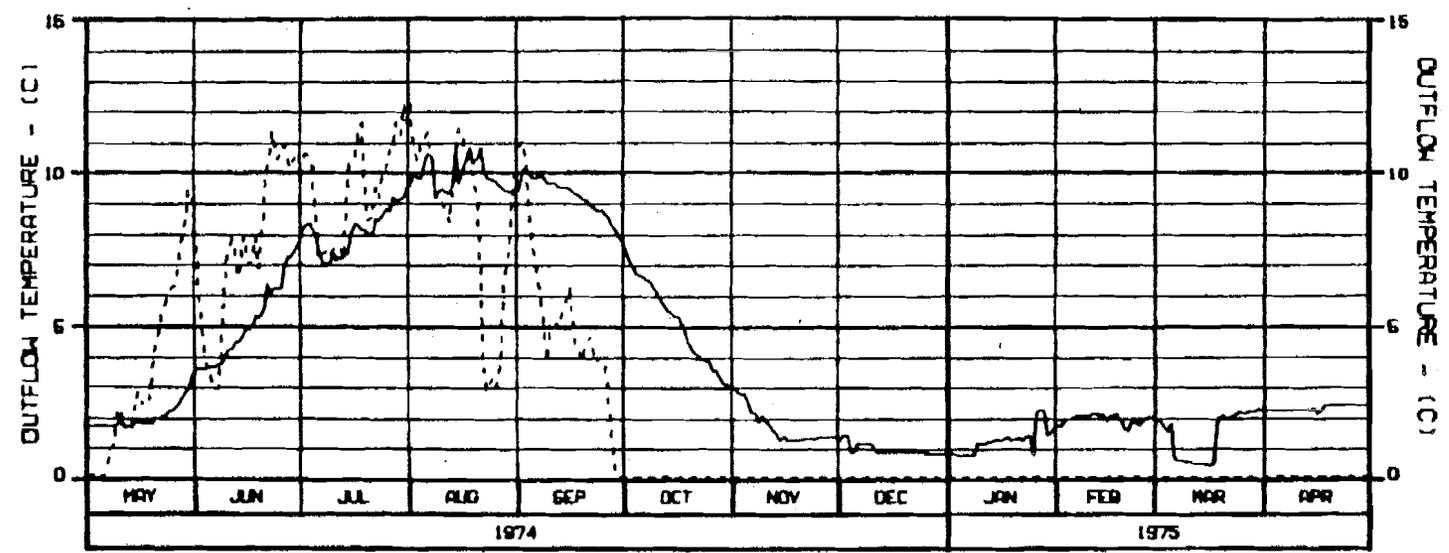
———— PREDICTED OUTFLOW TEMPERATURE FROM DEVIL CANYON RESERVOIR
 - - - - - INFLOW TEMPERATURE TO NATANA RESERVOIR

- NOTES: 1. INTAKE PORT LEVEL 1 AT ELEVATION 1426 FT (434.24 M)
 2. INTAKE PORT LEVEL 2 AT ELEVATION 1276 FT (410.10 M)
 3. CONE VALVE AT ELEVATION 990 FT (301.75 M)
 4. SPILLWAY CREST AT ELEVATION 1404 FT (427.84 M)

ALASKA POWER AUTHORITY	
SLUTTNA PROJECT	DYNNOR MODEL
DEVIL CANYON RESERVOIR OUTFLOW TEMPERATURE AND ICE GROWTH	
HARZA-EBRACO JOINT VENTURE	
DESIGN: E.L. ROSS	8 JAN 84
NO. 147-45-010-2a	



INTAKE	LEVEL 1	[Bar chart showing intake level 1 activity]											
	LEVEL 2	[Bar chart showing intake level 2 activity]											
CONE VALVE		[Bar chart showing cone valve activity]											
SPILLWAY		[Bar chart showing spillway activity]											

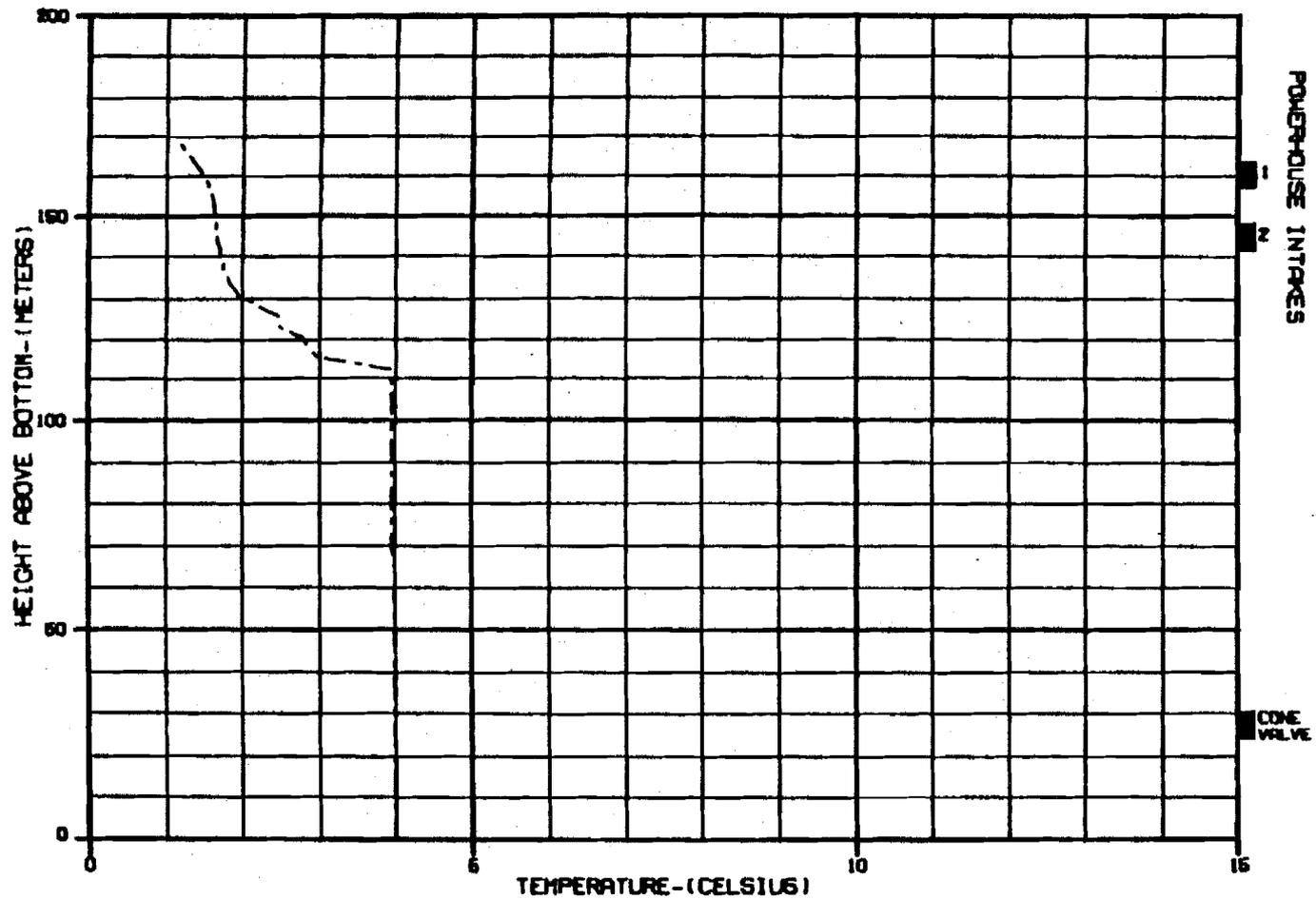


LEGEND: CASE: DC7420A - DEVIL CANYON OPERATION WITH WATANA IN 2020 MW

———— PREDICTED OUTFLOW TEMPERATURE FROM DEVIL CANYON RESERVOIR
 - - - - - INFLOW TEMPERATURE TO WATANA RESERVOIR

- NOTES: 1. INTAKE PORT LEVEL 1 AT ELEVATION 1425 FT (434.24 M)
 2. INTAKE PORT LEVEL 2 AT ELEVATION 1275 FT (419.10 M)
 3. CONE VALVE AT ELEVATION 990 FT (301.75 M)
 4. SPILLWAY CREST AT ELEVATION 1404 FT (427.94 M)

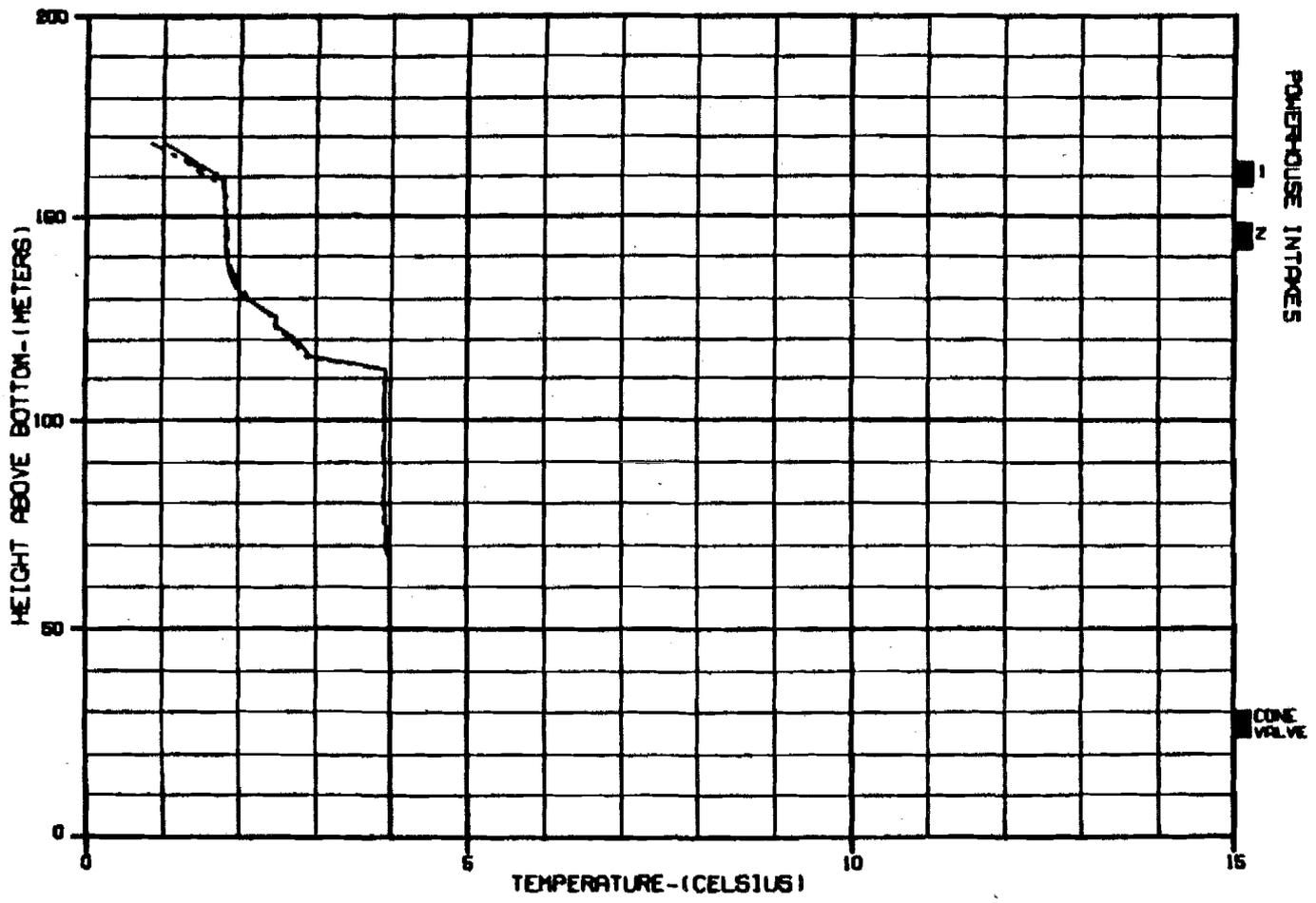
ALASKA POWER AUTHORITY	
SUBMITTA PROJECT	DYKEMA MODEL
DEVIL CANYON RESERVOIR OUTFLOW TEMPERATURE AND ICE GROWTH	
HARZA-EBRACCO JOINT VENTURE	
DESIGN - G.L. BROWN	7 JAN 81 1000.140 40-2000-25



CASE: ■■ DC7420A - DEVIL CANYON OPERATION WITH WATANA IN 2020 ■■

LEGEND: PREDICTED TEMPERATURE PROFILES:
 ———— | NOVEMBER 1973
 - - - - - | DECEMBER 1973
 - · - · - | JANUARY 1974

ALASKA POWER AUTHORITY	
SLITVA PROJECT	DFRESH FEED
DEVIL CANYON RESERVOIR TEMPERATURE PROFILES	
WARZA-EBRACD JOINT VENTURE	
DESIGN: ALASKA	DATE: 8 JAN 81
	42-010-04



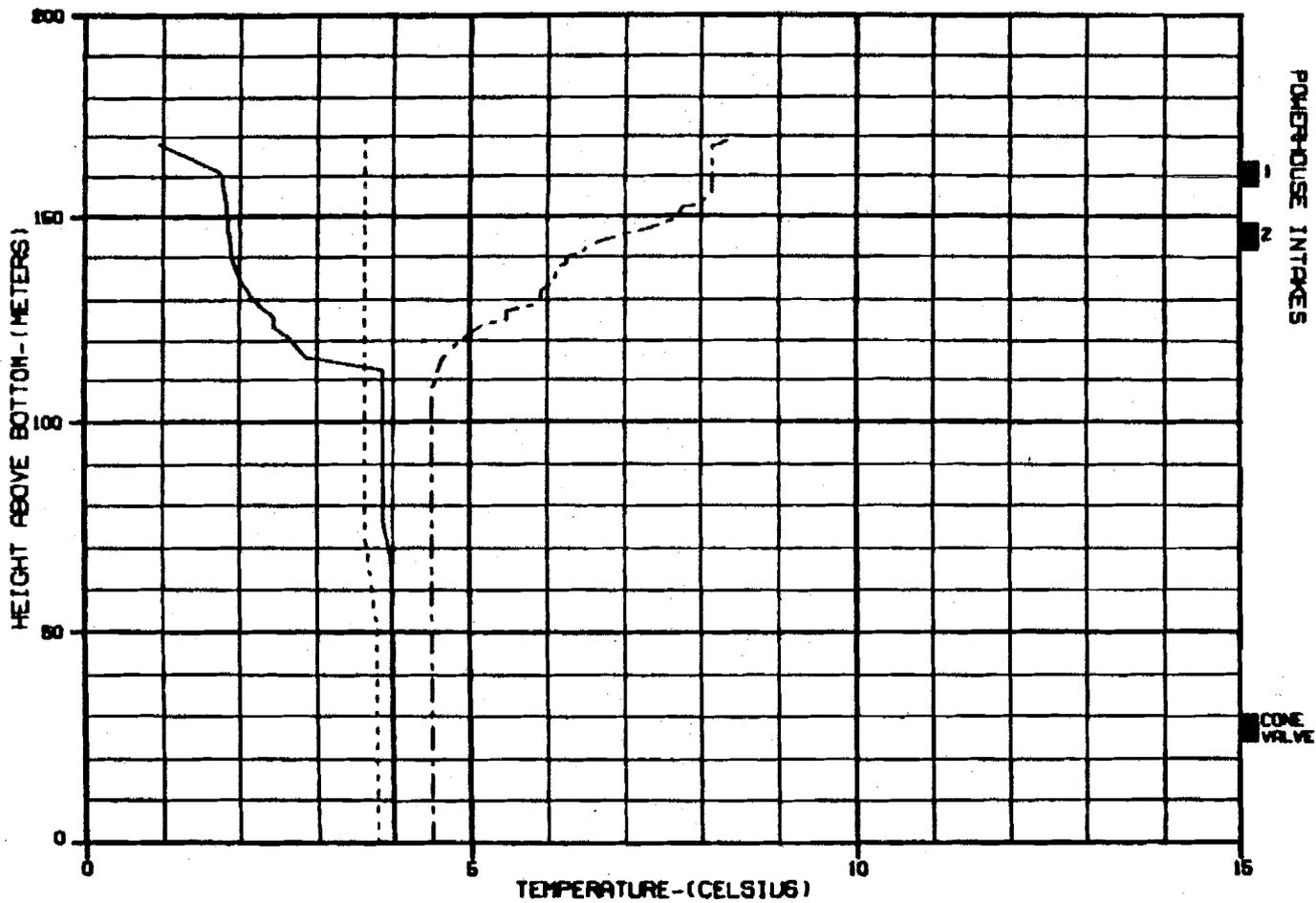
CASE: ■ DC7420A - DEVIL CANYON OPERATION WITH WATANA IN 2020 ■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

- 1 FEBRUARY 1974
- - - - 1 MARCH 1974
- · · · 1 APRIL 1974

ALASKA POWER AUTHORITY	
UNITED PROJECT	OPERATION MODEL
DEVIL CANYON RESERVOIR TEMPERATURE PROFILES	
HARZA-EBRACO JOINT VENTURE	
DESIGN - 01/20/74	REV - 01/20/74
DATE	BY



CASE: ■■ DC7420A - DEVIL CANYON OPERATION WITH WATANA IN 2020 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

_____ | MAY 1974
 | JUNE 1974
 - - - - - | JULY 1974

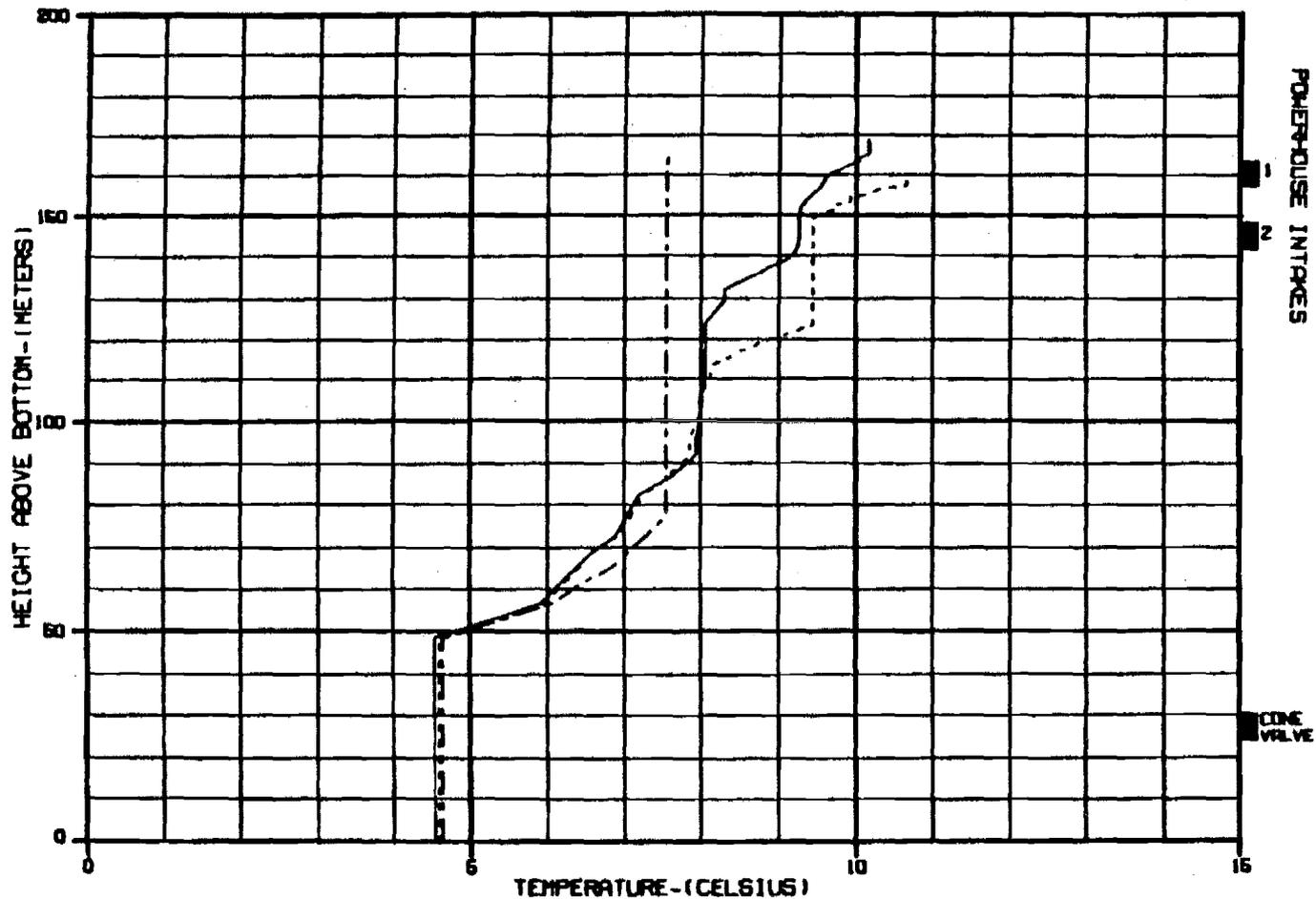
ALASKA POWER AUTHORITY

UNITED PROJECT | OPEN HEAD

DEVIL CANYON RESERVOIR
TEMPERATURE PROFILES

WARZA-EBRSCO JOINT VENTURE

DRAWN: B.L.B. 9 JAN 84 42-010-04



CASE: ■ DC7420A - DEVIL CANYON OPERATION WITH MATANA IN 2020 ■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

_____ | AUGUST 1974
 | SEPTEMBER 1974
 - - - - - | OCTOBER 1974

ALASKA POWER AUTHORITY

DESIGN PROJECT

ORDER NO.

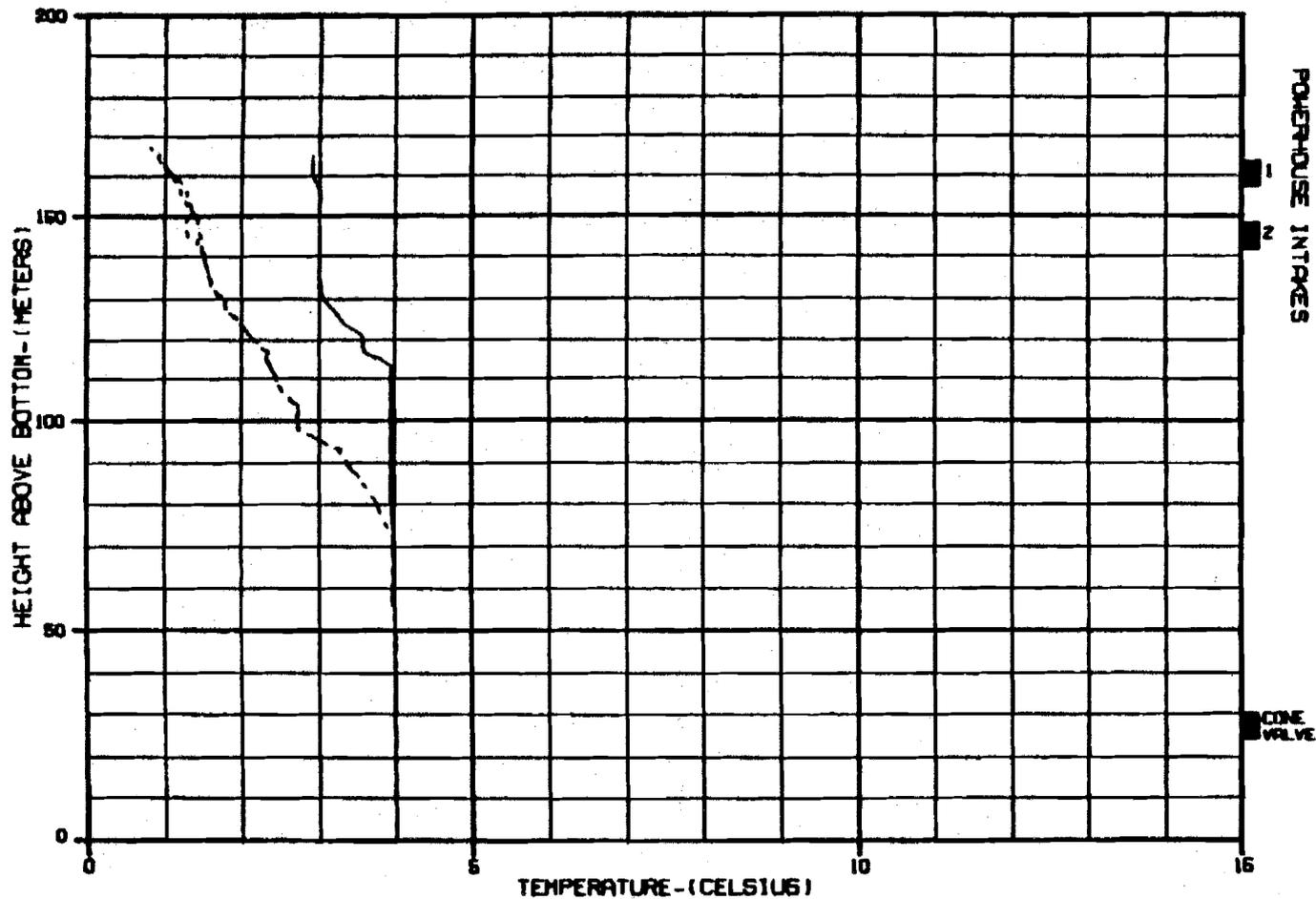
DEVIL CANYON RESERVOIR
TEMPERATURE PROFILES

WARZA-EBRACO JOINT VENTURE

ORDER: 84-0000

0 JAN 84

42-010-04



CASE: ■■ DC7420A - DEVIL CANYON OPERATION WITH MATANA IN 2020 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

- 1 NOVEMBER 1974
- 1 DECEMBER 1974
- 1 JANUARY 1975

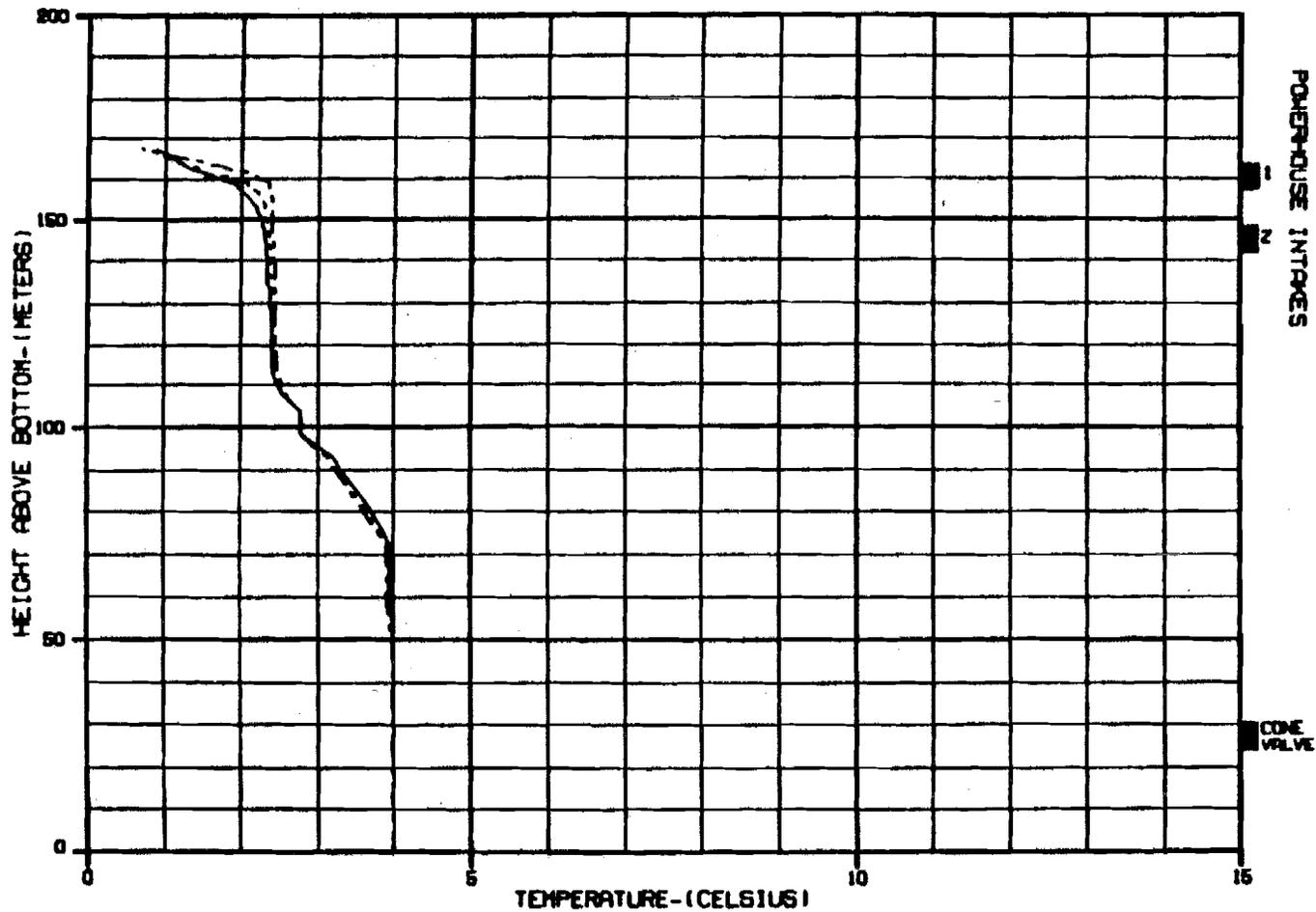
ALASKA POWER AUTHORITY

RESERVOIR PROJECT | OPER. MFD.

DEVIL CANYON RESERVOIR
TEMPERATURE PROFILES

WARZA-EBRACD JOINT VENTURE

DESIGNER: R. L. HARRIS | DRAWN BY: R. J. HARRIS | DATE: 4-21-74



CASE: ■ DC7420A - DEVIL CANYON OPERATION WITH WATANA IN 2020 ■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

— FEBRUARY 1975
 - - - MARCH 1975
 - · - · - APRIL 1975

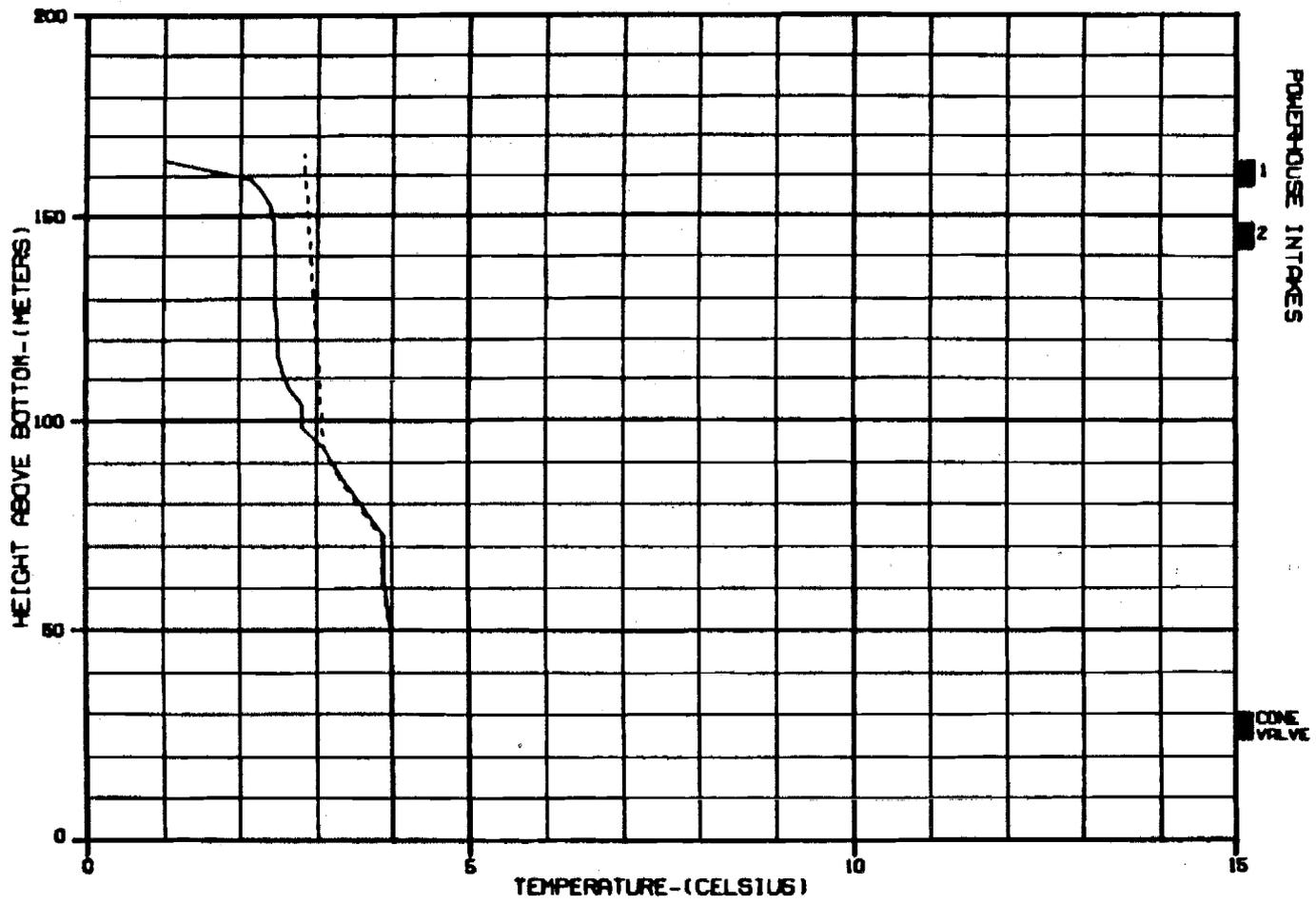
ALASKA POWER AUTHORITY

SUBMITTER PROJECT OPERATOR NAME

DEVIL CANYON RESERVOIR
TEMPERATURE PROFILES

WARDA-ENERSCO JOINT VENTURE

ORDER: 44-0000 8 JAN 84 42-010-04

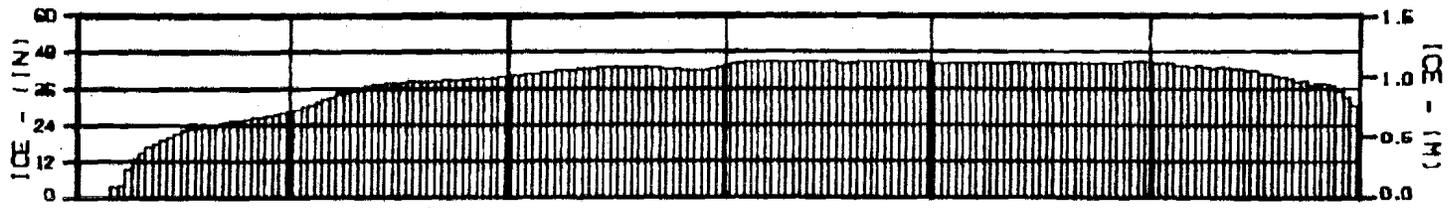


CASE: ■■ DC7420A - DEVIL CANYON OPERATION WITH WATANA IN 2020 ■■

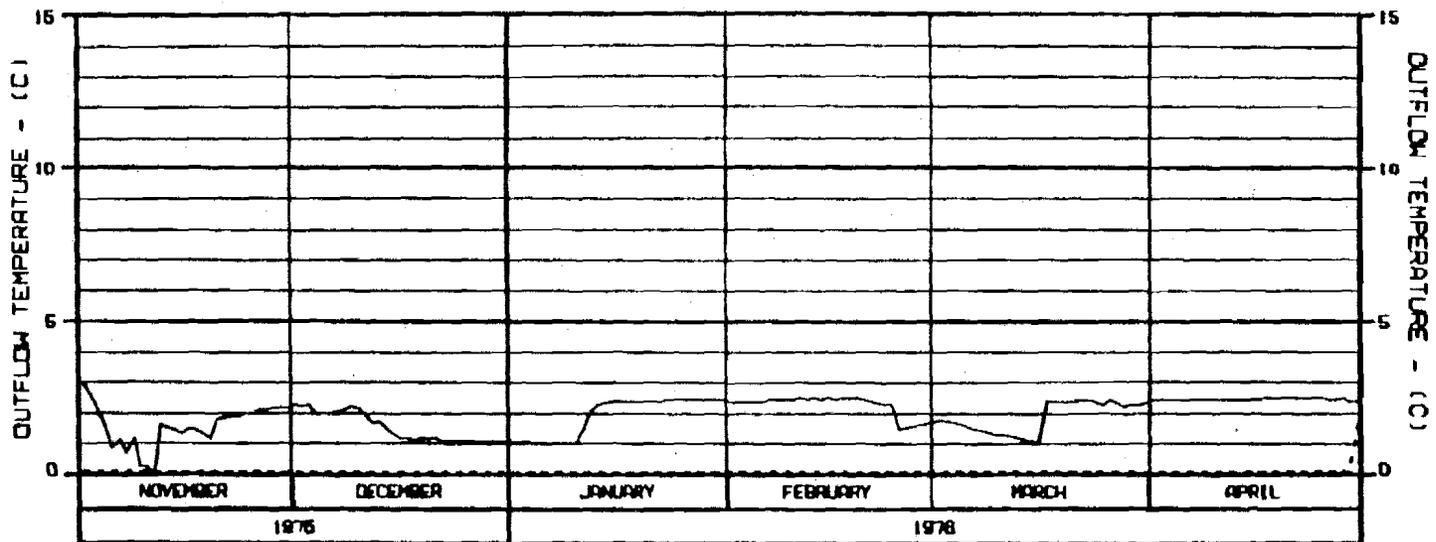
LEGEND:
 PREDICTED TEMPERATURE PROFILES:
 ——— | MAY 1975
 | JUNE 1975
 - - - - | JULY 1975

ALASKA POWER AUTHORITY		
DESIGN PROJECT	OPERATION MODEL	
DEVIL CANYON RESERVOIR TEMPERATURE PROFILES		
WARZA-EBASCO JOINT VENTURE		
DESIGNED BY	DATE	REV
AL-1000	8 JAN 81	42-010-04

EXHIBIT AQ



INTAKE	LEVEL 1					
	LEVEL 2					
	CONE VALVE					
	SPILLWAY					



LEGEND: CASE: ■ DC7620A - DEVIL CANYON OPERATION WITH WATANA IN 2020 ■

— PREDICTED OUTFLOW TEMPERATURE FROM DEVIL CANYON RESERVOIR
 - - - - - INFLOW TEMPERATURE TO WATANA RESERVOIR

- NOTES: 1. INTAKE PORT LEVEL 1 AT ELEVATION 1426 FT (434.24 M)
 2. INTAKE PORT LEVEL 2 AT ELEVATION 1276 FT (419.10 M)
 3. CONE VALVE AT ELEVATION 950 FT (301.75 M)
 4. SPILLWAY CREST AT ELEVATION 1404 FT (427.94 M)

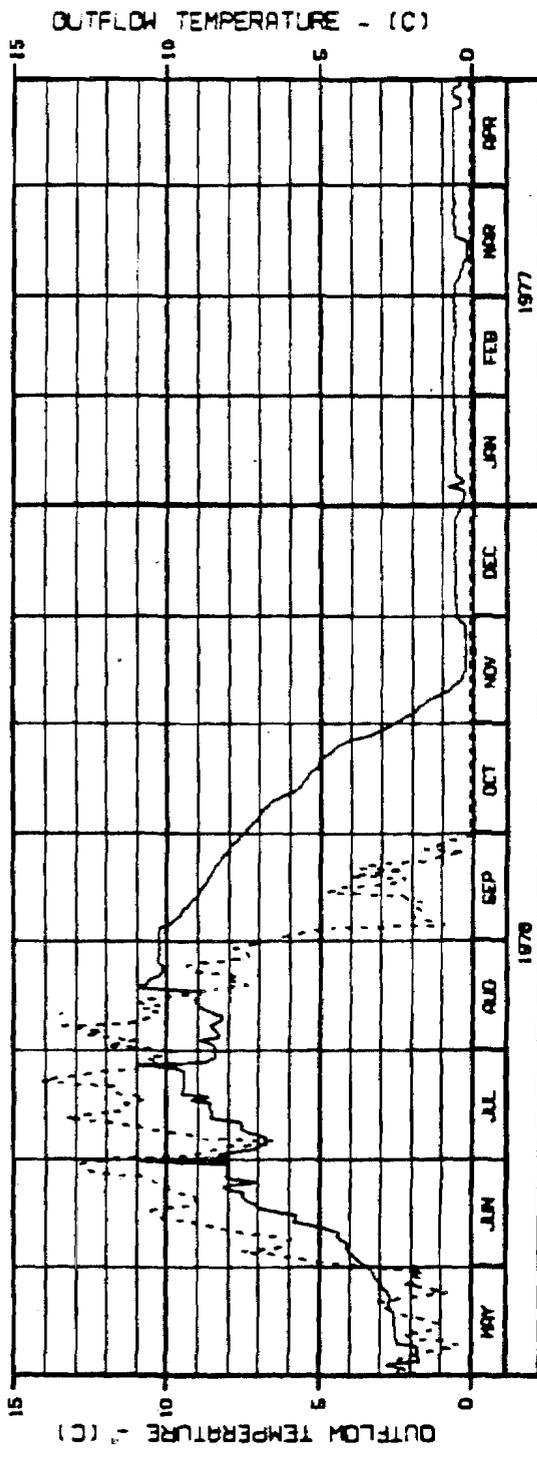
ALASKA POWER AUTHORITY

SUBMITTA PROJECT OPERA MODEL

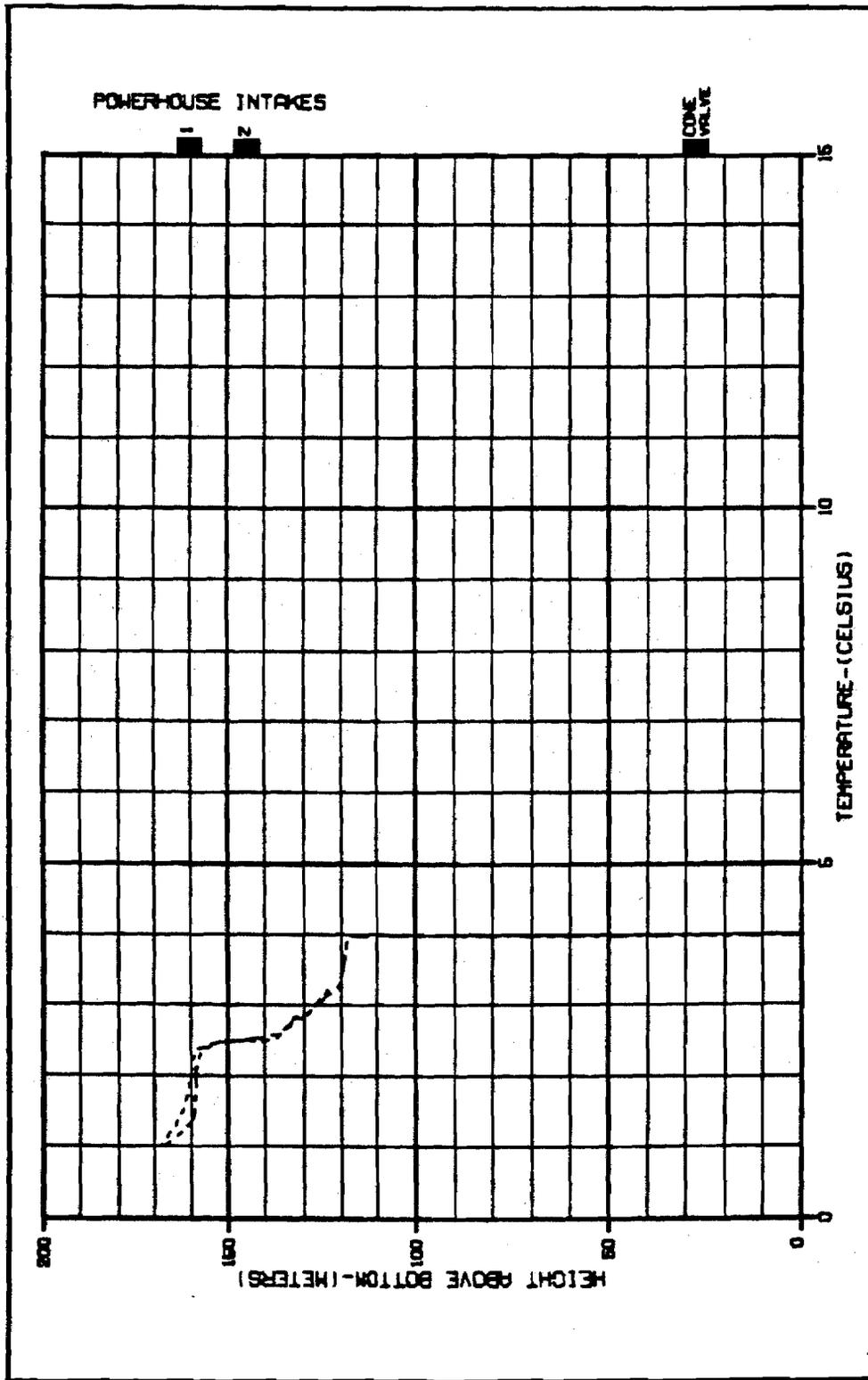
DEVIL CANYON RESERVOIR
 OUTFLOW TEMPERATURE
 AND ICE GROWTH

HARZA-EBRSCO JOINT VENTURE

SYNOPSIS: D.L. 8-8-80 3 JAN 81 1000.142.40-0000-04



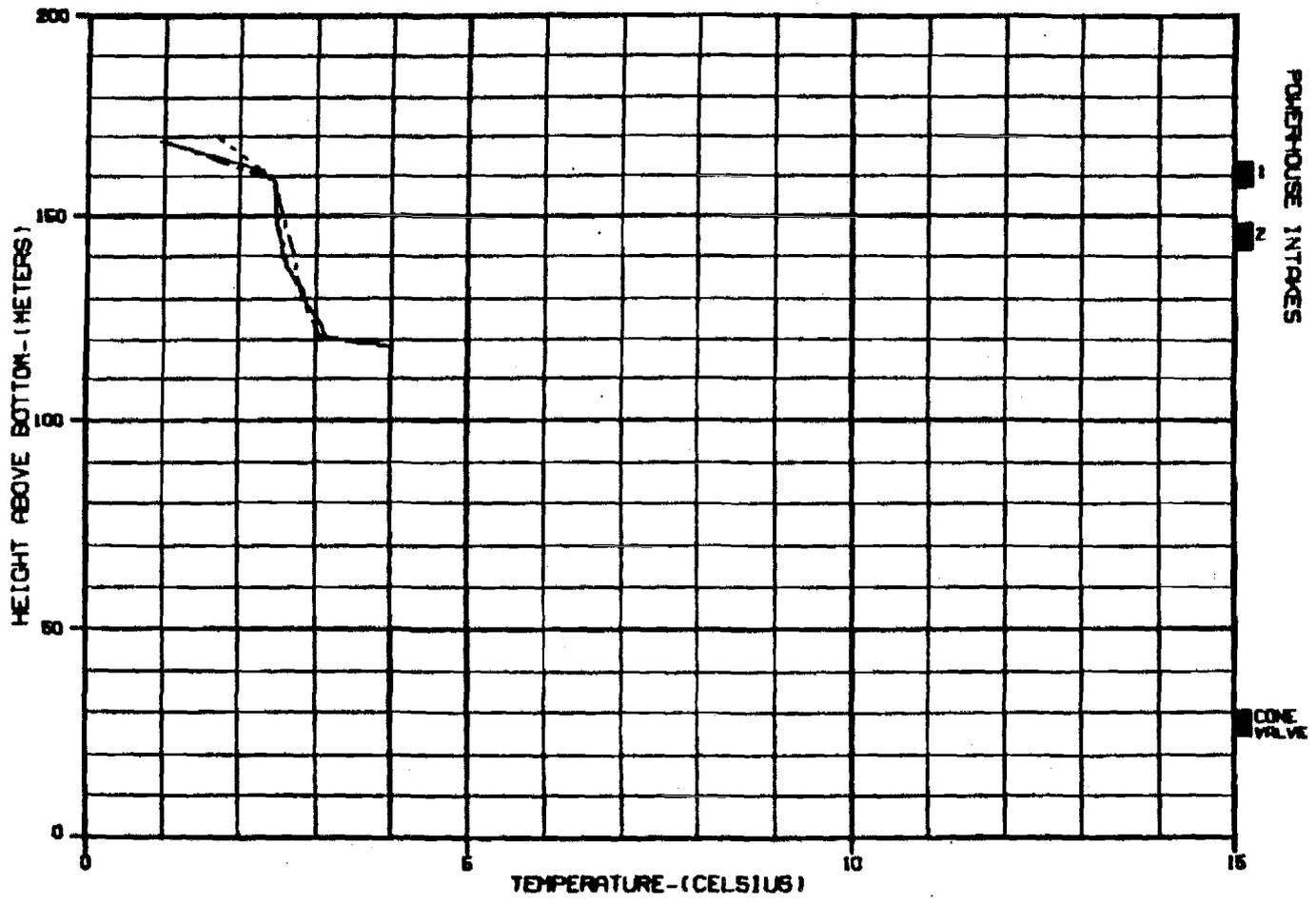
ALASKA POWER AUTHORITY
 SUBMITTER PROJECT: DEVIL CANYON RESERVOIR
 OUTFLOW TEMPERATURE AND ICE GROWTH
 HARZA-EBRSCO JOINT VENTURE
 DRAWING: AL-2020-01 8 JUN 84 10:15 AM



ALASKA POWER AUTHORITY
 DEVIL CANYON RESERVOIR
 TEMPERATURE PROFILES
 19720-EB0600 JOINT VENTURE
 0-418-04

CASE: 00 DC7820A - DEVIL CANYON OPERATION WITH NATANA IN 2020 III

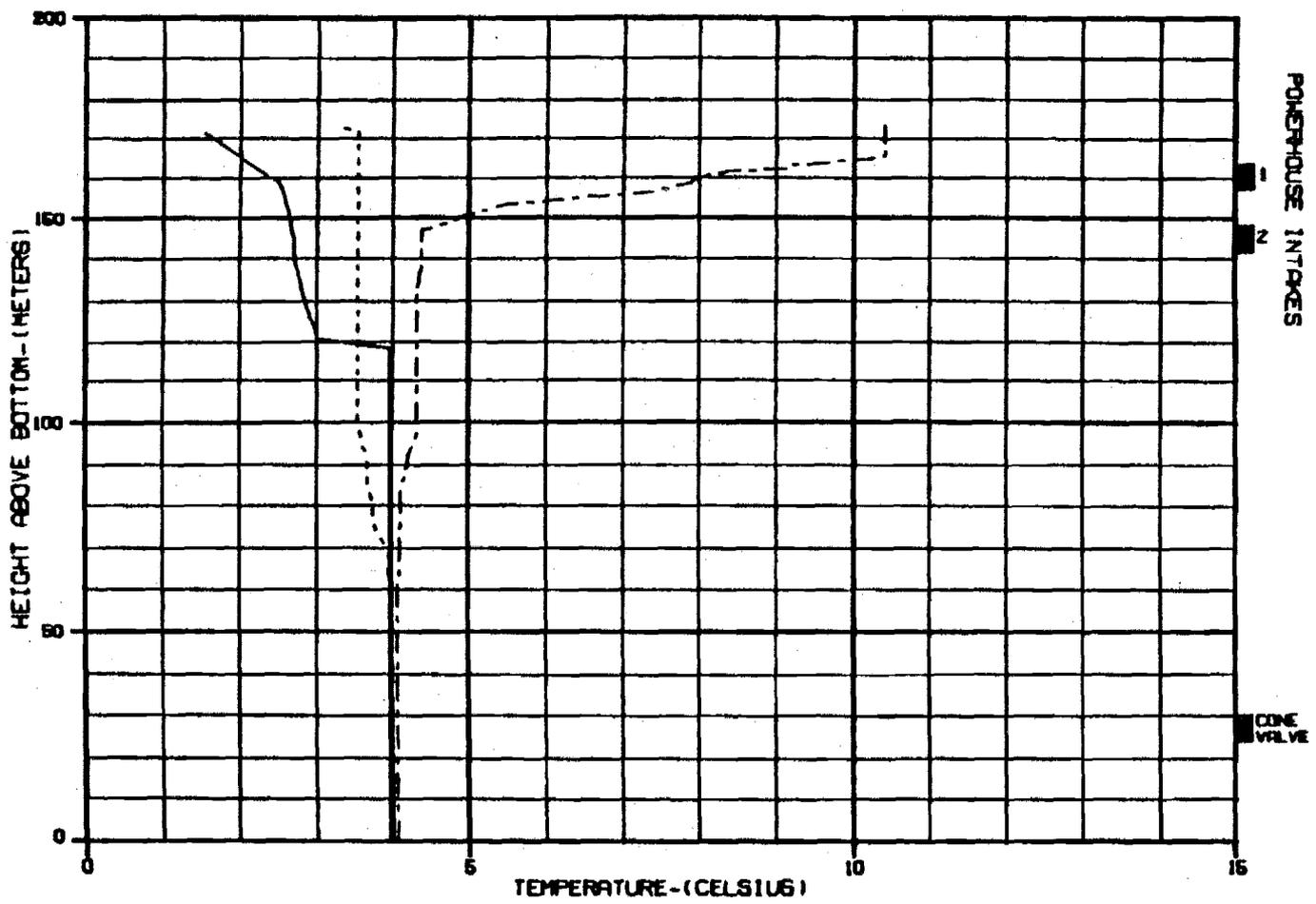
LEGEND:
 PREDICTED TEMPERATURE PROFILES:
 - - - - - NOVEMBER 1976
 _____ DECEMBER 1976
 _____ JANUARY 1976



CASE: DC7820A - DEVIL CANYON OPERATION WITH WATANA IN 2020

LEGEND: PREDICTED TEMPERATURE PROFILES:
 ———— | FEBRUARY 1976
 - - - - - | MARCH 1976
 - · - · - | APRIL 1976

ALASKA POWER AUTHORITY		
DESIGN PROJECT	DESIGN MODEL	
DEVIL CANYON RESERVOIR TEMPERATURE PROFILES		
HARZA-EBASCO JOINT VENTURE		
DESIGN NUMBER	DATE	REV
01-0000	0 JAN 76	02-010-01



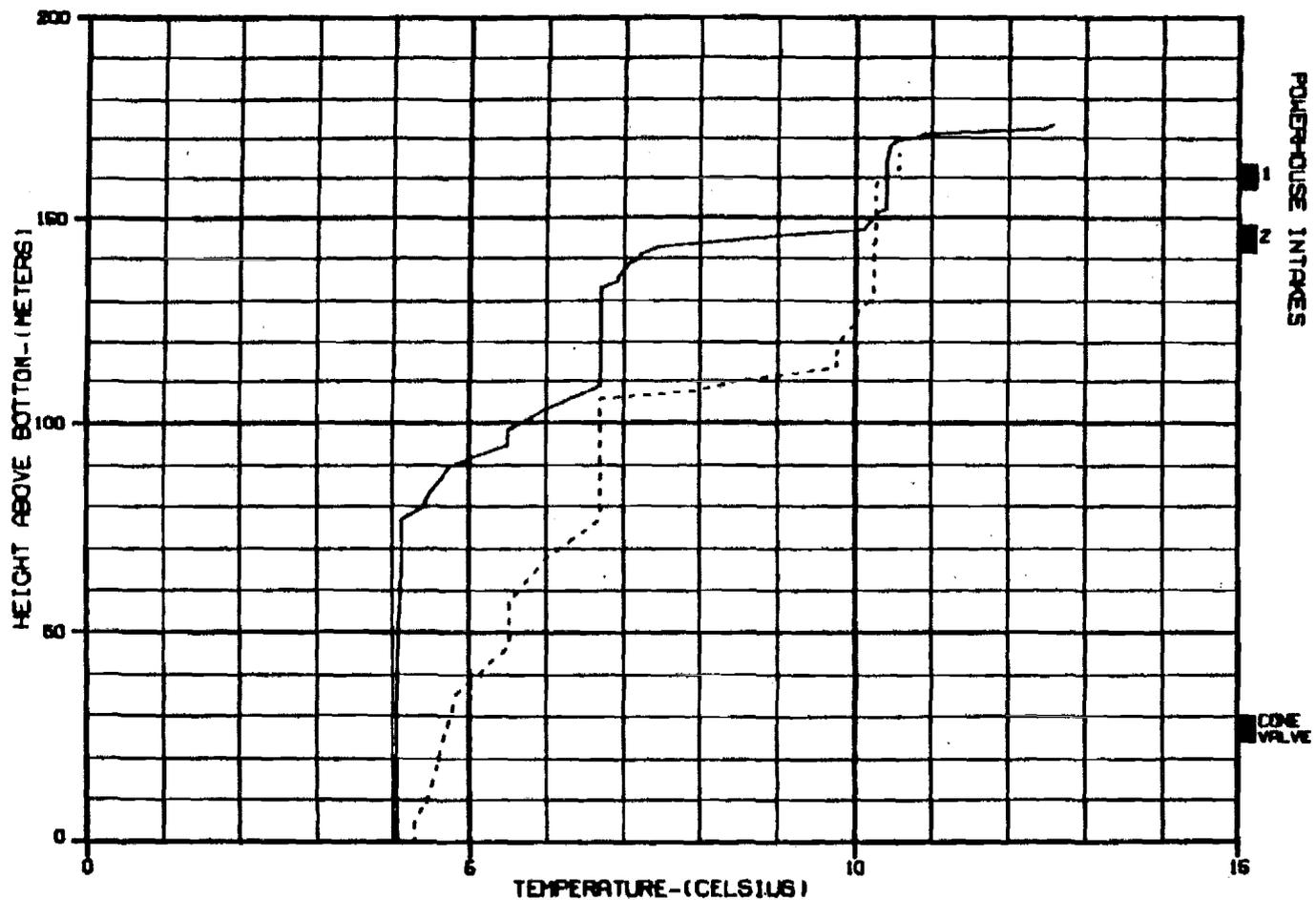
CASE: ■■ DC7620A - DEVIL CANYON OPERATION WITH WATANA IN 2020 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

- | MAY 1976
- | JUNE 1976
- · - · - | JULY 1976

ALASKA POWER AUTHORITY	
QUESTOR PROJECT	DEVIL CANYON
DEVIL CANYON RESERVOIR TEMPERATURE PROFILES	
WARZA-EBRACO JOINT VENTURE	
OWNER: ALPAC	DATE: 8-21-84



CASE: ■■ DC7620A - DEVIL CANYON OPERATION WITH MATANA IN 2020 ■■

LEGEND:

PREDICTED TEMPERATURE PROFILES:

——— | AUGUST 1976
 | SEPTEMBER 1976
 - - - - | OCTOBER 1976

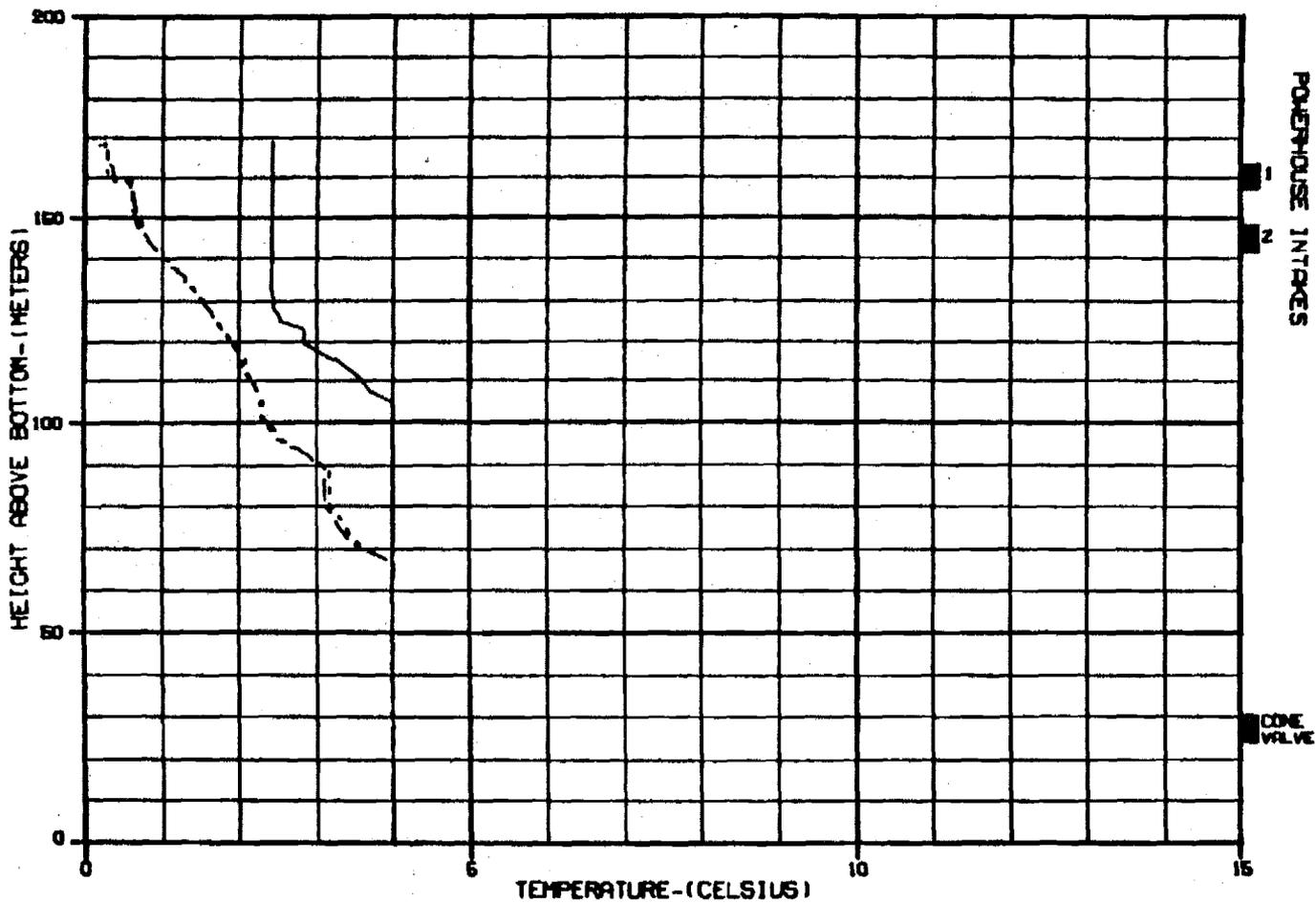
ALASKA POWER AUTHORITY

SUBMITTAL PROJECT GREEN HOLE

DEVIL CANYON RESERVOIR
TEMPERATURE PROFILES

HARZA-EBRSCO JOINT VENTURE

DESIGN NUMBER 7 JAN 84 42-010-04



CASE: DC7820A - DEVIL CANYON OPERATION WITH WATANA IN 2020

LEGEND:

PREDICTED TEMPERATURE PROFILES:

_____ 1 NOVEMBER 1976
 1 DECEMBER 1976
 - - - - - 1 JANUARY 1977

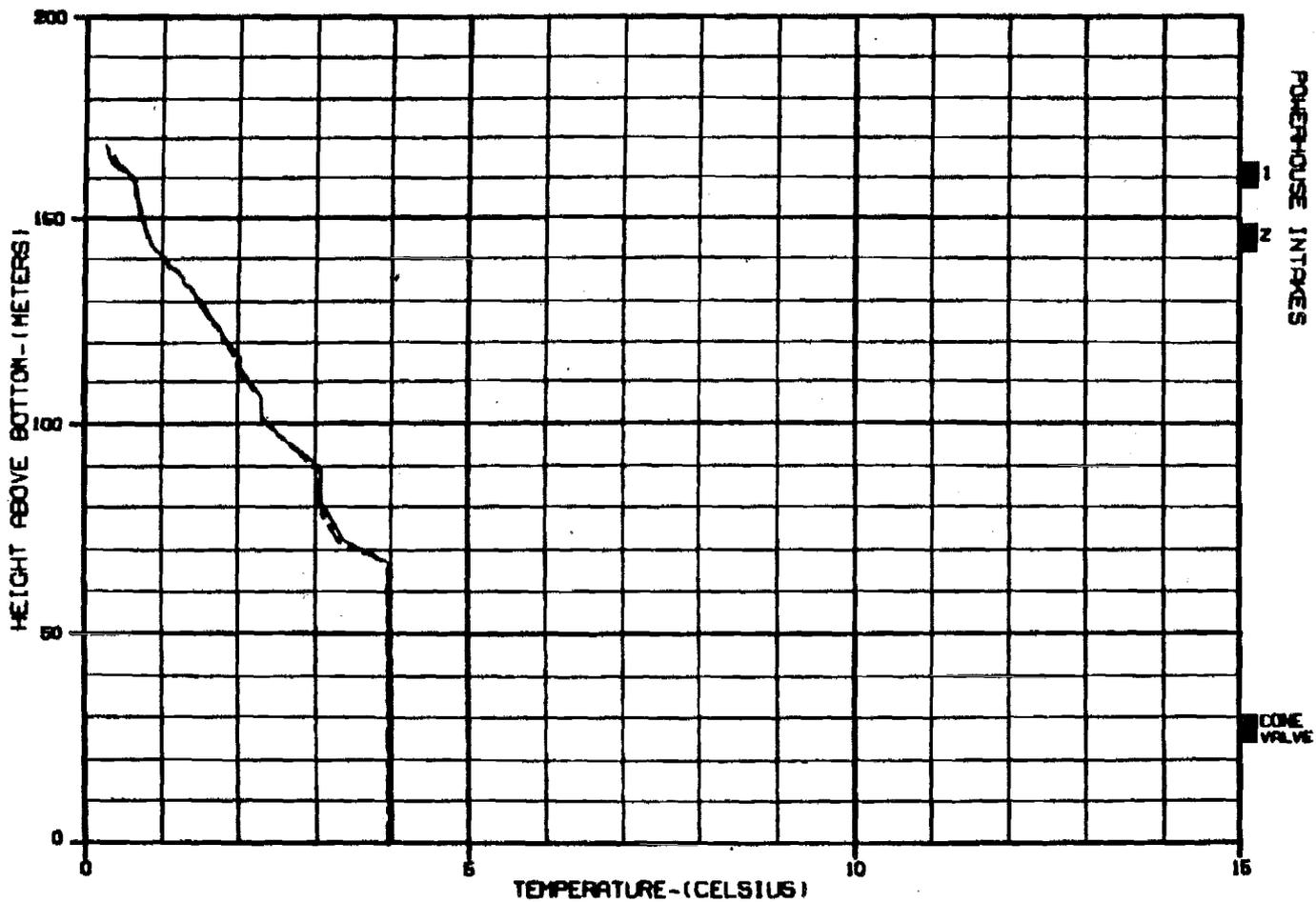
ALAGNA POWER AUTHORITY

DEVIL CANYON PROJECT OPEN WHEEL

DEVIL CANYON RESERVOIR
TEMPERATURE PROFILES

HRZA-EBRACD JOINT VENTURE

ISSUED: 01/08/77 0 JAN 87 42-210-04



CASE: DC7820A - DEVIL CANYON OPERATION WITH NATANA IN 2020

LEGEND:

PREDICTED TEMPERATURE PROFILES:

———— | FEBRUARY 1977
 - - - - | MARCH 1977
 - · - · | APRIL 1977

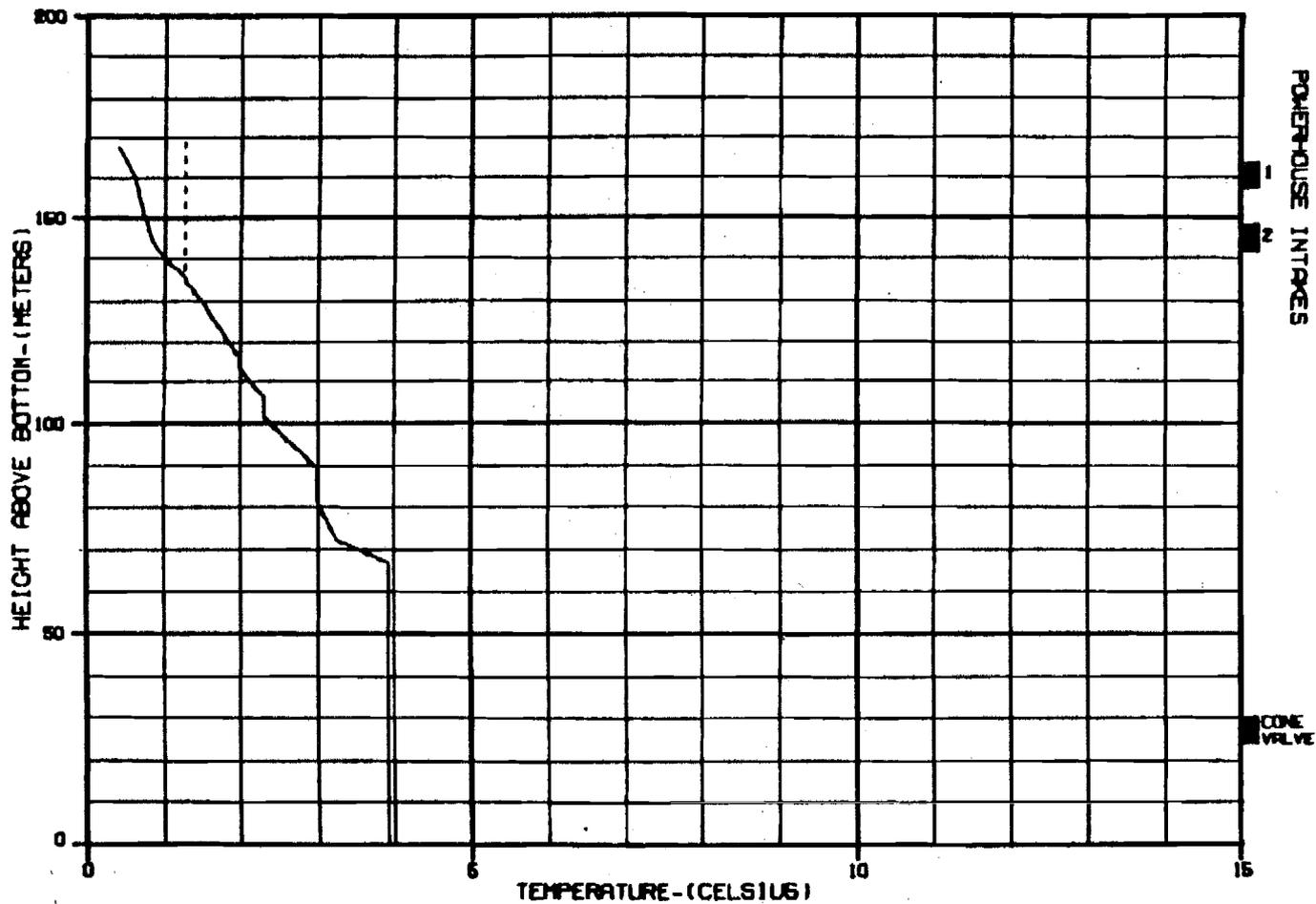
ALASKA POWER AUTHORITY

SUBMITTAL PROJECT | DESIGN MODEL

DEVIL CANYON RESERVOIR
TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

DESIGN: 44-0000 | 5 JAN 84 | 42-010-04



CASE: DC7620A - DEVIL CANYON OPERATION WITH WATANA IN 2020

LEGEND:

PREDICTED TEMPERATURE PROFILES:

— 1 MAY 1977
 - - - 1 JUNE 1977
 ····· 1 JULY 1977

ALASKA POWER AUTHORITY

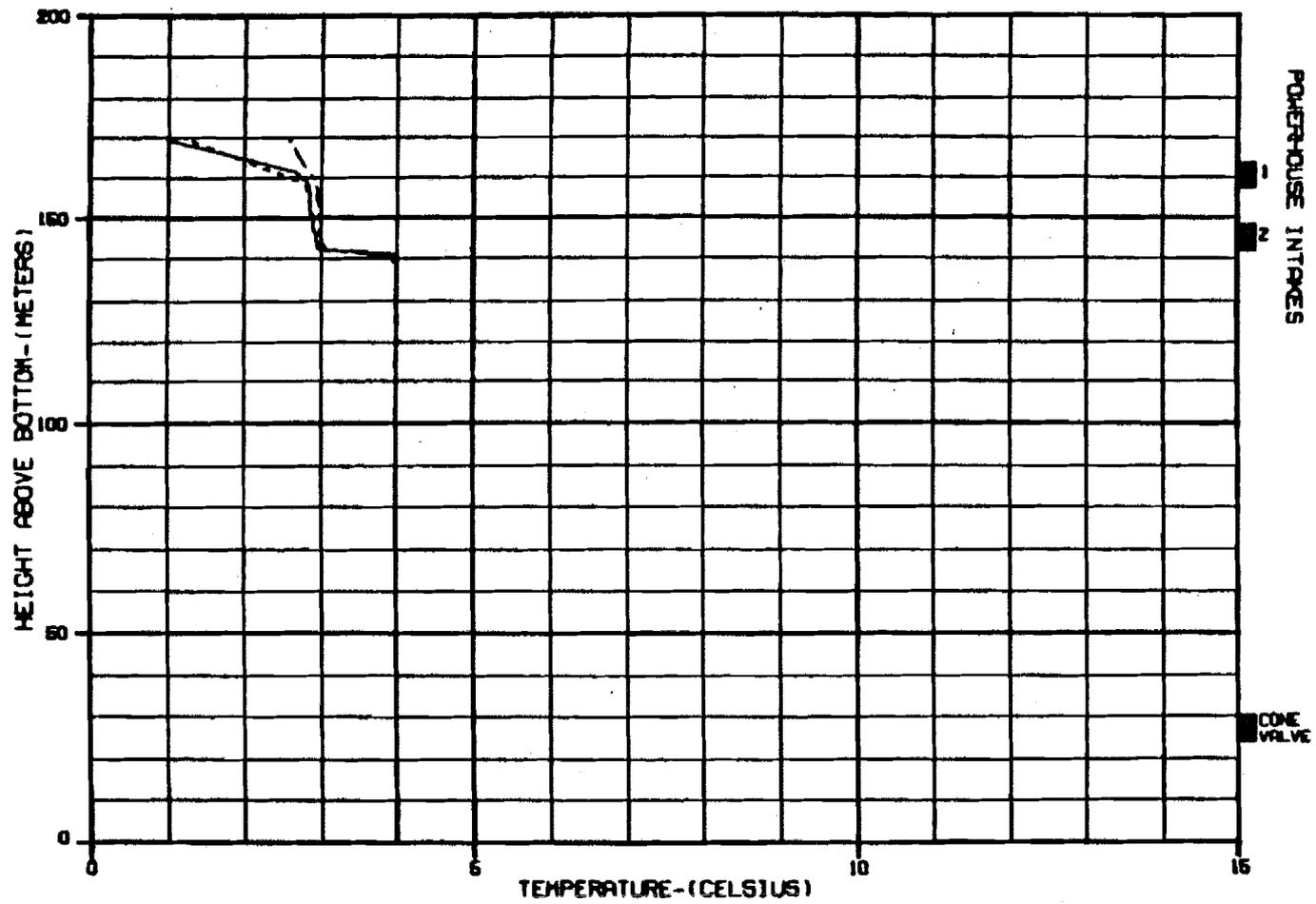
DEVELOPER PROJECT OPERATOR

DEVIL CANYON RESERVOIR
 TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

DESIGNED BY DATE 4-21-84

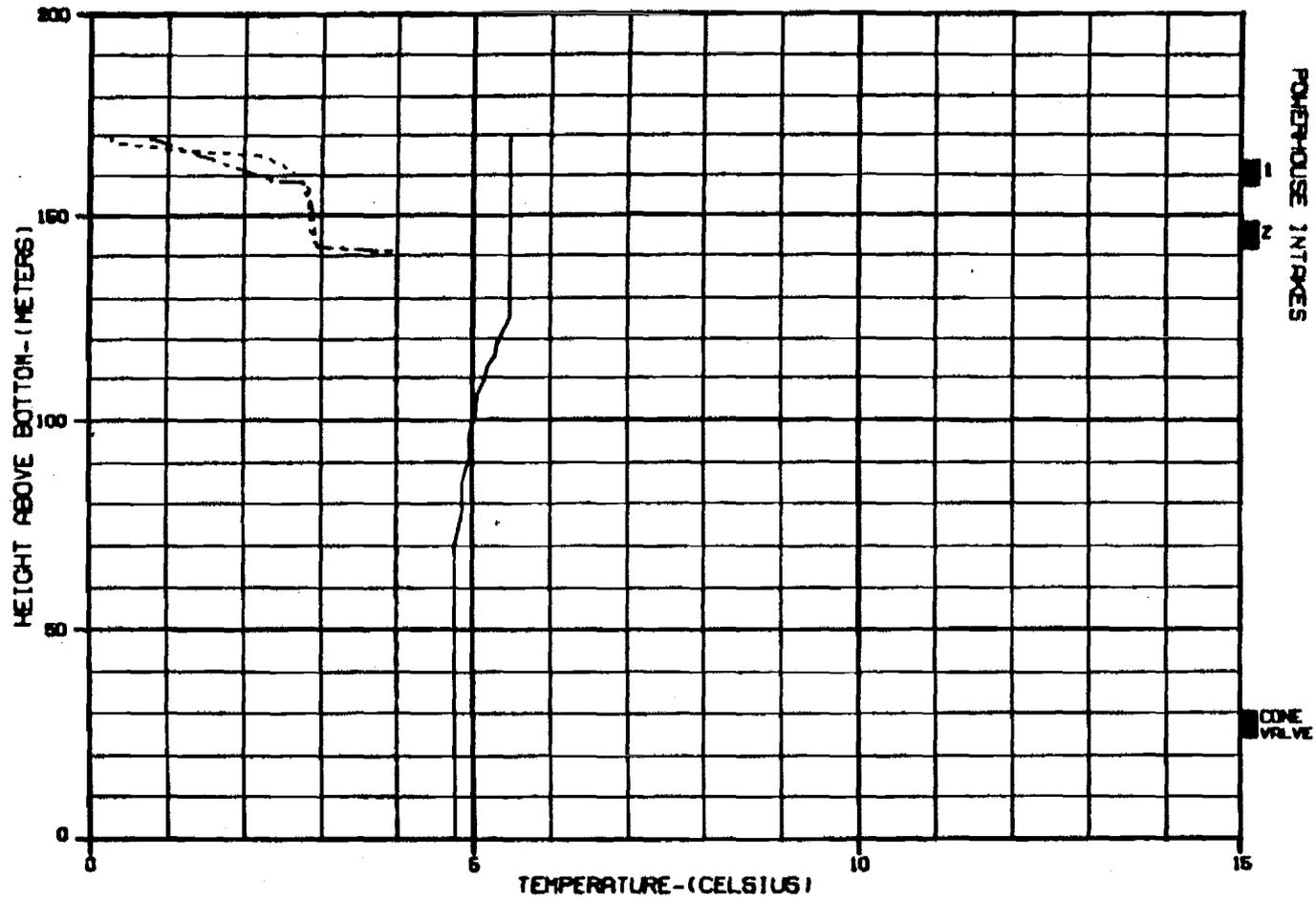
EXHIBIT AR



CASE: ■■ DC81182120B - DEVIL CANYON OPERATION WITH WATANA IN 2020 ■■
 - WATANA WEATHER STATION DATA

LEGEND: PREDICTED TEMPERATURE PROFILES:
 ———— | FEBRUARY 1982
 - - - - - | MARCH 1982
 ········ | APRIL 1982

ALASKA POWER AUTHORITY	
SUBMITTAL PROJECT	OPERATION MODEL
DEVIL CANYON RESERVOIR TEMPERATURE PROFILES	
MARZA-EBRSCO JOINT VENTURE	
ISSUED: 04/19/82	BY: JAR/SH
42-010-04	



CASE: ■■ DC811821208 - DEVIL CANYON OPERATION WITH MATANA IN 2020 ■■
 - MATANA WEATHER STATION DATA

LEGEND: PREDICTED TEMPERATURE PROFILES:
 ———— | NOVEMBER 1981
 - - - - - | DECEMBER 1981
 ········ | JANUARY 1982

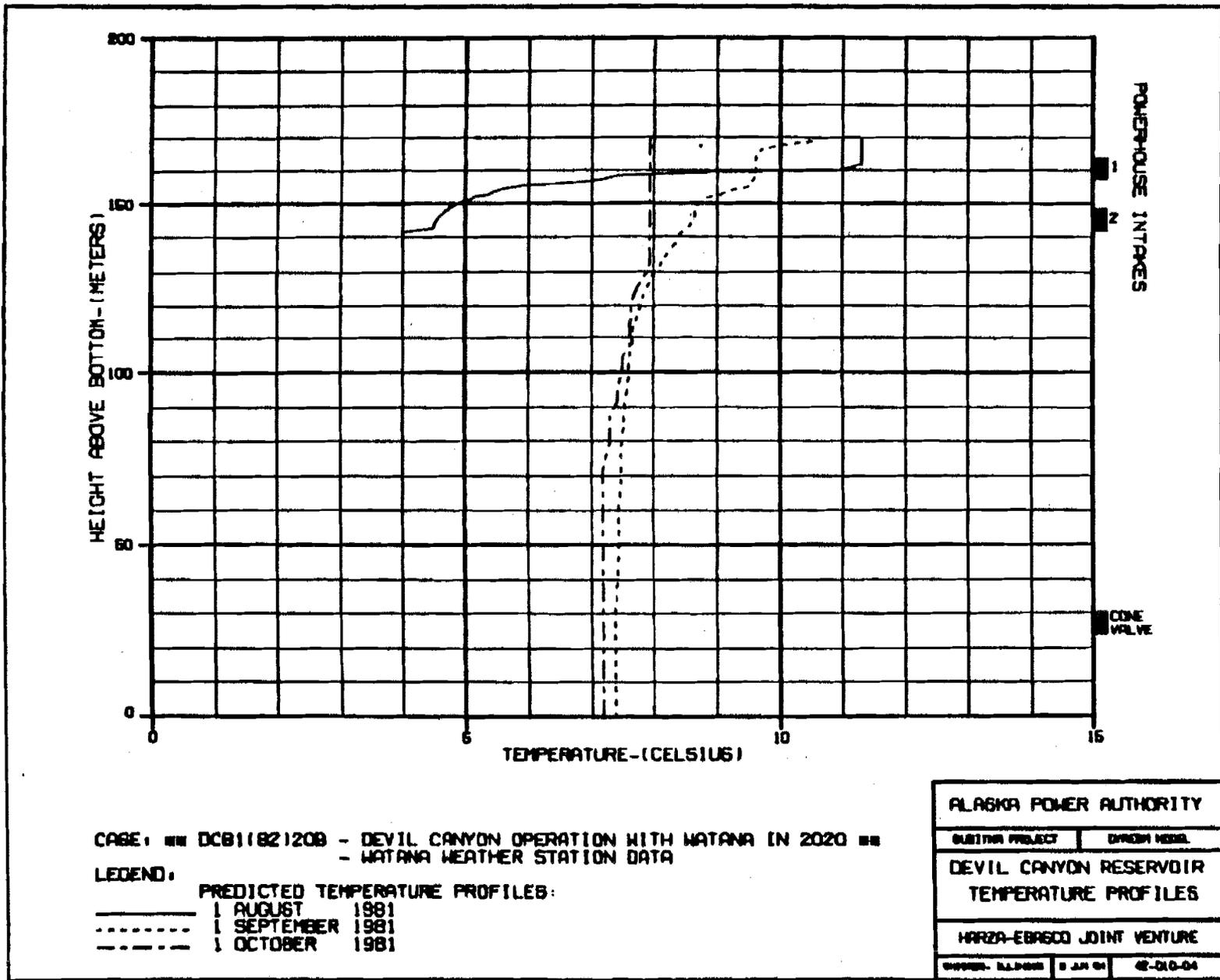
ALASKA POWER AUTHORITY

DISTRICT PROJECT OPENING NO. 2

DEVIL CANYON RESERVOIR
 TEMPERATURE PROFILES

HARZA-ENRICO JOINT VENTURE

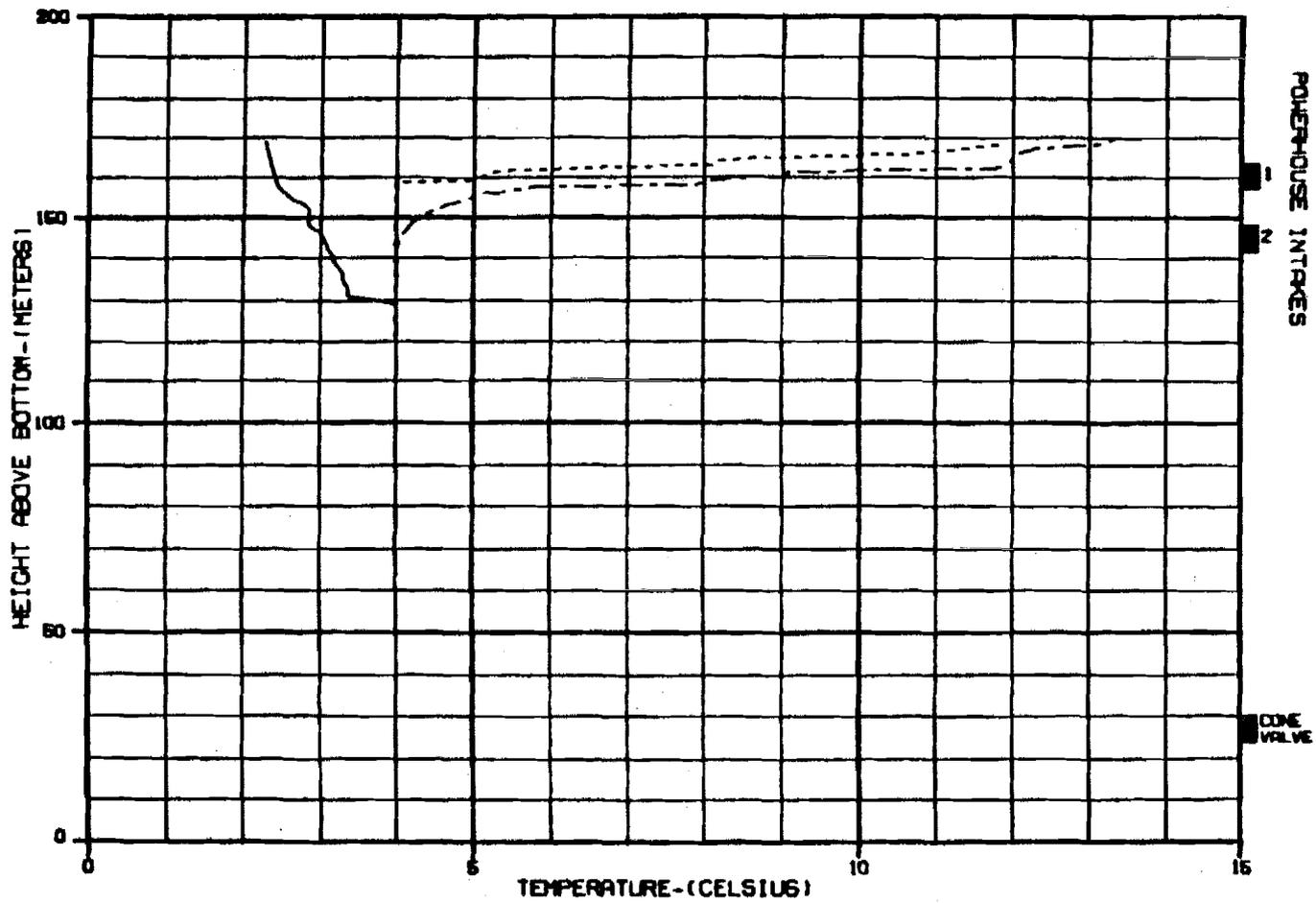
DRAWN: S.L.P. 8 JAN 81 42-018-04



CAGE: ■■ DCB11821208 - DEVIL CANYON OPERATION WITH WATANA IN 2020 ■■
 - WATANA WEATHER STATION DATA

LEGEND:
 PREDICTED TEMPERATURE PROFILES:
 ———— 1 AUGUST 1981
 1 SEPTEMBER 1981
 - - - - - 1 OCTOBER 1981

ALASKA POWER AUTHORITY		
OWNER PROJECT	DEVIL CANYON	
DEVIL CANYON RESERVOIR TEMPERATURE PROFILES		
WARZA-EBASCO JOINT VENTURE		
OWNER: ALPS	DATE: JUN 81	REV: 010-04



CASE: # DCB11821208 - DEVIL CANYON OPERATION WITH WATANA IN 2020 #
 - WATANA WEATHER STATION DATA

LEGEND:

PREDICTED TEMPERATURE PROFILES:

- MAY 1981
- - - JUNE 1981
- · · JULY 1981

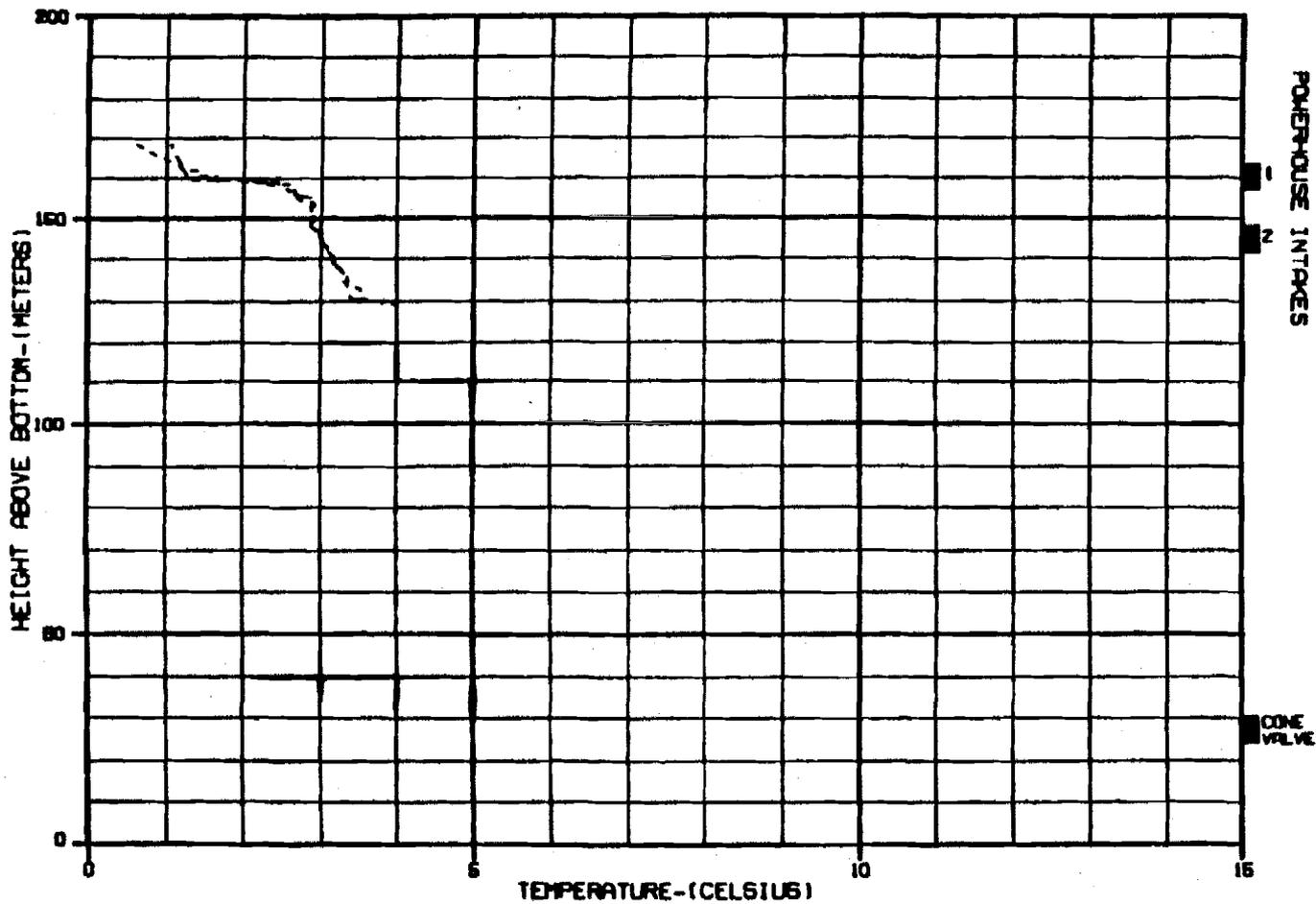
ALASKA POWER AUTHORITY

SUBMITTA PROJECT DYPHET PROJ.

DEVIL CANYON RESERVOIR
 TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

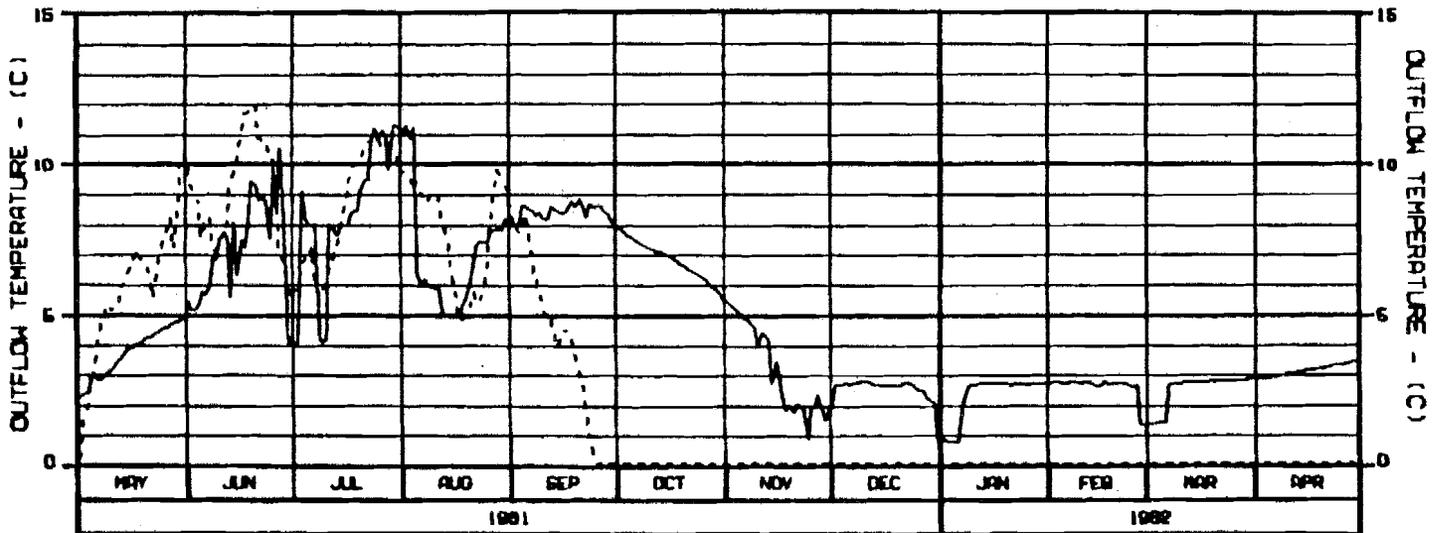
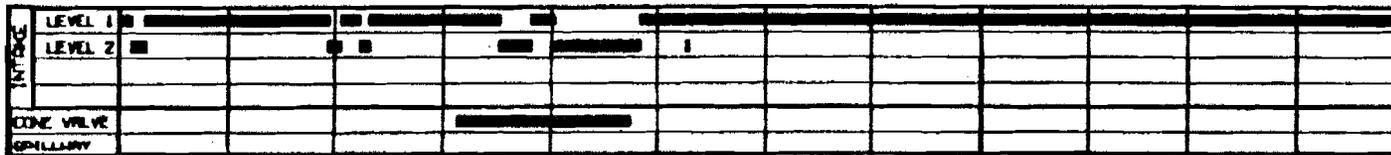
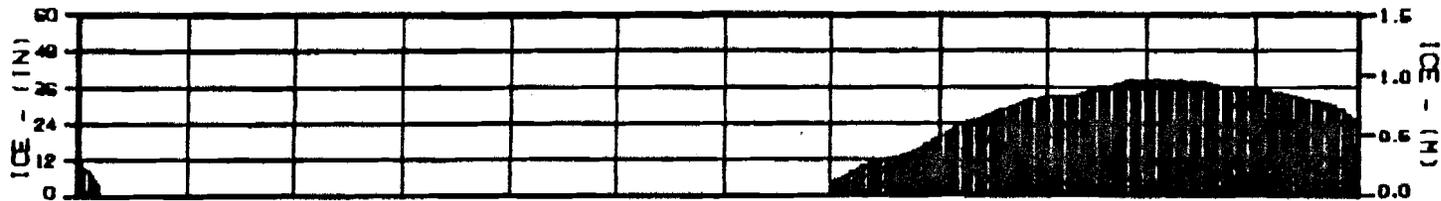
POWER - B.L.D. 8 JAN 81 42-010-04



CASE: # DCB1182120B - DEVIL CANYON OPERATION WITH WATANA IN 2020 #
 - WATANA WEATHER STATION DATA

LEGEND: PREDICTED TEMPERATURE PROFILES:
 _____ | NOVEMBER 1980
 | DECEMBER 1980
 - - - - - | JANUARY 1981

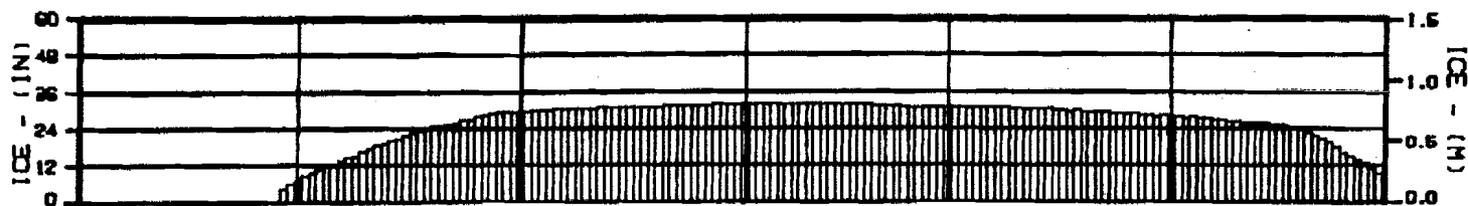
ALASKA POWER AUTHORITY		
OWNER PROJECT	OWNER NAME	
DEVIL CANYON RESERVOIR		
TEMPERATURE PROFILES		
WARZA-EBRSCO JOINT VENTURE		
DESIGN: ALP/RS	DATE: 8 JAN 81	REV: 02-010-04



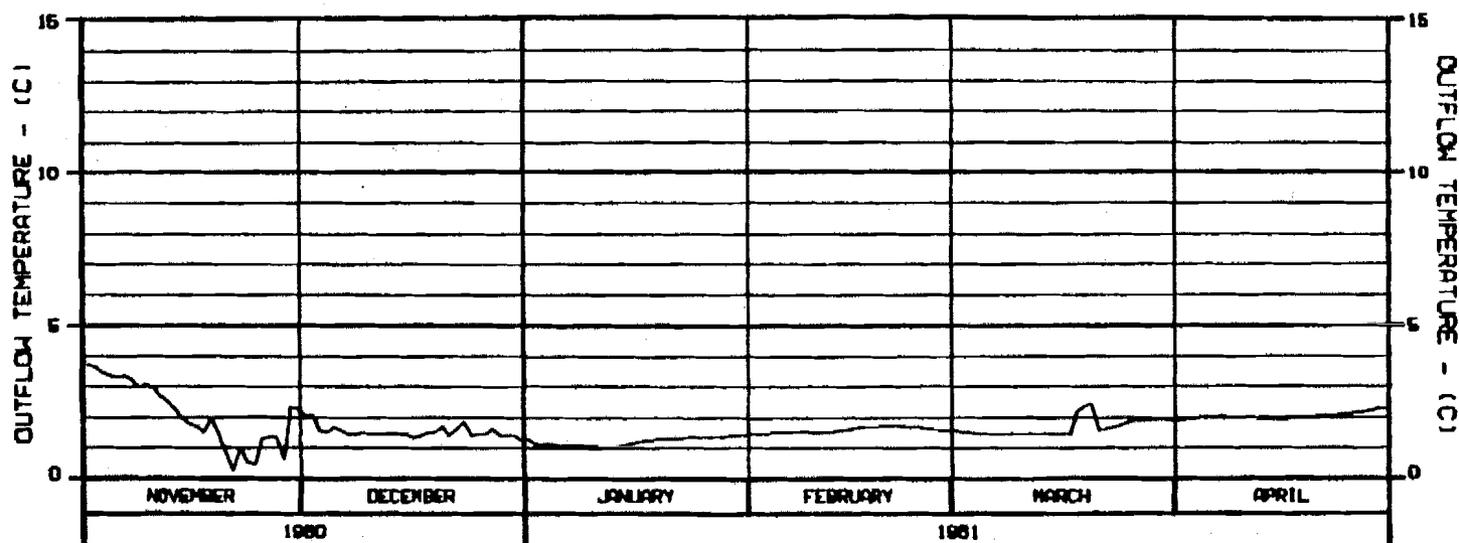
LEGEND: CASE: == DC811821208 - DEVIL CANYON OPERATION WITH MATANA IN 2020 ==
 - MATANA WEATHER STATION DATA
 ——— PREDICTED OUTFLOW TEMPERATURE FROM DEVIL CANYON RESERVOIR
 - - - - - INFLOW TEMPERATURE TO MATANA RESERVOIR

- NOTES:
1. INTAKE PORT LEVEL 1 AT ELEVATION 1426 FT (434.94 M)
 2. INTAKE PORT LEVEL 2 AT ELEVATION 1276 FT (419.10 M)
 3. CONE VALVE AT ELEVATION 990 FT (301.75 M)
 4. SPILLWAY CREST AT ELEVATION 1404 FT (427.94 M)

ALASKA POWER AUTHORITY	
DEVELOPER PROJECT	OWNER MODEL
DEVIL CANYON RESERVOIR OUTFLOW TEMPERATURE AND ICE GROWTH	
MARZA-EBRSCO JOINT VENTURE	
REVISED: 11-2-82	8 JUN 83 1000.148.48-248-24



INTAKE	LEVEL 1					
	LEVEL 2					
CONE VALVE						
SPILLWAY						



LEGEND: CASE: ■ DC81(82)208 - DEVIL CANYON OPERATION WITH MATANA IN 2020 ■

———— PREDICTED OUTFLOW TEMPERATURE FROM DEVIL CANYON RESERVOIR
 - - - - - INFLOW TEMPERATURE TO MATANA RESERVOIR

- NOTES: 1. INTAKE PORT LEVEL 1 AT ELEVATION 1425 FT (434.24 M)
 2. INTAKE PORT LEVEL 2 AT ELEVATION 1275 FT (419.10 M)
 3. CONE VALVE AT ELEVATION 990 FT (301.75 M)
 4. SPILLWAY CREST AT ELEVATION 1404 FT (427.94 M)

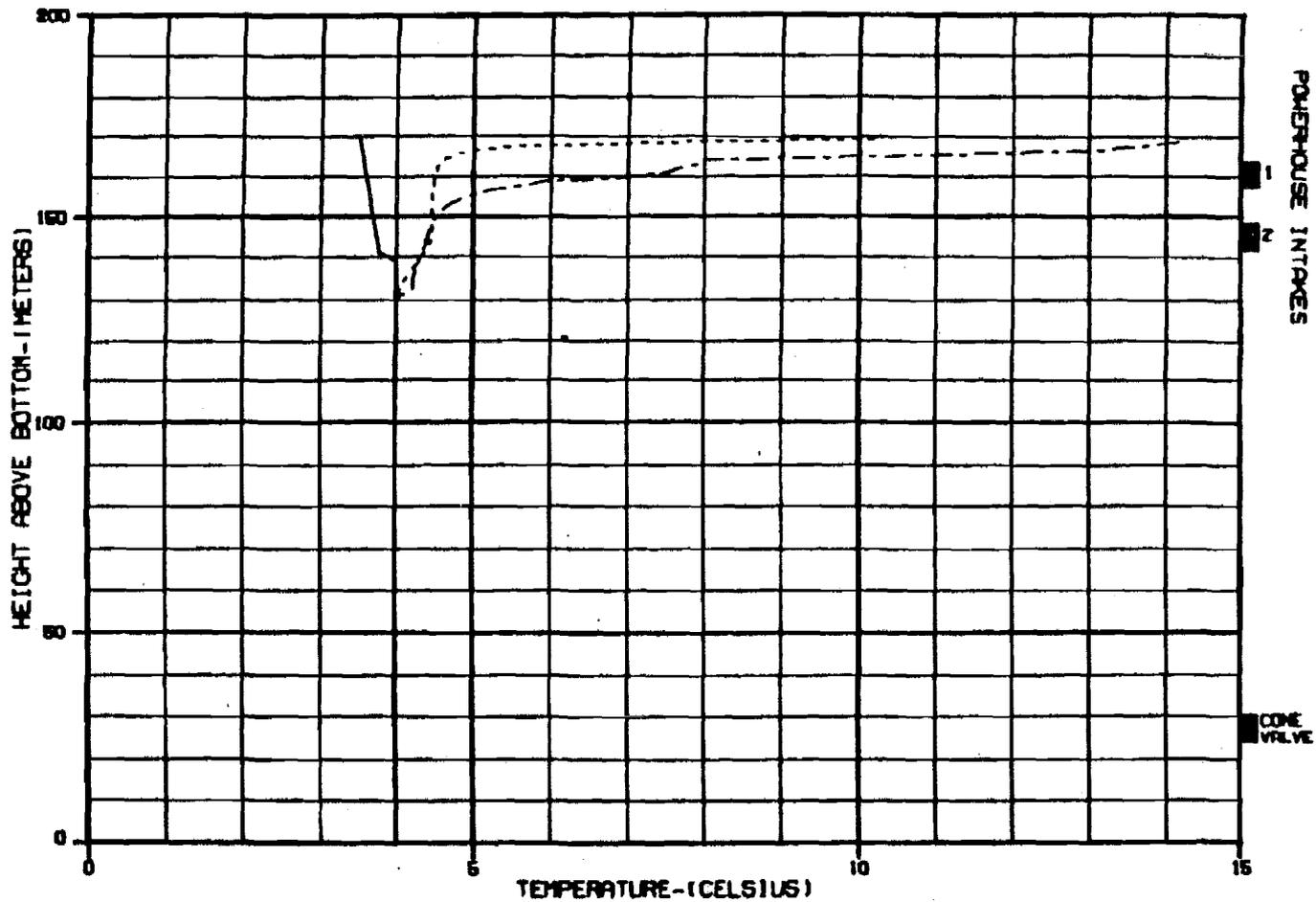
ALASKA POWER AUTHORITY

SUBMITTA PROJECT	DESIGN NO.
DEVIL CANYON RESERVOIR	
OUTFLOW TEMPERATURE	
AND ICE GROWTH	

HARZA-EBASCO JOINT VENTURE

DESIGNER: S.L.P. INC.	DATE: JAN 81	PROJECT NO.: 81-000-04
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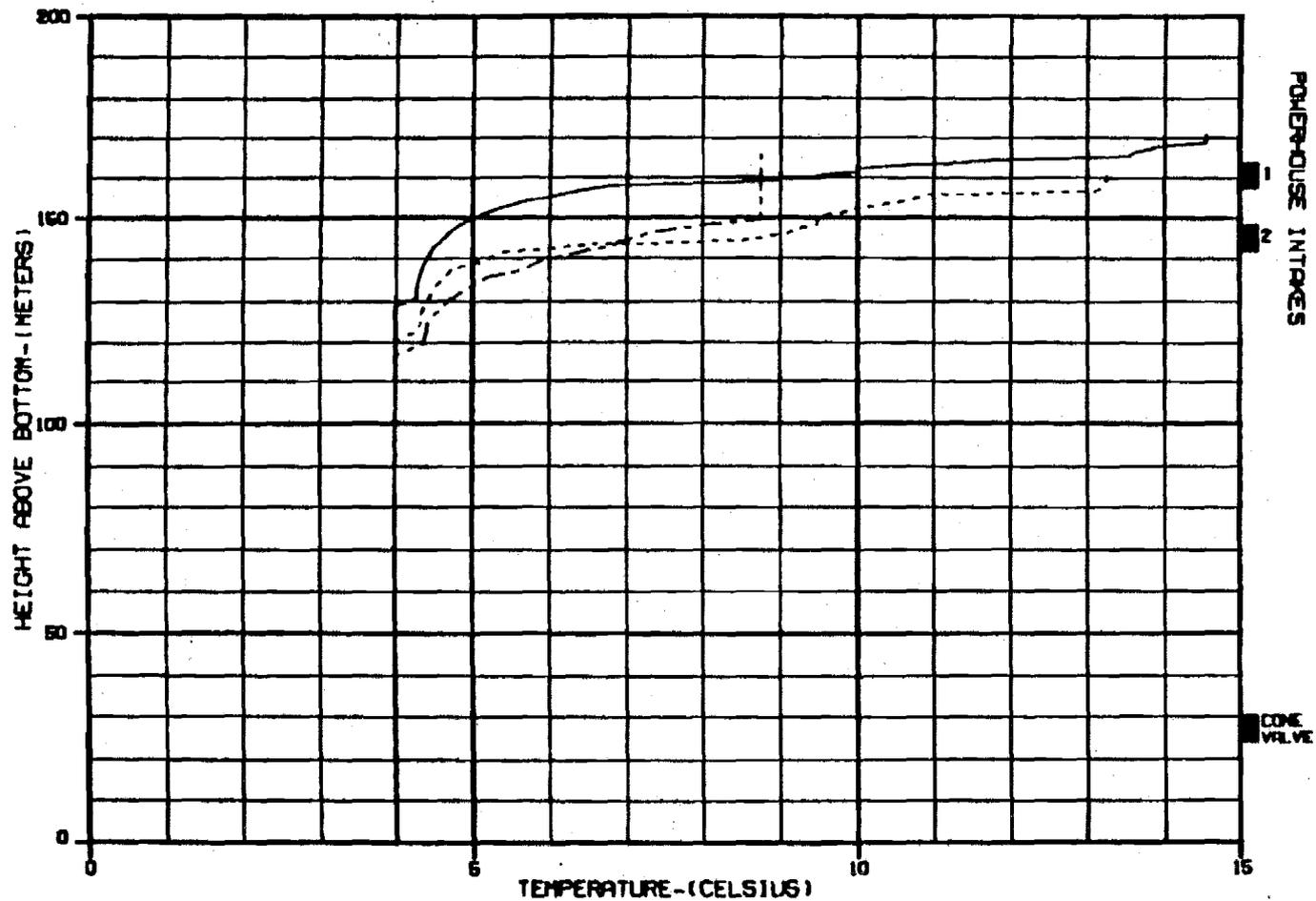
EXHIBIT AS



CASE: ■■ DC811821208 - DEVIL CANYON OPERATION WITH WATANA IN 2020 ■■
 - WATANA WEATHER STATION DATA

LEGEND: PREDICTED TEMPERATURE PROFILES:
 ———— | MAY 1982
 - - - - - | JUNE 1982
 - · - · - | JULY 1982

ALASKA POWER AUTHORITY	
EXISTING PROJECT	DESIGN MODEL
DEVIL CANYON RESERVOIR TEMPERATURE PROFILES	
HARZA-EDISON JOINT VENTURE	
ISSUED: 01/08/82	42-010-04



CASE: ■■ DC811821208 - DEVIL CANYON OPERATION WITH WATANA IN 2020 ■■
 - WATANA WEATHER STATION DATA

LEGEND:

PREDICTED TEMPERATURE PROFILES:

— | AUGUST 1982
 ···· | SEPTEMBER 1982
 - - - | OCTOBER 1982

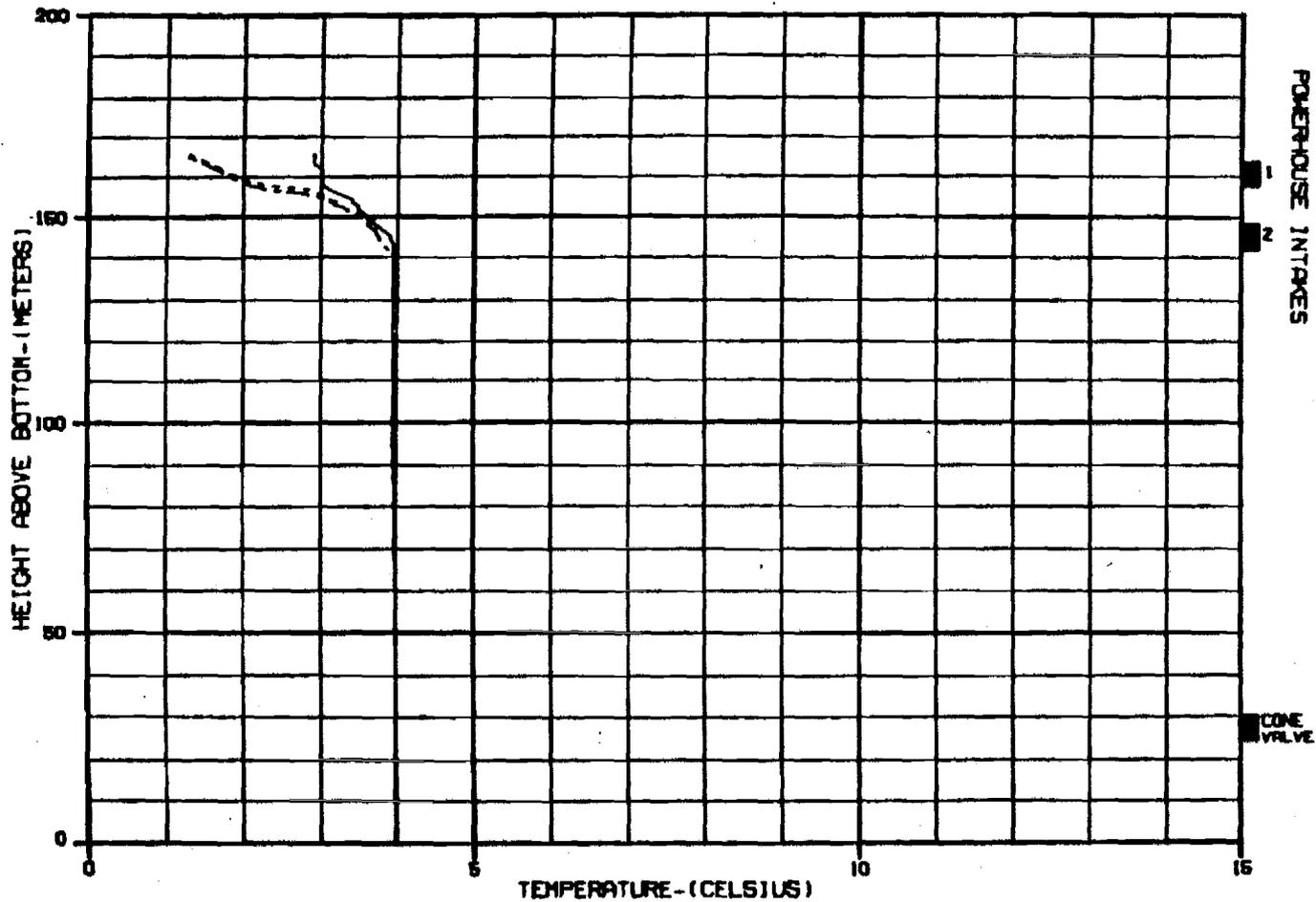
ALASKA POWER AUTHORITY

WATANA PROJECT | CROWN MODEL

DEVIL CANYON RESERVOIR
 TEMPERATURE PROFILES

WARDA-BASCO JOINT VENTURE

DATE: 01-19-82 9 AM '82 42-010-04



CASE: ## DC811821208 - DEVIL CANYON OPERATION WITH WATANA IN 2020 ##
 - WATANA WEATHER STATION DATA

LEGEND:

PREDICTED TEMPERATURE PROFILES:

— | NOVEMBER 1982
 | DECEMBER 1982
 - - - - | JANUARY 1983

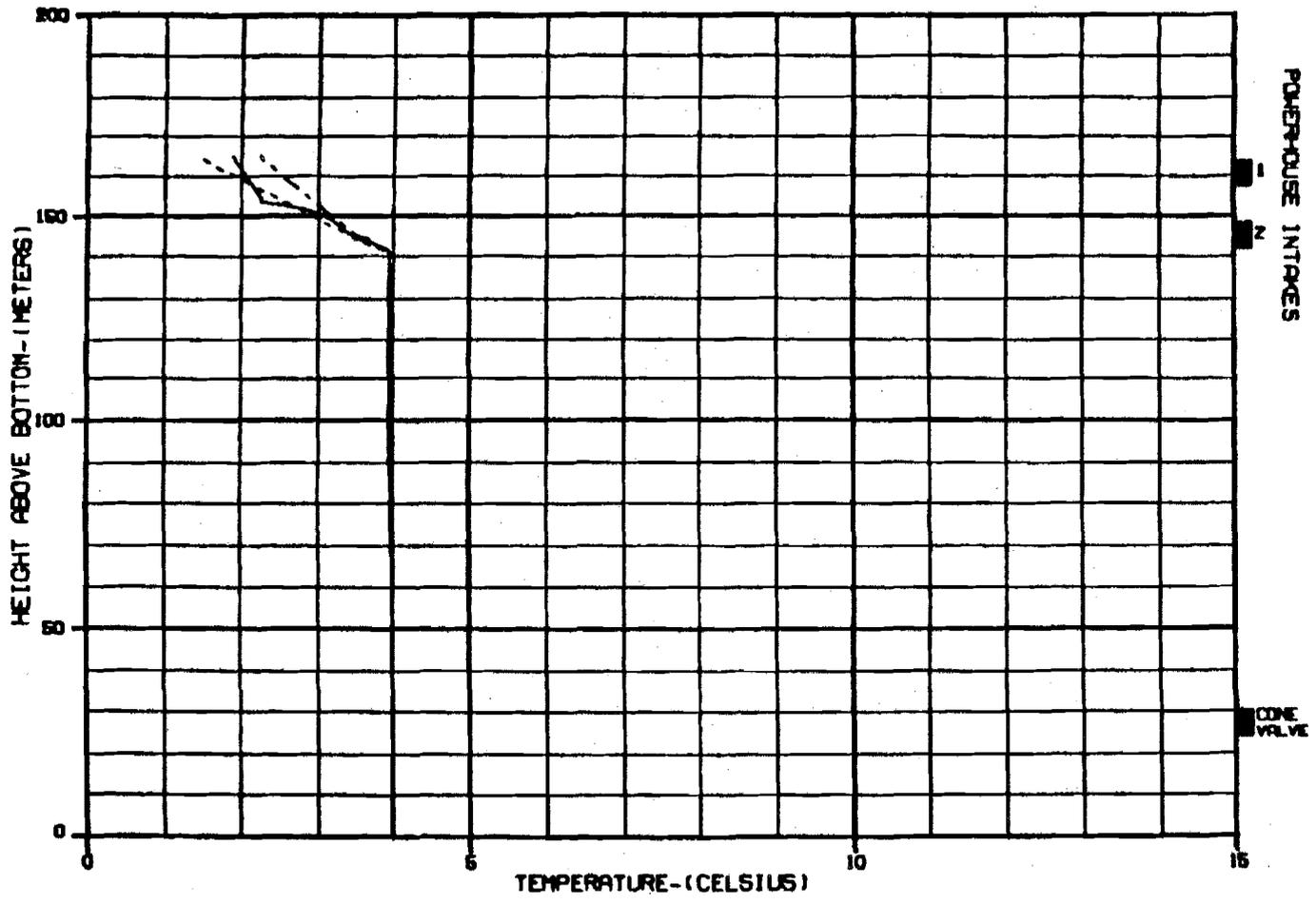
ALASKA POWER AUTHORITY

SUBMITTA PROJECT DIVISION HEAD

DEVIL CANYON RESERVOIR
 TEMPERATURE PROFILES

WARZA-EBRSCO JOINT VENTURE

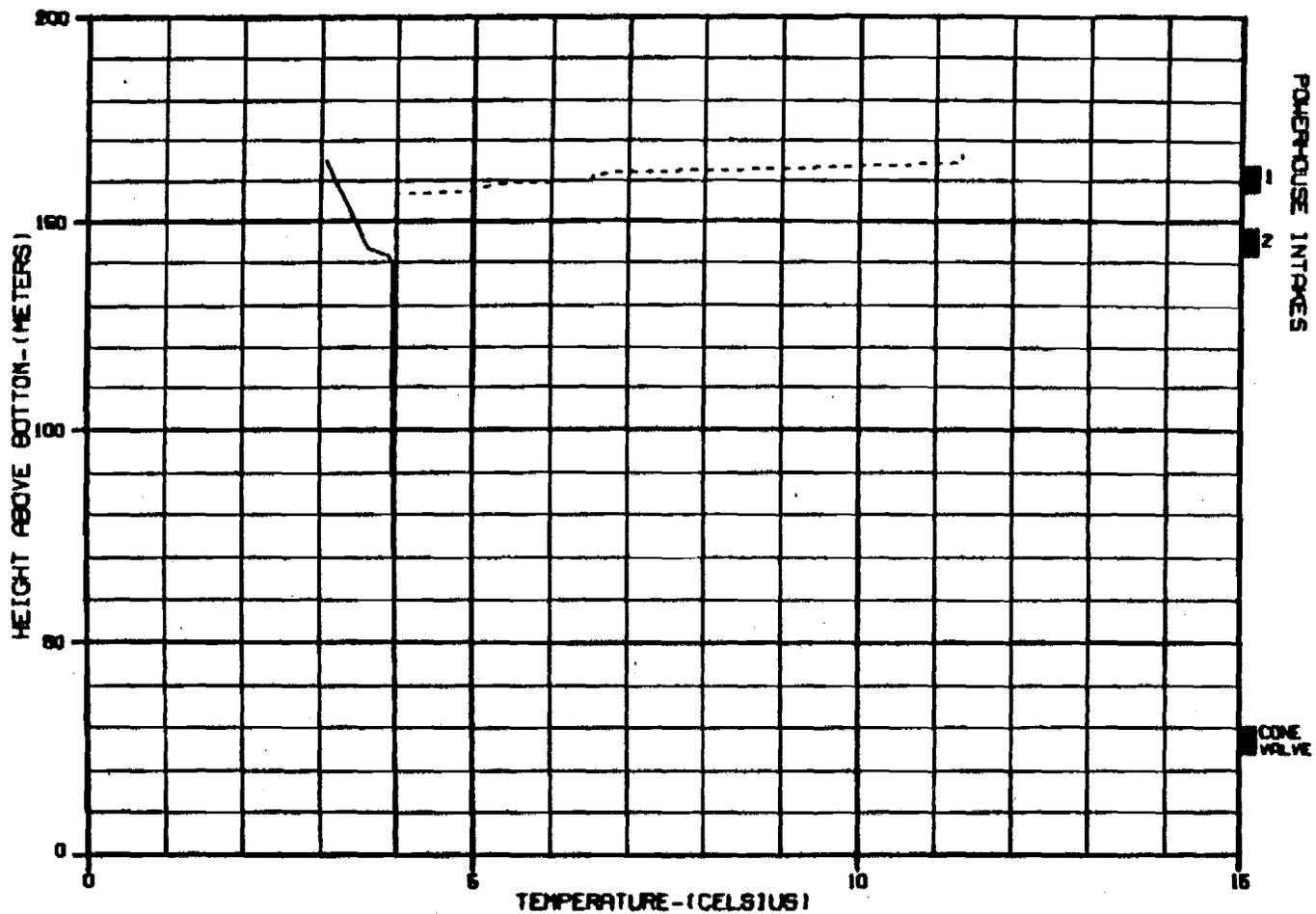
PROJECT: 811821208 8 JAN 83 42-010-04



CASE: DC811821208 - DEVIL CANYON OPERATION WITH MATANA IN 2020
 - MATANA WEATHER STATION DATA

LEGEND: PREDICTED TEMPERATURE PROFILES:
 ———— | FEBRUARY 1983
 | MARCH 1983
 - - - - | APRIL 1983

ALASKA POWER AUTHORITY	
DESIGN PROJECT	OPERATION
DEVIL CANYON RESERVOIR	
TEMPERATURE PROFILES	
HARZA-EBASCO JOINT VENTURE	
ISSUED: 11/01/83	8 JAN 84
42-018-04	



CASE: ■■ DCB1182120B - DEVIL CANYON OPERATION WITH WATANA IN 2020 ■■
 - WATANA WEATHER STATION DATA

LEGEND:

PREDICTED TEMPERATURE PROFILES:

——— | MAY 1983
 - - - - | JUNE 1983

ALASKA POWER AUTHORITY

DESIGN PROJECT DESIGN NO.

DEVIL CANYON RESERVOIR
 TEMPERATURE PROFILES

WARZA-ENBECO JOINT VENTURE

DESIGN: 11.18.83 3 JAN 84 42-010-04