E-82EA 01

BA Revision

General

PRIMARY	SECONDARY	TERTIARY	DPF SEQ
82EA01	BA REVISION	GENERAL	Z7701820
X	ACCESS ROAD		Z7701820
X	BILL OF MATL PRELIM		Z7701820
X	BOTTOM ASH POND RPT '83		Z7701820
X	BYPASS PPG		Z7701820
X	CLAY BORROW SITE		Z7701820
X	CLAY HAULING		Z7701820
X	CLAY LINER TESTING 8301		Z7701820
X	CLAY MINING		Z7701820
X	CLAY MINING OERATIONS		Z7701820
X	COMPACTION WATER		Z7701820
X	CONFERENCE MEMO 1		Z7701820
X	CULVERTS		Z7701820
X	EARTHWORK		Z7701820
X	EMBANKMENT		Z7701820
X	FIELD TRIP		Z7701820
X	INDEPENDENT DESIGN REVUE		Z7701820
X	JOHNSON HOWARD OWNER		Z7701820
X	LANDFILL		Z7701820
X	MATLS REPORT SOIL EXPL		Z7701820
X	PERMEABILITY TESTS		Z7701820
X	PPG		Z7701820
X	PPG BYPASS		Z7701820
X	REAL ESTATE		Z7701820
X	RECLAIMING		Z7701820
X	SECURITY FENCING		Z7701820
X	SOIL DENSITY TESTS		Z7701820
X	SOIL EXPLORATION RPT		Z7701820
X	TESTING CONSTR		Z7701820
X	TRESTLES BA LINE		Z7701820
X	TWIN CITY TEST/BA RPT'83		Z7701820
X	UTILIZATION VOLUME BA		Z7701820

GROSS CONSTRUCTION	
COST OLD CONSTRUCTION	
REMOVAL COSTS	
SALVAGE	
TOTAL AUTHORIZATION	400 000

CONSTRUCTION: START DATE 01/82 COMPLETE 09/82

FORECAST TYPE 01 CATEGORY & PRIORITY 2C

		19 82	19
PRIOR YEARS			
19 82	400 000	J 4 000	J
19		F 14 000	F
3RD YEAR		M 16 000	M
4TH YEAR		A 17 000	A
5TH YEAR		M 6 000	M
6TH YEAR		J 6 000	J
7TH YEAR		J 111 000	J
8TH YEAR		A 112 000	A
9TH YEAR		S 114 000	S
10TH YEAR		O	O
FUTURE		N	N
TOTAL	400 000	D	D

PROJECT TYPE

☒ BUDGET REQUEST 19 82 ☐ CONTINGENT FUND 19 ____

☐ ADDITION TO 19 ____ ☐ SUBREQUISITION 19 ____

MISCELLANEOUS PROJECT DATA

BUDGET ITEM A UNDERGROUND ____

RATE GUIDELINE CODE: ____ ____% ____ ____% ____ ____%

AFC — POLLUTION CONTROL TYPE: Water 100 %

FUNCTIONAL UNIT NO. 8690 LOCATION NO. ____

OLD CONSTRUCTION INSTALLED: YR 1 ____ YR 2 ____

ALTERNATIVES REVIEWED None

ECONOMIC ANALYSIS SUMMARY Project Necessary to Operate Plant

PROJECT DESCRIPTION AND JUSTIFICATION:

The purpose of this authorization is to provide funding to raise bottom ash pond on the north and east embankments to elevation 1000'. This project is required for additional containment.

NEW CONSTRUCTION

Direct Cost	287 000
Indirect Cost	68 300
Escalation	39 400
AFC	5 300
Gross Construction	400 000

	SIGNATURE	DATE		SIGNATURE	DATE
REQUESTED BY	G H Jacobson	08/15/81	CORPORATE MGMT.	DE Gilbert	NOV 2
ESTIMATED BY	A E Johnson	08/15/81	ACCOUNTING		
RECOMMENDED BY	J S Tacheny	08/15/81	SUBCONTRACTOR		11/24/81
RECOMMENDED FOR APPROVAL			BUDGET SERVICES		
RECOMMENDED FOR APPROVAL			PRE CONSTRUCTION		
RECOMMENDED FOR APPROVAL	D D Bohn	NOV 2 1981	WORK COMPLETED	H.K. Norgaarden	1-14-83
RECOMMENDED FOR APPROVAL			COMPLETED WORK APPROVED		

IMPROVEMENT REQUISITION

FORM 17-3120(7-79)

I.R. NO. 02736-19
EST. NO. 82EA
T PROJ. NO.
DATE W.O. ISSUED JAN 5 - 1982
INST. W.O. 21.86.92-19
REM. W.O.
CHG. W.O.

DIVISION Power - 19 (Northwest)
PROJECT TITLE Bottom Ash Pond Revision
LOCATION Sherburne Generating Plant
FINANCIAL RESPONSIBILITY 0477 WORK RESPONSIBILITY 0330
ACCOUNT NOS. 41.11.20

PROJECT CONSTRUCTION COSTS

GROSS CONSTRUCTION	400 000
COST OLD CONSTRUCTION	
REMOVAL COSTS	
SALVAGE	
TOTAL AUTHORIZATION	400 000

PROJECT TYPE

☒ BUDGET REQUEST 19 82 ☐ CONTINGENT FUND 19 ____
☐ ADDITION TO 19 ____ ☐ SUBREQUISITION 19 ____

MISCELLANEOUS PROJECT DATA

BUDGET ITEM A UNDERGROUND
RATE GUIDELINE CODE: ____ ____% ____ ____% ____ ____%
AFC POLLUTION CONTROL TYPE: Water 100 %
FUNCTIONAL UNIT NO. 8690 LOCATION NO.
OLD CONSTRUCTION INSTALLED: YR 1 YR 2

EXPENDITURE BUDGET

CONSTRUCTION: START DATE 01/82 COMPLETE 09/82
FORECAST TYPE 01 CATEGORY & PRIORITY 2C

		19 82		19
PRIOR YEARS				
19 82	400 000	J 4 000	J	
19 ____		F 14 000	F	
3RD YEAR		M 16 000	M	
4TH YEAR		A 17 000	A	
5TH YEAR		M 6 000	M	
6TH YEAR		J 6 000	J	
7TH YEAR		J 111 000	J	
8TH YEAR		A 112 000	A	
9TH YEAR		S 114 000	S	
10TH YEAR		O	O	
FUTURE		N	N	
TOTAL	400 000	D	D	

ALTERNATIVES REVIEWED None
ECONOMIC ANALYSIS SUMMARY Project Necessary To Operate Plant

PROJECT DESCRIPTION AND JUSTIFICATION:

The purpose of this authorization is to provide funding to raise bottom ash pond on the north and east embankments to elevation 1000'. This project is required for additional containment.

A-79062
A-86129 SA079

NEW CONSTRUCTION

Direct Cost	287 000
Indirect Cost	68 300
Escalation	39 400
AFC	5 300
Gross Construction	400 000

	SIGNATURE	DATE
REQUESTED BY	G H Jacobson	08/15/81
ESTIMATED BY	A E Johnson	08/15/81
RECOMMENDED BY	J F Tacheny	08/15/81
RECOMMENDED FOR APPROVAL		
RECOMMENDED FOR APPROVAL		
RECOMMENDED FOR APPROVAL	D O Bonn	NOV 2 - 1981
RECOMMENDED FOR APPROVAL		

	SIGNATURE	DATE
CORPORATE MGMT.	D E Gilberts	NOV 2
ACCOUNTING		
SUBCONTRACTOR	E J Price	11/24/81
BUDGET SERVICES		
PRE CONSTRUCTION		
WORK COMPLETED		
COMPLETED WORK APPROVED		

To: G. Jacobsen
F. Stenger

7/25/81

New Pond Construction Update
per Roger Anderson Call

1 – The completion of the site in the bottom ash pond will be by Oct. 1982. BPV originally had asphalt included in the cost of completing the bottom ash site at a cost of $165,000. I told Roger it wasn't necessary and to delete it. Thus the project will cost $600,000 – 165,000 = $435,000.

2 – The bottom ash piping re-routing will be a 1982 operating cost ($140,000).

3 – Permitting is expected to take 4-5 months.

4 – Both the BA & FA ponds are bondable because of their pollution control nature. DSP will be talking with Becker Metal concerning this.

Tom Johnson

FORM 17-3505

NORTHERN STATES POWER CO ENGINEERING AND CONSTRUCTION MINNEAPOLIS

DISTRIBUTION

DATE TRANSMITTED
ORIGINAL DEC 09 1981

1 BARRETT LR
1 MUELLER SJ
1 PETERSON RH
1 NOER JA
1 OOLS KK
1 BRANDES JL
1 ANDERSON LM
6 GILBERTS DE
5 TICE CJ
1 BEIHOFFER LC

82EA01

THIS ESTIMATE $ 400 000

NSP (MINNESOTA) (POWER) DIVISION
SHERBURNE COUNTY GENERATING PLANT, UNITS 1 & 2
BOTTOM ASH POND REVISION
ASSIGNED TO PLANT COMPLETE 06-01-82
REQUESTED 09-25-81 BY G. H. JACOBSON PROPOSED BUDGET YEAR 82

ESCALATION	1981	10.0%	ALLOW FOR FUNDS DURING CONST 1982	8.0%
ESCALATION	1982	10.0%	ADMINISTRATION & GENERAL	1.5%

ESTIMATE SUMMARY

BOILER PLANT EQUIPMENT		$ 19 000
LABOR		266 000
LABOR INDIRECTS		2 000
PERMITS & LICENSES		5 000
TOTAL SPECIFIC COSTS		$ 292 000
E&S - NSP	28 000	
E&S - CONSULTANT	30 000	
A&G	5 300	
AFDC	5 300	
TOTAL OVERHEADS		68 600
ESCALATION		39 400
GROSS CONSTRUCTION		400 000
NO REMOVALS INVOLVED		
TOTAL NET EXPENDITURE		$ 400 000 $ 400 000

MAINTENANCE EST $ 0 OPERATING EST $ 168000

RELATED WORK: E-80E004 REPLACEMENT FLY ASH POND

CONTINUATION OF OPERATING ESTIMATE

NSP FIELD LABOR	$ 1800
INDIRECTS ON NSP FIELD LABOR	$ 200
ESCALATION	$ 12000
TOTAL	$ 168000

PROJECT ASSIGNMENT		APPROVED	DATE
SPONSOR	A. E. JOHNSON	AEJ	10-26-81
JOB-CIVIL ENGINEERING	R.B. ANDERSON	RBA	10-26-81
JOB-ENVIRONMENTAL	D.L. STEPHENSON	BW for DLS	10-28-81
COST/SCHEDULING REP.	P.W. GOHR	PWG	10-26-81
MANAGER - PROJECTS	R.A. HOLMBERG	RAH	10/29/81
ASST SUPT DOC & PROC	J. O. BEHLING	JOB	10/26/81
PREPARED BY	BUDGET SERVICES		

REVIEWED AND APPROVED _____ DEPARTMENT MANAGER 11/5/81

JOB CLASSIFICATION _____

Northern States Power Company | Plant Engineering and Construction Department | Minneapolis, Minnesota October 15, 1981

PROJECT DESIGN GUIDE

LOCATION: SHERBURNE COUNTY GENERATING PLANT

TITLE OF PROJECT: Bottom Ash Pond Revision

PROJECT NUMBER: E-82EA01

I. PROJECT SCOPE

The objective of this project is to increase the storage capacity of the existing bottom ash pond. The low portion of the containment dike will be constructed to full height as planned in the original pond development sequence. The construction will provide total bottom ash holding capacity of 600 acre feet. The additional holding capacity is required by late 1982, based on current operating conditions.

II. SPECIFIC DESIGN FEATURES

The low portion of the dike will be raised 25 feet to match the remainder of the containment dikes. Onsite soils will be used for the embankment construction. Basic design features will match the existing pond. A 10 foot thick central clay core will be constructed to contain ash sluice water. No slope protection will be provided under this project since plans call for stacking bottom ash on embankment slopes.

An aggregate surfaced road will be constructed on top of the raised dike. A new pond access road from the bottom to the top of the dike will also be constructed to replace the current access road.

The present bottom ash and fly ash sluice pipelines are located in the construction areas. Prior to the start of earthwork, bypass pipelines will be furnished and installed and the present pipelines removed. After construction the existing pipelines will be reinstalled.

This project has been studied and documented in the report entitled "Scrubber Solids Pond Expansion".

PLANT PROJECT
ENVIRONMENTAL CONSIDERATIONS

Project No. 82EA01 Location and Title SHERCO 1 & 2 - BOTTOM ASH POND REVISION

	Aesthetic	Air	Noise Abatement	Water
Accessory Electric Equip	$____ or __ %	$____ or __ %	$____ or __ %	$____ or __ %
Boiler or Reactor Plant Equip	$____ or __ %	$____ or __ %	$____ or __ %	$____ or 100 %
Land & Land Rights	$____ or __ %	$____ or __ %	$____ or __ %	$____ or __ %
Misc Power Plant Equip	$____ or __ %	$____ or __ %	$____ or __ %	$____ or __ %
Structures & Improvements	$____ or __ %	$____ or __ %	$____ or __ %	$____ or __ %
Turbogenerator Units	$____ or __ %	$____ or __ %	$____ or __ %	$____ or __ %

Describe if each dollar amount or percentage calculation is based on material, labor or both.

Based on both material and labor.

Reasoning for environmental consideration Containment of ash and sluice water to protect ground and surface waters.

Job Engineer RB Anderson

PROJECT DESIGN GUIDE

LOCATION: SHERBURNE COUNTY GENERATING PLANT

TITLE OF PROJECT: Bottom Ash Pond Revision

PROJECT NUMBER: E-82EA01

I. PROJECT SCOPE

The objective of this project is to increase the storage capacity of the existing bottom ash pond. The low portion of the containment dike will be constructed to full height as planned in the original pond development sequence. The construction will provide total bottom ash holding capacity of 600 acre feet. The additional holding capacity is required by late 1982, based on current operating conditions.

II. SPECIFIC DESIGN FEATURES

The low portion of the dike will be raised 25 feet to match the remainder of the containment dikes. Onsite soils will be used for the embankment construction. Basic design features will match the existing pond. A 10 foot thick central clay core will be constructed to contain ash sluice water. No slope protection will be provided under this project since plans call for stacking bottom ash on embankment slopes.

An aggregate surfaced road will be constructed on top of the raised dike. A new pond access road from the bottom to the top of the dike will also be constructed to replace the current access road.

The present bottom ash and fly ash sluice pipelines are located in the construction areas. Prior to the start of earthwork, bypass pipelines will be furnished and installed and the present pipelines removed. After construction the existing pipelines will be reinstalled.

This project has been studied and documented in the report entitled "Scrubber Solids Pond Expansion".

Northern States Power Company — Plant Engineering and Construction Department — Minneapolis, Minnesota
October 15, 1981

PROJECT DESIGN GUIDE

LOCATION: SHERBURNE COUNTY GENERATING PLANT

TITLE OF PROJECT: Bottom Ash Pond Revision

PROJECT NUMBER: E-82EA01

III. RELATED ESTIMATES

Replacement Fly Ash Pond
Project Number E-80E004

Prepared by: _____
R. B. Anderson, P. E.
Civil Engineer

Approved by: _____
A. E. Johnson, P. E.
Project Engineer

Approved by: _____
R. A. Holmberg, Manager
Fossil Plant Projects

mfc

PLANT PROJECT
ENVIRONMENTAL CONSIDERATIONS

Project No. 82EA01 Location and Title SHERCO 1 & 2 - BOTTOM ASH POND REVISION

	Aesthetic	Air	Noise Abatement	Water
Accessory Electric Equip	$____ or __%	$____ or __%	$____ or __%	$____ or __%
Boiler or Reactor Plant Equip	$____ or __%	$____ or __%	$____ or __%	$____ or 100%
Land & Land Rights	$____ or __%	$____ or __%	$____ or __%	$____ or __%
Misc Power Plant Equip	$____ or __%	$____ or __%	$____ or __%	$____ or __%
Structures & Improvements	$____ or __%	$____ or __%	$____ or __%	$____ or __%
Turbogenerator Units	$____ or __%	$____ or __%	$____ or __%	$____ or __%

Describe if each dollar amount or percentage calculation is based on material, labor or both.

Based on both material and labor.

Reasoning for environmental consideration Containment of ash and sluice water to protect ground and surface waters.

Job Engineer RB Anderson

Internal Correspondence

NSP

Date August 6, 1982

From H K Norgaarden

Location General Office 7

To M F Dinville

Location Sherco

Subject SHERBURNE COUNTY GENERATING PLANT UNITS 1 & 2
Bottom Ash Pond Revision E-82EA01
Probable Cost

In a meeting at the plant on May 6, 1982 with Gordy Jacobson, it was agreed to keep you informed of the probable costs for both the capital and operating portions of the project.

Listed below are probable costs for the various phases of the project:

Capital Costs

	Original Authorization	Probable Cost	Probable Deviation
Direct Cost (contractor)	$301,000	$178,700*	-$122,300
Direct Cost (NSP)	17,800	18,400	+ 600
Indirects	81,200	107,900	+26,700
	$400,000	$305,000	-$95,000

Through June 1982 $44,000 have been spent.

The deviation indicated is due to the low bids received for the earthwork portion of the project.

Operating Costs

	Original Authorization	Probable Cost	Probable Deviation
Direct Cost (contractor)	$32,600	$60,400*	+27,800
Direct Cost (NSP)	135,400	214,600	+79,200
	$168,000	$275,000	+$107,000

Through June 1982 $46,000 have been spent.

*-Firm contract prices

RECEIVED
AUG 09 1982
SHERBURNE COUNTY
GENERATING PLANT

COPY

FORM 17-3467

The deviation indicated is due to underestimating the cost of material and labor involved with the bypass piping and supports for the re-installation of permanent piping.

Please review the above and inform me of any further needs regarding costs on the project.

H K Norgaarden
Project Manager

mub

cc: R A Holmberg
C D Hadley
R H Vagts
Project File A300
Field File A300

NORTHERN STATES POWER CO ENGINEERING AND CONSTRUCTION MINNEAPOLIS

DISTRIBUTION

DATE TRANSMITTED
ORIGINAL

1 BARRETT LR
1 MUELLER SJ
1 PETERSON KH
1 NOER JA
1 OOLS KK
1 BRANDES JL
1 ANDERSON LM
1 GILBERTS DE
1 TICE CJ
1 BEIHOFFER LC

82EA01

THIS ESTIMATE $ 400 000

NSP (MINNESOTA) (POWER) DIVISION
SHERBURNE COUNTY GENERATING PLANT, UNITS 1 & 2
BOTTOM ASH POND REVISION - 8
ASSIGNED TO PLANT COMPLETE 06-01-82
REQUESTED 09-25-81 BY G. H. JACOBSON PROPOSED BUDGET YEAR 82

ESCALATION	1981	10.0%	ALLOW FOR FUNDS DURING CONST 1982	8.0%
ESCALATION	1982	10.0%	ADMINISTRATION & GENERAL	1.5%

ESTIMATE SUMMARY

BOILER PLANT EQUIPMENT			$ 19 000
LABOR			206 000
LABOR INDIRECTS			2 000
PERMITS & LICENSES			5 000
TOTAL SPECIFIC COSTS			$ 292 000
E&S - NSP	28 000		
E&S - CONSULTANT	30 000		
A&G	5 300		
AFDC	5 300		
TOTAL OVERHEADS			68 600
ESCALATION			39 400
GROSS CONSTRUCTION			400 000
NO REMOVALS INVOLVED			
TOTAL NET EXPENDITURE		$ 400 000	$ 400 000

MAINTENANCE EST $ 0 OPERATING EST $ 168000

RELATED WORK: E-80E004 REPLACEMENT FLY ASH POND

DETAILED INSTALLATION ESTIMATE

BOILER PLANT EQUIPMENT

CODE	QUANTITY	DESCRIPTION	MAT'L	LABOR
	60000CY	EMBANKMENT	0	150000
	7500CY	CLAY SEAL	1000	77000
	1800FT	ROADWAY	6000	1000
	1LT	MISC. CULVERTS	7000	3000
	1LT	CONTINGENCIES	2000	23000
	1LT	NSP FIELD LABOR	0	12000
		PURCH. AND WHSE. CHARGES	1000	
		SALES TAX	1000	
		SHIPPING COSTS	1000	
TOTAL BOILER PLANT EQUIPMENT			$ 19000	$ 266000

DETAILED REMOVAL ESTIMATE

NONE

DETAILED MAINTENANCE ESTIMATE

NONE

DETAILED OPERATING ESTIMATE

PIPING REWORK-EXISTING SLUICE PIPING-SCRUBBER & BOTTOM ASH LINES, LABOR	$ 55000
PIPING BYPASS-SCRUBBER & BOTTOM ASH LINES - $17000 LABOR & $68000 MATERIAL	$ 85000
CONTINGENCIES	$ 14000

CONTINUATION OF OPERATING ESTIMATE

NSP FIELD LABOR	$ 1800
INDIRECTS ON NSP FIELD LABOR	$ 200
ESCALATION	$ 12000
TOTAL	$ 168000

PROJECT ASSIGNMENT

		APPROVED	DATE
SPONSOR	A. E. JOHNSON	JEJ	10-26-81
JOB-CIVIL ENGINEERING	R.B. ANDERSON	RBA	10-26-81
JOB-ENVIRONMENTAL	D.L. STEPHENSON	DLS for DLS	10-28-81
COST/SCHEDULING REP.	P.W. GOHR	PWG	10-26-81
MANAGER - PROJECTS	R.A. HOLMBERG	RAH	10/29/81
ASST SUPT DOC & PROC	J. O. BEHLING	JOB	10/29/81
PREPARED BY	BUDGET SERVICES		

REVIEWED AND APPROVED

JOB CLASSIFICATION _____

DEPARTMENT MANAGER 11/5/81

IMPROVEMENT REQUISITION

FORM 17-3120(7-79)

Additional Authorization

INFORMATIONAL COPY

I.R. NO. 02736-19

EST. NO.

T PROJ. NO.

DATE W.O. ISSUED

INST. W.O. 71.86.92-19

REM. W.O.

CHG. W.O.

DIVISION Power - 19 (Northwest)

PROJECT TITLE Bottom Ash Pond Revision

LOCATION Sherburne Generating Plant

FINANCIAL RESPONSIBILITY 0477 WORK RESPONSIBILITY 0330

ACCOUNT NOS. 41.11.20

PROJECT CONSTRUCTION COSTS

GROSS CONSTRUCTION	223 600
COST OLD CONSTRUCTION	
REMOVAL COSTS	
SALVAGE	
TOTAL AUTHORIZATION	223 600

EXPENDITURE BUDGET

CONSTRUCTION: START DATE 01/82 COMPLETE 01/83

FORECAST TYPE 29 CATEGORY & PRIORITY 2C

		19__	19__
PRIOR YEARS	623 600	J	J
19__		F	F
19__		M	M
3RD YEAR		A	A
4TH YEAR		M	M
5TH YEAR		J	J
6TH YEAR		J	J
7TH YEAR		A	A
8TH YEAR		S	S
9TH YEAR		O	O
10TH YEAR		N	N
FUTURE		D	D
TOTAL	623 600		

PROJECT TYPE

☐ BUDGET REQUEST 19__ ☒ CONTINGENT FUND 19 84

☐ ADDITION TO 19__ ☐ SUBREQUISITION 19__

MISCELLANEOUS PROJECT DATA

BUDGET ITEM A UNDERGROUND

RATE GUIDELINE CODE: ___, ___%, ___, ___%, ___, ___%

AFC — POLLUTION CONTROL TYPE: Water 100%

FUNCTIONAL UNIT NO. 8690 LOCATION NO.

OLD CONSTRUCTION INSTALLED: YR 1 YR 2

ALTERNATIVES REVIEWED

ECONOMIC ANALYSIS SUMMARY

PROJECT DESCRIPTION AND JUSTIFICATION:

The project was originally authorized as a Unit 1 and 2 project with certain costs charged to operation and maintenance expense. The decision on the ownership arrangement for Unit 3 caused these charges to be charged as capital, therefore, the additional authorization is needed.

	Original Authorization	Actual Cost	Additional Authorization
Gross Construction	400 000	623 600	223 600

	SIGNATURE	DATE		SIGNATURE	DATE
REQUESTED BY	G H Jacobson	01/06/84	CORPORATE MGMT.	D E Gilberts	1/20/84
ESTIMATED BY	G H Jacobson	01/06/84	ACCOUNTING	J L Brandes	
RECOMMENDED BY	M F Dinville	01/06/84	SUBCONTRACTOR		1/18/84
RECOMMENDED FOR APPROVAL			BUDGET SERVICES	L A Bluhm	
RECOMMENDED FOR APPROVAL	D D Bohn	1/12/84	PRE CONSTRUCTION		
RECOMMENDED FOR APPROVAL			WORK COMPLETED		
RECOMMENDED FOR APPROVAL	J R Thelen	1/30/84	COMPLETED WORK APPROVED		

IMPROVEMENT REQUISITION

FORM 17-3120(7-79)

Additional Authorization

I.R. NO. 02736-19
EST. NO.
T PROJ. NO.
DATE W.O. ISSUED
INST. W.O. 71.86.92-19
REM. W.O.
CHG. W.O.

DIVISION Power - 19 (Northwest)
PROJECT TITLE Bottom Ash Pond Revision
LOCATION Sherburne Generating Plant
FINANCIAL RESPONSIBILITY 0477 WORK RESPONSIBILITY 0330
ACCOUNT NOS. 41.11.20

PROJECT CONSTRUCTION COSTS

GROSS CONSTRUCTION	223 622
COST OLD CONSTRUCTION	
REMOVAL COSTS	
SALVAGE	
TOTAL AUTHORIZATION	223 622

PROJECT TYPE

☐ BUDGET REQUEST 19____ ☒ CONTINGENT FUND 19 83
☐ ADDITION TO 19 ____ ☐ SUBREQUISITION 19 ____

MISCELLANEOUS PROJECT DATA

BUDGET ITEM A UNDERGROUND
RATE GUIDELINE CODE: ____, ____%, ____, ____%, ____, ____%
AFC—POLLUTION CONTROL TYPE: Water, 100%
FUNCTIONAL UNIT NO. 8690 LOCATION NO.
OLD CONSTRUCTION INSTALLED: YR 1 ____ YR 2 ____

EXPENDITURE BUDGET

CONSTRUCTION: START DATE 01/82 COMPLETE 09/82
FORECAST TYPE 01 CATEGORY & PRIORITY 2C

		19 ___	19 ___
PRIOR YEARS		J	J
19 ___		F	F
19 ___		M	M
3RD YEAR		A	A
4TH YEAR		M	M
5TH YEAR		J	J
6TH YEAR		J	J
7TH YEAR		A	A
8TH YEAR		S	S
9TH YEAR		O	O
10TH YEAR		N	N
FUTURE		D	D
TOTAL			

ALTERNATIVES REVIEWED
ECONOMIC ANALYSIS SUMMARY

PROJECT DESCRIPTION AND JUSTIFICATION:

Please prepare an overrun IR.

The project was originally authorized as a Unit 1 and 2 project with certain costs charged to operation and maintenance expense. The decision on the ownership arrangement for Unit 3 caused these charges to be charged as capital. Therefore, the additional authorization needs to be increased from $400,000 to $623,622 and add the T project items.

	Authorized	Actual	Additional Authorization
Gross Construction	$400,000	$623,622	+ $223,622

	SIGNATURE	DATE
REQUESTED BY	G.H. Jacobson	01/06/84
ESTIMATED BY	G.H. Jacobson	01/06/84
RECOMMENDED BY	G.H. Jacobson	01/06/84
RECOMMENDED FOR APPROVAL	[signature]	1-6-84
RECOMMENDED FOR APPROVAL		
RECOMMENDED FOR APPROVAL		
RECOMMENDED FOR APPROVAL		

	SIGNATURE	DATE
CORPORATE MGMT.		
ACCOUNTING		
SUBCONTRACTOR		
BUDGET SERVICES		
PRE CONSTRUCTION		
WORK COMPLETED		
COMPLETED WORK APPROVED		

71.86.92-19

Northern States Power Company — Plant Engrg and Constr Dept

Date 1-13-83

PROJECT CLOSING ORDER

R/E No. 82EA01

I R No. 02736-19

Project Title BOTTOM ASH POND REVISION

Location Sherburne County

Division Northwest (Power-19)

Engineering, purchasing and construction authorized under this project has been terminated and the project closed as of 1-13 19 83.

After this date no charges of any kind shall be made to this project.

C. J. Tice (RVM)

C J Tice, General Manager
Plant Engineering and Construction

cc C D Hadley/with yellow work order copy
Project Sponsor
Plant Manager
Plant Accounting - Clare Grover
Drawing Control Services
Purchasing
File - gets routed to cognizant people

RECEIVED
JAN 17 1983
SHERBURNE COUNTY
GENERATING PLANT

FORM 17-1515

TRANSMITTAL MANIFEST

Date January 4, 1983

To: G Y Gunn - Black and Veatch
G H Jacobson - Sherco
H K Norgaarden
File F100 - A-82926

FILE COPY

Description: E-82EA01 SHERBURNE COUNTY GENERATING PLANT
UNITS 1 and 2 - Bottom Ash Pond Revision

Twin City Testing Company - Construction Testing Final Report.

Remarks: This report documents all soils testing results. Please call if there are questions.

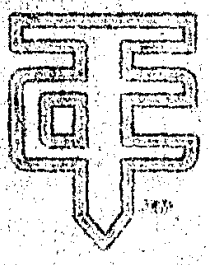
FROM R B Anderson
NORTHERN STATES POWER COMPANY
PLANT ENGINEERING & CONSTRUCTION DEPARTMENT

NSP SHERBURNE COUNTY GENERATING PLANT

BOTTOM ASH POND REVISIONS

BECKER, MINNESOTA

LABORATORY #9-1357



Twin City Testing and Engineering Laboratory, Inc.

Consulting Engineers and Chemists

FILE COPY

X Clay liner testing 8301
x Bottom Ash Pond rpt '83
x Twin Cities Test/BA rpt '83

NSP SHERBURNE COUNTY GENERATING PLANT

BOTTOM ASH POND REVISIONS

BECKER, MINNESOTA

LABORATORY #9-1357

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN. 55114
PHONE 612/645-3601

December 22, 1982

CHARLES W. BRITZIUS, P.E.
Chairman of the Board
NORMAN E. HENNING, P.E.
President
CLINTON R. EUE
Executive Vice-President
Treasurer
ALBERT C. HOLLER, F.A.I.C.
Vice-President Chemistry

Northern States Power Company
Attn: Roger B Anderson
414 Nicollet Mall
7th Floor - Plant Eng & Const
Minneapolis, MN 55401

Gentlemen:

Subj: NSP Sherburne County Generating Plant
Bottom Ash Pond Revisions
Becker, Minnesota
Laboratory #9-1357

We have completed our testing work for the Bottom Ash Pond Revisions. Our final report is attached. Copies of the report are being sent as noted below. This work was performed under your Purchase Order #A82926CT.

We appreciate having had the opportunity to work with you on this project. If you have any questions, please contact us.

Very truly yours,

Dale Britzius,
Civil Engineer

Thomas B Flick, P.E.
Manager, Soils & Geology Dept

DB/TBF/fm
cc: 1-Black & Veatch Consulting Eng
Attn: Larry Almaleh

OBSERVATIONS AND TEST PROGRAM

BOTTOM ASH POND REVISION

SHERBURNE COUNTY GENERATING PLANT

BECKER, MINNESOTA

LABORATORY #9-1357

INTRODUCTION

This report concerns the observations and testing we performed during the recent revisions to the bottom ash pond at Northern States Power Company's Sherburne County Generating Plant in Becker, Minnesota. Our work was performed in accordance with your Purchase Order No A82926CT.

The scope of our recent involvement consisted of:

1. Performing field observations at the borrow area and laboratory testing to judge if the imported cohesive fill materials were in compliance with the project specifications.

2. Performing field observations and compaction testing to document that the embankment and clay core fill materials were placed in accordance with the project specifications.

3. Performing laboratory testing to determine the permeability of undisturbed samples removed from the compacted clay core.

4. Performing laboratory testing to determine if the Type I filter material was in compliance with the project specifications.

PROJECT INFORMATION

The recent construction consisted of completing the northeast portion of the dike around the existing bottom ash pond. This portion of the dike was originally left at a lower elevation than the remainder of the dike around the pond. Final top of dike elevation in this area will be at elevation 1000'. The lowest portion of the existing dike was approximately elevation 975' prior to the start of the recent construction.

The central core of the dike extension will consist of an impervious clay core having a minimum thickness of 10'. The project specifications require that the material used to construct the clay core consist of a material classified as either a CL, CL-SC or an SC-CL. The cohesive material is to be compacted to at least 90% of ASTM:D1557 (Modified Proctor). The moisture content of the cohesive fill at the time of placement must be in the range of 0-5% over optimum moisture content. The clay is to be obtained from an off-site borrow source designated by Northern States Power Company.

The remainder of the dike is to consist primarily of on-site granular fill materials. These sand fill materials are to be compacted to at least 95% of ASTM:D1557 (Modified Proctor).

There is an existing filter blanket present beneath the outer half of the existing dike. Since the revisions in the northeast portion of the dike will include increasing the width of the dike base, the filter blanket will also be extended outward to the toe of the new embankment. The filter blanket material is to consist of Type I material with a minimum thickness of 1 1/2'. The filter material present at the very toe of the embankment is to consist of Type II filter material.

Parallel to the toe of the new embankment, a drainage ditch is to be constructed. This ditch is to be lined with an 18" impervious blanket consisting of material similar to that used for the clay core, although an SC material could also be used in this area. The impervious blanket in the drainage ditch is to be compacted to at least 100% of the Modified Proctor density.

OBSERVATION METHODS AND RESULTS

Initial Preparation

Between August 13 and October 15, 1982, we were present at the site on a full-time basis to observe and monitor construction operations during the dike revision. Initially, we documented that the contractor removed all surficial vegetation from the embankment, and also all granular materials and the remains of a roadway from above the existing impervious clay core. The surface of the existing clay core was subsequently scarified and re-compacted using a large sheepsfoot compactor. Listed below are the elevations at which the impervious clay core was exposed at representative locations prior to the start of recent fill placement:

Location	Top of Existing Clay Core
East dike-coordinate 865, 700	Elevation 985'
East dike-coordinate 865, 600	Elevation 993'
East dike-coordinate 865, 800	Elevation 974'
North dike-coordinate 2, 028, 900	Elevation 978'
North dike-coordinate 2, 028, 800	Elevation 984'
North dike-coordinate 2, 028, 700	Elevation 991'

After completion of the preparatory operations, we observed that the width of the existing clay core was approximately 13' to 15'. The existing core was generally centered along the centerline of the dike. However, on the east dike near coordinate 865, 700, the existing clay core was off-set about 3 1/2' east from the centerline of the dike.

Cohesive Fill Importation

The contractor elected to import and construct an on-site stockpile of the clay fill material needed for the impervious clay core early in the job. During excavation of cohesive material, we provided an engineer at the borrow pit to visually and manually classify the soil and provide judgements regarding the material's suitability. Those materials classified as either CL, SC-CL, or CL-SC were approved for importation to the site.

OBSERVATION METHODS AND RESULTS
(Cont.)

To assist NSP's field engineers in their determination of material quantities, we performed random field density tests of the undisturbed clay borrow materials. The densities averaged 100 pcf. In addition, we performed field density tests in the materials stockpiled at the project site to obtain data regarding the field density in a loose stockpiled condition, similar to the density the soil would have in a truck. The densities of the material in the loose condition averaged 77 pcf. We have attached a data sheet summarizing our field density tests in the borrow and stockpile areas.

Impervious Core Construction

During placement of the cohesive fill materials within the impervious core, we performed observations and documented that no granular fill materials became trapped within the new clay core. We also documented that those portions of the cohesive fill which became unacceptably dry were removed from the core area prior to placement of the succeeding lifts of cohesive fill. We observed that the cohesive fill was placed in maximum 8" thick layers, and that a large sheepsfoot compactor was utilized to thoroughly compact these materials prior to placement of additional fill. We documented that the width of the new core was at least 10'-12'.

During compaction of the cohesive fill materials, a series of field density tests were performed. These tests were performed at about 2' vertical intervals at representative locations within the new construction. The tests were performed utilizing the sand cone method, and the field density results were evaluated on the basis of ASTM:D1557 (Modified Proctor). Attached to this report are data sheets regarding each of the field compaction tests, as well as summary sheets including pertinent information about these density tests.

Based on the results of our recent testing, it is our opinion the clay core fill materials were placed and compacted in compliance with the project specifications.

OBSERVATION METHODS AND RESULTS
(Cont.)

Embankment Fill Construction

We were also present at the site on a full-time basis during the compaction and placement of the embankment fill materials adjacent to the clay core. Prior to fill placement, we observed that all surficial vegetation was removed from the existing embankments, and that the exposed granular materials were surface compacted. The existing embankment consisted primarily of sands and silty sands which would be classified as either SM or SP-SM. During placement of the new fill materials, we documented that the exisitng embankment face was terraced so that the new fill materials could be placed in relatively horizontal lifts.

During placement of the embankment fill materials, we performed a series of field density tests to document the effectiveness of the compaction procedures. Again, the compaction tests were evaluated on the basis of ASTM:D1557. Most of the on-site sands were very dry. It was necessary for the contractor to wet down these soils prior to compacting them in order to obtain the specified density.

Data sheets regarding each of the field density tests as well as a summary sheet indicating pertinent information regarding our tests of the granular embankment fill materials are attached. Based on this data, it is our opinion the embankment fill materials were placed and compacted in general compliance with the project specifications.

Permeability Testing

During placement and compaction of the impervious clay core, we obtained four undisturbed samples of the compacted cohesive fill materials. As indicated by the project specifications, two of these undisturbed samples were obtained after approximately 15% of the cohesive fill material had been placed. The remaining two samples were obtained after approximately 80-85% of the fill materials had been placed. The remaining two samples were obtained in accordance with ASTM procedure D1587. The 3" diameter thinwall tube samples were

OBSERVATION METHODS AND RESULTS
(Cont.)

then submitted to the laboratory, where they were extruded, and subjected to Falling Head permeability tests.

The samples were subjected to a maximum test head of 10', with a confining pressure 2 psi greater than the test head. In addition, the density and plasticity index of each of the samples were determined in the laboratory. The laboratory test results are indicated on the attached data sheet.

A review of the data suggests the permeability rates vary from 10^{-6} to about 10^{-8} cm/sec. The initial two samples, which consisted of CL type material, had permeability rates of 10^{-8} range. The final tube samples, obtained from the upper portions of the clay core, consisted of a mixture of sandy clay and clayey sand. The permeability of this material was considerably faster, in the range of 10^{-6}.

Filter Blanket Material

During our involvement, we also observed that the existing filter blanket beneath the outer portions of the existing embankment was extended to the toe of the new embankment prior to the placement of the embankment fill materials. The results of our laboratory gradation indicated the filter material was in compliance with the specified Type I material.

Drainage Ditch Line

At the time of our involvement terminated this fall, the drainage ditch at the toe of the embankment had not been completed and the Type II filter materials had not been placed in the specified area near the toe of the new embankment. We have observed the cohesive fill materials imported into the drainage ditch area, and it is our opinion these materials comply with the project specifications. Based on our recent conversations with Roger Anderson of NSP, we understand that no additional testing will be required in this area.

COMPACTION TESTS

CLAY CORE

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

DATE: August 24, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan Inc
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

LABORATORY No. 9-1292

TEST NUMBER:	C-1	C-2	C-3	C-4
DATE TAKEN:	August 17, 1982	August 17, 1982	August 17, 1982	August 17, 1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)	Sandy clay, trace of gravel, brown (SC-CL)-2	Sandy clay, a little gravel, brown (SC-CL)-2	Sandy clay, trace of gravel, brown (SC-CL)-2	Sandy clay, a little gravel, brown (SC-CL)-2
LOCATION:	East dike, existing clay core, coordinate N 866,120	East dike, existing clay core, coordinate N 866,000	East dike, existing clay core, coordinate N 865,800	North dike, existing clay core, coordinate E 2,028,810
ELEVATION OF TEST:	976'	973'	974'	984'
DEPTH BELOW EXISTING GRADE:	6"	6"	6"	6"

FIELD DENSITY DETERMINATION:

Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	115	119	124	124
Moisture Content	(%)	11.1	14.3	11.7	11.1
Plus #4 Material	(%)	5	9	5	8

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	126.0	126.0	126.0	126.0
Optimum Moisture	(%)	11.3	11.3	11.3	11.3

COMPACTION TEST RESULTS:

Compaction	(%)	91	94.5	99	99
Specified Compaction	(%)	90	90	90	90

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested. The test locations and number of tests were selected by Twin City Testing and Engineering Laboratory Inc.

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

By Dale R. Jones

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

DATE: August 24, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan Inc
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

LABORATORY No. 9-1292

TEST NUMBER:	C-5	C-6	C-7
DATE TAKEN:	August 18, 1982	August 18, 1982	August 18, 1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)	Sandy clay, a little gravel, brown (SC-CL)-2	Sandy clay, a little gravel, brown (SC-CL)-2	Sandy clay, trace of gravel, brown (SC-CL)-2
LOCATION:	East dike, clay core, coordinate N 866,100	East dike, clay core, coordinate N 866,000	East dike, clay core, coordinate N 865,850
ELEVATION OF TEST:	977.5'	975'	975.5'
DEPTH BELOW EXISTING GRADE:	6"	6"	6"

FIELD DENSITY DETERMINATION:

Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)		
Dry Density	(pcf)	115	115	115
Moisture Content	(%)	14.0	12.4	13.0
Plus #4 Material	(%)	8	6	4

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method		ASTM:D1557-78, Method "A", (-#4 Basis)		
Maximum Dry Density	(pcf)	126.0	126.0	126.0
Optimum Moisture	(%)	11.3	11.3	11.3

COMPACTION TEST RESULTS:

Compaction	(%)	91	91	91
Specified Compaction	(%)	90	90	90

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested. The test locations and number of tests were selected by Twin City Testing and Engineering Laboratory Inc.

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

By Dale B. Simons

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

DATE: August 24, 1982

COPIES TO: 1-C S McCrossan Inc
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

LABORATORY No. 9-1292

TEST NUMBER:	C-8	C-9	C-10	C-11
DATE TAKEN:	August 19, 1982	August 19, 1982	August 19, 1982	August 19, 1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)	Sandy clay, trace of gravel, brown (SC)-4	Sandy clay, trace of gravel, brown (SC)-4	Sandy clay, trace of gravel, brown (SC)-4	Sandy clay, trace of gravel, brown (SC)-4
LOCATION:	East dike, clay core, coordinate N 866,130	East dike, clay core, coordinate N 866,050	East dike, clay core, coordinate N 865,850	East dike, clay core, coordinate N 865,700
ELEVATION OF TEST:	979'	979'	976.5'	988.5'
DEPTH BELOW EXISTING GRADE:	1'	1'	1'	1'

FIELD DENSITY DETERMINATION:

Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	116	123	123	117
Moisture Content	(%)	14.3	12.4	12.3	13.3
Plus #4 Material	(%)	5	4	3	4

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	123.9	123.9	123.9	123.9
Optimum Moisture	(%)	11.2	11.2	11.2	11.2

COMPACTION TEST RESULTS:

Compaction	(%)	93.5	99	99	94.5
Specified Compaction	(%)	90	90	90	90

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested. The test locations and number of tests were selected by Twin City Testing and Engineering Laboratory Inc.

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

By Dale R. Jus

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

DATE: August 24, 1982

COPIES TO: 1-C S McCrossan Inc
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

LABORATORY No. 9-1292

TEST NUMBER:	C-12	C-13
DATE TAKEN:	August 19, 1982	August 19, 1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)	Sandy clay, a little gravel, brown (SC)-4	Sandy clay, a little gravel, brown (SC)-4
LOCATION:	North dike, clay core, coordinate E 2,028,950	North dike, clay core, coordinate E 028,800
ELEVATION OF TEST:	979'	985'
DEPTH BELOW EXISTING GRADE:	10"	10"

FIELD DENSITY DETERMINATION:

Method	Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)		
Dry Density	(pcf)	120	123
Moisture Content	(%)	11.7	11.7
Plus #4 Material	(%)	7	6

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method		ASTM:D1557-78, Method "A", (-#4 Basis)	
Maximum Dry Density	(pcf)	123.9	123.9
Optimum Moisture	(%)	11.2	11.2

COMPACTION TEST RESULTS:

Compaction	(%)	97	99
Specified Compaction	(%)	90	90

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

By Dale B. Jun

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

DATE: August 31, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan Inc
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

LABORATORY No. 9-1292

TEST NUMBER:	C-14	C-15	C-16	C-17
DATE TAKEN:	August 26, 1982	August 26, 1982	August 26, 1982	August 26, 1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)	Sandy clay, trace of gravel, brown (SC-CL)-4	Sandy clay, a little gravel, brown (SC-CL)-4	Sandy clay, trace of gravel, brown (SC-CL)-4	Sandy clay, trace of gravel, brown (SC-CL)-4
LOCATION:	East dike, clay core, coordinate N865,900	East dike, clay core, coordinate N866,000	North dike, clay core, coordinate E2,028,900	North dike, clay core, coordinate E2,028,800
ELEVATION OF TEST:	980'	980.5'	981.5'	984'
DEPTH BELOW EXISTING GRADE:	8"	8"	8"	8"
FIELD DENSITY DETERMINATION:				
Method	Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density (pcf)	124	113.5	125.5	123
Moisture Content (%)	10.8	10.8	12.0	12.0
Plus #4 Material (%)	5	9	4	3
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:				
Method	ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density (pcf)	123.9	123.9	123.9	123.9
Optimum Moisture (%)	11.2	11.2	11.2	11.2
COMPACTION TEST RESULTS:				
Compaction (%)	100	91.5	101	99
Specified Compaction (%)	90	90	90	90

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

By Dale B[illegible]

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

DATE: September 2, 1982

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

LABORATORY No. 9-1292

TEST NUMBER:	C-18	C-19	C-20	C-21
DATE TAKEN:	August 30, 1982	August 30, 1982	August 30, 1982	August 30, 1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)	Sandy clay, a little gravel, brown (SC-CL)-4	Sandy clay, trace of gravel, brown (SC-CL)-4	Sandy clay, a little gravel, brown (SC-CL)-4	Sandy clay, trace of gravel, brown (SC-CL)-4
LOCATION:	East dike, clay core, coordinate N865,900	East dike, clay core, coordinate N865,750	North dike, clay core, coordinate E2,028,900	North dike, clay core, coordinate E2,028,800
ELEVATION OF TEST:	982.0'	983.5'	982.5'	985.5'
DEPTH BELOW EXISTING GRADE:	1'	1'	1'	1'

FIELD DENSITY DETERMINATION:

Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	116	117	122	115
Moisture Content	(%)	13.0	12.7	13.0	12.7
Plus #4 Material	(%)	9	4	10	4

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	123.9	123.9	123.9	123.9
Optimum Moisture	(%)	11.2	11.2	11.2	11.2

COMPACTION TEST RESULTS:

Compaction	(%)	94	95	99	93
Specified Compaction	(%)	90	90	90	90

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

By Dale B Zimmer

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

LABORATORY No. 9-1357

TEST NUMBER:	C-22	C-23	C-24	C-25
DATE TAKEN:	Sept 10,1982	Sept 10,1982	Sept 10,1982	Sept 10,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)	Sandy clay, trace of gravel, brown (SC-CL)-4	Sandy clay, trace of gravel, brown (SC-CL)-4	Sandy clay, trace of gravel, brown (SC-CL)-4	Sandy clay, trace of gravel, brown (SC-CL)-4
LOCATION:	East dike coofdinate N865,850	East dike coordinate N866,000	North dike coordinate E2,029,010	North dike coordinate E2,028,700
ELEVATION OF TEST:	984.5'	985.5'	986'	987'
DEPTH BELOW EXISTING GRADE:	1'	1'	1'	1'

FIELD DENSITY DETERMINATION:

Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	123	117	128	128
Moisture Content	(%)	12.4	13.0	14.3	14.3
Plus #4 Material	(%)	5	4	7	4

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	123.9	123.9	128.3	128.3
Optimum Moisture	(%)	11.2	11.2	11.0	11.0

COMPACTION TEST RESULTS:

Compaction	(%)	99	94.5	99.5	99.5
Specified Compaction	(%)	90	90	90	90

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

By Dale R Jurs

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

LABORATORY No. 9-1357

		C-26	C-27	C-28	C-29
TEST NUMBER:					
DATE TAKEN:		Sept 16,1982	Sept 16,1982	Sept 16,1982	Sept 17,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)		Sandy clay, trace of gravel, brown (SC-CL)-4	Sandy clay, trace of gravel, brown (SC-CL)-4	Sandy clay, a little gravel, brown (SC-CL)-4	Sandy clay, trace of gravel, brown (SC-CL)-4
LOCATION:		East dike coordinate N865,850	East dike coordinate N866,000	East dike coordinate N865,900	East dike coordinate N866,050
ELEVATION OF TEST:		987'	988'	989'	990'
DEPTH BELOW EXISTING GRADE:		1'	1'	1'	1'
FIELD DENSITY DETERMINATION:					
Method	Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)				
Dry Density	(pcf)	124	112.5	124	115
Moisture Content	(%)	12.4	11.1	12.4	11.7
Plus #4 Material	(%)	4	5	7	4
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:					
Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	123.9	123.9	123.9	123.9
Optimum Moisture	(%)	11.2	11.2	11.2	11.2
COMPACTION TEST RESULTS:					
Compaction	(%)	100	91	100	93
Specified Compaction	(%)	90	90	90	90

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

By Dale Ryan

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

LABORATORY No. 9-1357

TEST NUMBER:	C-30	C-31	C-32	C-33
DATE TAKEN:	Sept 17,1982	Sept 17,1982	Sept 20,1982	Sept 20,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)	Sandy clay, a little gravel, brown (SC-CL)-4	Sandy clay, a little gravel, brown (CL)-1	Sandy clay, a little gravel, brown (SC-CL)-4	Sandy clay, a little gravel, brown (SC-CL)-4
LOCATION:	North dike coordinate E2,028,800	North dike coordinate E2,029,000	East dike coordinate N865,700	East dike coordinate N866,050
ELEVATION OF TEST:	987'	988'	991'	992'
DEPTH BELOW EXISTING GRADE:	1'	1'	1'	1'

FIELD DENSITY DETERMINATION:

Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	116	125	116	123
Moisture Content	(%)	14.5	14.5	13.3	14.3
Plus #4 Material	(%)	9	8	9	7

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	123.9	128.3	123.9	123.9
Optimum Moisture	(%)	11.2	11.0	11.2	11.2

COMPACTION TEST RESULTS:

Compaction	(%)	94	95	94	99
Specified Compaction	(%)	90	90	90	90

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

By

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

LABORATORY No. 9-1357

TEST NUMBER:		C-34	C-35	C-36	C-37
DATE TAKEN:		Sept 20,1982	Sept 20,1982	Sept 21,1982	Sept 21,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)		Sandy clay, a little gravel, brown (SC-CL)-4	Sandy clay, a little gravel, brown (SC-CL)-4	Sandy clay, a little gravel, brown (SC-CL)-4	Sandy clay, a little gravel, brown (SC-CL)-4
LOCATION:		East dike coordinate N865,800	East dike coordinate N866,000	East dike coordinate N865,850	East dike coordinate N866,000
ELEVATION OF TEST:		993'	994'	994.5'	995'
DEPTH BELOW EXISTING GRADE:		1'	1'	1'	1'
FIELD DENSITY DETERMINATION:					
Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	122	115	121.5	114
Moisture Content	(%)	13.0	11.1	13.3	13.0
Plus #4 Material	(%)	8	6	8	7
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:					
Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	123.9	123.9	123.9	123.9
Optimum Moisture	(%)	11.2	11.2	11.2	11.2
COMPACTION TEST RESULTS:					
Compaction	(%)	98.5	93	98	92.5
Specified Compaction	(%)	90	90	90	90

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

By Dale B Jones

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

LABORATORY No. 9-1357

TEST NUMBER:	C-38	C-39
DATE TAKEN:	Sept 21,1982	Sept 21,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)	Sandy clay, a little gravel, brown (CL)-2	Sandy clay, a little gravel, brown (CL)-2
LOCATION:	North dike coordinate E2,028,880	North dike coordinate E2,029,000
ELEVATION OF TEST:	989.5'	991'
DEPTH BELOW EXISTING GRADE:	1'	1'

FIELD DENSITY DETERMINATION:

Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)	
Dry Density	(pcf)	124	120.5
Moisture Content	(%)	12.7	12.4
Plus #4 Material	(%)	6	9

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method		ASTM:D1557-78, Method "A", (-#4 Basis)	
Maximum Dry Density	(pcf)	126.0	126.0
Optimum Moisture	(%)	11.3	11.3

COMPACTION TEST RESULTS:

Compaction	(%)	98.5	96
Specified Compaction	(%)	90	90

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

By Dale R. [illegible]

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

LABORATORY No. 9-1357

		C-40	C-41	C-42	C-43
TEST NUMBER:					
DATE TAKEN:		Sept 22,1982	Sept 22,1982	Sept 22,1982	Sept 23,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)		Sandy clay, trace of gravel, brown (SC-CL)-4	Sandy clay, a little gravel, brown (SC-CL)-4	Sandy clay, trace of gravel, brown (SC-CL)-4	Sandy clay, a little gravel, brown (SC-CL)-4
LOCATION:		East dike coordinate N866,120	East dike coordinate N866,000	East dike coordinate N865,850	East dike coordinate N865,800
ELEVATION OF TEST:		994'	994'	995'	996'
DEPTH BELOW EXISTING GRADE:		1'	1'	1'	1'
FIELD DENSITY DETERMINATION:					
Method	Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)				
Dry Density	(pcf)	112.5	112	123	122
Moisture Content	(%)	13.0	12.7	12.4	12.7
Plus #4 Material	(%)	5	6	5	6
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:					
Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	123.9	123.9	123.9	123.9
Optimum Moisture	(%)	11.2	11.2	11.2	11.2
COMPACTION TEST RESULTS:					
Compaction	(%)	91	90.5	99	98.5
Specified Compaction	(%)	90	90	90	90

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

By Dale B Zimm

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

LABORATORY No. 9-1357

TEST NUMBER:		C-44	C-45	C-46	C-47
DATE TAKEN:		Sept 23,1982	Sept 23,1982	Sept 23,1982	Sept 24,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)		Sandy clay, a little gravel, brown (SC-CL)-4	Sandy clay, a little gravel, brown (SC-CL)-4	Sandy clay, a little gravel, brown (SC-CL)-4	Sandy clay, a little gravel, brown (SC-CL)-4
LOCATION:		East dike coordinate N865, 750	East dike coordinate N865,950	East dike coordinate N866,180	North dike coordinate E2,028, 950
ELEVATION OF TEST:		997'	997'	995'	993'
DEPTH BELOW EXISTING GRADE:		1'	1'	1'	1'
FIELD DENSITY DETERMINATION:					
Method	Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)				
Dry Density	(pcf)	120	119	117	112
Moisture Content	(%)	12.4	12.4	11.1	12.4
Plus #4 Material	(%)	6	10	9	7
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:					
Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	123.9	123.9	123.9	123.9
Optimum Moisture	(%)	11.2	11.2	11.2	11.2
COMPACTION TEST RESULTS:					
Compaction	(%)	97	96	94.5	90.5
Specified Compaction	(%)	90	90	90	90

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

By Dale R Jamison

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

LABORATORY No. 9-1357

TEST NUMBER:	C-48	C-49
DATE TAKEN:	Sept 24,1982	Sept 24,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)	Sandy clay, a little gravel, brown (SC-CL)-4	Sandy clay, a little gravel, brown (SC-CL)-4
LOCATION:	North dike coordinate E2,029,000	North dike coordinate E2,028,800
ELEVATION OF TEST:	994.5'	996'
DEPTH BELOW EXISTING GRADE:	1'	1'

FIELD DENSITY DETERMINATION:

Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)	
Dry Density	(pcf)	118.5	120.5
Moisture Content	(%)	14.3	13.0
Plus #4 Material	(%)	7	6

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method		ASTM:D1557-78, Method "A", (-#4 Basis)	
Maximum Dry Density	(pcf)	123.9	123.9
Optimum Moisture	(%)	11.2	11.2

COMPACTION TEST RESULTS:

Compaction	(%)	96	97.7
Specified Compaction	(%)	90	90

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

By _____

SG-225 (81-A)

COMPACTION TESTS

EMBANKMENT

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

DATE: August 24, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan Inc
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

LABORATORY No. 9-1292

TEST NUMBER:	E-1	E-2	E-3	E-4
DATE TAKEN:	August 20, 1982	August 20, 1982	August 20, 1982	August 20, 1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)	Silty sand, mostly fine grained, trace of gravel, dark brown (SM)-5	Silty sand, mostly fine grained, a little gravel, dark brown (SM)-5	Silty sand, mostly fine grained, a little gravel, dark brown (SM)-5	Silty sand, mostly fine grained, a little gravel, dark brown (SM)-5
LOCATION:	East dike, W embankment, coordinate N 865,900	East dike, W embankment, coordinate N 865,900	East dike, E embankment, coordinate N 865,900	East dike, E embankment, coordinate N 865,900
ELEVATION OF TEST:	976.5'	979'	976.5'	979'
DEPTH BELOW EXISTING GRADE:	1'	1'	1'	1'

FIELD DENSITY DETERMINATION:

Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	119	111	122	112
Moisture Content	(%)	7.0	8.7	8.1	5.3
Plus #4 Material	(%)	3	15	9	6

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	125.0	125.0	125.0	125.0
Optimum Moisture	(%)	11.1	11.1	11.1	11.1

COMPACTION TEST RESULTS:

Compaction	(%)	95.5	89	97.5	90
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested. The test locations and number of tests were selected by Twin City Testing and Engineering Laboratory Inc.

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

By Dale R. Sun

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612/645 3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

DATE: August 24, 1982

COPIES TO: 1-C S McCrossan Inc
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

LABORATORY No. 9-1292

TEST NUMBER:	E-5	E-6
DATE TAKEN:	August 20, 1982	August 20, 1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)	Silty sand, mostly fine grained, a little gravel, brown (SM)-5	Silty sand, mostly fine grained, trace of gravel, brown (SM)-5
LOCATION:	North dike, N embankment, coordinate E2, 029, 010	East dike, E embankment, corrdinate N866, 090
ELEVATION OF TEST:	975'	978'
DEPTH BELOW EXISTING GRADE:	1'	1'

FIELD DENSITY DETERMINATION:

Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)	
Dry Density	(pcf)	125	118.5
Moisture Content	(%)	4.3	4.7
Plus #4 Material	(%)	7	2

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method		ASTM:D1557-78, Method "A", (-#4 Basis)	
Maximum Dry Density	(pcf)	125.0	125.0
Optimum Moisture	(%)	11.1	11.1

COMPACTION TEST RESULTS:

Compaction	(%)	100	95
Specified Compaction	(%)	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested. The test locations and number of tests were selected by Twin City Testing and Engineering Laboratory Inc.

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

By Dale B. Ayers

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP: SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

DATE: September 2, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

LABORATORY No. 9-1292

TEST NUMBER:	E-7	E-8	E-9	E-10
DATE TAKEN:	August 23, 1982	August 23, 1982	August 23, 1982	August 23, 1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)	Silty sand, mostly fine grained, a little gravel, dark brown (SM)-5	Silty sand, mostly fine grained, trace of gravel, dark brown (SM)-5	Silty sand, mostly fine grained, dark brown (SM)-5	Silty sand, mostly fine grained, dark brown (SM)-5
LOCATION:	East dike, E embankment, coordinate N865,900 (retest of #E-4)	East dike, W embankment, coordinate N865,900 (retest of #E-2)	East dike, W embankment, coordinate N866,065	East dike, W embankment, coordinate N865,950
ELEVATION OF TEST:	977.5'	977.5'	980'	980'
DEPTH BELOW EXISTING GRADE:	1'	1'	1'	1'
FIELD DENSITY DETERMINATION:				
Method	Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density (pcf)	128	125.5	117	110
Moisture Content (%)	7.2	7.0	6.4	7.0
Plus #4 Material (%)	6	4	0	0
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:				
Method	ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density (pcf)	125.0	125.0	125.0	125.0
Optimum Moisture (%)	11.1	11.1	11	11
COMPACTION TEST RESULTS:				
Compaction (%)	102.5	100.5	93.5	88
Specified Compaction (%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

By Dale B Lyn

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

DATE: September 2, 1982

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

LABORATORY No. 9-1292

TEST NUMBER:		E-11	E-12	E-13	E-14
DATE TAKEN:		August 24, 1982	August 24, 1982	August 24, 1982	August 24, 1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)		Silty sand, mostly fine grained, trace of gravel, dark brown (SM)-5	Silty sand, mostly fine grained, trace of gravel, dark brown (SM)-5	Sand, fine to medium grained, trace of gravel, brown (SP)-6	Sand, fine to medium grained, trace of gravel, brown (SP)-6
LOCATION:		East dike, W embankment, coordinate N866,065 (retest of E-9)	East dike, W embankment, coordinate N865,950 (retest of E-10)	East dike, toe ditch fill area, coordinate N865,900	East dike, toe ditch fill area, coordinateN866,100
ELEVATION OF TEST:		980'	980'	960'	960'
DEPTH BELOW EXISTING GRADE:		1'	1'	10"	10"
FIELD DENSITY DETERMINATION:					
Method	Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)				
Dry Density	(pcf)	121	118.5	111	119
Moisture Content	(%)	7.2	7.5	2.0	2.8
Plus #4 Material	(%)	1	1	3	3
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:					
Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	125.0	125.0	115.2	115.2
Optimum Moisture	(%)	11.1	11.1	11.9	11.9
COMPACTION TEST RESULTS:					
Compaction	(%)	97	95	96	103
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

By _____

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

DATE: September 2, 1982

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

LABORATORY No. 9-1292

TEST NUMBER:	E-15	E-16	E-17	E-18
DATE TAKEN:	August 24, 1982	August 24, 1982	August 25, 1982	August 25, 1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)	Sand, mostly fine grained, trace of gravel, brown (SP-SM)-7	Silty sand, mostly fine grained, a little gravel, dark brown (SM)-5	Sand, fine to medium grained, trace of gravel, brown (SP)-6	Sand, mostly fine grained, trace of gravel, brown (SP-SM)-7
LOCATION:	North dike, S embankment, coordinate E2,028,750	North dike, N embankment, coordinate E2,028,750	East dike, E embankment, coordinate N865,750	East dike, W embankment, coordinate N865,750
ELEVATION OF TEST:	986'	986'	979'	981'
DEPTH BELOW EXISTING GRADE:	10"	10"	8"	8"

FIELD DENSITY DETERMINATION:

Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	114	119	111	114
Moisture Content	(%)	3.6	6.4	2.8	3.4
Plus #4 Material	(%)	1	10	5	2

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	120.0	125.0	115.2	120.0
Optimum Moisture	(%)	10.5	11.1	11.9	10.5

COMPACTION TEST RESULTS:

Compaction	(%)	95	95.5	96.5	95
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

By Dale B Lam

twin city testing and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

DATE: September 2, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

LABORATORY No. 9-1292

TEST NUMBER:		E-19	E-20	E-21	E-22
DATE TAKEN:		August 25, 1982	August 25, 1982	August 25, 1982	August 25, 1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)		Silty sand, mostly fine grained, trace of gravel, dark brown (SM)-5	Silty sand, mostly fine grained, trace of gravel, dark brown (SM)-5	Sand, mostly fine grained, a little gravel, brown (SP-SM)-7	Sand, mostly fine grained, trace of gravel, brown (SP-SM)-7
LOCATION:		North dike, S embankment, coordinate E2,028,900	North dike, N embankment, coordinate E2,028,900	Toe of east dike, E embankment, coordinate N865,800	Toe of east dike, E embankment, coordinate 866,000
ELEVATION OF TEST:		979.5'	980.5'	961'	961'
DEPTH BELOW EXISTING GRADE:		10"	10"	8"	8"
FIELD DENSITY DETERMINATION:					
Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	111.5	125	118.5	118
Moisture Content	(%)	5.8	9.3	4.2	3.4
Plus #4 Material	(%)	2	3	11	4
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:					
Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	125.0	125.0	120.0	120.0
Optimum Moisture	(%)	11.1	11.1	10.5	10.5
COMPACTION TEST RESULTS:					
Compaction	(%)	89.5	100	98.5	98
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

By Dale B[illegible]

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

DATE: August 31, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan Inc
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

LABORATORY No. 9-1292

TEST NUMBER:	E-23	E-24	E-25	E-26
DATE TAKEN:	August 25, 1982	August 25, 1982	August 26, 1982	August 26, 1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)	Sand, fine to medium grained, a little gravel, brown (SP)-6	Sand, fine to medium grained, trace of gravel, brown (SP)-6	Sand, mostly fine grained, trace of gravel, brown (SP-SM)-7	Sand, mostly fine grained, brown (SP)-8
LOCATION:	East dike, W embankment, coordinate N866,000	East dike, E embankment, coordinate N866,000	North dike, S embankment, coordinate E2,028,900	East dike, E embankment, coordinate N866,090
ELEVATION OF TEST:	979.5'	978.5'	979.5'	978'
DEPTH BELOW EXISTING GRADE:	10"	10"	10"	10"

FIELD DENSITY DETERMINATION:

Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	111.5	114.5	116.5	104.5
Moisture Content	(%)	2.8	4.2	5.8	4.7
Plus #4 Material	(%)	8	4	2	0

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	115.2	115.2	120.0	109.8
Optimum Moisture	(%)	11.9	11.9	10.5	13.8

COMPACTION TEST RESULTS:

Compaction	(%)	97	99.5	97	95
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

By Dale R Jan

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

DATE: August 31, 1982

COPIES TO: 1-C S McCrossan Inc
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

LABORATORY No. 9-1292

		E-27	E-28	E-29	E-30
TEST NUMBER:		E-27	E-28	E-29	E-30
DATE TAKEN:		August 27, 1982	August 27, 1982	August 27, 1982	August 27, 1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)		Sand, mostly fine grained, trace of gravel, brown (SP-SM)-7	Silty sand, mostly fine grained, a little gravel, dark brown (SM-5)	Sand, fine to medium grained, trace of gravel, brown (SP)-6	Sand, mostly fine grained, trace of gravel, brown (SP)-8
LOCATION:		East dike, E embankment, coordinate N865,800	East dike, W embankment, coordinate N865,750	East dike, E embankment, coordinate N866,050	East dike, E embankment, coordinate N865,900
ELEVATION OF TEST:		982.5'	984'	969'	971.5'
DEPTH BELOW EXISTING GRADE:		10"	10"	1'	1'
FIELD DENSITY DETERMINATION:					
Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	120.5	124	120	114
Moisture Content	(%)	6.7	7.2	5.5	3.6
Plus #4 Material	(%)	2	7	5	2
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:					
Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	120.0	125.0	115.2	109.8
Optimum Moisture	(%)	10.5	11.1	11.9	13.8
COMPACTION TEST RESULTS:					
Compaction	(%)	100.5	99	104	104
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

By Dale B[illegible]

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

DATE: August 31, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan Inc
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

LABORATORY No. 9-1292

TEST NUMBER:	E-31	E-32	E-33	E-34
DATE TAKEN:	August 27, 1982	August 27, 1982	August 27, 1982	August 27, 1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)	Sand, fine to medium grained, trace of gravel, brown (SP)-6	Sand, mostly fine grained, trace of gravel, brown (SP-SM)-7	Sand, mostly fine grained, trace of gravel, brown (SP-SM)-7	Sand, mostly fine grained, trace of gravel, brown (SP-SM)-7
LOCATION:	North dike, N embankment, coordinate E2,028,800	North dike, S embankment, coordinate E2,028,800	East dike, E embankment, coordinate N866,000	East dike, E embankment, coordinate N865,800
ELEVATION OF TEST:	987'	987.5'	971.5'	973'
DEPTH BELOW EXISTING GRADE:	10'	10"	10"	10"

FIELD DENSITY DETERMINATION:

Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	111	121	115.5	117
Moisture Content	(%)	5.0	6.4	3.4	3.6
Plus #4 Material	(%)	4	4	5	5

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	115.2	120.0	120.0	120.0
Optimum Moisture	(%)	11.9	10.5	10.5	10.5

COMPACTION TEST RESULTS:

Compaction	(%)	96.5	101	96	97.5
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

By Dale B Gus

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

DATE: August 31, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan Inc
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

LABORATORY No. 9-1292

TEST NUMBER:	E-35	E-36	E-37	E-38
DATE TAKEN:	August 27, 1982	August 27, 1982	August 27, 1982	August 27, 1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)	Sand, mostly fine grained, trace of gravel, brown (SP-SM)-7	Sand, fine to medium grained, trace of gravel, brown (SP)-6	Sand, fine to medium grained, trace of gravel, brown (SP)-6	Sand, fine to medium grained, trace of gravel, brown (SP)-6
LOCATION:	East dike, E embankment, coordinate N865,950	East dike, W embankment, coordinate N865,950	East dike, W embankment, coordinate N866,050	East dike, E embankment, coordinate N866,050
ELEVATION OF TEST:	982'	982.5'	982'	981'
DEPTH BELOW EXISTING GRADE:	10"	10"	10"	10"

FIELD DENSITY DETERMINATION:

Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	116.5	116.5	119	115
Moisture Content	(%)	8.7	5.3	5.8	6.1
Plus #4 Material	(%)	1	2	3	3

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	120.0	115.2	115.2	115.2
Optimum Moisture	(%)	10.5	11.9	11.9	11.9

COMPACTION TEST RESULTS:

Compaction	(%)	97	101	103	100
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

By Dale Bolton

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

LABORATORY No. 9-1357

TEST NUMBER:	E-39	E-40	E-41	E-42
DATE TAKEN:	Sept 1, 1982	Sept 1, 1982	Sept 1, 1982	Sept 1, 1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)	Sand, mostly fine grained, trace of gravel, brown (SP-SM)-7	Sand, fine to medium grained, trace of gravel, brown (SP)-6	Sand, fine to medium grained, a little gravel, brown (SP)-6	Sand, mostly fine grained trace of gravel, brown (SP-SM)-7
LOCATION:	East dike west embankment coordinate N865,800	East dike west embankment coordinate N865,950	East dike west embankment coordinate N866,050	East dike east embankment coordinate N866,100
ELEVATION OF TEST:	985'	985'	986'	981'
DEPTH BELOW EXISTING GRADE:	1'	1'	1'	1'

FIELD DENSITY DETERMINATION:

Method	Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)				
Dry Density	(pcf)	122.5	115.5	112.5	123.0
Moisture Content	(%)	9.9	8.7	9.3	10.2
Plus #4 Material	(%)	4	4	7	3

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	120.0	115.2	115.2	120.0
Optimum Moisture	(%)	10.5	11.9	11.9	10.5

COMPACTION TEST RESULTS:

Compaction	(%)	102	100.5	97.5	102.5
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested. The test locations and number of tests were selected by Twin City Testing & Engineering Laboratory.

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

By Dale B. Jan

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

LABORATORY No. 9-1357

TEST NUMBER:	E-43	E-44	E-45
DATE TAKEN:	Sept 1,1982	Sept 1,1982	Sept 1,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)	Sand, fine to medium grained, brown (SP-SM)-6	Sand, mostly fine grained, brown (SP)-7	Sand, fine to medium grained, brown (SP-SM)-6
LOCATION:	East dike east embankment coordinate N866,000	East dike east embankment coordinate N865,800	East dike east embankment coordinate N866,000 (Retest #E43)
ELEVATION OF TEST:	982'	983'	982'
DEPTH BELOW EXISTING GRADE:	1'	1'	1'
FIELD DENSITY DETERMINATION:			
Method	Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)		
Dry Density (pcf)	101.5	118	109
Moisture Content (%)	10.2	8.1	10.2
Plus #4 Material (%)	6	3	7
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:			
Method	ASTM:D1557-78, Method "A", (-#4 Basis)		
Maximum Dry Density (pcf)	115.2	120.0	115.2
Optimum Moisture (%)	11.9	10.5	11.9
COMPACTION TEST RESULTS:			
Compaction (%)	88.5	98.5	95
Specified Compaction (%)	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested. The test locations and number of tests were selected by Twin City Testing & Engineering Laboratory

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

By [signature]

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

DATE: October 11, 1982

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

LABORATORY No. 9-1357

TEST NUMBER:	E46	E47	E48	E49
DATE TAKEN:	Sept 2,1982	Sept 2,1982	Sept 2,1982	Sept 2,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)	Sand, fine to medium grained, trace of gravel, grown (SP)-6	Sand, fine to medium grained, trace of gravel, brown (SP)-6	Sand, fine to medium grained, trace of gravel, brown (SP)-6	Sand, fine to medium grained, trace of gravel, brown (SP)-6
LOCATION:	East dike east embankment coordinate N865750	East dike east embankment coordinate N865,880	East dike east embankment coordinate N866,000 access road	East dike east embankment coordinate N866,120 access road
ELEVATION OF TEST:	976'	975'	973'	975'
DEPTH BELOW EXISTING GRADE:	1'	1'	1'	1'

FIELD DENSITY DETERMINATION:

Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	109	119	119	111
Moisture Content	(%)	5.3	5.8	6.4	5.8
Plus #4 Material	(%)	5	4	3	4

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	115.2	115.2	115.2	115.2
Optimum Moisture	(%)	11.9	11.9	11.9	11.9

COMPACTION TEST RESULTS:

Compaction	(%)	95	103	103	96.5
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

By Dale R. Fass

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

LABORATORY No. 9-1357

TEST NUMBER:		E50	E51	E52	E53
DATE TAKEN:		Sept 2,1982	Sept 2,1982	Sept 2,1982	Sept 2,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)		Sand, mostly fine grained, trace of gravel, brown (SP-SM)-7	Sand, mostly fine grained, trace of gravel, brown (SP-SM)-7	Sand, mostly fine grained, trace of gravel, brown (SP-SM)-7	Sand, mostly fine grained, trace of gravel, brown (SP-SM)-7
LOCATION:		East dike east embankment coordinate N865,800	East dike east embankment coordinate N865,950 access road	East dike east embankment coordinate N866,050 access road	East dike east embankment coordinate N866,120
ELEVATION OF TEST:		978'	977'	975'	976'
DEPTH BELOW EXISTING GRADE:		1'	1'	1'	1'
FIELD DENSITY DETERMINATION:					
Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	121	119	118	122.5
Moisture Content	(%)	7.2	6.7	6.1	9.9
Plus #4 Material	(%)	5	4	4	5
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:					
Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	120.0	120.0	120.0	120.0
Optimum Moisture	(%)	10.5	10.5	10.5	10.5
COMPACTION TEST RESULTS:					
Compaction	(%)	101	99	98.5	102
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

By Dale B. Simonson

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

LABORATORY No. 9-1357

		E-54	E-55	E-56	E-57
TEST NUMBER:					
DATE TAKEN:		Sept 7,1982	Sept 7,1982	Sept 7,1982	Sept 7,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)		Sand, fine to medium grained, a little gravel, brown (SP-SM)-9	Sand, fine to medium grained, a little gravel, brown (SP-SM)-9	Sand, fine to medium grained, a little gravel, brown (SP-SM)-9	Sand, fine to medium grained, a little gravel, brown (SP-SM)-9
LOCATION:		East dike west embankment coordinate N865,790	East dike west embankment coordinate N865,900	East dike west embankment coordinate N866,090	East dike east embankment coordinate N866,000
ELEVATION OF TEST:		987'	987'	987'	988'
DEPTH BELOW EXISTING GRADE:		1'	1'	1'	1'
FIELD DENSITY DETERMINATION:					
Method	Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)				
Dry Density	(pcf)	124	120	114	118.5
Moisture Content	(%)	6.4	6.4	5.3	5.3
Plus #4 Material	(%)	6	6	10	6
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:					
Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	117.7	117.7	117.7	117.7
Optimum Moisture	(%)	13.9	13.9	13.9	13.9
COMPACTION TEST RESULTS:					
Compaction	(%)	105	102	97	101
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

By Dale R[illegible]

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

LABORATORY No. 9-1357

TEST NUMBER:		E-58	E-59	E-60	E-61
DATE TAKEN:		Sept 7,1982	Sept 7,1982	Sept 7,1982	Sept 7,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)		Sand, mostly fine grained, trace of gravel, brown (SP-SM)-7	Sand, mostly fine grained, a little gravel, brown (SP-SM)-7	Sand, fine to medium grained, a little gravel, brown (SP)-6	Sand, fine to medium grained, trace of gravel, brown (SP)-6
LOCATION:		East dike east embankment coordinate N865,800	East dike east embankment coordinate N865,950	East dike east embankment coordinate N866,150	East dike east embankment coordinate N866,000
ELEVATION OF TEST		984	983	978.5	980
DEPTH BELOW EXISTING GRADE:		1'	1'	1'	1'
FIELD DENSITY DETERMINATION:					
Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	125	117	114	112
Moisture Content	(%)	7.0	6.7	5.5	5.3
Plus #4 Material	(%)	4	6	8	3
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:					
Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	120.0	120.0	115.2	115.2
Optimum Moisture	(%)	10.5	10.5	11.9	11.9
COMPACTION TEST RESULTS:					
Compaction	(%)	104.5	98	97	97
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

By Dale B [signature]

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

LABORATORY No. 9-1357

		E62	E63	E64	E65
TEST NUMBER:					
DATE TAKEN:		Sept 8,1982	Sept 8,1982	Sept 8,1982	Sept 8,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)		Sand, fine to medium grained, a little gravel, brown (SP-SM)-9	Sand, fine to medium grained, a little gravel, brown (SP-SM)-9	Sand, mostly fine grained, a little gravel, brown (SP-SM)-7	Sand, mostly fine grained, a little gravel, brown (SP-SM)-7
LOCATION:		East dike east embankment coordinate N865,850	East dike east embankment coordinate N866,100	East dike east embankment coordinate N865,950	East dike east embankment coordinate N865,800
ELEVATION OF TEST:		985'	981'	984'	916.5
DEPTH BELOW EXISTING GRADE:		1'	1'	1'	1'
FIELD DENSITY DETERMINATION:					
Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	115	115	116.5	115
Moisture Content	(%)	5.0	5.3	5.0	6.1
Plus #4 Material	(%)	6	8	7	6
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:					
Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	117.7	117.7	120.0	120.0
Optimum Moisture	(%)	13.9	13.9	10.5	10.5
COMPACTION TEST RESULTS:					
Compaction	(%)	98	98	97	96
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

By Dale R Tan

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

LABORATORY No. 9-1357

TEST NUMBER:	E-66	E-67	E-68	E-69
DATE TAKEN:	Sept 9,1982	Sept 9,1982	Sept 9,1982	Sept 9,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)	Sand, fine to medium grained, trace of gravel, brown (SP-SM)-9	Sand, fine to medium grained, trace of gravel, brown (SP-SM)-9	Sand, fine to medium grained, trace of gravel, brown (SP-SM)-9	Sand, fine to medium grained, trace of gravel, brown (SP-SM)-9
LOCATION:	East dike east embankment coordinate N866,100	East dike east embankment coordinate N865,950	East dike east embankment coordinate N865,800	North dike north embankment coordinate E2,028,800
ELEVATION OF TEST:	982'	985'	985.5'	983'
DEPTH BELOW EXISTING GRADE:	1'	1'	1'	1'

FIELD DENSITY DETERMINATION:

Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	115	117	120	115
Moisture Content	(%)	4.7	5.0	4.7	4.7
Plus #4 Material	(%)	4	3	6	7

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	117.7	117.7	117.7	117.7
Optimum Moisture	(%)	13.9	13.9	13.9	13.9

COMPACTION TEST RESULTS:

Compaction	(%)	98	99	102	98
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

By _____

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

LABORATORY No. 9-1357

TEST NUMBER:		E-70	E-71	E-72	E-73
DATE TAKEN:		Sept 9,1982	Sept 9,1982	Sept 9,1982	Sept 9,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)		Sand, mostly fine grained, a little gravel, brown (SP-SM)-7	Sand, mostly fine grained, a little gravel, brown (SP-SM)-7	Sand, mostly fine grained, a little gravel, brown (SP-SM)-7	Sand, mostly fine grained, a little gravel, brown (SP)-8
LOCATION:		North dike north embankment coordinate E2,028,950	North dike north embankment coordinate E2,028,980	North dike north embankment coordinate E2,029,610	North dike north embankment coordinate E2,029,100
ELEVATION FO TEST:		981'	989'	982'	883'
DEPTH BELOW EXISTING GRADE:		1'	1'	1'	1'
FIELD DENSITY DETERMINATION:					
Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	122	125	116	107
Moisture Content	(%)	6.1	5.5	6.4	6.4
Plus #4 Material	(%)	8	6	6	7
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:					
Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	120.0	120.0	120.0	109.8
Optimum Moisture	(%)	10.5	10.5	10.5	13.8
COMPACTION TEST RESULTS:					
Compaction	(%)	101.5	104	96.5	98
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

By Dale R Lyn

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

LABORATORY No. 9-1357

		E-74	E-75	E-76	E-77
TEST NUMBER:					
DATE TAKEN:		Sept 10,1982	Sept 10,1982	Sept 10,1982	Sept 10,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)		Sand, fine to medium grained, trace of gravel, brown (SP-SM)-9	Sand, fine to medium grained, trace of gravel, brown (SP-SM)-9	Sand, fine to medium grained, trace of gravel, brown (SP-SM)-9	Sand, fine to medium grained, trace of gravel, brown (SP-SM)-9
LOCATION:		North dike north embankment coordinate E2,028,620	North dike north embankment coordinate E2,028,800	North dike north embankment coordinate E2,029,000	North dike north embankment coordinate E2,028,900
ELEVATION OF TEST:		993'	992'	990'	991'
DEPTH BELOW EXISTING GRADE:		1'	1'	1'	1'
FIELD DENSITY DETERMINATION:					
Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	123	112	114	112
Moisture Content	(%)	5.0	5.3	5.5	5.0
Plus #4 Material	(%)	5	3	4	5
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:					
Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	117.7	117.7	117.7	117.7
Optimum Moisture	(%)	13.9	13.9	13.9	13.9
COMPACTION TEST RESULTS:					
Compaction	(%)	114	95.5	97	95.5
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

By Dale R Jan

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

LABORATORY No. 9-1357

TEST NUMBER:	E-78	E-79	E-80	E-81
DATE TAKEN:	Sept 10,1982	Sept 10,1982	Sept 10,1982	Sept 10,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)	Sand, mostly fine grained, a little gravel, brown (SP-SM)-7	Sand, fine to medium grained, a little gravel, brown (SP-SM)-9	Sand, mostly fine grained, a little gravel, brown (SP)-8	Sand, mostly, fine grained, a little gravel, brown (SP-SM)-7
LOCATION:	North dike north embankment coordinate E2,028,700	North dike north embankment coordinate E2,028,950	North dike south embankment coordinate E2,028,850	North dike south embankment coordinate E2,028,940
ELEVATION OF TEST:	996'	994'	991.5'	992'
DEPTH BELOW EXISTING GRADE:	1'	1'	1'	1'

FIELD DENSITY DETERMINATION:

Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	117	122	110	120
Moisture Content	(%)	5.0	6.1	5.0	5.5
Plus #4 Material	(%)	8	6	5	5

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	120.0	117.7	119.8	120.0
Optimum Moisture	(%)	10.5	13.9	13.8	10.5

COMPACTION TEST RESULTS:

Compaction	(%)	97	103.5	100	100
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

By Dale R Jan

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

LABORATORY No. 9-1357

TEST NUMBER:		E-82	E-83	E-84	E-85
DATE TAKEN:		Sept 13,1982	Sept 13,1982	Sept 13,1982	Sept 13,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)		Sand, mostly fine grained, a little gravel, brown)SP-SM)-7	Sand, mostly fine grained, a little gravel, brown (SP-SM)-7	Sand, mostly fine grained, a little gravel, brown (SP-SM)-7	Sand, mostly fine grained, a little gravel, brown (SP-SM)-7
LOCATION:		North dike north embankment coordinate E2,029,000	North dike north embankment coordinate E2,028,940	North dike south embankment coordinate E2,028,850	North dike south embankment coordinate E2,029,980
ELEVATION OF TEST:		995'	995'	993.5'	994.5'
DEPTH BELOW EXISTING GRADE:		1'	1'	1'	1'
FIELD DENSITY DETERMINATION:					
Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	124	125	122	125
Moisture Content	(%)	5.5	5.0	6.1	5.8
Plus #4 Material	(%)	8	6	10	6
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:					
Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	120.0	120.0	120.0	120.0
Optimum Moisture	(%)	10.5	10.5	10.5	10.5
COMPACTION TEST RESULTS:					
Compaction	(%)	103	104	101.5	104
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

By _____

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

LABORATORY No. 9-1357

TEST NUMBER:		E-86	E-87	E-88	E-89
DATE TAKEN:		Sept 14,1982	Sept 14,1982	Sept 14,1982	Sept 14,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)		Sand, fine to medium grained, a little gravel, brown (SP-SM)-9	Sand, mostly fine grained, a little gravel, brown (SP-SM)-7	Sand, mostly fine grained, a little gravel, brown (SP-SM)-7	Sand, fine to medium grained, trace of gravel, brown (SP-SM)-9
LOCATION:		East dike east embankment coordinate N866,100	East dike east embankment coordinate N865,900	East dike east embankment coordinate N865,800	East dike west embankment coordinate N865,850
ELEVATION OF TEST:		984'	984.5'	988'	987'
DEPTH BELOW EXISTING GRADE:		1'	1'	1'	1'
FIELD DENSITY DETERMINATION:					
Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	119	121	121.5	121
Moisture Content	(%)	6.1	7.0	6.7	6.1
Plus #4 Material	(%)	6	6	7	3
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:					
Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	117.7	120.0	120.0	117.7
Optimum Moisture	(%)	13.9	10.5	10.5	13.9
COMPACTION TEST RESULTS:					
Compaction	(%)	101	101	101.5	103
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

By [signature]

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

LABORATORY No. 9-1357

TEST NUMBER:		E-90	E-91	E-92	E-93
DATE TAKEN:		Sept 14,1982	Sept 14,1982	Sept 14,1982	Sept 14,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)		Sand, fine to medium grained, a little gravel, brown (SP-SM)-9	Sand, fine to medium grained, a little gravel, brown (SP-SM)-9	Sand, mostly fine grained, a little gravel, brown (SP)-8	Sand, mostly fine grained, a little gravel, brown (SP)-8
LOCATION:		East dike west embankment coordinate N866,000	East dike west embankment coordinate N865,800	East dike west embankment coordinate N866,100	East dike east embankment coordinate N865,850
ELEVATION OF TEST:		987.5'	988.5'	989'	990'
DEPTH BELOW EXISTING GRADE:		1'	1'	1'	1'
FIELD DENSITY DETERMINATION:					
Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	124	112	105	114
Moisture Content	(%)	5.5	5.0	5.0	6.1
Plus #4 Material	(%)	7	7	8	8
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:					
Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	117.7	117.7	109.8	109.8
Optimum Moisture	(%)	13.9	13.9	13.8	13.8
COMPACTION TEST RESULTS:					
Compaction	(%)	105	95	95.5	104.5
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

By

twin city testing and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

LABORATORY No. 9-1357

		E-94	E-95	E-96	E-97
TEST NUMBER:		E-94	E-95	E-96	E-97
DATE TAKEN:		Sept 16,1982	Sept 16,1982	Sept 16,1982	Sept 16,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)		Sand, fine to medium grained, a little gravel, brown (SP-SM)-9	Sand, fine to medium grained, a little gravel, brown (SP-SM)-9	Sand, fine to medium grained, a little gravel, brown (SP-SM)-9	Sand, fine to medium grained, a little gravel, brown (SP-SM)-9
LOCATION:		East dike east embankment coordinate N866,050	East dike east embankment coordinate N865,800	East dike west embankment coordinate 865, 700	East dike west embankment coordinate N866,000
ELEVATION OF TEST:		991'	992'	990'	991'
DEPTH BELOW EXISTING GRADE:		1'	1'	1'	1'
FIELD DENSITY DETERMINATION:					
Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	120	114.5	115	116
Moisture Content	(%)	5.5	5.0	5.5	5.8
Plus #4 Material	(%)	10	6	7	6
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:					
Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	117.7	117.7	117.7	117.7
Optimum Moisture	(%)	13.9	13.9	13.9	13.9
COMPACTION TEST RESULTS:					
Compaction	(%)	102	97.5	98.5	98.5
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

By Dale Ba[illegible]

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

LABORATORY No. 9-1357

TEST NUMBER:	E-98	E-99	E-100	E-101
DATE TAKEN:	Sept 17,1982	Sept 17,1982	Sept 17,1982	Sept 17,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)	Sand, fine to medium grained, trace of gravel, brown (SP-SM)-9	Sand, fine to medium grained, a little gravel, brown (SP-SM)-9	Sand, fine to medium grained, a little gravel, brown (SP-SM)-9	Sand, fine to medium grained, trace of gravel, brown (SP-SM)-9
LOCATION:	East dike east embankment coordinate N865,800	East dike east embankment coordinate N866,000	East dike west embankment coordinate N865,900	East dike west embankment coordinate N866,100
ELEVATION OF TEST:	993'	994'	992'	993'
DEPTH BELOW EXISTING GRADE:	1'	1'	1'	1'

FIELD DENSITY DETERMINATION:

Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	118	112	112	114
Moisture Content	(%)	5.0	4.2	5.0	5.5
Plus #4 Material	(%)	3	6	6	4

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	117.7	117.7	117.7	117.7
Optimum Moisture	(%)	13.9	13.9	13.9	13.9

COMPACTION TEST RESULTS:

Compaction	(%)	100	95	95	96.5
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

By _____

SG-225 (81-A)

MOISTURE-DENSITY RELATIONSHIPS

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612 645 3601

MOISTURE - DENSITY CURVE

SAMPLE NO. 1

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

REPORTED TO: Northern States Power Co

DATE: August 24, 1982

COPIES TO: 1-C S McCrossan Inc
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

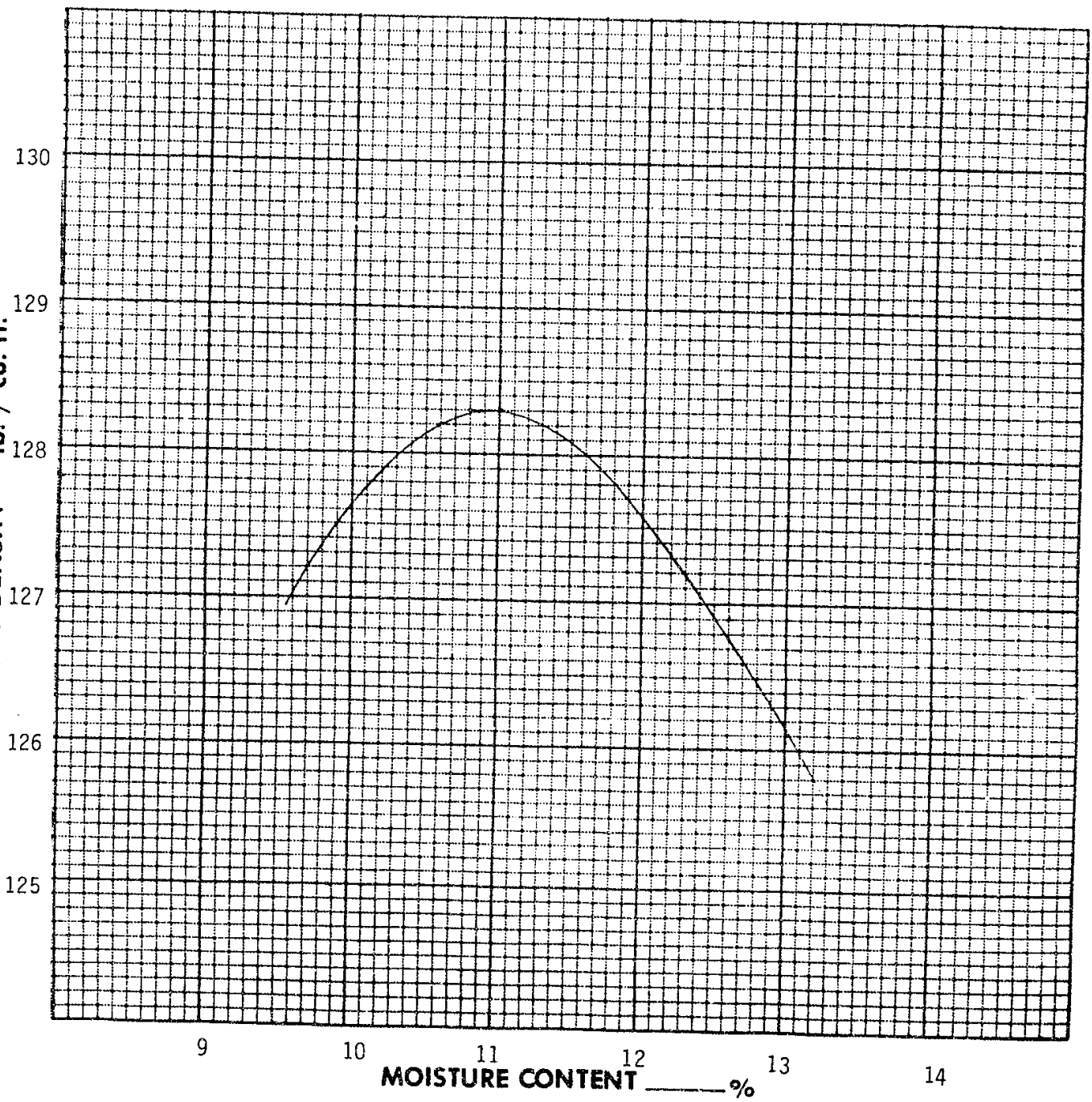
LABORATORY NO. 9-1292

METHOD OF TEST: ASTM:D1557-78, Method "A"

TYPE OF MATERIAL: Sandy clay, brown (CL)

MAXIMUM DENSITY: 128.3 lb./cu. ft.

OPTIMUM MOISTURE 11.0 %



twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL MN 55114
PHONE 612/645 3601

MOISTURE - DENSITY CURVE

SAMPLE NO. 2

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

DATE: August 24, 1982

REPORTED TO: Northern States Power Co

COPIES TO: 1-C S McCrossan Inc
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

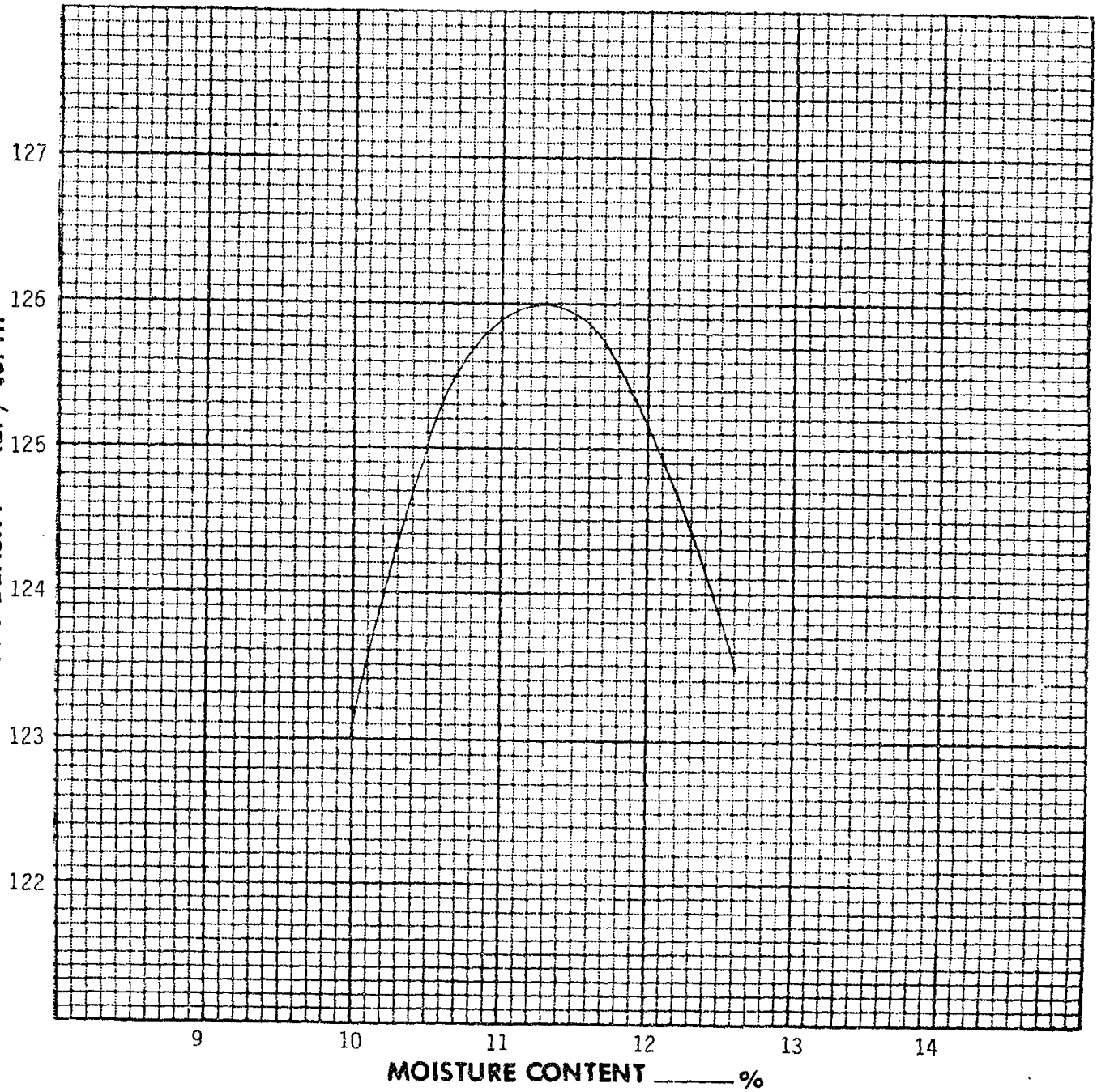
LABORATORY NO. 9-1292

METHOD OF TEST: ASTM:D1557-78, Method "A"

TYPE OF MATERIAL: Sandy clay, brown (CL)

MAXIMUM DENSITY: 126.0 lb./cu. ft.

OPTIMUM MOISTURE 11.3 %



twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL MN 55114
PHONE 612 645 3601

MOISTURE - DENSITY CURVE

SAMPLE NO. 3

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

REPORTED TO: Northern States Power Co

LABORATORY NO. 9-1292

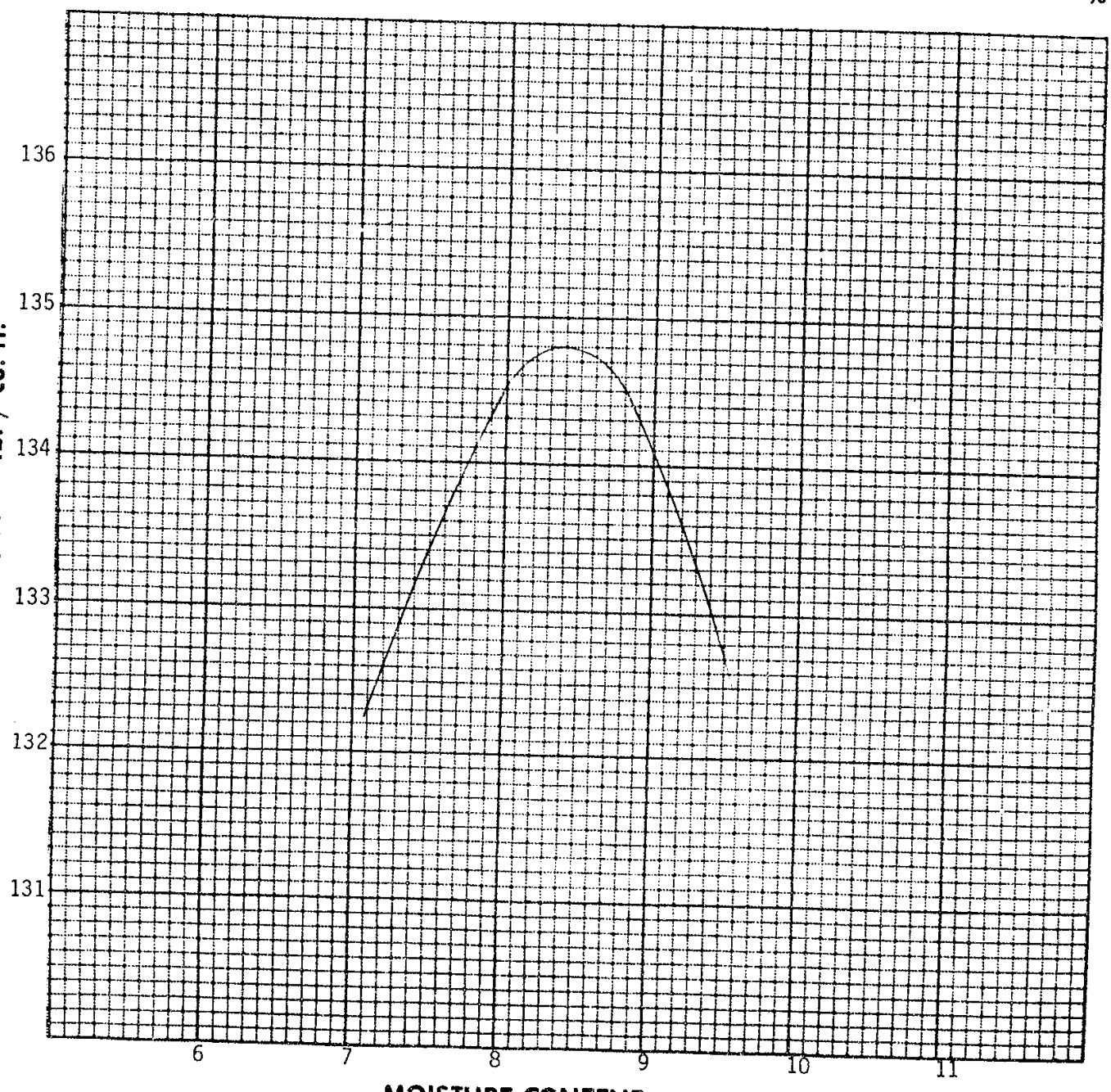
DATE: August 24, 1982

COPIES TO: 1-C S McCrossan Inc
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

METHOD OF TEST: ASTM:D1557-78, Method "A"

TYPE OF MATERIAL: Clayey sand, mostly fine grained, reddish brown (SC)

MAXIMUM DENSITY: 134.8 lb./cu. ft. **OPTIMUM MOISTURE** 8.4 %



twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL MN 55114
PHONE 612-645-3601

MOISTURE-DENSITY CURVE

SAMPLE NO. 4

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

DATE: August 24, 1982

REPORTED TO: Northern States Power Co

COPIES TO: 1-C S McCrossan Inc
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

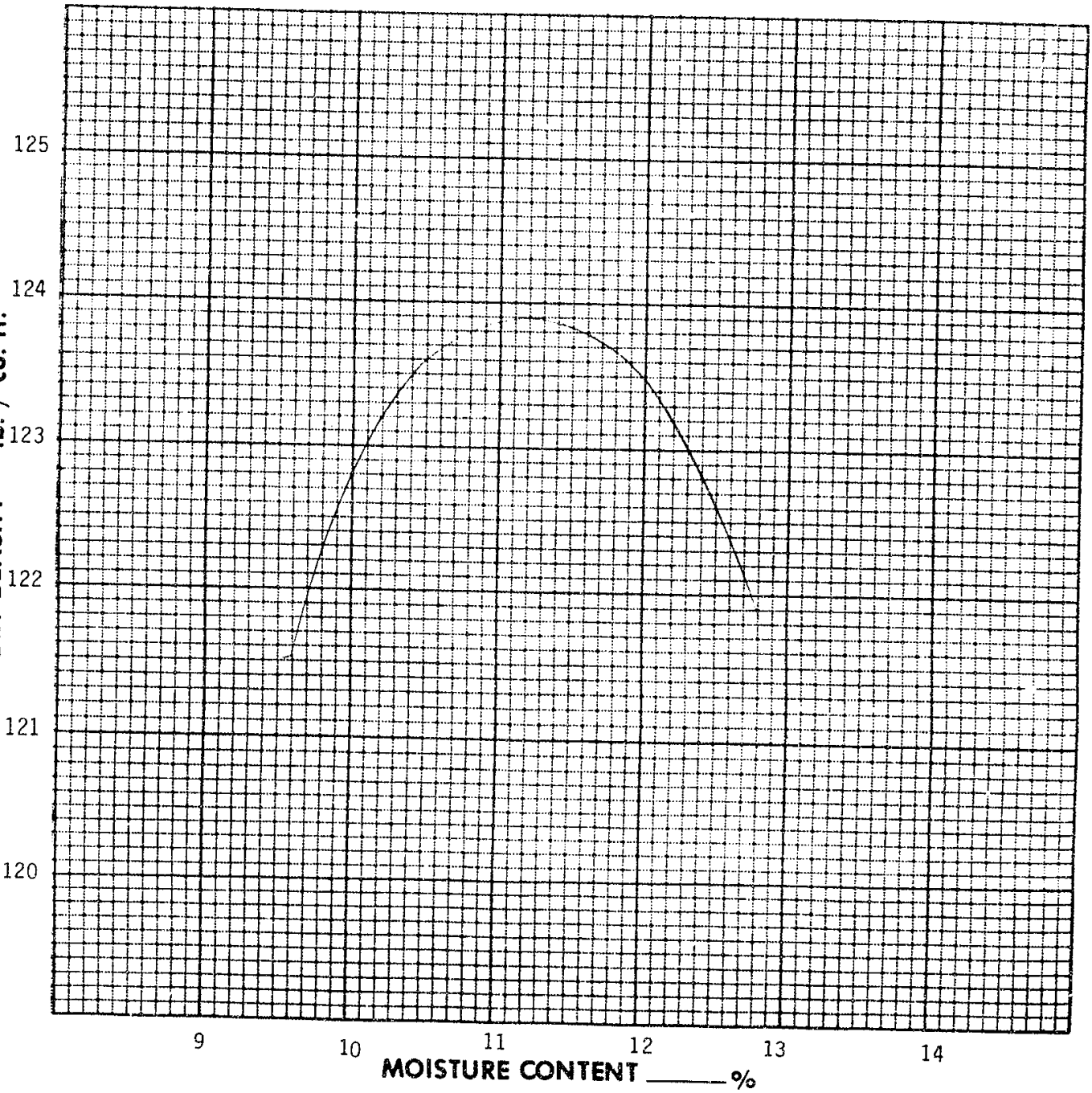
LABORATORY NO. 9-1292

METHOD OF TEST: ASTM:D1557-78, Method "A"

TYPE OF MATERIAL: Sandy clay brown (SC-CL)

MAXIMUM DENSITY: 123.9 lb./cu. ft.

OPTIMUM MOISTURE 11.2 %



twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612-645-3601

MOISTURE-DENSITY CURVE

SAMPLE NO. 5

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

DATE: September 2, 1982

REPORTED TO: Northern States Power Co

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

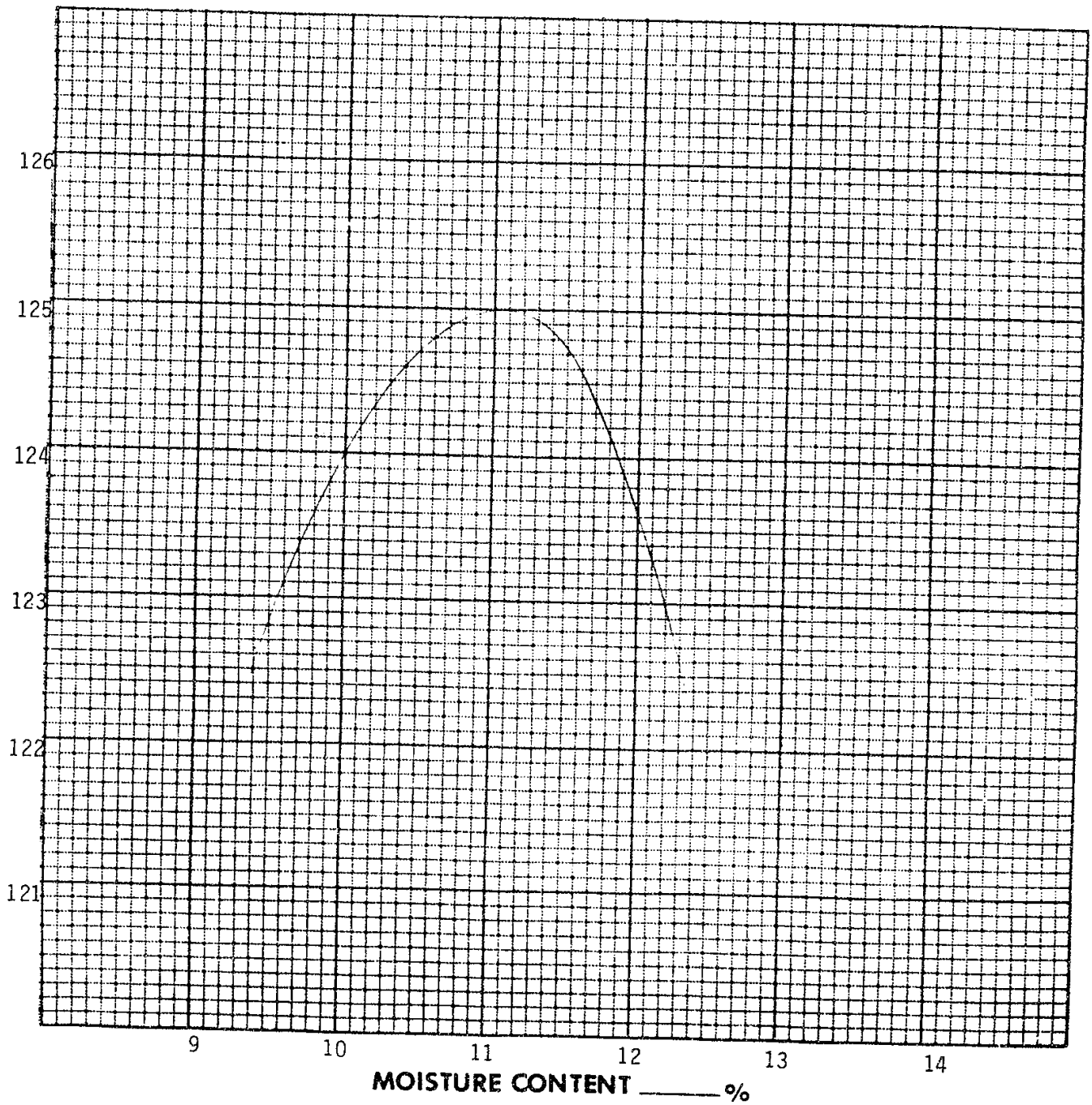
LABORATORY NO. 9-1292

METHOD OF TEST: ASTM:D1557-78, Method "A"

TYPE OF MATERIAL: Silty sand, mostly fine grained, dark brown (SM)

MAXIMUM DENSITY: 125.0 lb./cu. ft.

OPTIMUM MOISTURE 11.1 %



twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL MN 55114
PHONE 612 645 3601

MOISTURE-DENSITY CURVE

SAMPLE NO. 6

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

DATE: August 24, 1982

REPORTED TO: Northern States Power Co

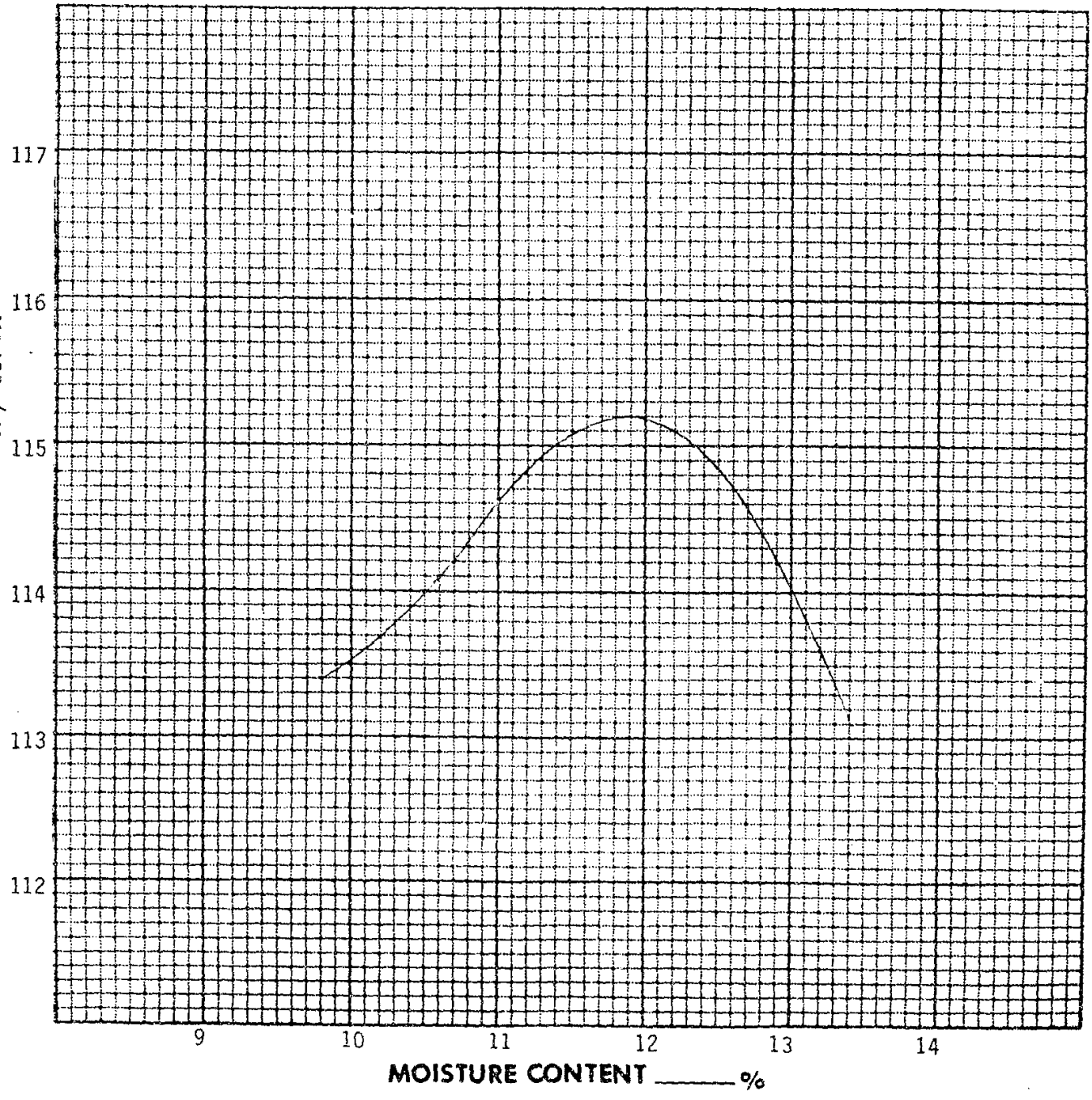
COPIES TO: 1-C S McCrossan Inc
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

LABORATORY NO. 9-1292

METHOD OF TEST: ASTM:D1557-78, Method "A".

TYPE OF MATERIAL: Sand, fine to medium grained, brown (SP)

MAXIMUM DENSITY: 115.2 lb./cu. ft. **OPTIMUM MOISTURE** 11.9 %



twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612 645 3601

MOISTURE - DENSITY CURVE

SAMPLE NO. 7

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

DATE: September 2, 1982

REPORTED TO: Northern States Power Co

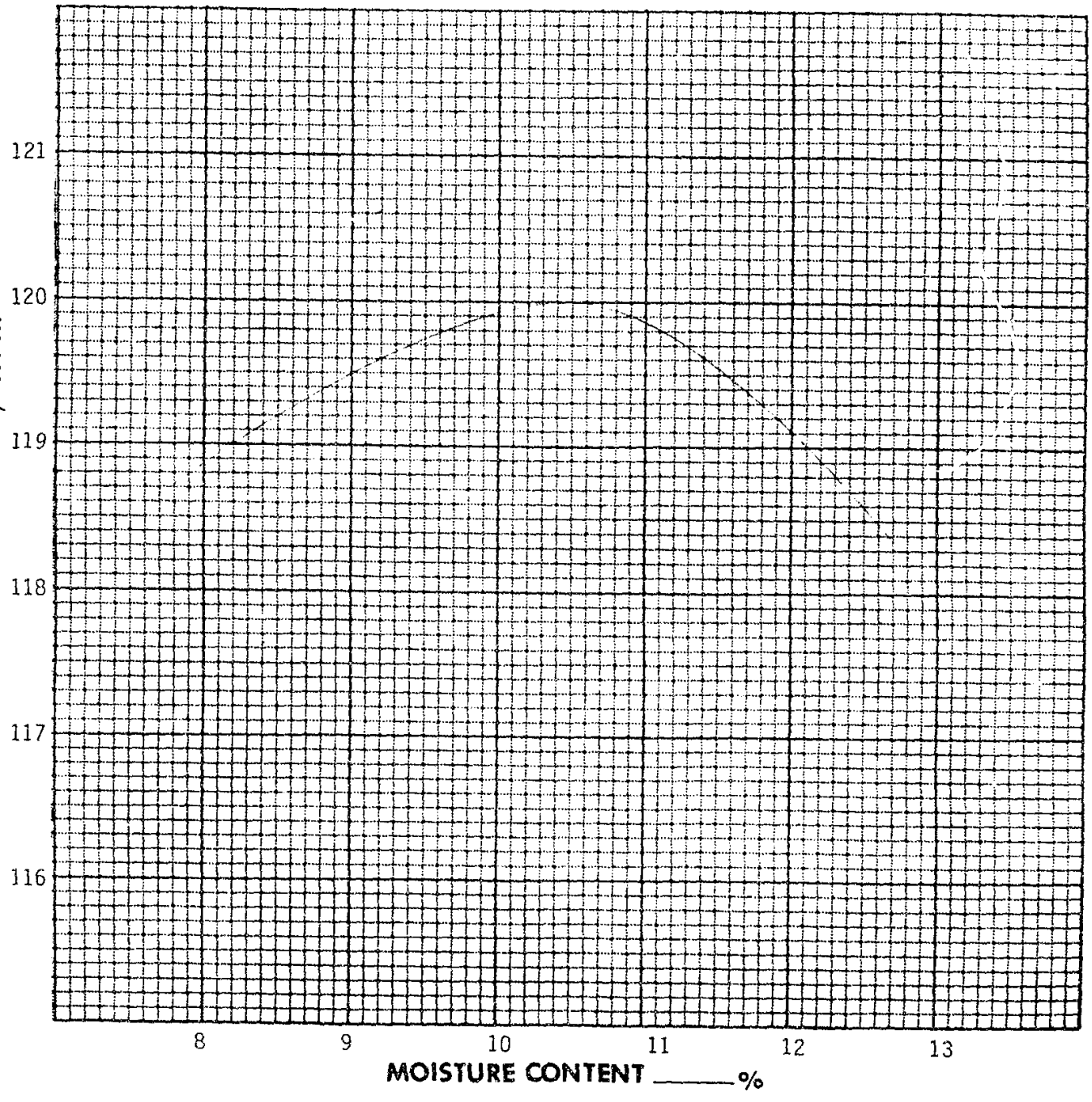
COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

LABORATORY NO. 9-1292

METHOD OF TEST: ASTM:D1557-78, Method "A"

TYPE OF MATERIAL: Sand, mostly fine grained, brown (SP-SM)

MAXIMUM DENSITY: 120.0 lb./cu. ft. **OPTIMUM MOISTURE** 10.5 %



twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612 645-0601

MOISTURE - DENSITY CURVE

SAMPLE NO. 8

PROJECT: SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

DATE: August 31, 1982

REPORTED TO: Northern States Power Co

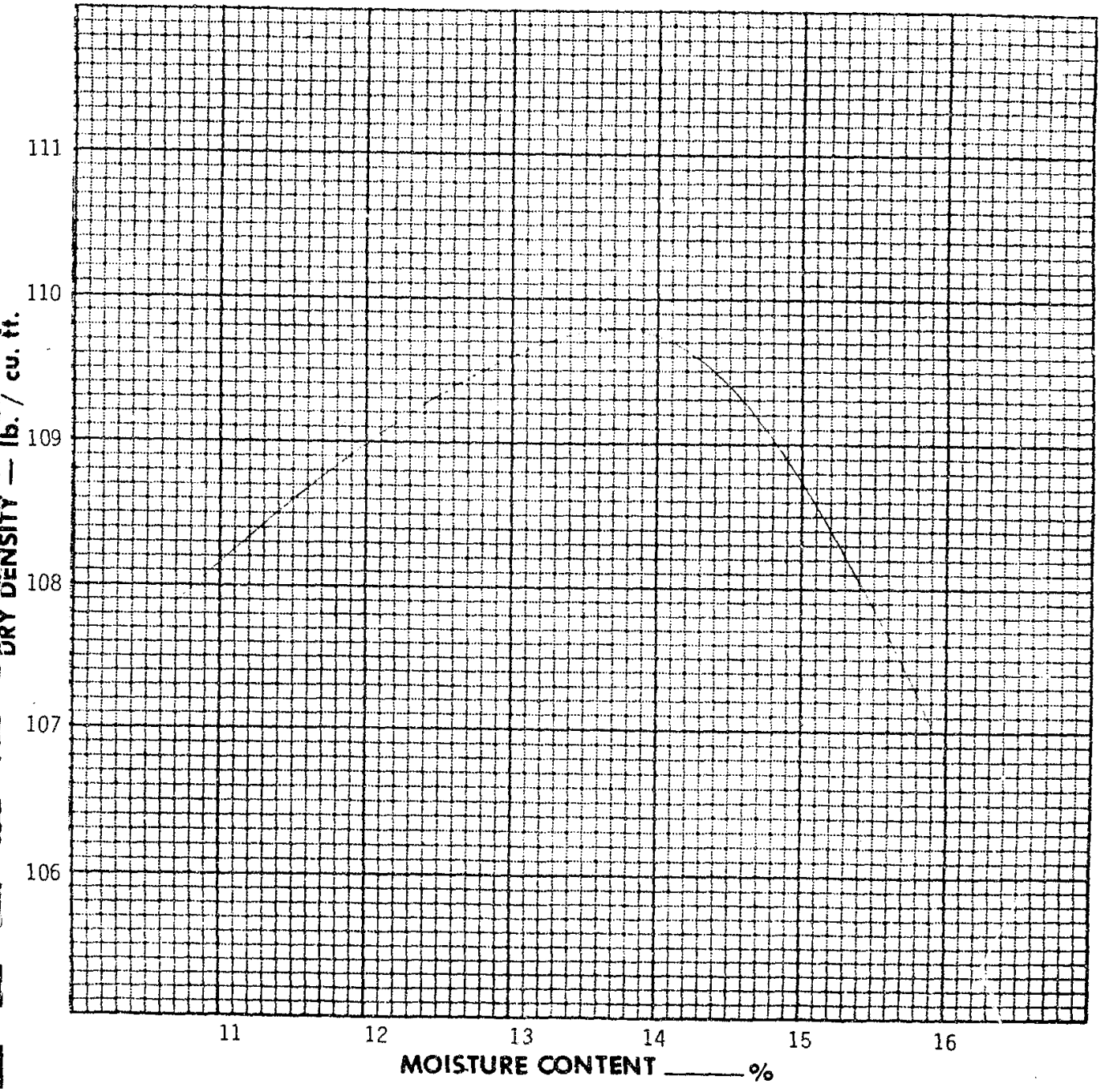
COPIES TO: 1-C S McCrossan Inc
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

LABORATORY NO. 9-1292

METHOD OF TEST: ASTM:D1557-78, Method "A".

TYPE OF MATERIAL: Sand, mostly fine grained, brown (SP)

MAXIMUM DENSITY: 109.8 lb./cu. ft. **OPTIMUM MOISTURE** 13.8 %



twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612/645-3601

MOISTURE-DENSITY CURVE

SAMPLE NO. 9

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT BOTTOM ASH POND REVISIONS BECKER, MINNESOTA

DATE: October 11, 1982

REPORTED TO: Northern States Power Co

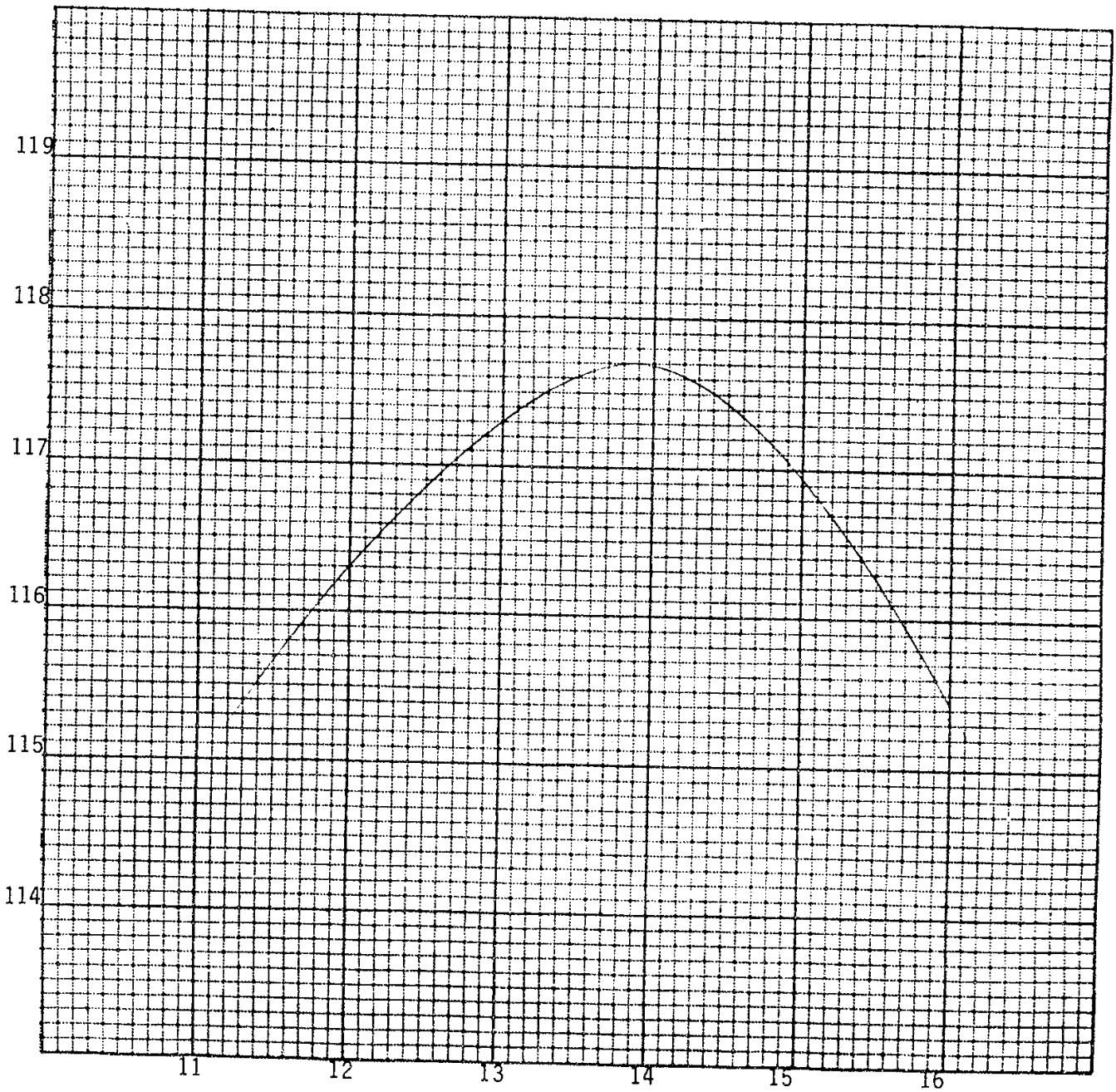
COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

LABORATORY NO. 9-1357

METHOD OF TEST: ASTM:D1557-78, Method "A"

TYPE OF MATERIAL: Sand, fine to medium grained, brown (SP-SM)-9

MAXIMUM DENSITY: 117.7 lb./cu. ft. **OPTIMUM MOISTURE** 13.9 %



COMPACTION SUMMARY SHEET

TWIN CITY TESTING AND ENGINEERING LABORATORY INC

Summary of Passing Soil Density Tests

PROJECT: Bottom Ash Pond Revisions
Northern States Power Co
Sherburne County Generating Plant

Impervious Clay Core

Date: Sept 2, 1982
Lab #9-1292

Test No	Date	Location of Test	Elev.	Field Moist. (%)	Opt. Moist. (%)	Moisture Variance From Optimum	Field Density (pcf)	Max. Density (pcf)	Comp-action (%)	Comp. Spec. (%)	Remarks
C-1	8-17-82	East Dike, Coordinate N 866, 120 (Existing Clay Core)	976'	11.1	11.3	-0.2	115.0	126.0	91	90	
C-2	8-17-82	East Dike, Coordinate N 866, 000 (Existing Clay Core)	973'	14.3	11.3	+3.0	119.0	126.0	94.5	90	
C-3	8-17-82	East Dike, Coordinate N 865, 800 (Existing Clay Core)	974'	11.7	11.3	+0.4	124.0	126.0	99	90	
C-4	8-17-82	North Dike, Coordinate E 2, 028, 810 (Existing Clay Core)	984'	11.1	11.3	-0.2	124.0	126.0	99	90	
C-5	8-18-82	East Dike, Coordinate N 866, 100	977.5'	14.0	11.3	+2.7	115.0	126.0	91	90	
C-6	8-18-82	East Dike, Coordinate N 866, 000	975'	12.4	11.3	+1.1	115.0	126.0	91	90	
C-7	8-18-82	East Dike, Coordinate N 865, 850	975.5'	13.0	11.3	+1.7	115.0	126.0	91	90	
C-8	8-19-82	East Dike, Coordinate N 866, 130	979'	14.3	11.2	+3.1	116.0	123.9	93.5	90	
C-9	8-19-82	East Dike, Coordinate N 855, 050	979'	12.4	11.2	+1.2	123.0	123.9	99	90	
C-10	8-19-82	East Dike, Coordinate N 865, 850	976.5'	12.3	11.2	+1.1	123.0	123.9	99	90	
C-11	8-19-82	East Dike, Coordinate N 865, 700	988.5'	13.3	11.2	+2.1	117.0	123.9	94.5	90	

TWIN CITY TESTING AND ENGINEERING LABORATORY INC

Summary of Passing Soil Density Tests

Impervious Clay Core

PROJECT: Bottom Ash Pond Revisions
Northern States Power Co
Sherburne County Generating Plant

Date: Sept 2, 1982
Lab #9-1292

Test No	Date	Location of Test	Elev.	Field Moist. (%)	Opt. Moist. (%)	Moisture Variance From Optimum	Field Density (pcf)	Max. Density (pcf)	Comp-action (%)	Comp. Spec. (%)	Remarks
C-12	8-19-82	North Dike, Coordinate E 2, 028, 950	979'	11.7	11.2	+0.5	120.0	123.9	97	90	
C-13	8-19-82	North Dike, Coordinate E 2, 028, 800	985'	11.7	11.2	+0.5	123	123.9	99	90	
C-14	8-26-82	East Dike, Coordinate N 865, 900	980'	10.8	11.2	-0.4	124	123.9	100	90	
C-15	8-26-82	East Dike Coordinate N 866, 000	980.5'	10.8	11.2	-0.4	113.5	123.9	91.5	90	
C-16	8-26-82	North Dike Coordinate E 2, 028, 900	981.5'	12.0	11.2	+0.8	125.5	123.9	101	90	
C-17	8-26-82	North Dike Coordinate E 2, 028, 800	984'	12.0	11.2	+0.8	123	123.9	99	90	
C-18	8-30-82	East Dike Coordinate N 869, 900	982'	13.0	11.2	+1.8	116.0	123.9	94	90	
C-19	8-30-82	East Dike Coordinate N 865, 750	983.5'	12.7	11.2	+1.5	117.0	123.9	95	90	
C-20	8-30-82	North Dike Coordinate E 2, 028, 900	982.5'	13.0	11.2	+1.8	122.0	123.9	99	90	
C-21	8-30-82	North Dike Coordinate E 2, 028, 800	985.5'	12.7	11.2	+1.5	115.0	123.9	93	90	

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

Summary of Passing Soil Density Tests

PROJECT: Northern States Power Co — Bottom Ash Pond Revision — Impervious Clay Core — Date:

Sherburne County Generating Plant

Test No.	Date	Location of Test	Elev.	Field Moist. (%)	Opt. Moist. (%)	Moisture Variance From Optimum	Field Density (pcf)	Max. Density (pcf)	Comp-action (%)	Comp. Spec. (%)	Remarks
C-22	9-10-82	East Dike Coordinate, N 865, 850	984.5'	12.4	11.2	+1.2	123	123.9	99	96	
C-23	9-10-82	East Dike Coordinate, N 866, 000	985.5'	13.0	11.2	+1.8	117	123.9	94.5	90	
C-24	9-14-82	North Dike, Coordinate E 2 029 010	986'	14.3	11.0	+3.3	128	128.3	99.5	90	
C-25	9-14-82	North Dike Coordinate E 2, 028 700	987'	14.3	11.0	+3.3	128	128.3	99.5	90	
C-26	9-16-82	East Dike, Coordinate N 865 850	987'	12.4	11.2	+2.2	124	123.9	100	90	
C-27	9-16-82	East Dike, Coordinate N 866, 000	988'	11.1	11.2	-0.1	112.5	123.9	91	90	
C-28	9-16-82	East Dike Coordinate N 865 900	989'	12.4	11.2	+2.2	124	123.9	100	90	
C-29	9-17-82	East Dike Coordinate N 866 050	990'	11.7	11.2	+0.5	115	123.9	93	90	
C-30	9-17-82	North Dike Coordinate E 2 028 800	987'	14.5	11.2	+3.3	116	123.9	94	90	
C-31	9-17-82	North Dike Coordinate E 2 029 000	988'	14.5	11.0	+3.5	125	128.3	95	90	
C-32	9-20-82	East Dike Coordinate N 865 900	991'	13.3	11.2	+2.1	116	123.9	94	90	
C-33	9-20-82	East Dike Coordinate N 866 050	992'	14.3	11.2	+3.1	123	123.9	99	90	

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

Summary of Passing Soil Density Tests

Bottom Ash Pond Revision

PROJECT: Northern States Power Co — Impervious Clay Core — Date:

Sherburne County Generating Plant

Test No.	Date	Location of Test	Elev.	Field Moist. (%)	Opt. Moist. (%)	Moisture Variance From Optimum	Field Density (pcf)	Max. Density (pcf)	Comp-action (%)	Comp. Spec. (%)	Remarks
C-34	9-20-82	East Dike Coordinate N 865 800	993'	13.0	11.2	+1.8	122	123.9	98.5	90	
C-35	9-20-82	East Dike Coordinate N 866 000	994'	11.1	11.2	-0.1	115	123.9	93	90	
C-36	9-21-82	East Dike Coordinate N 865 850	994.5'	13.3	11.2	+2.1	121.5	123.9	98	90	
C-37	9-21-82	East Dike Coordinate N 866 000	995'	13.0	11.2	+1.8	114	123.9	92.5	90	
C-38	9-21-82	North Dike Coordinate E 2 028 880	989.5'	12.7	11.3	+1.4	124	126.0	98.5	90	
C-39	9-21-82	North Dike Coordinate E 2 029 000	991'	12.4	11.3	+1.1	120.5	126.0	96	90	
C-40	9-22-82	East Dike Coordinate N 866 120	994'	13.0	11.2	+1.8	112.5	123.9	91	90	
C-41	9-22-82	East Dike Coordinate N 866 000	994'	12.7	11.2	+1.5	112	123.9	90.5	90	
C-42	9-22-82	East Dike Coordinate N 865 850	995'	12.4	11.2	+1.2	123	123.9	99	90	
C-43	9-23-82	East Dike Coordinate N 865 800	996'	12.7	11.2	+1.5	122	123.9	98.5	90	
C-44	9-23-82	East Dike Coordinate N 865 750	997'	12.4	11.2	+1.2	120	123.9	97	90	
C-45	9-23-82	East Dike Coordinate N 865 950	997'	12.4	11.2	+1.2	119	123.9	96	90	

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

Summary of Passing Soil Density Tests

Bottom Ash Pond Revision

PROJECT: Northern States Power Co — Impervious Clay Core — Date:

Sherburne County Generating Plant

Test No.	Date	Location of Test	Elev.	Field Moist. (%)	Opt. Moist. (%)	Moisture Variance From Optimum	Field Density (pcf)	Max. Density (pcf)	Comp-action (%)	Comp. Spec. (%)	Remarks
C-46	9-23-82	East Dike Coordinate N 866 100	995'	11.1	11.2	-0.1	117	123.9	94.5	90	
C-47s	9-24-82	North Dike Coordinate N 2 028 950	993'	12.4	11.2	+1.1	112	123.9	90.5	90	
C-48	9-24-82	North Dike Coordinate N 2 029 000	994.5'	14.3	11.2	+3.1	118.5	123.9	96	90	
C-49	9-24-82	North Dike Coordinate E 2 028 000	996'	13.0	12.2	+1.8	120.5	123.9	97.5	90	

TWIN CITY TESTING AND ENGINEERING LABORATORY INC

Summary of Passing Soil Density Tests
Embankment

PROJECT: Bottom Ash Pond Revisions
Northern States Power Co
Sherburne County Generating Plant

Date: Sept 2, 1982
Lab #9-1292

Test No	Date	Location of Test	Elev.	Field Moist. (%)	Opt. Moist. (%)	Moisture Variance From Optimum	Field Density (pcf)	Max. Density (pcf)	Comp-action (%)	Comp. Spec. (%)	Remarks
E-1	8-20-82	East Dike, West Embankment, Coordinate N 865, 900	976.5'	7.0	11.1	-4.0	119	125.0	95.5	95	
E-3	8-20-82	East Dike, East Embankment Coordinate N 865, 900	976.5'	8.1	11.1	-3.0	122	125.0	97.5	95	
E-5	8-20-82	North Dike, North Embankment Coordinate E 2,029,010	975'	4.3	11.1	-6.8	125	125.0	100	95	
E-6	8-20-82	East Dike, East Embankment Coordinate N 866, 090	978'	4.7	111	-6.4	118.5	125.0	95	95	
E-7	8-23-82	East Dike, East Embankment Coordinate N 865, 900	977.5'	7.2	11.1	-3.9	128	125.0	102.5	95	Retest of #E-4
E-8	8-23-82	East Dike, West Embankment Coordinate N 865, 900	977.5'	7.0	11.1	-4.1	125.5	125.0	100.5	95	Retest of #E-2
E-11	8-24-82	East Dike, West Embankment Coordinate N 866, 065	980'	7.2	11.1	-3.9	125.0	125.0	97	95	Retest of #E-9
E-12	8-24-82	East Dike, West Embankment Coordinate N 865, 950	980'	7.5	11.1	-3.6	118.5	125.0	95	95	Retest of #E-10
E-13	8-24-82	Old toe ditch area, East Dike, East Embankment Coordinate N 865, 900	960'	2.0	11.9	-9.9	111	115.2	96	95	
E-14	8-24-82	Old toe ditch area, East Dike, East Embankment Coordinate N 866, 100	960'	2.8	11.9	-9.1	119	115.2	103	95	
E-15	8-24-82	North Dike, South Embankment Coordinate E 2, 028, 750	986'	3.6	10.5	-6.9	114	120.0	95	95	

TWIN CITY TESTING AND ENGINEERING LABORATORY INC

Summary of Passing Soil Density Tests

PROJECT: Bottom Ash Pond Revisions
Northern States Power Co
Sherburne County Generating Plant

Embankment

Date: Sept 2, 1982
Lab #9-1292

Test No	Date	Location of Test	Elev.	Field Moist. (%)	Opt. Moist. (%)	Moisture Variance From Optimum	Field Density (pcf)	Max. Density (pcf)	Comp-action (%)	Comp. Spec. (%)	Remarks
E-16	8-24-82	North Dike, North Embankment, Coordinate E 2, 028, 750	986'	6.4	11.1	-4.7	119	125.0	95.5	95	
E-17	8-25-82	East Dike, East Embankment Coordinate N 865, 750	979'	2.8	11.9	-9.1	111	115.2	96.5	95	
E-18	8-25-82	East Dike, West Embankment Coordinate N 865, 750	981'	3.4	10.5	-7.1	114	120.0	95	95	
E-20	8-25-82	North Dike, North Embankment Coordinate E 2, 028, 900	980.5	9.3	11.1	-1.8	125	125.0	100	95	
E-21	8-25-82	Toe of East Dike, East Embankment Coordinate N 865, 800	961'	4.2	10.5	-6.3	118.5	120.0	98.5	95	
E-22	8-25-82	Toe of East Dike, East Embankment Coordinate N 866, 000	961'	3.4	10.5	-7.1	118	120.0	98	95	
E-23	8-25-82	East Dike, West Embankment Coordinate N 866, 000	979.5'	2.8	11.9	-9.1	111.5	115.2	97	95	
E-24	8-25-82	East Dike, East Embankment Coordinate N 866, 000	978.5'	4.2	11.9	-7.7	114.5	115.2	99.5	95	
E-25	8-26-82	North Dike, South Embankment Coordinate E 2, 028, 900	979.5'	5.8	10.5	-4.7	116.5	120.0	97	95	Retest of #E-19
E-26	8-26-82	East Dike, East Embankment Coordinate N 866, 090	978'	4.7	13.8	-9.1	104.5	109.8	95	95	
E-27	8-27-82	East Dike, East Embankment Coordinate N 365, 800	982.5	6.7	10.5	-3.8	120.5	120.0	100.5	95	

TWIN CITY TESTING AND ENGINEERING LABORATORY INC

Summary of Passing Soil Density Tests

PROJECT: Bottom Ash Pond Revisions
Northern States Power Co
Sherburne County Generating Plant

Embankment

Date: Sept 2, 1982
Lab #9-1292

Test No	Date	Location of Test	Elev.	Field Moist. (%)	Opt. Moist. (%)	Moisture Variance From Optimum	Field Density (pcf)	Max. Density (pcf)	Comp-action (%)	Comp. Spec. (%)	Remarks
E-28	8-27-82	East Dike, West Embankment Coordinate N 865, 750	984'	7.2	11.1	-3.9	124	125.5	99	95	
E-29	8-27-82	East Dike, East Embankment Coordinate N 866, 050	969'	5.5	11.9	-6.4	120	115.2	104	95	
E-30	8-27-82	East Dike, East Embankment Coordinate N 865, 900	971.5'	3.6	13.8	-10.2	114	109.8	104	95	
E-31	8-27-82	North Dike, North Embankment Coordinate E 2, 028, 800	987'	5.0	11.9	-6.9	111	115.2	96.5	95	
E-32	8-27-82	North Dike, South Embankment Coordinate E 2, 028, 800	987.5'	6.4	10.5	-4.1	121	120.0	101	95	
E-33	8-27-82	East Dike, East Embankment Coordinate N 866, 000	971.5'	3.4	10.5	-2.1	115.5	120.0	96	95	
E-34	8-27-82	East Dike, East Embankment Coordinate N 865, 800	973'	3.6	10.5	-6.9	117	120.0	97.5	95	
E-35	8-27-82	East Dike, East Embankment Coordinate N 865, 950	982'	8.7	10.5	-1.8	116.5	120.0	97	95	
E-36	8-27-82	East Dike, West Embankment Coordinate N 865, 950	982.5'	5.3	11.9	-6.6	116.5	115.2	101	95	
E-37	8-27-82	East Dike, West Embankment Coordinate N 866, 050	982'	5.8	11.9	-6.1	119	115.2	103	95	
E-38	8-27-82	East Dike, East Embankment Coordinate N 866, 050	981'	6.1	11.9	-5.8	115	115.2	100	95	

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

Summary of Passing Soil Density Tests

Date:

PROJECT: Bottom Ash Pond Revisions
Northern States Power Co
Sherburne County Generating Plant

Embankment

Test No.	Date	Location of Test	Elev.	Field Moist. (%)	Opt. Moist. (%)	Moisture Variance From Optimum	Field Density (pcf)	Max. Density (pcf)	Comp-action (%)	Comp. Spec. (%)	Remarks
E-39	9-1-82	East Dike, West Embankment Coordinate N 865, 800	985'	9.9	10.5	-0.6	122.5	120.0	102	95	
E-40	9-1-82	East Dike, West Embankment Coordinate N 865 950	985'	8.7	11.9	-3.2	115.5	115.2	100.5	95	
E-41	9-1-82	East Dike, West Embankment Coordinate N 866 050	986'	9.3	11.9	-2.6	112.5	115.2	97.5	95	
E-42	9-1-82	East Dike, East Embankment Coordinate N 866 100	981'	10.2	10.5	-0.3	123.0	120.0	102.5	95	
E-44	9-1-82	East Dike, East Embankment Coordinate N 865, 800	983'	8.1	10.5	-2.4	118	120.0	98.5	95	
E-45	9-1-82	East Dike, East Embankment Coordinate N 866 000	982'	10.2	11.9	-1.7	109	115.2	95	95	Retest of #43
E-46	9-2-82	East Dike, East Embankment Coordinate N 865 750	976'	5.3	11.9	-6.6	109	115.2	95	95	
E-47	9-2-82	East Dike, East Embankment Coordinate N 865 880	975'	5.8	11.9	-6.1	119	115.2	103	95	
E-48	9-2-82	East Dike, East Embankment, Coordinate N 866 000, Access Road	973'	6.4	11.9	-5.5	119	115.2	103	95	
E-49	9-2-82	East Dike, East Embankment, Coordinate N 866 120, Access Road	975'	5.8	11.9	-6.1	111	115.2	96.5	95	
E-50	9-2-82	East Dike, East Embankment, Coordinate N 865 800	978'	7.2	10.5	-2.7	121	120.0	101	95	

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

Summary of Passing Soil Density Tests

Date:

PROJECT: Bottom Ash Pond Revisions
Northern States Power Co
Sherburne County Generating Plant

Embankment

Test No.	Date	Location of Test	Elev.	Field Moist. (%)	Opt. Moist. (%)	Moisture Variance From Optimum	Field Density (pcf)	Max. Density (pcf)	Comp-action (%)	Comp. Spec. (%)	Remarks
E-51	9-1-82	East Dike, East Embankment Coordinate N 865 950	977'	6.7	10.5	-3.8	119	120.0	99	95	
E-52	9-1-82	East Dike, East Embankment Coordinate N 866 050	975'	6.1	10.5	-4.4	118	120.0	98.5	95	
E-53	9-1-82	East Dike, East Embankment Coordinate N 866 120	976'	9.9	10.5	-0.6	122.5	120.0	102	95	
E-54	9-7-82	East Dike, West Embankment Coordinate N 865 790	987'	6.4	13.9	-7.5	124	117.7	105	95	
E-55	9-7-82	East Dike, West Embankment Coordinate N 865 900	987'	6.4	13.9	-7.5	120	117.7	102	95	
E-56	9-7-82	East Dike, West Embankment Coordinate N 866 090	987'	5.3	13.9	-8.6	114	117.7	97	95	
E-57	9-7-82	East Dike, East Embankment Coordinate N 866 000	988'	5.3	13.9	-8.6	118.5	117.7	101	95	
E-58	9-7-82	East Dike, East Embankment Coordinate N 865 800	984'	7.0	10.5	-3.5	125	120.0	104.5	95	
E-59	9-7-82	East Dike, East Embankment, Coordinate N 865 950, Access Road	983'	6.7	10.5	-3.8	117	120.5	98	95	
E-60	9-7-82	East Dike, East Embankment, Coordinate N 866 150	978.5'	5.5	11.9	-5.4	114	115.2	97	95	
E-61	9-7-82	East Dike, East Embankment, Coordinate N 866 000	980'	5.3	11.9	-6.6	112	115.2	97	95	
E-62	9-8-82	East Dike, East Embankment, Coordinate	985'	5.0	12.9	-8.9	115	117.7	98	95	

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

Summary of Passing Soil Density Tests

Date:

Bottom Ash Pond Revisions

PROJECT: Northern States Power Co — Embankment

Sherburne County Generating Plant

Test No.	Date	Location of Test	Elev.	Field Moist. (%)	Opt. Moist. (%)	Moisture Variance From Optimum	Field Density (pcf)	Max. Density (pcf)	Comp-action (%)	Comp. Spec. (%)	Remarks
E- 63	9-8-82	East Dike, East Embankment, Coordinate N 866 100	981'	5.3	13.9	-8.6	115	117.7	98	95	
E-64	9-8-82	East Dike, East Embankment, Coordinate N 865 950	984'	5.0	10.5	-5.5	116.5	120.0	97	95	
E-65	9-8-82	East Dike, East Embankment, Coordinate N 865 800	986.5'	6.1	10.5	-4.4	115	120.0	96	95	
E-66	9-9-82	East Dike, East Embankment, Coordinate N 866 100	982'	4.7	13.9	-9.2	115	117.7	98	95	
E-67	9-9-82	East Dike, East Embankment, Coordinate N 865 950, Access Road	985'	5.0	13.9	-8.9	117	117.7	99	95	
E-68	9-9-82	East Dike, East Embankment, Coordinate N 865 800	985.5'	4.7	13.9	-9.2	120	117.7	102	95	
E-69	9-9-82	North Dike, North Embankment, Coordinate E 2 028 800	983'	4.7	13.9	-9.2	115	117.7	98	95	
E-70	9-9-82	North Dike, North Embankment, Coordinate, E 2 028 950	981'	6.1	10.5	-4.4	122	120.0	101.5	95	
E-71	9-9-82	North Dike, North Embankment, Coordinate E 2 028 980	989'	5.5	10.5	-5.0	125	120.0	104	95	
E-72	9-9-82	North Dike, North Embankment, Coordinate, E 2 029 010	982'	6.4	10.5	-4.1	116	120.0	96.5	95	
E-73	9-9-82	North Dike, North Embankment, Coordinate, E 2 029 100	983'	6.4	13.8	-7.4	107	109.8	98	95	
E-74	9-10-82	North Dike, North Embankment, Coordinate E 2 028 620	982'	5.0	13.9	-8.9	122	117.7	104	95	

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

Summary of Passing Soil Density Tests

Date:

PROJECT: Bottom Ash Pond Revisions
Northern States Power Co
Sherburne County Generating Plant

Embankment

Test No.	Date	Location of Test	Elev.	Field Moist. (%)	Opt. Moist. (%)	Moisture Variance From Optimum	Field Density (pcf)	Max. Density (pcf)	Comp-action (%)	Comp. Spec. (%)	Remarks
E- 75	9-10-82	North Dike, North Embankment, Coordinate, E 2 028 800	992'	5.3	13.9	-8.6	112	117.7	95.5	95	
E-76	9-10-82	North Dike, North Embankment, Coordinate, E 2 029 000	990'	5.5	13.9	-8.4	114	117.7	97	95	
E-77	9-10-82	North Dike, North Embankment, Coordinate, E 2 028 900	991'	5.0	13.9	-8.9	112	117.7	95.5	95	
E-78	9-10-82	North Dike, North Embankment, Coordinate, E 2 028 700	996'	5.0	10.5	-5.5	117	120	97	95	
E-79	9-10-82	North Dike, North Embankment, Coordinate, E 2 028 950	994'	6.1	13.9	-7.8	122	117.7	103.5	95	
E-80	9-13-82	North Dike, North Embankment, Coordinate, E 2 028 850	991.5'	5.0	13.8	-8.8	110	119.8	100	95	
E-81	9-13-82	North Dike, North Embankment, Coordinate, E 2 028 940	992'	5.5	10.5	-5.5	120	120.0	100	95	
E-82	9-13-82	North Dike, North Embankment, Coordinate, E 2 029 000	995'	5.5	10.5	-5.5	124	120.0	103	95	
E-83	9-13-82	North Dike, North Embankment Coordinate, E 2 028 940	995'	5.0	10.5	-5.5	125	120.0	104	95	
E-84	9-13-82	North Dike, North Embankment, Coordinate, E 2 028 850	993.5'	6.1	10.5	-4.4	122	120.0	101.5	95	
E-85	9-13-82	North Dike, North Embankment Coordinate, E 2 028 980	994.5'	5.8	10.5	-4.3	125	120.0	104	95	
E-86	9-14-82	East Dike, East Embankment	986'	6.1	13.0	-7.8	110	117.7	101	95	

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

Summary of Passing Soil Density Tests

Date:

Bottom Ash Pond Revisions

PROJECT: Northern States Power Co — Embankment

Sherburne County Generating Plant

Test No.	Date	Location of Test	Elev.	Field Moist. (%)	Opt. Moist. (%)	Moisture Variance From Optimum	Field Density (pcf)	Max. Density (pcf)	Comp-action (%)	Comp. Spec. (%)	Remarks
E-87	9-14-82	East Dike, East Embankment, Coordinate N 865 900, Access Road	986.5'	7.0	10.5	-3.5	121	120.0	101	95	
E-88	9-14-82	East Dike, East Embankment, Coordinate, 865 800	988'	6.7	10.5	-3.8	121.5	120.0	101.5	95	
E-89	9-14-82	East Dike, West Embankment, Coordinate, N 865 850	989'	6.1	13.9	-7.8	121	117.7	103	95	
E-90	9-14-82	East Dike, West Embankment, Coordinate, N 866 000	989.5'	5.5	13.9	-8.4	124	117.7	105	95	
E-91	9-14-82	East Dike, West Embankment Coordinate, N 865 800	990'	5.0	13.9	-8.9	112	117.7	95	95	
E-92	9-16-82	East Dike, West Embankment Coordinate, N 866 100	991'	5.0	13.8	-8.8	105	109.8	95.5	95	
E-93	9-16-82	East Dike, East Embankment Coordinate, N 865 850	990'	6.1	13.8	-7.7	114	109.8	104.5	95	
E-94	9-16-82	East Dike, East Embankment Coordinate N 866, 050	991'	5.5	13.9	-8.4	120	117.7	102	95	
E-95	9-16-82	East Dike, East Embankment Coordinate, N 865, 800	992'	5.0	13.9	-8.9	114.5	117.7	97.5	95	
E-96	9-16-82	East Dike, West Embankment Coordinate, N 865, 700	992'	5.5	13.9	-8.4	115	117.7	98.5	95	
E-97	9-16-82	East Dike, West Embankment Coordinate, N 866, 000	993'	5.8	13.9	-8.1	116	117.7	98.5	95	
E-98	9-17-82	East Dike, East Embankment Coordinate N 865 800	993'	5.0	13.9	-8.9	118	117.7	100	95	

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

Summary of Passing Soil Density Tests

Date:

Bottom Ash Pond Revisions

PROJECT: Northern States Power Co — Embankment

Sherburne County Generating Plant

Test No.	Date	Location of Test	Elev.	Field Moist. (%)	Opt. Moist. (%)	Moisture Variance From Optimum	Field Density (pcf)	Max. Density (pcf)	Comp-action (%)	Comp. Spec. (%)	Remarks
E-99	9-17-82	East Dike, East Embankment, Coordinate, N 866 000	994'	4.2	13.9	-9.7	112	117.7	95	95	
E-100	9-17-82	East Dike, West Embankment, Coordinate, N 865 900	994'	5.0	13.9	-8.9	112	117.7	95	95	
E-101	9-17-82	East Dike, West Embankment, Coordinate, N 866 100	995'	5.5	13.9	-8.4	114	117.7	96.5	95	

TWIN CITY TESTING AND ENGINEERING LABORATORY INC

Summary of Failing Soil Density Tests

PROJECT: Bottom Ash Pond Revisions
Northern States Power Co
Sherburne County Generating Plant

Embankment

Date: Sept 2, 1982
Lab # 9-1292

Test No	Date	Location of Test	Elev.	Field Moist. (%)	Opt. Moist. (%)	Moisture Variance From Optimum	Field Density (pcf)	Max. Density (pcf)	Comp-action (%)	Comp. Spec. (%)	Remarks
E-2	8-20-82	East Dike, West Embankment Coordinate N865, 900	979'	8.7	11.1	-2.4	111.0	125.0	89	95	Passed by #E-8
E-4	8-20-82	East Dike, East Embankment Coordinate N 865, 900	979'	5.3	11.1	-5.8	112.0	125.0	90	95	Passed by #E-7
E-9	8-23-82	East Dike, West Embankment Coordinate N 866, 065	980'	6.4	11.1	-4.7	117	125.0	93.5	95	Passed by #E-11
E-10	8-23-82	East Dike, West Embankment Coordinate N 865, 950	980'	7.0	11.1	-4.1	110	125.0	88	95	Passed by #E-12
E-19	8-25-82	North Dike, South Embankment Coordinate E 2, 028, 900	979.5'	5.8	11.1	-5.3	111.5	125.0	89.5	95	Passed by #E-25
E-43	9-1-82	East Pile, East Embankment Coordinate N 866,000	982'	10.2	11.9	-1.7	101.5	115.2	88.5	95	Passed by E-45

FIELD DENSITY TESTS

BORROW AREA

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: TESTS OF SOIL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS

DATE: August 25, 1982

REPORTED TO: BECKER, MINNESOTA
Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

FURNISHED BY:

COPIES TO: 1-C S McCrossan
1-Black &Veatch Consulting Eng

LABORATORY No. 9-1292

SAMPLE NUMBER:	1	2
SAMPLE IDENTIFICATION:	Proposed Clay Core Fill	Proposed Clay Core Fill
LOCATION SAMPLED:	Borrow Area	Borrow Area
UNIFIED SOIL CLASSIFICATION:	Sandy Clay. a little gravel, brown (CL)	Sandy Clay a little gravel, brown (SC-CL)

MECHANICAL ANALYSIS:

Passing	3/8"	100%	100%
	#4	98	95
	#10	96	92
	#40	84	79
	#100	62	59
	#200	57	48

LABORATORY MOISTURE-DENSITY RELATION OF SOIL: (see attached curve)

Method -	ASTM:D1557 Modified	ASTM:D1557 Modified
Maximum Dry Density (pcf)	128.3	126.0
Optimum Moisture (%)	11.0	11.3
LL	44	26
PL	16	13
PI	28	13
Undisturbed Field Density (pcf)	94	-

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

By _____

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: TESTS OF SOIL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POINT REVISIONS

REPORTED TO: BECKER, MINNESOTA
Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

DATE: August 25, 1982

FURNISHED BY:

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting
Attn: Larry Almalch Eng

LABORATORY No. 9-1292

SAMPLE NUMBER:		3	4
SAMPLE IDENTIFICATION:		Proposed Clay Core Fill	Proposed Clay Core Fill
LOCATION SAMPLED:		Borrow Area	Borrow Area
UNIFIED SOIL CLASSIFICATION:		Clayey Sand, trace of gravel, reddish brown (SC)	Sandy Clay, a little gravel, brown (SC-CL)
MECHANICAL ANALYSIS:			
Passing	3/8"	100%	100%
	#4	96	92
	#10	92.8	91
	#40	80.9	76
	#100	59.4	53
	#200	49.6	41
LABORATORY MOISTURE-DENSITY RELATION OF SOIL: (see attached curve)			
	Method	ASTM:D1557 Modified	ASTM:D1557 Modified
	Maximum Dry Density (pcf)	134.8	123.9
	Optimum Moisture (%)	8.4%	11.2%
	LL	16	29
	PL	13	14
	PI	3	15
	Undisturbed Field Density (pcf)	114.5	107

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL

Twin City Testing and Engineering Laboratory, Inc.

By _____

FILTER MATERIAL GRADATION

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL MN 55114
PHONE 612/645-3601

REPORT OF: TEST OF BASE AGGREGATE

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: November 29, 1982

REPORTED TO: Northern States Power Company
Attn: Roger B Anderson
414 Nicollet Mall, 7th Floor
Minneapolis, Minnesota 55401

FURNISHED BY:

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almaleh

LABORATORY No. 9-1357

SAMPLE NUMBER:		1	SPECIFICATIONS
TYPE OF AGGREGATE:		Filter Material - Type 1	Type I Filter Material
LOCATION SAMPLED:		East Embankment Coordinant 866, 150N	
MECHANICAL ANALYSIS:			
Passing	3"	100	100
	2"	100	85-100
	1 1/2"	85	72-90
	3/4"	58	50-70
	1/2"	50	35-50
	3/8"	27	-
	#3	22	22-32
	#6	16	12-20
	#10	12	0-12

REMARKS:

The above sample meets the project specification for a Type I Filter material.

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF CLIENTS, AND AUTHORIZATION FOR PUBLICATION OF STATEMENTS, CONCLUSIONS OR EXTRACTS FROM OR REGARDING OUR REPORTS IS RESERVED PENDING OUR WRITTEN APPROVAL.

PERMEABILITY TESTS

LABORATORY TEST DATA

PROJECT: N.S.P. Sherburne County Generating Plant
Bottom Ash Pond Revisions, Becker, Minnesota

DATE: Sept 10, 1982

REPORTED TO: Northern States Power Company

JOB NO.: 9-1357

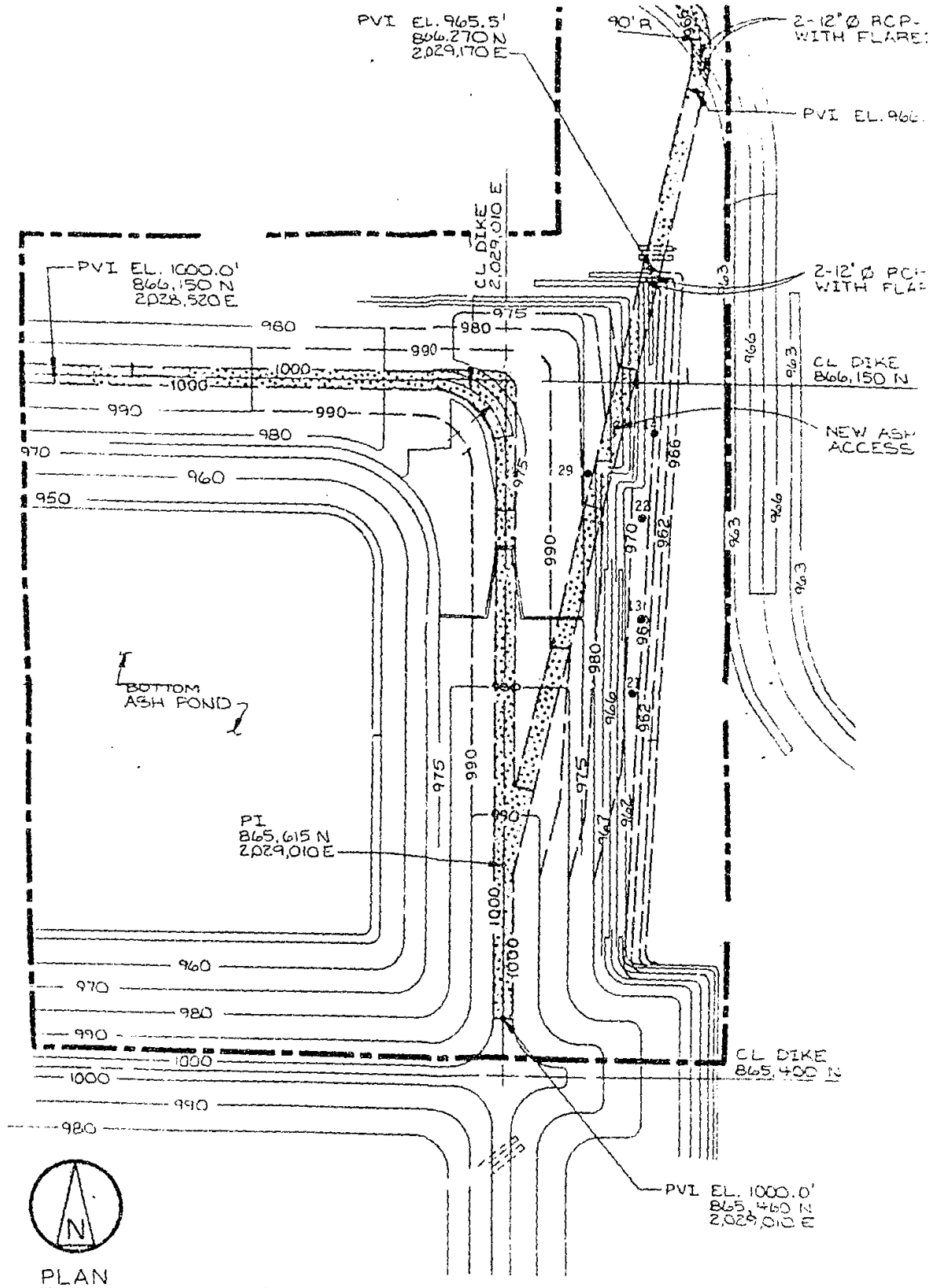
Permeability Sample Number	1	2	3	4
Sample Location	Impermeable Clay Core, East Dike, Coordinate N865, 950	Impermeable Clay Core, East Dike, Coordinate N866, 075,	Impermeable Clay Core East Dike, Coordinate N866, 000	Impermeable Clay Core North Dike, Coordinate E2, 029, 925
Elevation	984'	984'	994	994
Soil Classification (ASTM:D2487)	Fill, mostly Sandy Clay (CL)	Fill, mostly Sandy Clay (CL)	Fill, Mixture of Sandy Clay and Clayey Sand, Brown (SC-CL)	Fill, Mixture of Sandy Clay and Clayey Sand, Brown (SC-CL)
Type of Sample	3T	3T	3T	3T
Moisture-Density Relation of Soil (ASTM:D698) 1557-78, Method "A" Modified Proctor	Proctor #1	Proctor #2	Proctor #4	Proctor #4
Max. Dry Density (PCF)	128.3	126.0	123.9	123.9
Optimum Moisture Content (%)	11.0	11.3	11.2	11.2
Permeability Test				
Trial No.	6-9	6-9	6-9	6-9
Type of Test	Falling Head	Falling Head	Falling Head	Falling Head
Type of Specimen	In-Situ (Clay Core)	In-Situ (Clay Core)	In-Situ (Clay Core)	In-Situ (Clay Core)
Specimen Height (inches)	2.33	2.58	2.12	2.45
Specimen Diameter (inches)	2.84	2.81	2.83	2.89
Dry Density (PCF)	120.0	113.8	114.2	112.1
Percent of Max. Density	93.5%	90.5%	92%	90.5%
Moisture Content (%)	12.0	14.4	11.9	12.5
Max. Head Differential (ft)	10.0	10.0	10.0	10.0
Confining Pressure (effective - PSI)	2.0	2.0	2.0	2.0
Water Temperature (^{o}C)	23	23	22	22
Coefficient of Permeability K @ 20^{o}C (cm/sec)	$1X10^{-8}$	$2X10^{-8}$	$1x10^{-6}$	4×10^{-6}
K @ 20^{o}C (ft/min)	$2X10^{-8}$	$4X10^{-8}$	2×10^{-6}	8×10^{-6}
Atterberg Limits				
Liquid Limits (%)	22.3	20.7	25.0	22.6
Plastic Limit (%)	12.4	13.5	11.9	12.5
Plasticity Index	9.9	7.2	13.1	10.1

twin city testing and engineering laboratory, inc.

SKETCHES OF

COMPACTION TEST

LOCATIONS



PLAN

SCALE: 1" = 100'-0"

BOTTOM ASH POND MODIFICATION

NORTHERN STATES POWER COMPANY

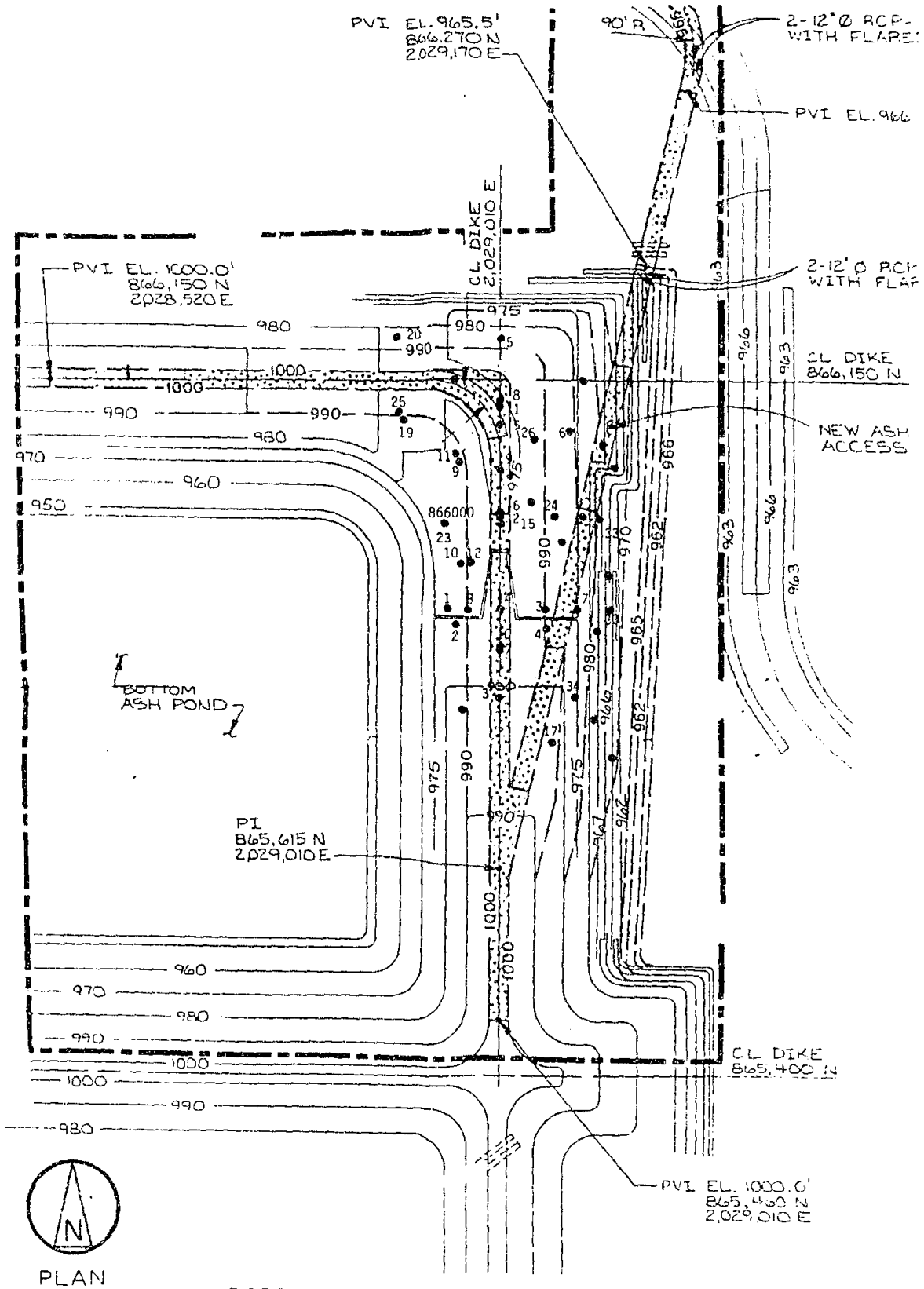
MINNEAPOLIS, MINNESOTA

SHERBURNE COUNTY GENERATING PLANT

COMPACTION TESTING LOCATIONS

BETWEEN ELEVATIONS 960'-970'

TWIN CITY TESTING LABORATORY #9-1292



PLAN

SCALE: 1" = 100'-0"

BOTTOM ASH POND MODIFICATION

NORTHERN STATES POWER COMPANY

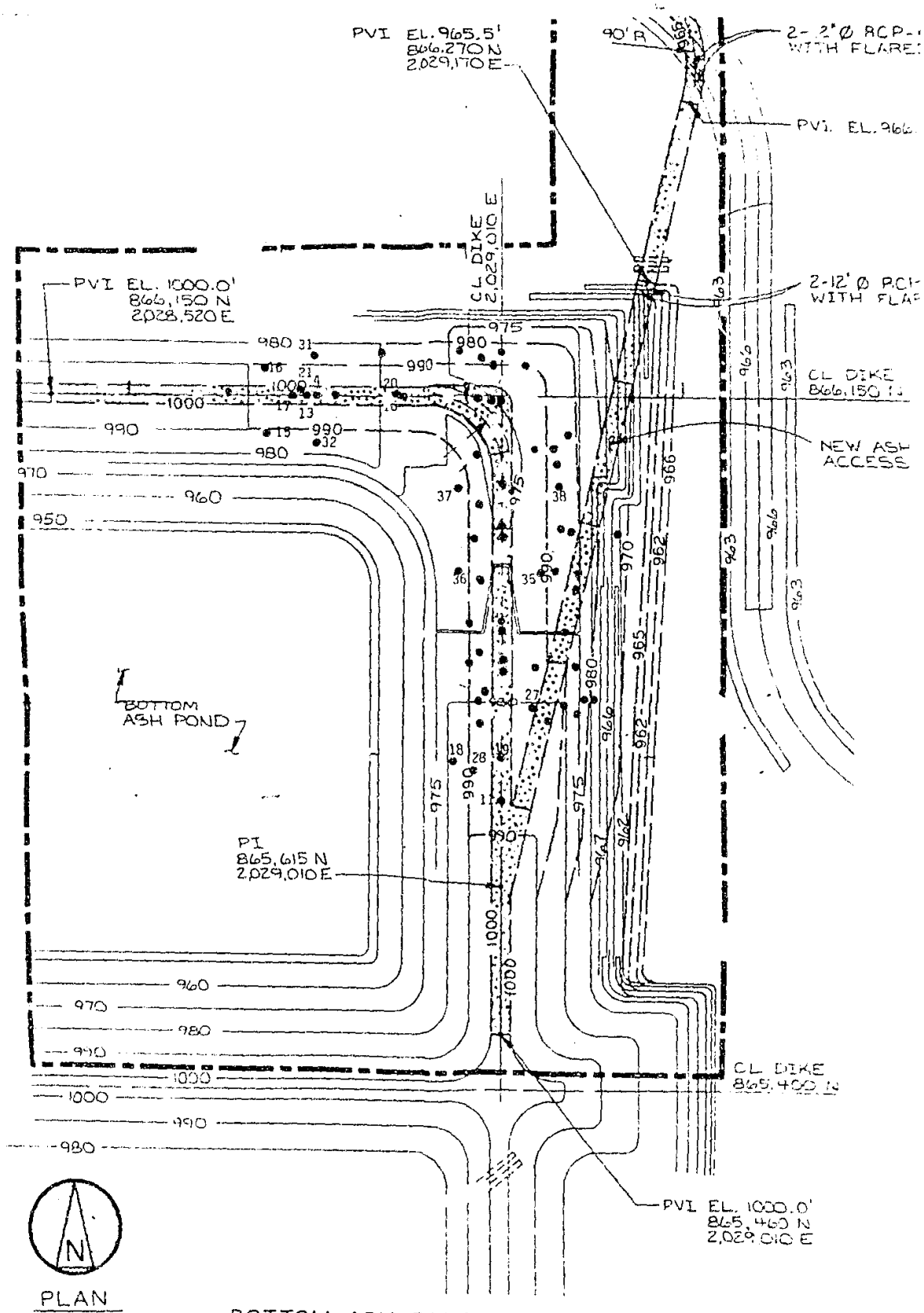
MINNEAPOLIS, MINNESOTA

SHERBURNE COUNTY GENERATING PLANT

COMPACTION TESTING LOCATIONS

BETWEEN ELEVATIONS 971'-980'

TWIN CITY TESTING LABORATORY #9-1292



PLAN

SCALE: 1" = 100'-0"

BOTTOM ASH POND MODIFICATION

NORTHERN STATES POWER COMPANY

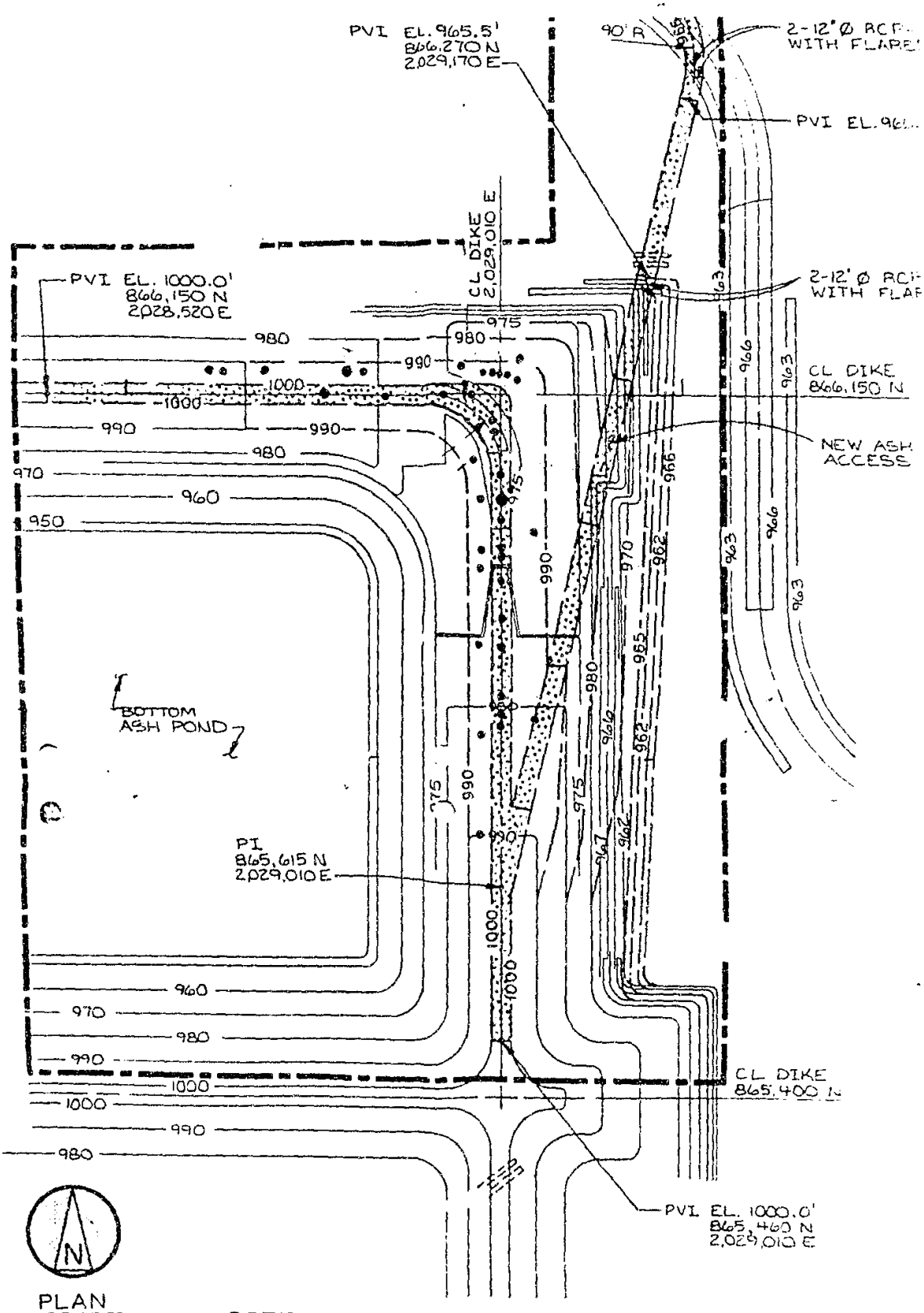
MINNEAPOLIS, MINNESOTA

SHERBURNE COUNTY GENERATING PLANT

COMPACTION TEST LOCATIONS

BETWEEN ELEVATION 981' - 990'

TWIN CITY TESTING LABORATORY #9-1292



PLAN

SCALE: 1" = 100'-0"

BOTTOM ASH POND MODIFICATION

NORTHERN STATES POWER COMPANY

MINNEAPOLIS, MINNESOTA

SHERBURNE COUNTY GENERATING PLANT

COMPACTION TEST LOCATIONS

BETWEEN ELEVATIONS 991' - 1000'

TWIN CITY TESTING LABORATORY #9-1292

82EA01

TRIP REPORT

SHERBURNE COUNTY GENERATING PLANT - UNITS 1 AND 2

BOTTOM ASH POND REVISION

E-82EA01

PLANT FILE COPY

October 25, 1982

A field trip was made to observe job progress and discuss several unrelated items with J T O'Donnell.

Observations were as follows:

1. Earthwork construction appeared complete with the exception of surface finish grading, roadway, and filter work.

2. Work was proceeding on pipe supports. A question regarding tie-in of contract 14-inch line to line by the plant operations was resolved. The plant has constructed some "trestles" which will elevate the line 5'-6" above bottom ash level.

3. Site perimeter security fencing was discussed with Darel Day. Darel would like to install fence in two areas related to our ash pond projects this fall. He would like feedback from us before November 1, so construction can start. The areas are:

   a. A fence is desired running south from the coal yard fence tying into the bottom ash pond. The fence would run just east of the "haul road", and a 12' gate would be installed where it crosses the old county road. Darel would use existing 5 foot high construction type fencing for most of this work.

   b. A short "exclusion radius" type fence is desired on the east and north sides of our new 500 ft by 1/4 mile land parcel, and running north to about the midpoint of the section line. The fence would be not installed across the old county road.

4. The plant is reworking a chlorine line leak south of No 2 cooling tower. This area was visited and discussed with J T O'Donnell.

5. The plant is having some problems with bank erosion and ditch silting in the coal yard. A "fix" to the problem has been proposed. The area was visited and discussed with J T O'Donnell.

By: _____
R B Anderson, P E
Project Engineer

mfc
cc: G H Jacobson
H K Norgaarden

82EA01

TELEPHONE COMMUNICATIONS RECORD

E-Number E-82EA01 A/E Project

Plant Sherco 1 & 2 A/E File #

Project Bottom Ash Pond Revision Date 9/21/82

NSP File # A-82926 P.O. #

Date of Conversation 9/21/82 Time 2:00 p m

Subject Testing - Construction

From R B Anderson (RA)	To Dale Britzius (DB)
Phone x6962	Phone 645-3601
Company NSP	Company Twin City Testing (TCT)
Position Civil Engineer	Position Engineer

Item	Subject	Action Required
RA	Have you performed permeability tests as yet, per testing program?	
DB	Have done first two, and have two tests on-going - Results are:	
	Perm. = 1×10^{-8} cm/sec	
	Perm. = 2×10^{-8} cm/sec	
	Should note that these results came from best possible soils. real average could be higher.	
RA	Please send memo with details.	
DB	Will do. Will also include in final test report.	
RA	Have filter rock tests been performed?	
DB	Yes, on Type I (ok results) Type II pending.	
DB	Note that TCT may be able to help with wording in Fly Ash Pond Spec regarding success of clay removal for this project, and other testing related areas.	

Distribution: H K Norgaarden
C E Marzolf
G H Jacobson
File
G Y Gunn (B&V)

By: R B Anderson

R.G.READ

Control Systems Specialists

7565 Corporate Way
Eden Prairie, Minnesota 55344
Phone: 612/934-5100

Soil Density Tests
for
Bottom Ash Pond Expansion

Please put in file.

[signature] 10/6/92

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

82EA01
Bottom Ash Revision
General

Bottom Ash Pond Revision — Summary of Passing Soil Density Tests

PROJECT: Northern States Power Co
Sherburne County Generating Plant

Impervious Clay Core

Date:

Test No.	Date	Location of Test	Elev.	Field Moist. (%)	Opt. Moist. (%)	Moisture Variance From Optimum	Field Density (pcf)	Max. Density (pcf)	Comp-action (%)	Comp. Spec. (%)	Remarks
C-1	8-17-82	East Dike, Coordinate (Existing Clay Core) N 866,120	976'	11.1	11.3	-0.2	115.0	126.0 (≠2)	91	90	
2		— " — N 866,000	973'	14.3	11.3	+3.0	119.0		94.5		
3		— " — N 865,800	974'	11.7	11.3	+0.4	124.0		99		
4	↓	North Dike, Coordinate (Existing Clay Core) E 2,028,110	974'	11.1	11.3	-0.2	124.0	↓	99		
5	8-18-82	East Dike, Coordinate N 866,100	977.5'	14.0	11.3	+2.7	115.0	126.0 (≠2)	91		
6	↓	— " — N 866,000	975'	12.4	11.3	+1.1	115.0	↓	91		
7		— " — N 865,850	975.5	13.0	11.3	+1.7	115.0		91		
8	8-19-82	East Dike, Coordinate — " — N 866,130	979'	14.3	11.2	+3.1	116.0	123.9 (≠4)	93.5		
9		— " — N 866,050	979'	12.4	11.2	+1.2	123.0		99		
10		— " — N 865,850	976.5	12.3	11.2	+1.1	123.0		99		
11		— " — N 865,700	976.5	13.3	11.2	+2.1	117.0		94.5		
12	↓	North Dike, Coordinate E 2,028,960	979'	11.7	11.2	+0.5	120.6	↓	97	↓	

X Soil Density Test

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

Summary of Passing Soil Density Tests

Bottom Ash Pond Revision

Impervious Clay Core

PROJECT: Northern States Power Co
Sherburne County Generating Plant

Date:

Test No.	Date	Location of Test	Elev.	Field Moist. (%)	Opt. Moist. (%)	Moisture Variance From Optimum	Field Density (pcf)	Max. Density (pcf)	Comp-action (%)	Comp. Spec. (%)	Remarks
C-13	8-19-82	North Dike, Cordinate E 2,028,800	985	11.7	11.2	+ 0.5	123	123.9	99	90	
14	8/26/82	EAST DIKE COORDINATE N865,900	980	10.8	11.2	-0.4	129	123.9	100	90	
15	↓	EAST DIKE COORDINATE N866,000	980.5	10.8	11.2	-0.4	113.5	123.9	91.5	90	
16	↓	NORTH DIKE COORDINATE E 2028,900	981.5	12.0	11.2	+0.8	125.5	123.9	101	90	
17	↓	NORTH DIKE COORDINATE E 2028,800	984	12.0	11.2	+0.8	123	123.9	99	90	
18	9/30/82	East Dike Cordinate N 865,900	982	13.0	11.2	+ 1.8	116.0	123.9	94	90	
19	↓	East Dike cordinate N 865,750	983.5	12.7	11.2	+ 1.5	117.0	123.9	95	90	
20	↓	North Dike cordinate E 2,028,900	982.5	13.0	11.2	+ 1.8	122.0	123.9	99	90	
21	↓	North Dike Cordinate E 2,028,900	985.5	12.7	11.2	+1.5	115.0	123.9	93	90	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

Summary of Passing Soil Density Tests

Bottom Ash Pond Revision

PROJECT: Northern States Power Co

Sherburne County Generating Plant

Impervious Clay Core

Date:

Test No.	Date	Location of Test	Elev.	Field Moist. (%)	Opt. Moist. (%)	Moisture Variance From Optimum	Field Density (pcf)	Max. Density (pcf)	Comp-action (%)	Comp. Spec. (%)	Remarks
C-											

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

Summary of Passing Soil Density Tests

Bottom Ash Pond Revision

PROJECT: Northern States Power Co — Impervious Clay Core — Date:

Sherburne County Generating Plant

Test No.	Date	Location of Test	Elev.	Field Moist. (%)	Opt. Moist. (%)	Moisture Variance From Optimum	Field Density (pcf)	Max. Density (pcf)	Comp-action (%)	Comp. Spec. (%)	Remarks
C-											

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

Summary of Passing Soil Density Tests

Bottom Ash Pond Revision

PROJECT: Northern States Power Co — Impervious Clay Core — Date:

Sherburne County Generating Plant

Test No.	Date	Location of Test	Elev.	Field Moist. (%)	Opt. Moist. (%)	Moisture Variance From Optimum	Field Density (pcf)	Max. Density (pcf)	Comp-action (%)	Comp. Spec. (%)	Remarks
C-[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	

FORM 17-1515

TRANSMITTAL MANIFEST

Date July 20, 1982

To:
H K Norgaarden
R P Ellis
G H Jacobson
E J Cramolini
P D Colgan
G Y Gunn (B&V) - 2 copies
File E-82EA01 - F100 , A66080
File E-80E004 - D400

Description: E-82EA01 SHERBURNE COUNTY GENERATING PLANT - UNITS 1 and 2
Bottom Ash Pond Revision

Bottom Ash Materials Report

Remarks:
For your use and general information. We do plan to use some bottom ash for scrubber pond construction as a "buffer" between clay seal and slope protection.

FROM R B Anderson
NORTHERN STATES POWER COMPANY
PLANT ENGINEERING & CONSTRUCTION DEPARTMENT

X material + soil tests
X soil exploration rpt

differed somewhat from the program outlined in our proposal to you, dated February 24, 1982. The actual tests and procedures used were discussed with you and with Mr. Larry Almaleh and Mr. Mike Horner with Black and Veatch. Included are ten copies of our report.

Field Sampling

The field samples were obtained from four separate test pits, where designated by Mr. Charles Marzolf at the site. The test pits were dug through the frozen zone with a back hoe. Bag samples containing about 40 pounds of ash material were obtained from each test pit, on March 10, 1982. The bag samples were obtained by our technician.

The approximate locations of the test pits are shown on the attached sketch.

Laboratory Tests

Relative Density

Because of the very porous nature of the bottom ash material relative density tests (max-min) were run in lieu of standard proctor density tests. These tests were run in general accordance with ASTM: D 2049 procedures. The tests were run on material finer than 1½".

PLANT FILE COPY

AS A MUTUAL PROTECTION TO CLIENTS, THE PUBLIC AND OURSELVES, ALL REPORTS ARE SUBMITTED AS THE CONFIDENTIAL PROPERTY OF THE CLIENT.

Specific Gravity

Two specific gravity tests were run on the minus 4 material from both TP-2 and TP-3, in accordance with ASTM: D 854 procedures. Further, one specific gravity test was run on the plus 4 material from TP-3, this in accordance with ASTM: C-127.

Triaxial Tests

We attempted to prepare the test specimens at about 75% relative density. However, it became obvious that this condition could not be reached under normal compactive efforts. The relative density of the minus 4 material is obviously less than the relative density determined on the material finer than 1½".

The specimens were then prepared to an estimated 75% relative density for the minus 4 material, by using a compaction effort comparable to that required for achieving nearly 100% of maximum density as determined by the standard proctor density test. The specimens were then saturated and allowed to consolidate for one-two hours, and were then stressed to well beyond failure at a constant strain rate of 0.01"/min. All of the pertinent test data is given on the attached Mohr Circle graphs.

A review of the attached graphs will show that the shear strengths, the angles of internal friction and the apparent cohesion values are all fairly similar. The maximum deviator stresses were reached at about 3-5% and at about 5-7% strain for the TP-2 and TP-3 series, respectively.

General

We will hold the remaining portions of the samples until September 1, 1982. We will then contact you regarding their disposal.

The opportunity to be of service to you is greatly appreciated. If you have any questions regarding the test results, or if we can be of further assistance to you, please contact us.

Very truly yours

Gordon R Eischens
Manager-Laboratory

GRE/pw

Encs

PROJECT: BOTTOM ASH - SHERCO UNITS 1 AND 2 DATE: April

REPORTED TO: NORTHERN STATES POWER COMPANY JOB NO. 120-8469

SUMMARY - TEST DATA

Sampling Location Depth (ft)	TP-1 @3	TP-2 @4	TP-3 @4	TP-4 @5
Type of Sample	BAG	BAG	BAG	BAG
Type of Material	BOTTOM ASH	BOTTOM ASH	BOTTOM ASH	BOTTOM ASH
Relative Density (ASTM: D 2049)				
Maximum Density (pcf)	113	81	108	96
Minimum Density (pcf)	88	61	84	76
Specific Gravity				
ASTM: D854		2.51	2.53	
ASTM: C-127			2.58	
Average Specific Gravity (-#4 and +#4 Combined)			2.55	

SIEVE ANALYSIS TESTS

PROJECT BOTTOM ASH - SHERCO UNITS 1 AND 2 DATE 3-19-82

P. O. #A66080

REPORTED TO Northern States Power Company JOB NO. 120-8469

BORING NO.					
SAMPLE NO.		TP-1	TP-2	TP-3	TP-4
DEPTH (ft)		3	4	4	5
TYPE OF SAMPLE		BAG	BAG	BAG	BAG
CLASSIFICATION (ASTM: D 2487)					
Symbol					
Description					
MECHANICAL ANALYSIS:					
Dry Weight of Total Sample (grams)		16,500	12,500	17,300	14,300
Based on Total Sample					
% Finer Than	3"				100.0
	2"	100.0	100.0	100.0	98.9
	1"	98.9	98.8	92.0	94.4
	3/4"	92.0	96.3	86.8	91.4
	3/8"	73.4	89.6	72.8	83.0
	# 4	54.6	79.6	56.0	70.0
	# 10	30.3	70.8	40.8	59.7
	# 40	8.7	40.9	13.6	30.8
	# 100	2.6	21.4	3.5	12.1
	# 200	1.0	13.8	1.2	5.4

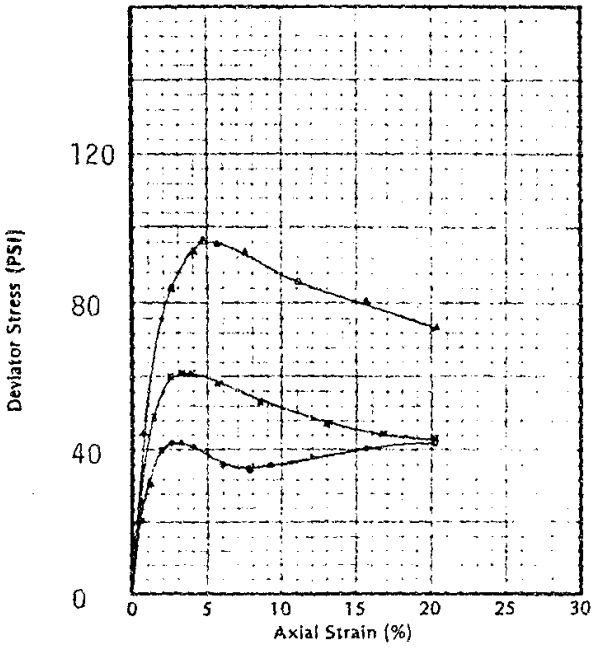
TRIAXIAL TEST DATA Date 4-9-82 Job No. 120-8469

Project BOTTOM ASH - SHERCO UNITS 1 AND 2 - P. O. A66080

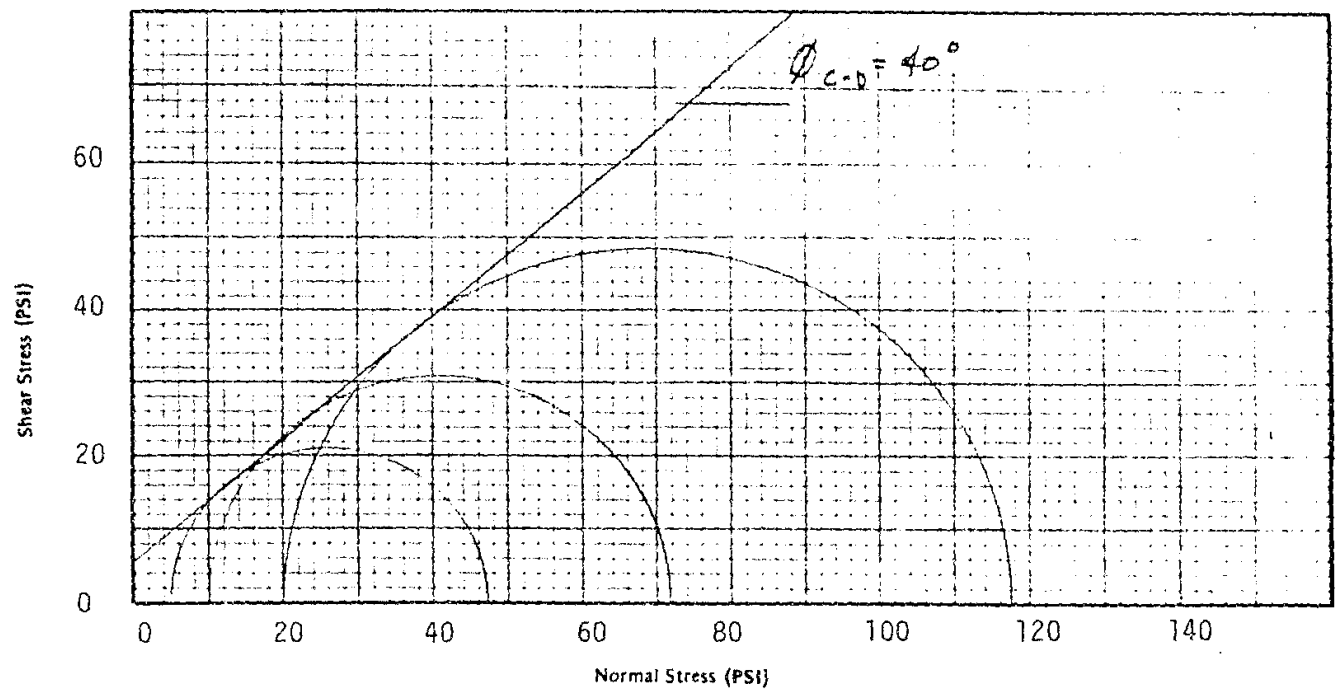
Boring No. _____ Sample No. TP-2 Depth (ft) 4' Type of Sample BAG

Soil Type BOTTOM ASH Type of Test C-D (SATURATED)

Remarks: Specimens compacted to given conditions using a comparable effort for achieving nearly 100% of maximum standard proctor density. Saturated and consolidated for 1-2 hours. Stressed to given strains at constant rate of 0.01"/min.



SPECIMEN NO.		A	B	C
Initial	Diameter (inches)	2.81	2.81	2.81
	Height (inches)	5.56	5.54	5.59
	Moisture Content (%)	41.6	40.5	42.7
	Dry Density (PCF)	62.9	62.5	63.2
	Saturation (%)	69.9	67.4	72.3
	Void Ratio	1.49	1.51	1.48
Before Shear	Moisture Content (%)			
	Dry Density (PCF)			
	Saturation (%)	≃100	≃100	≃100
	Void Ratio			
	Back Pressure (PSI)	NONE	NONE	NONE
Minor Principal Stress (PSI) σ_3		5.0	10.0	20.0
Maximum Deviator Stress (PSI) $(\sigma_1 - \sigma_3)_f$		41.72	61.19	97.00
Ultimate Deviator Stress (PSI) $(\sigma_1 - \sigma_3)_u$		≃41	≃43	≃74
LL	PI NP			
PL	G_s 2.51			



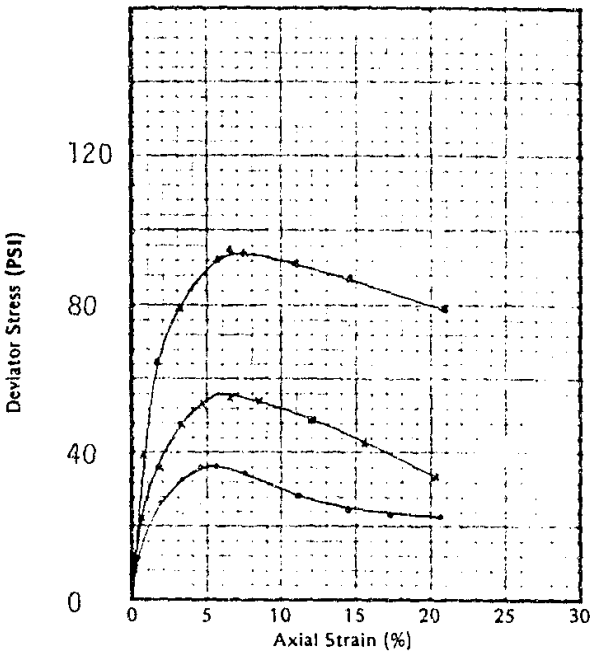
TRIAXIAL TEST DATA Date 4-12-82 Job No. 120-8469

Project BOTTOM ASH - SHERCO UNITS 1 AND 2 - P. O. A66080

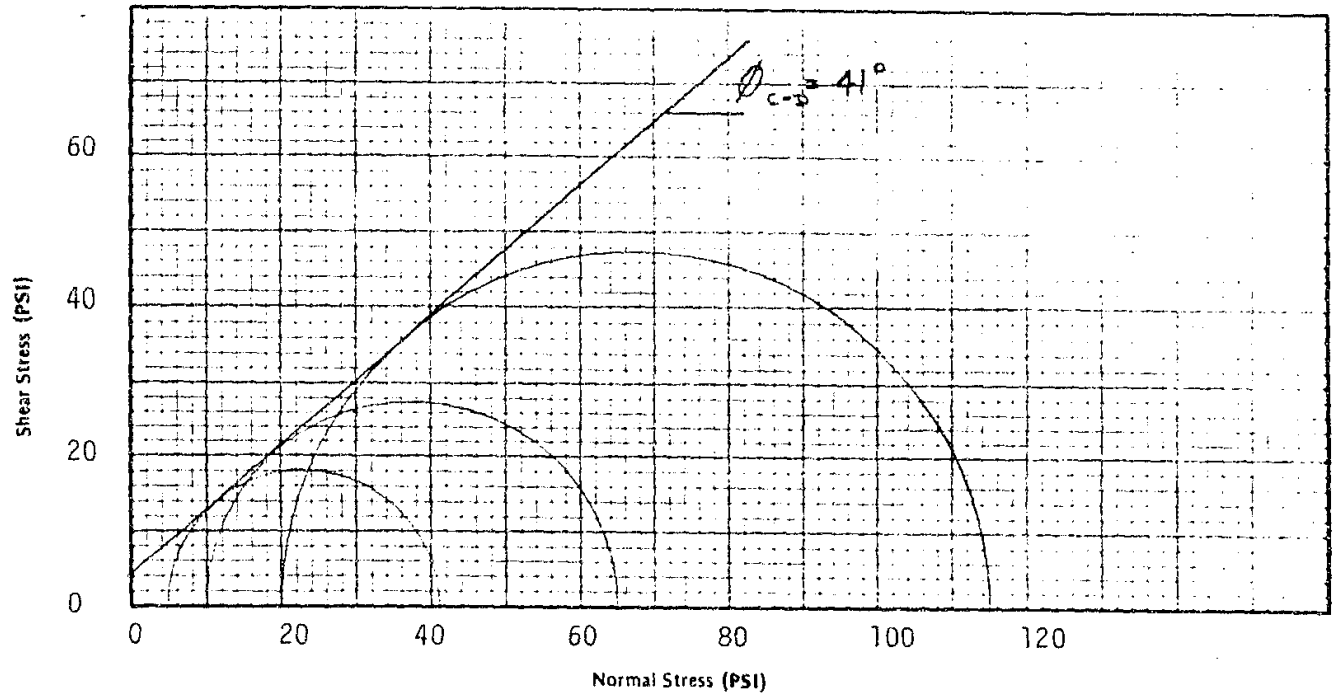
Boring No. _____ Sample No. TP-3 Depth (ft) 4' Type of Sample BAG

Soil Type BOTTOM ASH Type of Test C-D (SATURATED)

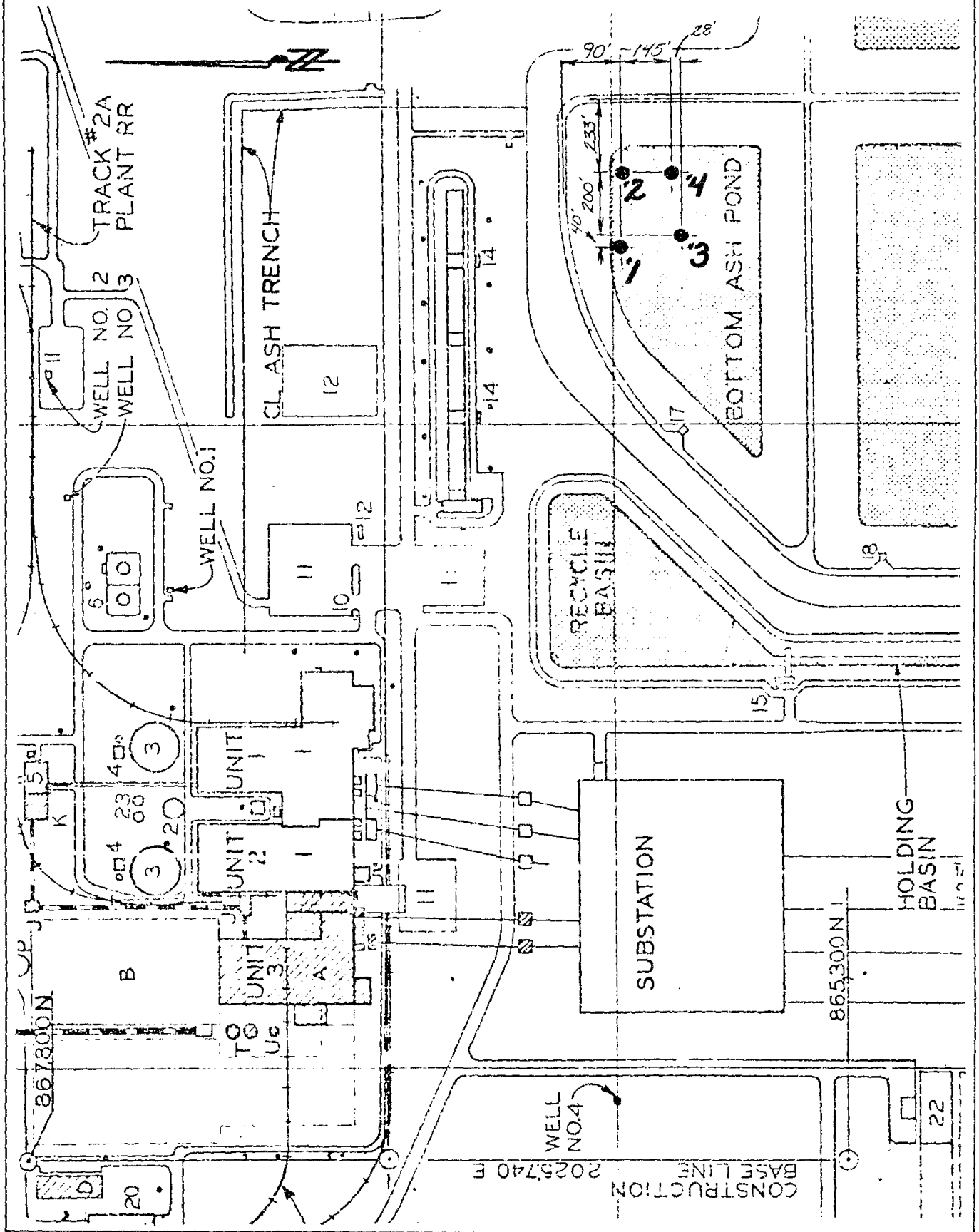
Remarks: Specimens compacted to given conditions using a comparable effort for achieving nearly 100% of maximum standard proctor density. Saturated and consolidated for 1-2 hours. Stressed to given strains at constant rate of 0.01"/min.



SPECIMEN NO.		A	B	C
Initial	Diameter (inches)	2.82	2.82	2.82
	Height (inches)	5.64	5.59	5.67
	Moisture Content (%)	0.88	0.87	0.89
	Dry Density (PCF)	85.0	88.0	85.4
	Saturation (%)	2.6	2.8	2.6
	Void Ratio	.86	.79	.85
Before Shear	Moisture Content (%)			
	Dry Density (PCF)			
	Saturation (%)	≃ 100	≃ 100	≃ 100
	Void Ratio			
	Back Pressure (PSI)	NONE	NONE	NONE
Minor Principal Stress (PSI) σ_3		5.0	10.0	20.0
Maximum Deviator Stress (PSI) $\sigma_1 - \sigma_3$		36.08	54.91	95.04
Ultimate Deviator Stress (PSI) $(\sigma_1 - \sigma_3)_f$		≃ 23	≃ 33	≃ 79
LL	PI NP			
PL	G_s 2.53			



SOIL EXPLORATION COMPANY



TEST PIT LOCATIONS	JOB NO. 120-8469	SCALE: NONE	DRAWN BY RO	CHECKED BY G.E.

SE-14 (73A)

82EA01
Bottom ash Revision

BLACK & VEATCH
CONSULTING ENGINEERS

TEL. (913) 967-2000
TELEX 42-6263

1500 MEADOW LAKE PARKWAY
MAILING ADDRESS: P.O. BOX NO. 8405
KANSAS CITY, MISSOURI 64114

Northern States Power Company
Sherburne County Generating Plant
Units 1 & 2 (E-82EA01)
Bottom Ash Pond Revision
Independent Design Review

B&V Project 10169
June 7, 1982

Northern States Power Company
414 Nicollet Mall
Minneapolis, Minnesota 55401

Attention: Mr. R. B. Anderson

Gentlemen:

We are enclosing four copies each of B&V memoranda dated May 24, 1982, and June 3, 1982. These memoranda document the results of our independent design review for the bottom ash pond dikes.

For your information, the personnel listed in the memoranda have the following positions.

- G. J. Van Riessen--Soils Engineer
- V. H. Snell--Head of Civil-Structural Department

If you have any questions or comments, please do not hesitate to call.

Very truly yours,

BLACK & VEATCH

G. Y. Gunn

bw
Enclosures

cc: Mr. R. B. Anderson

X Independent design review

BLACK & VEATCH

MEMORANDUM

Northern States Power Company
Sherco, Units 1 and 2
Bottom Ash Pond Revision
Independent Design Review

B&V Project 10169
May 24, 1982

To: G. Y. Gunn/V. H. Snell

From: G. J. Van Riessen
GVR

In response to a request by NSP on April 7, 1982, and the Civil-Structural Department task assignment dated April 13, 1983, I have conducted an independent design review of the bottom ash pond revisions. Since the proposed work is limited to raising a low section of the existing bottom ash embankment, the review will be confined to an examination of construction materials and specifications to verify conformance with methods and techniques used to design and construct the existing embankment. The review will specifically address three subjects; soil materials to be used in construction, design sections, and construction specifications.

Soil Materials

Based on a review of the contract specifications for the original work (Specification 5377 D-4C) and the proposed work (Specification 10169.71.1000), soil materials to be used for construction are similar. The only exception is that CL-SC and SC-CL materials will be allowed for use as clay core and impervious earth blanket material. When placed and compacted as specified, these materials are quite suitable for use as impervious material. The sandy clays were used in construction of the core and impervious blanket for the existing embankments. These clay materials have performed adequately to date and are considered compatible for this application. Sources of clay and sand have been identified by previous subsurface investigations and construction. Soils being used for the proposed construction are being obtained from these previously tested borrow areas and are considered acceptable for use in the proposed work.

Design Sections

Four areas were examined for continuity with previous embankment design and construction; the clay core, the embankment slopes, the blanket drain, and the toe drain ditch. The extension of the clay core is being constructed in a manner consistent with prior construction. The interface between the existing clay core and the new clay core is being prepared in a proper manner as specified. Proper stripping of existing topsoiled surfaces has been specified.

The embankments are being constructed to a slope of 2.5 H to 1.0 V. This slope is identical to the existing slopes. Slope stability analyses conducted for earlier construction will apply to the modifications. The slope is stable for all expected operating conditions. The riprap is not

being extended on the upstream slope. Topsoil and seeding will be used to control erosion due to precipitation runoff. Apparently, bottom ash from within the pond will be used to protect the upstream slope as the pond fills. Care must be exercised to ensure that adequate thickness of bottom ash is used to prevent wave erosion of the upstream slope.

The downstream blanket drain is being extended to provide protection against seepage within the downstream embankment. The toe ditch detail is similar to the existing toe ditch and the ditch should perform adequately.

Construction Specifications

With regard to compaction requirements, all soil materials are being compacted to densities (per cent of maximum density) and moisture contents consistent with in-situ embankment materials. Excavation, subgrade preparation, placement, and compaction requirements are identical to those used for the earlier work, and are adequate for the work. An uncompacted thickness of nine inches is appropriate for the type of materials being used for construction. A statement should be included in Section 2C.10.6 limiting lift thickness to nine inches for construction of the impervious earth blanket.

mb

cc: L. J. Almaleh
J. M. Horner
P. R. Zaman

BLACK & VEATCH

MEMORANDUM

Northern States Power Company
Sherburne County Units 1 and 2
Bottom Ash Pond Revision
Independent Design Review

B&V Project 10169
June 3, 1982

To: G. Y. Gunn

From: V. H. Snell

In response to your Task Assignment dated April 13, 1982, I have caused an independent review to be performed on the revisions to the bottom ash pond project. The independent review was performed by Mr. Gary Van Riessen.

I concur with the scope and results of the independent review as presented in Mr. Van Riessen's memorandum dated May 24, 1982. The recommended limit on uncompacted thickness for the impervious earth blanket material has been included in Addendum Number 1.

ra

cc: L. J. Almaleh
J. M. Horner
G. J. Van Riessen
P. R. Zaman

82EA01

MEETING NOTES

E-82EA01 SHERBURNE COUNTY GENERATING PLANT
UNITS 1 and 2
Bottom Ash Pond Revision
E-80E004 SHERBURNE COUNTY GENERATING PLANT
UNITS 1 and 2
Replacement Fly Ash Pond

Time: 9:30 a.m.
Date: May 6, 1982
Place: Sherco Site

ATTENDEES

H. K. Norgaarden
R. B. Anderson
G. H. Jacobson
J. T. O'Donnell
G. H. Kutil (part-time)

ITEMS DISCUSSED

Bottom Ash Project

1. Bypass Piping - The option of bidding the installation of bypass piping and removal of permanent piping was discussed. It was later resolved that this work would be done by PE&C crafts personnel.

2. Bottom Ash Line Trestles - Because of the intent to mine bottom ash in the future, lowering the elevation of top of bottom ash, the desirability of "high trestles" is in question. It may be more desirable to use flexible lines to carry bottom ash into the slope to the water line or the bottom ash line. The plant personnel will inform PE&C regarding resolution on this issue.

3. Operating Estimate - Bypass Piping and Permanent Piping - The original estimated cost for this work seems a bit low. The authorized amount is $168,000 and recent rough estimates seem to exceed that amount. The plant would like updates on forecasted expenditure as they become available.

4. Compaction Water - Black and Veatch has estimated that assuming a 3% addition to soil moisture content is required, or about 12 gallons per cubic yard, 600 to 700,000 gallons total would be required over six week's construction time; or approximately 36,000 gallons per day maximum. Based on those numbers, plant personnel will allow use of the Unit 1 cooling tower basin for compaction water. Potential pump locations and pipe locations and loading area will be arranged. Some existing equipment and piping left from previous jobs may be usable.

5. Landfill - A small landfill area will be required for rocks discovered in the borrow area. The previous general dumping area for this sort of material can be used for this project. PE&C will verify if a special permit is needed.

The following items were discussed with regard to the Fly Ash Pond project.

1. Fly Ash Pond Survey - A volumetric survey of the fly ash pond is now complete and calculated results should be available in the near future. The plant will make results available to PE&C.

2. Project Interface with Plant - The plant will have control over project money authorizations including authorization of scope change requests. The plant will also have general input regarding existing system problems which should be avoided in design of the new system.

   Review of design documents such as SDS's, specifications, drawings etc. will continue. Responsibility for detail design rests with PE&C and their consulting engineer, Black and Veatch.

3. Numbering System - For consistency and lack of complication, plant personnel feel that the Unit 1 and 2 numbering system should be adopted for controls and piping and mechanical systems in general.

4. Transition Period - Existing Pond to New Pond - Plant personnel will consider how the existing pond will be retired and how the transition will be arranged.

5. Site Visit - May 13, 1982 - The upcoming site visit with Black and Veatch will be primarily a technical meeting. The plant will give PE&C and B&V comments on operating problems with the existing system.

R. B. Anderson, P. E.
Civil Engineer

mfc

cc: Attendees
E. J. Cramolini
File E-80E004 A610
E-82EA01 A610

FORM 17 3465

NORTHERN STATES POWER COMPANY

COPY

April 22, 1982

Jim O'Donnell — ShorCo

Tom Johnson — ShorCo

Bottom Ash Pond Expansion

1. Culverts -- If culverts are intended to be used for the bypass piping, I would recommend separating the culverts required for the bypass piping from the specification and allow project people to supply this material (i.e., would use 30" diameter pipe laying around site for culverts).

2. Bottom Ash Reclaiming --

   a. If the contractor is going to use bottom ash for fill, I would recommend stating that "stock piled ash" is not to be used by the contractor. The contractor must obtain his material from other areas of the pond.

   b. The specifications should state that NSP (plant) is not required to lower pond water level to aid in reclamation of the ash from the bottom ash pond.

Internal Correspondence

NSP

Date April 14, 1982

From R. B. Anderson - Civil Engineer

Location GO 7

To R. P. Ellis

Location Fuel Supply
Sheraton Ritz

Subject SHERBURNE COUNTY GENERATING PLANT UNITS 1 and 2 - E-82EA01
Bottom Ash Pond Revision
Projected Bottom Ash Utilization Volume

This letter is to respond to your recent request for volume estimates regarding future potential bottom ash utilization. An excerpt page (3-20) from the report "Scrubber Solids Pond Expansion" is attached.

The following information may also be of interest.

1. The "Bottom Ash Pond Revision" project scheduled for 1982 will increase storage capacity of the existing bottom ash pond to about 600 acre feet total.

2. A test program is currently underway with Twin City Testing Company to determine the engineering properties of bottom ash. If technically feasible, from 20- to 30,000 cubic yards (12.4 - 14.8 acre feet) will be utilized in construction of the bottom ash pond revision by using bottom ash as fill on the inside of the clay core.

For further information regarding utilization in this project and the flyash pond expansion project, please call me. For questions regarding bottom ash production or plant uses, notify Gordy Jacobson.

R. B. Anderson, P. E.
Civil Engineer

A. E. Johnson, P. E.
Project Engineer

mfc

cc: G. H. Jacobson
H. K. Norgaarden
File

Attachment

PLANT FILE COPY

FORM 17-3467

3.8.17 Optional Costs

The optional slope protection cost using bottom ash for riprap bedding is provided to indicate the maximum potential savings using bottom ash instead of conventional bedding.

3.9 BOTTOM ASH POND

The existing Bottom Ash Pond at the Sherburne County Generating Plant was constructed with the northeast corner lower than the rest of the enclosure dikes. To fully utilize the potential 600 acre-feet holding volume of the pond, the lowered portion of the dike should be completed by October 31, 1982 when the present capacity will be filled.

3.9.1 Bottom Ash Utilization

NSP estimates that there are about 470,000 cubic yards (290 acre-feet) of bottom ash currently in the pond. Using bottom ash production rates given in Table B-5 of the "Pond Management and Wastewater" Systems Analysis--Revision 1, the Bottom Ash Pond should be full by the end of 1985. Since undetermined amounts of bottom ash have been removed from the Bottom Ash Pond, it is not known how closely the estimated amounts of bottom ash production compare to the actual amounts.

By the end of 1985 it will be necessary to either construct a new bottom ash pond or start removing the accumulated bottom ash from the existing pond. It will be necessary to cover the scrubber solids ponds after they fill to minimize future leachate production due to precipitation. A 3-foot minimum thickness of granular fill was also recommended in the "Evaluation of Scrubber Sludge" by Twin City Testing, Inc. The cover should also be sloped to reduce infiltration of precipitation. A minimum of 480 acre-feet of bottom ash could be used for covering the present Fly Ash Pond after it fills. It is also possible to use up to 90 acre-feet of bottom ash for the 5-1/2 foot clay cover when constructing the new Phase I Scrubber Solids Pond. Compaction and shear strength tests will be required to determine the engineering properties of the bottom ash.

It should not be necessary to construct new bottom ash storage ponds in the future, since bottom ash can be used for pond construction and reclaiming.

Northern States Power Company

414 Nicollet Mall
Minneapolis, Minnesota 55401
Telephone (612) 330-5500

March 23, 1982

Black and Veatch Consulting Engineers
Post Office 8405
Kansas City, Missouri 64114

Attention: G. Y. Gunn

SHERBURNE COUNTY GENERATING PLANT UNITS 1 and 2
Bottom Ash Pond Revision E-82EA01
Bypass Piping Preliminary Bill of Material

Dear Mr. Gunn:

This letter is to document comments on the review document issued March 10, 1982. These comments were given to Black and Veatch by telephone previously.

Item 1 - The inquiry number used for this project should be the E-number, E-82EA01.

Item 2 - The direct pay permit for sales tax, DP-1047 should be used for this project.

Item 3 - Terms and Conditions on page 1, delete the existing sentence referring to supplier standard conditions and insert words that state "attached NSP General Conditions of Supply Contracts, dated September 1, 1981 shall apply except as specifically revised herein".

Item 4 - Page 2 under Taxes - add a statement saying that "Section 7 of the NSP General Conditions are amended as follows:..."

Item 5 - Page 3, Item 2 - the word "spools" should be deleted and the word "lengths" inserted. It should be made clear that where plain ends are supplied, they are for field butt fusion (by others).

The thermal butt fusion machine should be capable of use on 6 inch or 14 inch pipe. The proposal should also include a separate per day and per week price for a capable technician to educate NSP crews on butt fusion.

Black and Veatch has suggested that adding the bolts and nuts to this order would be advisable. We concur with that recommendation.

We would also like to get an optional quote for items 1 and 2 to supply flanges loose and do all field connection by butt fusion (by others). Also included would be the necessary hardware for field butt fusion.

Proposal should include some sort of commitment on meeting our schedule.

Present plans are for NSP to go out for bids on this package. Approximately 12 copies will be required. B & V intends to give us the necessary 12 copies by the end of the week of March 22.

Very truly yours,

R. B. Anderson, P. E.
Civil Engineer

A. E. Johnson, P. E.
Project Engineer

mfc

cc: G. H. Jacobson
E. J. Cramolini

Northern States Power Company

414 Nicollet Mall
Minneapolis, Minnesota 55401
Telephone (612) 330-5500

February 11, 1982

Black and Veatch Consulting Engineers
Post Office Box 8405
Kansas City, Missouri 64114

Attention: Mr. G. Y. Gunn

SHERBURNE COUNTY GENERATING PLANT UNITS 1 and 2 E-82EA01
Bottom Ash Pond Revision
Clay Mining and Hauling Drawings

Dear Gary:

This letter is to transmit various information for your use in preparing the above drawings. In particular, conditions of the clay contract should be used in preparation of applicable drawings and specifications.

Please call if there are questions.

Information includes:

1. Letter of 1/29/82 from R. O. Jondahl to J. E. Kettner, D. W. King, J. R. Tacheny.

2. Memo to File dated 1/22/82 - Clay Purchase Contract Comments.

3. Letter dated 1/24/81 from G. Y. Gunn to A. E. Johnson.

4. Clay Borrow Site - Figure 1

5. Telecon Record dated 11/18/81.

6. Meetings notes dated 12/15/81 prepared by D. J. Fisher.

7. Memo dated 9/15/81 re Sherco Clay Pit from D. J. Fisher to RBA.

PLANT FILE COPY

8. Memo from RBA dated 10/12/81 from R. O. Jondahl.

9. September 29, 1973 letter from J. A. Danens & Son, Inc. to Jim Sullivan.

10. March 7, 1974 letter from Merle Anderson to Mr. Harvey A. Alfords.

Very truly yours,

R. B. Anderson, P. E.
Civil Engineer

A. E. Johnson

A. E. Johnson, P. E.
Project Engineer

mfc

Enclosures

cc: G. H. Jacobson (w/o attachments)
E. J. Cramolini (w/o attachments)
File (w/o attachments)

82 E A 01

MEMORANDUM TRANSMITTAL

Northern States Power Company
Sherburne County Generating Plant
Units 1 and 2 (E-82EA01)
Memorandum Transmittal

B&V Project 10169
Date February 5, 1982

To: A. E. Johnson

The following memoranda are attached for your information and files:

✓ Conference Memoranda 1

Telephone Memoranda

Please review the statements contained in the attached memoranda and provide comments as you feel appropriate for the statements to accurately reflect the results of discussions between the participants. Please use the space provided on this form and return it to us within fourteen (14) calendar days.

BLACK & VEATCH

Memoranda Prepared by JMH B&V Project Management Review by GYG

Comments by ☐ NSP ☐ Third Party - E-82EA01

[redacted] SHERCO 3

AEJ
JEK HHN

RBA

Copies to: E. J. Cramolini
H. Jacobsen
File
RBA
JMO'Donnell

Comments Prepared by Date

Return Comments to: Black & Veatch
P. O. Box 8405
Kansas City, Missouri 64114

Attention: G. Y. Gunn

PLANT FILE COPY

BLACK & VEATCH

CONFERENCE MEMORANDUM 1

Northern States Power Company
Sherburne County Generating Plant
Units 1 and 2 (E-82EA01)
Bottom Ash Pond Revision

B&V Project 10169
February 5, 1982

This meeting was held at the Sherburne County Generating Plant on January 27, 1982.

Attending:	NSP	B&V
	R. B. Anderson	L. J. Almaleh
	J. T. O'Donnell	J. M. Horner

The purpose of the meeting was to discuss design and construction of the upcoming bottom ash pond revision project.

1. Clay Borrow Site

   NSP stated that a special use permit from Sherburne County will be required for the borrow site. Drawings and specifications will be required for the permit application.

2. Piping

   a. The existing Transol bottom ash and scrubber sludge pipelines pass through the construction area. It was agreed that redundant polybutylene bypass piping will be installed outside the construction area.

   b. NSP suggested that it might be preferable for their personnel to perform all temporary and permanent pipeline work. NSP will review this subject and let B&V know their final decision.

   c. NSP suggested that the bypass piping start within 20 feet of the drain house north of the bottom ash pond. The bottom ash bypass piping will be 14-inch round SDR 13.5 polybutylene with flanged connections. The bottom ash bypass should include two 90 degree Transol elbows. The scrubber sludge bypass should include two 90 degree Schedule 10, type 304 stainless steel elbows.

   d. B&V will prepare the permanent and bypass piping layouts and bills of material for purchase of pipe and fittings for NSP review.

   e. NSP requested that the permanent pipe supports be 2 feet closer together than the previous design.

CONFERENCE MEMORANDUM 1

Northern States Power Company
Sherburne County Generating Plant
Units 1 and 2 (E-82EA01)
Bottom Ash Pond Revision

B&V Project 10169
February 5, 1982

3. Bottom Ash for Embankment

The use of bottom ash for the embankment inside the clay seal was discussed. B&V will prepare test program technical requirements for NSP to use in obtaining testing services.

4. Pipe Trestles

NSP asked B&V to design new trestles similar to the old ones. The trestles should be at about elevation 1,000 feet and extend about 125 feet west from the embankment centerline. NSP will probably construct the pipe trestles.

5. Access Road

The existing pond access road at the northeast corner of the bottom ash pond will be removed when the embankment is raised. A new access road similar to the one west of the scrubber sludge pond will be constructed. NSP requested that the grade be 7 per cent or less.

6. Underground Utilities

NSP will check to see if they know of any utilities in the construction area not shown on the Units 1 and 2 construction drawings.

7. Engineering Services Proposal

NSP stated that they were expecting a proposal from B&V. The proposal should include manpower and cost budgets and schedules for the bottom ash pond completion project.

8. Scrubber Water Recycle Piping

NSP stated that the existing lines to the units are experiencing scaling problems. It was agreed that new piping will include cleanout provisions.

JMH:tjb

G. H. Jacobson
82 EA 01
Bottom Ash Revision
General

MEETING NOTES

E-82EA01 SHERCO 1 & 2

BOTTOM ASH POND REVISION

MEETING WITH HOWARD JOHNSON

December 11, 1981

A meeting was held with Howard Johnson, (HJ) owner of proposed clay mine areas and Dave Fisher, Real Estate, to discuss upcoming mining operations. Howard was agreeable to our proposed mining plans. He agreed that property "B" could be used for bottom ash pond clay in 1982, and property "K" in major pond work in 1983 and 1984 (see attached marked-up Figure 1). A major concern of his was that the price per yard (12¢) in the current contract be adjusted for inflation. Real Estate has taken this under advisement. Details of the meeting follow:

. Wooded Areas - HJ has no problem with us using wooded spots. We would prefer not to use those areas.

. HJ has mined some sand out for a building project from Area B. Disturbance was minimal.

. Crop Damage Agreement - For 1982 work Howard will plant corn as normal - we will pay crop damage for disturbed area. However, it appears such damage will be minimal, since most of proposed mining area is not usually farmed due to steep slopes.

*. Contract should be made available to B & V so proper conditions can be put in specs.

*. HJ prefers mining operations to leave a thick layer of clay so rainfall water will not seep away quickly.

. Access - Roads for access should be relatively easy to site and build, both for 1982 bottom ash pond work and major pond work.

. Washouts exist in previously mined areas, on NSP owned land. NSP might consider repair of those areas in 1982. These areas are currently leased by HJ.

. Black and Veatch should be made aware of drainage erosion concerns. Owner has had problems with drainage path erosion on Property A. He has installed a dike system involving six dikes and drainage line. Drawings from Sherburne County USDA SCS (1981 drawings) are available, showing HJ's erosion control work. Work should not interfere with 1982, 1983 or 1984 work.

x
x
x

PLANT FILE COPY

. It appears that mining property K and/or J first for major pond work may be advantageous. Doing so would have less interferences than Property A. Property B would not yield all the necessary clay.

. HJ asked if an upward adjustment of the unit price of clay could be arranged due to inflation since the original contract. Real Estate will consider such an adjustment with input from PE & C.

. Real Estate will further arrange an agreement covering crop damage due to major clay mining for the ash pond. This may be combined with the above inflation adjustment.

. PE & C will give Real Estate more detail on clay mining by March 1982 as B & V develops engineering plans. Real Estate will convey information to HJ.

. On another matter, covering land purchase at the northeast corner of proposed ash pond, Real Estate requests a sketch showing land needs. This sketch should be completed by B & V in January after project approval.

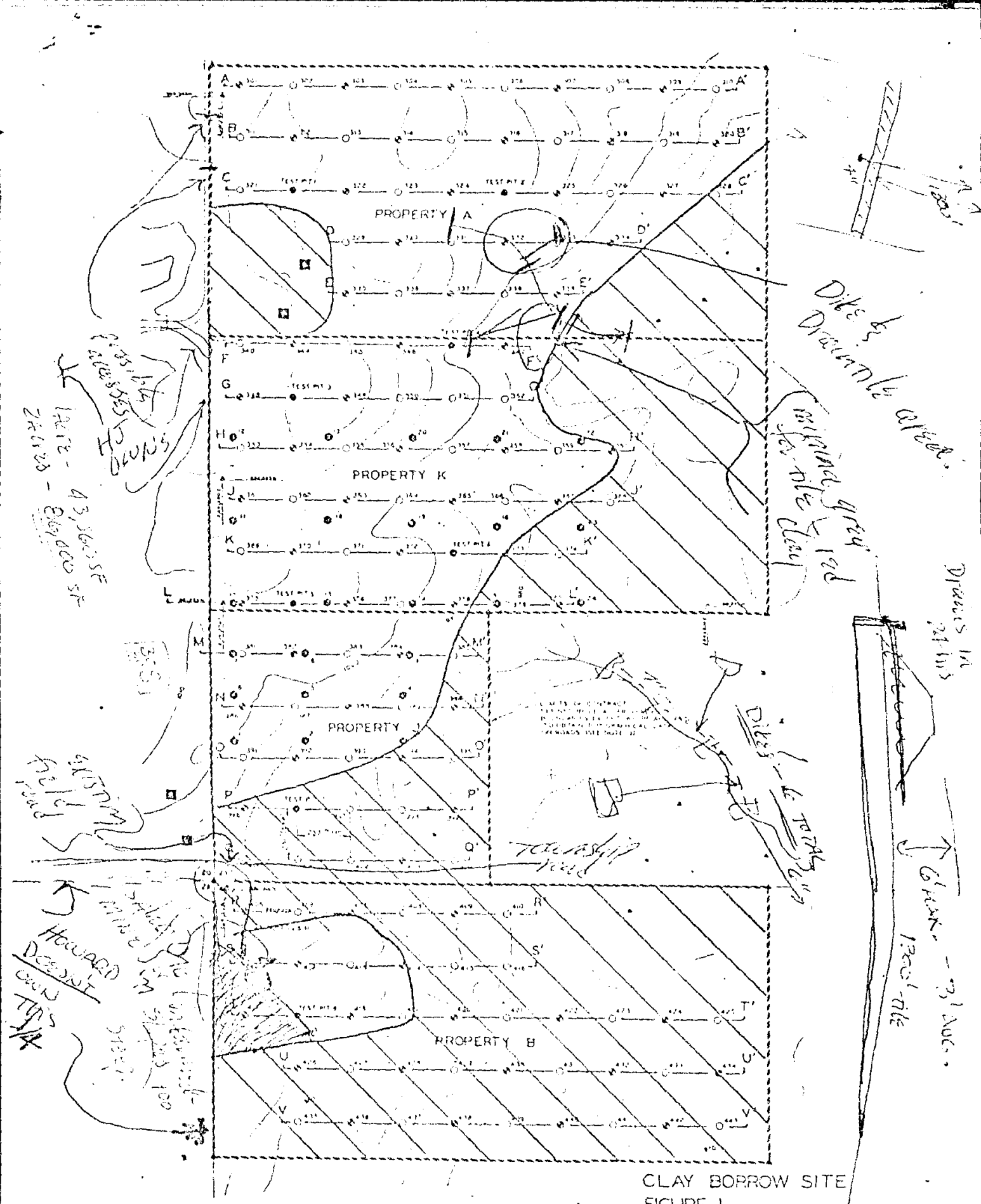
*Action items.

By RB Anderson
R. B. Anderson, P. E.
Civil Engineer

mfc

Attachment

cc: Dave Fisher
A. E. Johnson
J. E. Kettner
G. H. Jacobson
Ward King
Files



CLAY BORROW SITE
FIGURE 1

PRIMARY	SECONDARY	TERTIARY	DPF SEQ
82EA01	BA REVISION	A300	Z7701780
&		COST CONTROL	
X	BA PRODUCTION RATES		Z7701780
X	CAPITAL OP&MAINT ACCTG		Z7701780
X	COST ESTIMATES		Z7701780
X	COST STUDIES INCREMENTAL		Z7701780
X	COSTS PROBABLE CAP&OP		Z7701780
X	COSTS POLLUTION CONTROL		Z7701780
X	COSTS SLUDGE DISPOSAL		Z7701780
X	COSTS UNIT 3 PARTNERS		Z7701780
X	EXPENDITURE FORECASTS		Z7701780
X	PRODUCTION RATE SLUDG/BA		Z7701780
X	PROJECT DESIGN GUIDE		Z7701780
X	PWR/SLUDGE RATIO		Z7701780
X	SCRUB SOLIDS POND EXPAN		Z7701780
X	SLUDGE DISPOSAL COSTS		Z7701780
X	SLUDGE PRODUCTION RATES		Z7701780

82EA01
BA REVISION
A300
COST CONTROL

Internal Correspondence

NSP

Date August 26, 1982

From H K Norgaarden — Location GO - 7

To File and Distribution — Location GO - 7

Subject SHERBURNE COUNTY GENERATING PLANT UNITS 1 AND 2
E-80E004 - Replacement Flyash Pond
E-82EA01 - Bottom Ash Pond Revision
Capital, Operating and Maintenance Accounts

In order to properly accumulate charges for pollution control work and the Sherco 3 partnership, it has been determined that all charges, for subject projects, shall be made against the capital accounts.

The Bottom Ash Pond Revision work has been started with some charges already made against the operating work order number. In order to avoid confusion, we will continue in this manner and transfer all operating charges to the capital account at the end of the project.

The Replacement Flyash Pond charges to date have all been against the capital account. All work originally estimated for operating and maintenance work orders will be charged directly to the capital account.

H K Norgaarden
Project Manager

mub

cc: R A Holmberg
M F Dinville
J L Brandes
C D Hadley
G D Wiese
J O Behling
M J Miller
Project File A300
Field File A300

RECEIVED
AUG 30 1982
SHERBURNE COUNTY
GENERATING PLANT

FILE COPY
8-30-83

Internal Correspondence

NSP

82EA01 Bottom Ash Pond Revision E-82EA01

Date August 6, 1982

From H K Morgaarden — Location General Office 7

To M F Dinville — Location Sherco

Subject SHERBURNE COUNTY GENERATING PLANT UNITS 1 & 2
Bottom Ash Pond Revision E-82EA01
Probable Cost

In a meeting at the plant on May 6, 1982 with Gordy Jacobson, it was agreed to keep you informed of the probable costs for both the capital and operating portions of the project.

Listed below are probable costs for the various phases of the project:

Capital Costs

	Original Authorization	Probable Cost	Probable Deviation
Direct Cost (contractor)	$301,000	$178,700*	-$122,300
Direct Cost (NSP)	17,800	18,400	+ 600
Indirects	81,200	107,900	+26,700
	$400,000	$305,000	-$95,000

Through June 1982 $44,000 have been spent.

The deviation indicated is due to the low bids received for the earthwork portion of the project.

Operating Costs

	Original Authorization	Probable Cost	Probable Deviation
Direct Cost (contractor)	$32,600	$60,400*	+27,800
Direct Cost (NSP)	135,400	214,600	+79,200
	$168,000	$275,000	+$107,000

Through June 1982 $46,000 have been spent.

*-Firm contract prices

RECEIVED
AUG 09 1982
SHERBURNE COUNTY
GENERATING PLANT

PLANT FILE COPY

FORM 17.3457

The deviation indicated is due to underestimating the cost of material and labor involved with the bypass piping and supports for the re-installation of permanent piping.

Please review the above and inform me of any further needs regarding costs on the project.

H K Norgaarden
Project Manager

mub

cc: R A Holmberg
C D Hadley
R H Vagts
Project File A300
Field File A300

PROJECT CONTROL SYSTEMS SECTION

TRANSMITTAL MANIFEST

FROM: C. J. TICE DATE: April 26, 1982

PROJECT: SHERBURNE GENERATING PLANT PLANT NO.

REMARKS: Bottom Ash Pond Revision E-82EA01

☐ STATUS REPORT _____ SHEET(S)

☐ TIME SCALE NETWORK _____ SHEET(S)

☒ COMPUTER REPORT(S) Expenditure Forecasts as of April 1, 1982

☐ OTHER _____

COPIES TO:

D E Gilberts, Senior Vice President
A V Dienhart, Vice President

PLANT ENGINEERING & CONSTRUCTION

E A Fulton	P J Schappa
R A Holmberg	C J Tice
H K Morgaarden	Project File

ENERGY SUPPLY PLANNING
S D Caskey, Manager
100 Washington Square

POWER PRODUCTION
D D Bohn, General Manager -
Conventional Plants - 8th floor

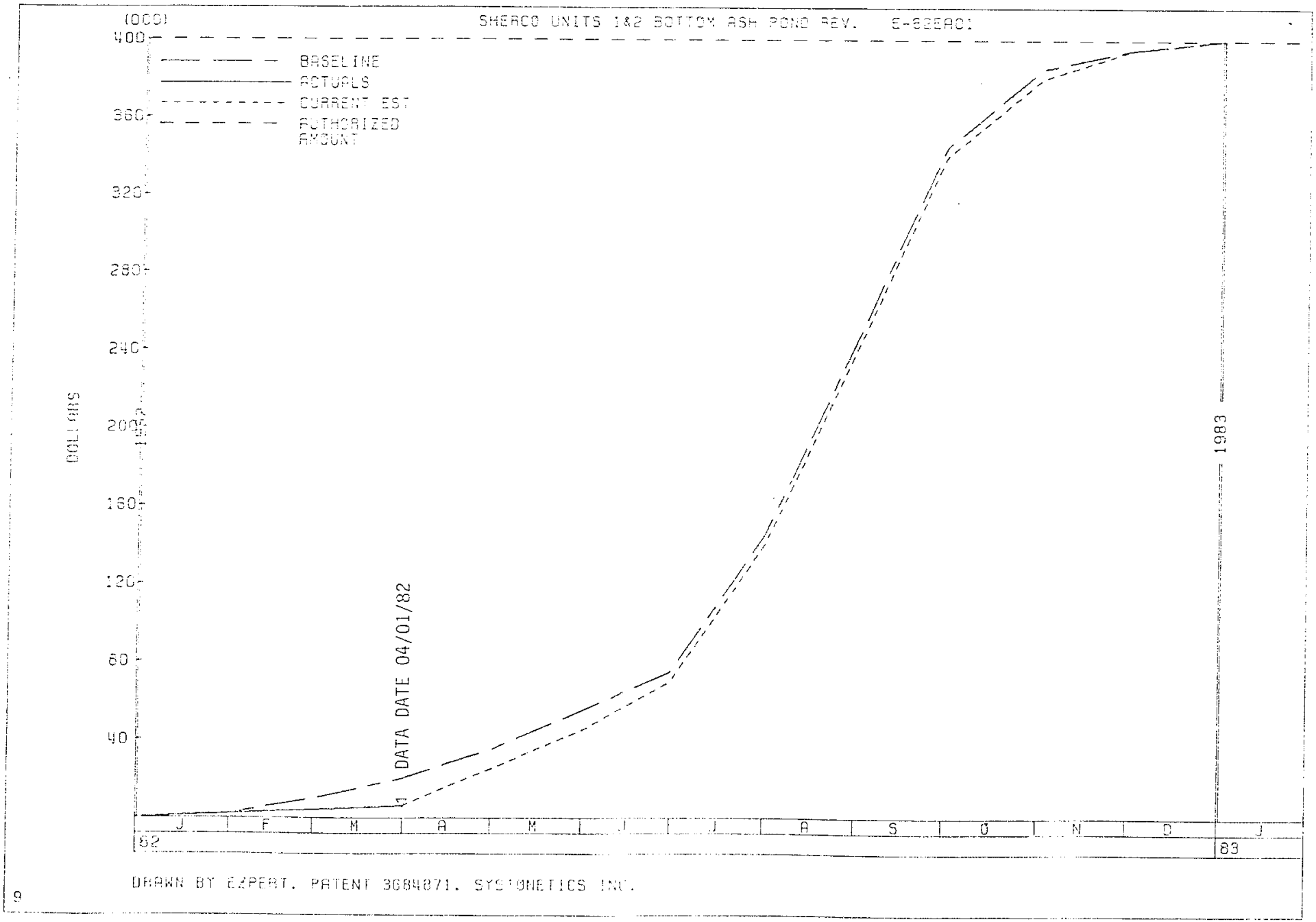
Approved by _____
R A Holmberg, Manager
Fossil Plant Projects

By: P. J. Schappa, Manager - Project Control Systems

FORM 17-0261 (8-78)

NORTHERN STATES POWER COMPANY
PLANT ENGINEERING & CONSTRUCTION

PLANT FILE COPY



DRAWN BY EXPERT. PATENT 3684871. SYSTONETICS INC.

PROJECT CONTROL SYSTEMS SECTION
PLANT ENGINEERING + CONSTRUCTION DEPARTMENT

APRIL 26, 1982

BASELINE/REVISED
VERSUS
ACTUAL EXPENDITURE MATRIX

AS OF APRIL 1, 1982

I.R. 00736-19
1982 COMPLETION
RESPONSIBILITY: J E KETTNER
E-82EA01 SHERCO - BOTTOM ASH POND REVISION

	1982 BASELINE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
JAN	2.0	2.3A											
FEB	8.0	7.7	2.0A										
MAR	10.0	10.0	10.7	2.0A									
APR	15.0	15.0	15.0	18.7									
MAY	20.0	20.0	20.0	20.0									
JUN	20.0	20.0	25.0	25.0									
JUL	70.0	70.0	70.0	70.0									
AUG	100.0	100.0	100.0	100.0									
SEP	100.0	100.0	100.0	100.0									
OCT	40.0	40.0	40.0	40.0									
NOV	10.0	10.0	10.0	15.0									
DEC	5.0	5.0	5.0	5.0									
	400.0	400.0	400.0	400.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

I.R. 02736-19
1982 COMPLETION
RESPONSIBILITY: J E KETTNER
E-82EA01 SHERCO - BOTTOM ASH POND REVISION

EXPENDITURE FORECAST RECAP

	1982 PERFORMANCE MEASUREMENT BASELINE	CURRENT	
PRE 1982 ACTUAL EXPENDITURES	0A	0A	PRE 1982 ACTUAL EXPENDITURES
1982 ESTIMATED EXPENDITURES	400000	400000	1982 ACTUAL + ESTIMATED EXPENDITURES
1983 ESTIMATED EXPENDITURES	0	0	1983 ESTIMATED EXPENDITURES
1984 + FUTURE ESTIMATED EXPENDITURES	0	0	1984 + FUTURE ESTIMATED EXPENDITURES
TOTAL PROBABLE COST	400000	400000	
PROJECT AUTHORIZATION	400000	400000	

PROGRESS TO DATE: 1% MONEY EXPENDED
0% CONSTRUCTION

SCHEDULE COMPLETION OCT 1982

AFC RATES: 1982 8.00% ANNUAL EFFECTIVE RATE
1983-97 8.05% ANNUAL EFFECTIVE RATE

AFC TERMINATED

A+G RATE: 1.5%

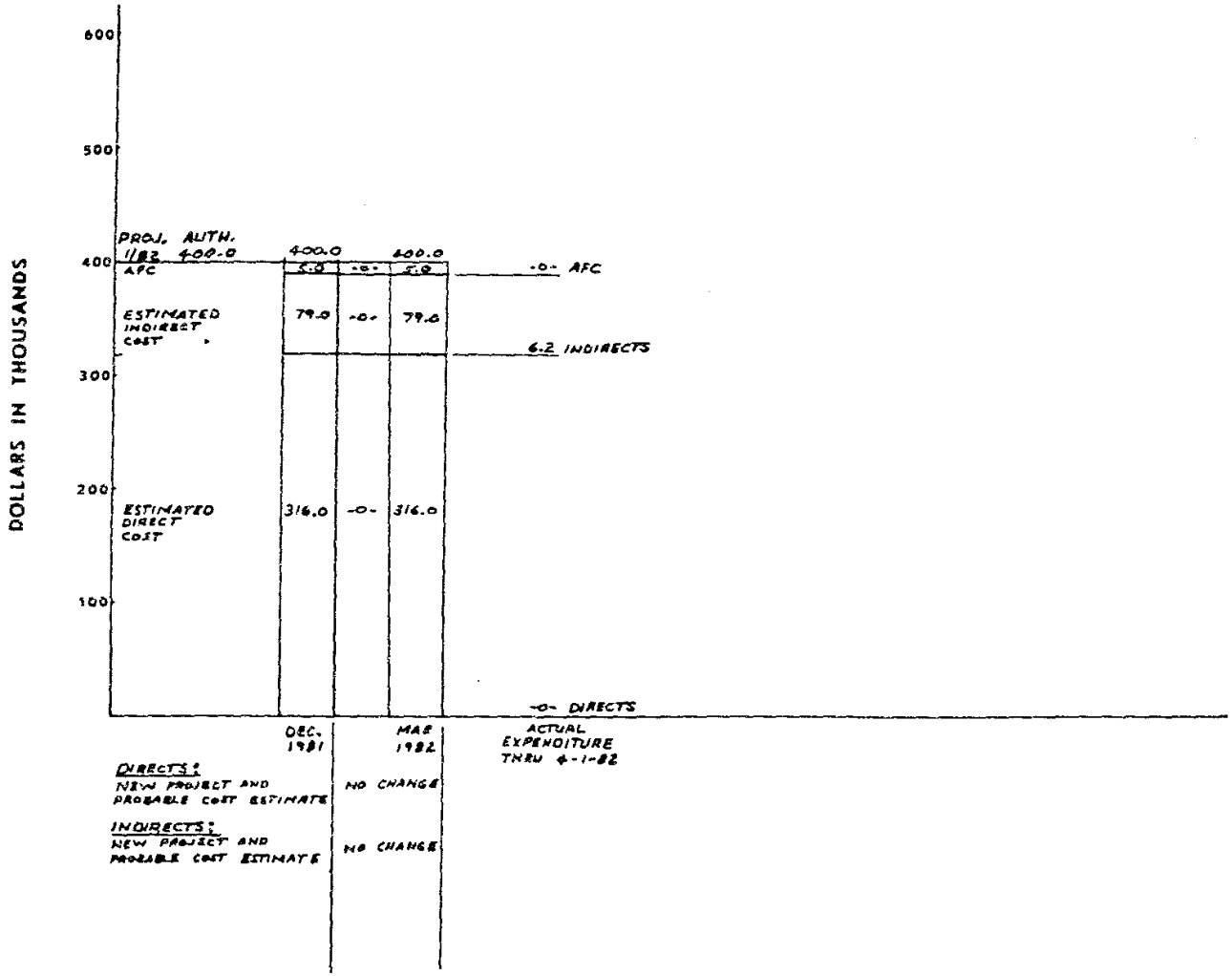
I.R. 02736-19
1982 COMPLETION
RESPONSIBILITY: J E KETTNER
SH0CEA01 SHERCO - BOTTOM ASH POND REVISION

	DEVIATION	CORRECTIVE ACTION
1982		
JANUARY	NO SIGNIFICANT CASH FLOW DEVIATION.	JANUARY
FEBRUARY	NO STATUS CHANGE.	FEBRUARY
MARCH	THE PMCS SYSTEM AND NETWORK ARE BEING DEVELOPED FOR THIS PROJECT. WHEN THE ENTIRE SYSTEM IS FUNCTIONAL MONTHLY CASH FLOW DEVIATION SHOULD BE SMALLER THAN PAST AND PRESENT DEVIATIONS.	MARCH

SHERBURNE COUNTY

BOTTOM ASH POND REVISION

E-82EA01



NORTHERN STATES POWER COMPANY
MINNEAPOLIS

NSP

TELEPHONE COMMUNICATIONS RECORD

E-Number E-82EA01 A/E Project

Plant Sherburne County Generating Plant 1 & 2 A/E File #

Project Bottom Ash Pond Revision Date

NSP File # A610 P.O. #

Date of Conversation 4/23/82 Time 11:00 a.m.

Subject Miscellaneous data for incremental cost studies.

From Dan Bernt (DB)	To Roger Anderson (RA)
Phone 5543	Phone 6962
Company NSP	Company NSP
Position Associate Envir. Engineer	Position Civil Engineer

Item	Subject	Action Required
DB	Requests various information re fly ash pond and bottom ash pond at Sherco: 1. Rough capital costs of sludge disposal for ponding per volume stored. 2. Some indication of sludge and bottom ash production rates.	
RA	1. Total authorization for new fly ash pond, in 1984 dollars is $15 million. Storage capacity added will be about 5 million cubic yards. 2. Referencing a 4/22/80 memo from T. J. Johnson, "power to sludge" ratio used was 0.78 MWH/cubic foot sludge in pond. A similar ratio for bottom ash production could be roughed out using typical annual generation rates, and an estimated annual bottom ash production of 69 acre feet (based on a 1979 B & V study, "Pond Management"). Recommend checking with plant personnel and possibly Fuel Supply for more current information.	

Distribution: Dan Bernt
G. H. Jacobson
File

By: R. B. Anderson RBA

FORM 17-2090(4-80)

Internal Correspondence

NSP

Date November 1, 1981

From R. B. Anderson - Civil Engineer — Location GO 7

To G. H. Jacobson - Plant Superintendent Engineering — Location Sherburne County Plant

Subject SHERBURNE COUNTY GENERATING PLANT E-80E004
Replacement Fly Ash Pond
Bottom Ash Pond Revision E-82EA01

Attached is a copy (additional copy of report sent previously) of the report, "Scrubber Solids Pond Expansion" including copies of the cost estimates associated with the two related projects. The report addresses both projects. This material documents in detail, the basis for the recommended conclusions and estimated cost. This transmittal completes our response to this Request for Engineering.

By _____
R. B. Anderson, P. E.
Civil Engineer

_____
A. E. Johnson, P. E.
Sponsor Engineer

mfc

Enclosures

cc: R. A. Holmberg
A. E. Johnson/J. E. Kettner (letter and estimates only - report issued under separate cover)
File (RBA PDC GY) E-80E004
File (RBA) E-82EA01
L. R. Manecke (letter and estimates only)
J. O. Behling/P. W. Gohr (letter and estimate only)

NORTHERN STATES POWER CO   ENGINEERING AND CONSTRUCTION   MINNEAPOLIS

DISTRIBUTION

DATE TRANSMITTED
ORIGINAL

1 BARRETT LR	1 BRANDES JL
1 MUELLER SO	1 ANDERSON LM
1 PETERSON KH	6 GILBERTS DE
1 [illegible] JA	5 TICE CJ
1 [illegible] KK	1 REDHOEFER LC

60E004

TNE THIS ESTIMATE $ 14 000 000

NSP (MINNESOTA) (POWER) DIVISION
SHERBURNE COUNTY, UNITS 1 & 2
REPLACEMENT FLY ASH POND
ASSIGNED TO PLANT   COMPLETE 11-01-84
REQUESTED 09-28-80 BY G. H. JACOBSON   PROPOSED BUDGET YEAR 82

ESCALATION 1981-1984 10.0%   ALLOW FOR FUNDS DURING CONST 1982   8.0%
ADMINISTRATION & GEN. 1.5%   ALLOW FOR FUNDS DURING CONST 1983-84   8.25%

ESTIMATE SUMMARY

BOILER PLANT EQUIPMENT		$ 1 600 000
LABOR		7 185 000
LABOR INDIRECTS		30 000
PERMITS & LICENSES		50 000
TESTING, DESIGN, STUDIES, CONSULTANT		625 000
ENVIRONMENTAL STUDIES & REPORTS		5 000
TOTAL SPECIFIC COSTS		$ 9 495 000
E&S - NSP	200 000	
A&G	145 000	
AFUC	760 000	
TOTAL OVERHEADS		1 105 000
ESCALATION		3 400 000
GROSS CONSTRUCTION		14 000 000
LESS: OLD CONSTRUCTION REMOVED		390 000
NET NEW CONSTRUCTION		$ 13 610 000

CONTINUATION OF ESTIMATE SUMMARY

REMOVAL LABOR	$	5 000
LABOR INDIRECTS		0
REMOVAL COSTS	$	5 000
E&S	0	
A&G	0	
OVERHEADS		0
REMOVAL TOTALS	$	5 000
SALVAGE		5 000

NET DEPRECIATION 190 000

TOTAL NET EXPENDITURE $ 14 000 000 $ 14 000 000

MAINTENANCE EST $ 36000 OPERATING EST $ 520000

RELATED WORK: E-82EA01 SHERCO 1 & 2 BOTTOM ASH POND REVISION

-*-----*-----*-----*-----*-----*-----*-----*-----*-----*-----*-----*-----*-----*-----*-----*-----*-

DETAILED INSTALLATION ESTIMATE
==============================

BOILER PLANT EQUIPMENT

CODE	QUANTITY	DESCRIPTION	MAT'L	LABOR
**********	*********	**************************************	*******	********
	[illegible]000CY	EMBANKMENT	0	2600000
	2650000CY	CLAY SEAL	40000	2140000
	620000SY	SLOPE PROTECTION	150000	150000
	100AC	SITE PREPARATION	0	190000
	[illegible]000LF	ROADWAY	[illegible]	[illegible]
	5700LF	MAKE-UP PIPING	250000	430000
	5700LF	RECYCLE PIPING	290000	350000
	2000LF	PROVIDE WATER, COMPRESSED AIR	[illegible]	85000
	1LT	PUMPHOUSE STRUCTURE	160000	120000
	1LT	PUMPHOUSE EXCAVATION-BACKFILL	0	20000
	1LT	INTAKE STRUCTURE	55000	35000
	1LT	PUMPHOUSE MECH.-PUMPS, PIPING, ETC.	72000	48000
	1LT	ELECTRICAL	110000	120000
	1LT	CONTINGENCIES	135000	635000
	1LT	NSP FIELD LABOR	0	200000

CONTINUATION OF BOILER PLANT EQUIPMENT

CODE	QUANTITY	DESCRIPTION	MAT'L	LABOR
		PURCH. AND WHSE. CHARGES	15000	
		SALES TAX	85000	
		SHIPPING COSTS	15000	
		TOTAL BOILER PLANT EQUIPMENT	$ 1600000	$ 7185000

DETAILED REMOVAL ESTIMATE

QUANTITY	DESCRIPTION	SALVAGE	INST. COST	REMOVAL LABOR
1LT	OLD CONSTRUCTION	5000	190000	5000
	TOTAL SALVAGE AND REMOVAL LABOR	$ 5000		$ 5000
	COST OF OLD CONSTRUCTION REMOVED		$ 190000	
	REMOVAL TOTALS		5000	
	SALVAGE		5000	
	NET DEPRECIATION		$ 190000	

DETAILED MAINTENANCE ESTIMATE

RELOCATE 2 TRANSMISSION LINES - $16000 LABOR & $4000 MATERIAL	$ 20000
MISC MAINT - $3000 LABOR & $3000 MAT'L	$ 6000
NSP FIELD LABOR	$ 3650
INDIRECTS ON FIELD LABOR	$ 450
ESCALATION	$ 5900
TOTAL	$ 36000

DETAILED OPERATING ESTIMATE

REPLACE EXISTINGSLUICE LINES- $60000 LABOR & $260000 MATERIAL	$ 320000
REMOVAL COSTS	$ 10000
SALVAGE	$ -10000
CONTINGENCIES - $6000 LABOR & $26000 MATERIAL	$ 32000
NSP FIELD LABOR	$ 5000
INDIRECTS ON NSP FIELD LABOR	$ 1000
ESCALATION	$ 162000
TOTAL	$ 520000

PROJECT ASSIGNMENT		APPROVED	DATE
SPONSOR	A.E. JOHNSON		11/4/81
JOB-CIVIL ENGINEERING	R.P. ANDERSON		10-28-81
JOB-ENVIRONMENTAL	D.L. STEPHENSON	[illegible]	10-28-81
COST/SCHEDULING REP.	P.W. GOHR	[illegible]	10/30/81
MANAGER - PROJECTS	R.A. HOLMBERG	[illegible]	11/2/81
ASST SUPT DOC & PROC	J. O. BEHLING		
PREPARED BY	BUDGET SERVICES		

REVIEWED AND APPROVED

[signature] DEPARTMENT MANAGER 11/5/81

JOB CLASSIFICATION _____

PROJECT DESIGN GUIDE

LOCATION: SHERBURNE COUNTY GENERATING PLANT

TITLE OF PROJECT: Replacement Fly Ash Pond

PROJECT NUMBER: E-80E004

I. PROJECT SCOPE

The objective of this project is to provide 3200 acre feet of additional scrubber solids storage capacity by 1985. The present pond's fill rate will necessitate added holding volume by 1985, to allow proper scrubber water management and final filling of the existing pond. The scope of work includes embankment construction, clay liner, slurry piping, maintenance roads, slope protection, recycle and makeup piping, intake structure, recycle pumps and pumphouse. The existing intake structure will be retired after the pond is filled.

II. SPECIFIC DESIGN FEATURES

The new pond will be built adjacent to the existing pond and cover about 100 acres. The embankments will be 44 feet high and constructed primarily of onsite soils. The bottom clay liner will be 18 inches thick and the sloping embankment liner will be 3'-6" thick.

An aggregate surfaced maintenance road will be constructed on top of the dike. The dike slopes will be protected from erosion, heavy equipment operations, burrowing animals and pipeline ruptures. Conventional riprap slope protection will be placed halfway up embankment slopes. To allow pond construction, minor electrical transmission line rerouting will be required. Two thousand feet each of a 34.5 kv and a 115 kv line, both mounted on wood pole structures will be moved, reusing the conductor and the structures.

New scrubber slurry piping will be furnished and installed to replace the existing pipelines. Slurry pipe length will match existing length and will be placed on the existing embankment common to both ponds. An extension of this line may be necessary in future years.

A new intake structure, scrubber water recycle piping and scrubber return water pumps and structure will be constructed. The new intake structure will be located at the north end of the new pond. The scrubber water return building will be located east of the Unit 1

PROJECT DESIGN GUIDE

LOCATION: SHERBURNE COUNTY GENERATING PLANT

TITLE OF PROJECT: Replacement Fly Ash Pond

PROJECT NUMBER: E-80E004

II. SPECIFIC DESIGN FEATURES (Continued)

cooling tower basin. The piping will convey scrubber recycle water from the intake structure to the pumphouse and then to Units 1 and 2 scrubbers.

New piping will be constructed to transport makeup to the scrubber system. Cooling tower blowdown will be conveyed from a new valve pit northwest of the recycle basin to the scrubber water return pumps. Makeup from the existing recycle basin will be conveyed by extending the existing pipeline to the new intake structure.

This project has been studied and documented in the "Scrubber Solids Pond Expansion" report.

III. RELATED ESTIMATES

Bottom Ash Pond Revision
Project Number E-82EA01

Prepared by: _____
R. B. Anderson, P. E.
Civil Engineer

Approved by: _____
A. E. Johnson, P. E.
Project Engineer

Approved by: _____
R. A. Holmberg, Manager
Fossil Plant Projects

mfc

PLANT PROJECT
ENVIRONMENTAL CONSIDERATIONS

Project No. E-BO8004 Location and Title Stanton 1&2 - Replacement Fly Ash Pond

	Aesthetic	Air	Noise Abatement	Water
Accessory Electric Equip	$____ or __%	$____ or __%	$____ or __%	$____ or __%
Boiler ~~or Reactor~~ Plant Equip	$____ or __%	$____ or 75%	$____ or __%	$____ or 25%
Land & Land Rights	$____ or __%	$____ or __%	$____ or __%	$____ or __%
Misc Power Plant Equip	$____ or __%	$____ or __%	$____ or __%	$____ or __%
Structures & Improvements	$____ or __%	$____ or __%	$____ or __%	$____ or __%
Turbogenerator Units	$____ or __%	$____ or __%	$____ or __%	$____ or __%

Describe if each dollar amount or percentage calculation is based on material, labor or both.

Based on both material and labor.

Reasoning for environmental consideration Need for storage results from Air Quality Control Systems. Clay seal is required to protect waters, both ground water and surface waters.

Job Engineer R B Anderson

Project Sponsor: A E Johnson

NORTHERN STATES POWER CO   ENGINEERING AND CONSTRUCTION   MINNEAPOLIS

DISTRIBUTION

DATE TRANSMITTED
ORIGINAL

1 GARRETT ER   1 GRANDES JL
1 KOHLER SJ   1 ANDERSON LM
1 PETERSON RG   1 GILBERTS OE
1 [illegible] JZ   1 TICE CJ
1 [illegible] RK   1 SCHOEFFER LC

82EA01

THE THIS ESTIMATE $ 400 000

ASP (MINNESOTA) (POWER) DIVISION
SHERBURNE COUNTY GENERATING PLANT, UNITS 1 & 2
BOTTOM ASH POND REVISION
ASSIGNED TO PLANT   COMPLETE 09-01-82
REQUESTED 09-25-81 BY G. P. JACOBSON   PROPOSED BUDGET YEAR 82

ESCALATION	1981	10.0%	ALLOW FOR FUNDS DURING CONST 1982	6.0%
ESCALATION	1982	10.0%	ADMINISTRATION & GENERAL	1.5%

ESTIMATE SUMMARY

MAJOR PLANT EQUIPMENT	$	19 000
LABOR		200 000
LABOR PRODUCTS		2 000
PERMITS & LICENSES		[illegible]
TOTAL SPECIFIC COSTS	$	292 000

E&C - NSP	[illegible]
E&C - CONSULTANT	[illegible]
A&G	5 000
AFDC	[illegible]

TOTAL OVERHEADS		68 600	
ESCALATION		39 400	
GROSS CONSTRUCTION		400 000	
LESS REMOVALS SALVAGE			
TOTAL NET EXPENDITURE	$	400 000 $	400 000

MAINTENANCE EST $ 0   OPERATING EST $ 10,000

RELATED WORK [illegible] REPLACEMENT [illegible] ASH POND

Northern States Power Company | Plant Engineering and Construction Department | Minneapolis, Minnesota October 15, 1981

PROJECT DESIGN GUIDE

LOCATION: SHERBURNE COUNTY GENERATING PLANT

TITLE OF PROJECT: Bottom Ash Pond Revision

PROJECT NUMBER: E-82EA01

III. RELATED ESTIMATES

Replacement Fly Ash Pond
Project Number E-80E004

Prepared by: _____
R. B. Anderson, P. E.
Civil Engineer

Approved by: _____
A. E. Johnson, P. E.
Project Engineer

Approved by: _____
R. A. Hoimberg, Manager
Fossil Plant Projects

mfc

PLANT PROJECT
ENVIRONMENTAL CONSIDERATIONS

Project No. 82601 Location and Title Sharon 1 & 2 - Bottom Ash Pond Revision

	Aesthetic	Air	Noise Abatement	Water
Accessory Electric Equip	$____ or ___%	$____ or ___%	$____ or ___%	$____ or ___%
Boiler or Reactor Plant Equip	$____ or ___%	$____ or ___%	$____ or ___%	$____ or 100%
Land & Land Rights	$____ or ___%	$____ or ___%	$____ or ___%	$____ or ___%
Misc Power Plant Equip	$____ or ___%	$____ or ___%	$____ or ___%	$____ or ___%
Structures & Improvements	$____ or ___%	$____ or ___%	$____ or ___%	$____ or ___%
Turbogenerator Units	$____ or ___%	$____ or ___%	$____ or ___%	$____ or ___%

Describe if each dollar amount or percentage calculation is based on material, labor or both.

Based on both material and labor.

Reasoning for environmental consideration Containment of ash and sluice water to protect ground and surface waters.

Job Engineer RB Anderson

PROJECT DESIGN GUIDE

LOCATION: SHERBURNE COUNTY GENERATING PLANT

TITLE OF PROJECT: Bottom Ash Pond Revision

PROJECT NUMBER: E-82EA01

I. PROJECT SCOPE

The objective of this project is to increase the storage capacity of the existing bottom ash pond. The low portion of the containment dike will be constructed to full height as planned in the original pond development sequence. The construction will provide total bottom ash holding capacity of 600 acre feet. The additional holding capacity is required by late 1982, based on current operating conditions.

II. SPECIFIC DESIGN FEATURES

The low portion of the dike will be raised 25 feet to match the remainder of the containment dikes. Onsite soils will be used for the embankment construction. Basic design features will match the existing pond. A 10 foot thick central clay core will be constructed to contain ash sluice water. No slope protection will be provided under this project since plans call for stacking bottom ash on embankment slopes.

An aggregate surfaced [illegible] will be constructed on top of the raised dike. A new pond access road from the bottom to the top of the dike will also be constructed to replace the current access road.

The present bottom ash and fly ash sluice pipelines are located in the construction areas. Prior to the start of earthwork, bypass pipelines will be furnished and installed and the present pipelines removed. After construction the existing pipelines will be reinstalled.

This project has been studied and documented in the report entitled "Scrubber Solids Pond Expansion".

CONTINUATION OF OPERATING ESTIMATE
NSP FIELD LABOR
INDIRECTS ON NSP FIELD LABOR
ESCALATION
TOTAL

NSP FIELD LABOR	$ 1500
INDIRECTS ON NSP FIELD LABOR	$ 200
ESCALATION	$ 12000
TOTAL	$ 168000

PROJECT ASSIGNMENT

		APPROVED	DATE
SPONSOR	A. E. JOHNSON	[illegible]	[illegible]
JOB-CIVIL ENGINEERING	R.E. ANDERSON	[illegible]	10-28-81
JOB-ENVIRONMENTAL	D.L. STEPHENSON	JSW for DLS	10-28-81
COST/SCHEDULING ENGR.	R.N. GEHR	[illegible]	10-26-81
MANAGER - PROJECTS	R.A. HOLMBERG	[illegible]	[illegible]
ASST SUPT DOC & PROC	J. O. BEHLING	[illegible]	[illegible]
PREPARED BY	BUDGET SERVICES		

REVIEWED AND APPROVED

JOB CLASSIFICATION ______

[signature] DEPARTMENT MANAGER 11/5/81

DETAILED INSTALLATION ESTIMATE

BOILER PLANT EQUIPMENT

CODE	QUANTITY	DESCRIPTION	MAT'L	LABOR
	600000CY	EMBANKMENT	0	150000
	75000CY	CLAY SEAL	1000	77000
	1900FT	ROADWAY	6000	3000
	1LT	MISC. CULVERTS	7000	3000
	1LT	CONTINGENCIES	2000	25000
	1LT	NSP FIELD LABOR	0	12000
		PURCH. AND PERS. CHARGES	1000	
		SALES TAX	1000	
		SHIPPING COSTS	1000	
TOTAL BOILER PLANT EQUIPMENT			$ 19000	$ 266000

DETAILED REMOVAL ESTIMATE

NONE

DETAILED MAINTENANCE ESTIMATE

NONE

DETAILED OPERATING ESTIMATE

PIPING REMOVE-EXISTING SLUDGE PIPING-SCRUBBER & BOTTOM ASH LINES, LABOR	$ 55000
PIPING BYPASS-SCRUBBER & BOTTOM ASH LINES - $17000 LABOR & $50000 MATERIAL	$ 65000
CONTINGENCIES	$ 14000

NORTHERN STATES POWER COMPANY
SHERBURNE COUNTY GENERATING PLANT

SCRUBBER SOLIDS POND EXPANSION

PROJECT 9701
SPECIAL REPORT

Black & Veatch
Consulting-Engineers

NORTHERN STATES POWER COMPANY
SHERBURNE COUNTY GENERATING PLANT

SCRUBBER SOLIDS POND EXPANSION

PROJECT 9701
SPECIAL REPORT

ISSUE DATE AND REVISION NO.
100981-1

Black & Veatch
Consulting-Engineers

I hereby certify that this report was prepared by me or under my direct supervision and that I am a duly Registered Professional Engineer under the laws of the State of Minnesota.

Carl Gunn

Date August 11, 1989 Reg. No. 10909

TABLE OF CONTENTS

LIST OF TABLES

TABLE OF CONTENTS (Continued)

LIST OF FIGURES

1.0 INTRODUCTION

The Northern States Power Company has contracted Black & Veatch to investigate the addition of a new scrubber solids pond for Sherburne County Units 1 and 2. The following topics are considered in this analysis.

(1) Pond sealing criteria.

(2) Dike slope protection criteria.

(3) The effect of increased sulfur removal on pond chemistry and on the quantities of scrubber solids to be ponded.

(4) The most advantageous method of returning Scrubber Solids Pond overflow to the system.

(5) Budget cost estimates for the scrubber solids pond expansion and completing the bottom ash pond.

E-2305

2.0 SUMMARY

2.1 SUMMARY OF IMPORTANT INFORMATION

2.1.1 Pond Sealing

Current Federal regulations specifically exempt wastes generated by the burning of coal from being hazardous wastes. This exemption could change.

The controlling requirements for design of the pond seal are the Minnesota statutes and regulations, federal Environmental Protection Agency sanitary landfill regulations, and any additional forthcoming applicable guidelines.

2.1.2 Pond Dike Slope Protection

For the budget estimate, the dike slopes were assumed to be covered halfway with riprap and bedding for wave protection. Bottom ash may be used for this application if it continues to be effective. Concrete troughs will be installed to control erosion from sluice pipeline breaks on dikes with slope seals. The sloped clay seal will be covered with seven feet of soil or bottom ash to protect the clay from tree roots, burrowing animals and earthmoving equipment.

2.1.3 Pond Development and Water Return

A desirable method of reclaiming ponded water would be to pump it directly from the ponds and eliminate the scrubber water return basin. Two methods of direct pumping from the ponds were evaluated. The preferred method to accomplish direct water return from the ponds would be to locate an intake structure in each pond. The intake structure would feed a pump house located outside the ponds by means of pressure pipes passing through the dikes. The pump house would utilize horizontal pumps for water return. In the second method considered, a new pump structure housing vertical pumps could be built in the new Phase I pond. When this pond is full, the dike between the Phase I pond and the Phase II pond could be breeched, allowing water from the Phase II pond to flow to the pump structure. Periodic dredging of the channels between the ponds would be necessary.

The horizontal pump plan will cost approximately $320,000 less than the vertical pump plan, and it will save approximately $75,000 per year in

pump maintenance costs. On an annual basis, the horizontal pump plan will save approximately $117,000 per year based on 1985 initial operation.

2.1.4 Effect of Increased Sulfur Removal on Pond Chemistry

Increasing the SO_2 removal efficiency of the scrubbers will decrease the pond life. Without extensive data on the pond chemistry before and after the increase in SO_2 removal efficiency, it is difficult to accurately predict what effect this change will have.

2.1.5 Budget Cost Estimate

A budget cost estimate was made for a 3,200-acre/feet Scrubber Solids Pond based on the design criteria determined in this study. Design engineering and permit work was assumed to occur in 1982. The pond construction was assumed to occur during the construction seasons of 1983 and 1984. Initial operation of the pond was assumed to be in 1985.

The Bottom Ash Pond was scheduled for completion by October 31, 1982. Design engineering, permit and purchase activities were assumed to start in January 1982. Construction was assumed to occur during the summer and fall of 1982.

2.2 CONCLUSIONS

The pond seal should be designed to meet Federal and Minnesota regulations and guidelines governing ground water protection. Based on the data available, an 18-inch thick natural clay bottom seal was used for the estimate. The slope seal will be 3.5 feet thick, due to constructability considerations. Both the bottom and slope seal should be compacted to have a maximum hydraulic conductivity of 5×10^{-8} cm/sec. The pond depth will be limited to 40 feet.

For budget purposes the new dikes were assumed to be riprapped halfway up the slope with stone similar to that used on the existing pond. For the budget estimate, a trough was included to contain sluice pipeline break flows.

A separate intake structure should be installed in the new pond. The structure will feed a pump house located outside the ponds by means of a pressure pipe. Horizontal pumps should be used.

Increasing the SO_2 removal efficiency of the scrubbers from 65 to 85 per cent will decrease pond life by approximately 10 per cent.

The estimated 1981 direct cost for the Phase I pond is $9,120,000. The estimated 1981 direct cost for completing the Bottom Ash Pond is $451,000.

3.0 ANALYSIS

3.1 OBJECTIVE

The objective of this analysis is to prepare design criteria for an additional scrubber solids pond at the Sherburne County Generating Station.

3.2 REQUIREMENTS

The following requirements shall govern this analysis.

(1) The Scrubber Solids Pond shall have a useable volume of 3,200 acre-feet.

(2) The pond seal shall comply with current federal and state regulations.

(3) Scrubber Solids Pond construction would be accomplished during the construction seasons of 1983 and 1984.

(4) The Bottom Ash Pond shall be completed by October 31, 1982.

3.3 POND SEALING CRITERIA

3.3.1 Federal and State Regulations

Federal statutes and regulations require protection of the environment from solid wastes. Currently, wastes produced or resulting from the combustion of coal (fly ash, bottom ash and scrubber sludge) are considered non-hazardous by the Environmental Protection Agency. However, the EPA is studying the environmental impacts of current disposal practices for these wastes and has until the fall of 1982 to report its findings to Congress. The final report to Congress will likely not be available until 1983. The Environmental Protection Agency has issued proposed guidelines for the disposal of non-hazardous solid waste (44FR18138 et seq.) and promulgated criteria for solid waste disposal facilities (45FR53438 et seq.).

3.3.2 Sherburne Geohydrology

The report titled "Ground Water Investigation, NSP Sherco Power Plant" by Barr Engineering Company, November 1977 provides a general description of the ground water conditions beneath the site of the new scrubber solids pond. An unconfined ground water aquifer exists beneath the site. The ground water flows to the south towards the Mississippi River. The ground water is suitable as a potable water source and the aquifer is recharged from infiltration of precipitation.

3.3.3 Existing Pond

The existing scrubber solids pond is lined with 1.5 feet of clay and has been in use since January 1976. Figure 3-1 shows the dike cross section of the existing pond. Based on data reported by Barr Engineering Company, April 1979, in "NSP Sherburne Power Plant: Ground Water Monitoring Report," the hydraulic conductivity (k) of the liner was estimated to be 3×10^{-8} cm/sec with a range of 1.5×10^{-8} cm/sec to 6×10^{-8} cm/sec. Under an average head of 30 feet, these hydraulic conductivities translate into a seepage rate of approximately 36,000 gallons/day from the existing pond. When the head on the pond is increased to 50 feet, the resulting estimated seepage will be approximately 62,000 gallons/ day.

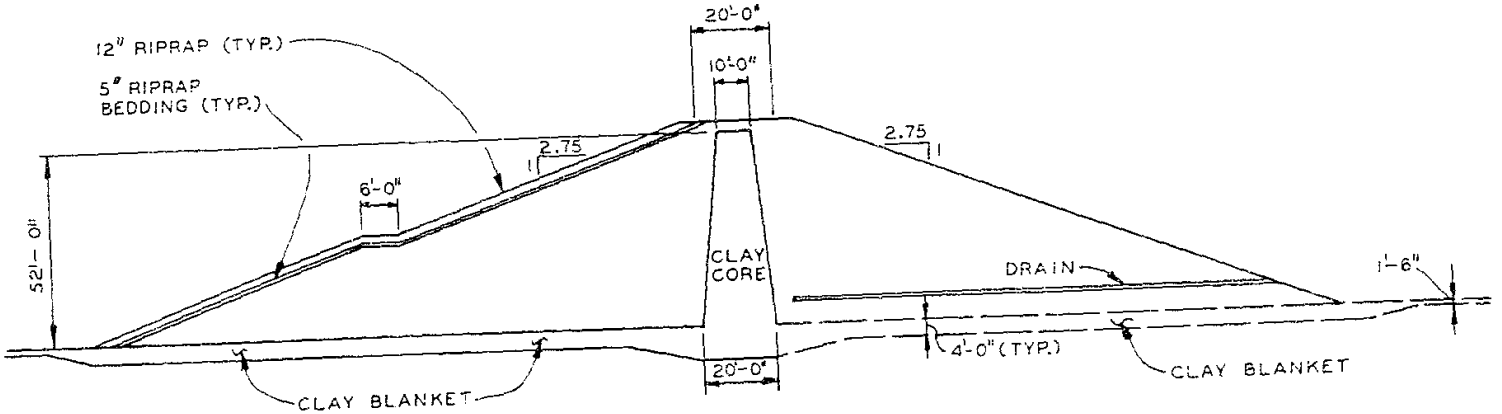
Data in the Barr Engineering Report provides chemical analyses of ground water samples from piezometers around the existing pond. The current ground water monitoring program and a new program by A. D. Little Inc. for the EPA will provide additional data to evaluate the effect of the seepage on the ground water.

3.3.4 Pond Liner Design

Based on existing liner performance and existing Federal and state regulations, an 18-inch clay bottom liner and 3-1/2 foot sloping clay liner should be adequate and was used as an estimate basis.

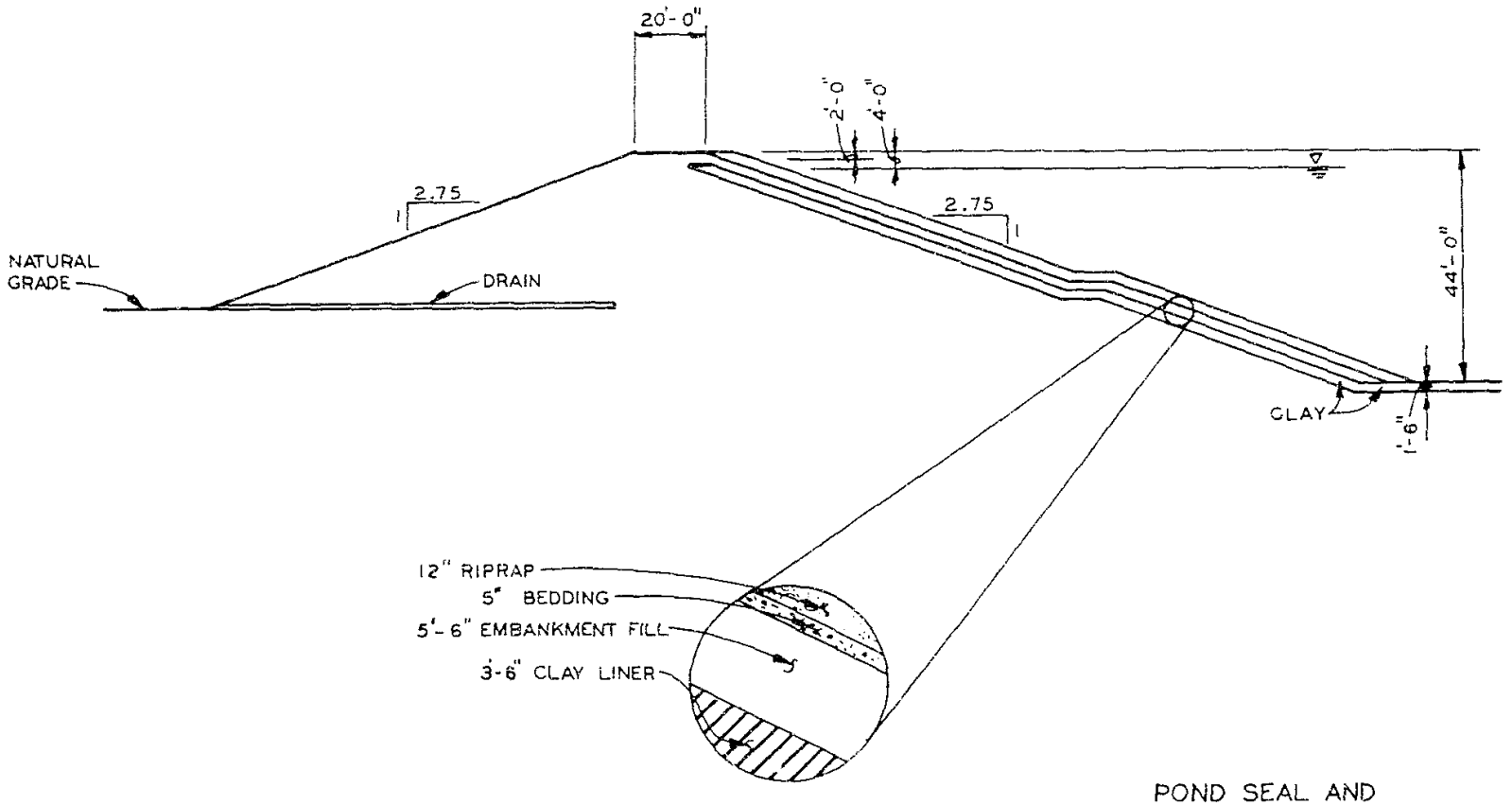
The ground water flows toward the river at the plant and no offsite ground water users have been affected by the existing pond. It also does not appear that future seepage from either the existing Fly Ash Pond or new Phase I Scrubber Solids Pond will affect offsite ground water users (Investigation of Alternate Ash Basin Seepage Control Systems, Barr Engineering Co.).

Based on economics and environmental considerations, the maximum pond depth for the new pond will be reduced to 40 feet from 50 feet as determined in "Pond Management and Wastewater" System Analysis, February 27, 1980. It is estimated that the maximum seepage rate for the 95-acre pond will be about 67,000 gallons/day. Figure 3-2 shows the proposed dike cross section used for the estimate.



EXISTING POND SEAL AND SLOPE PROTECTION DETAIL

FIGURE 3-1



POND SEAL AND
SLOPE PROTECTION DETAIL
FIGURE 3 - 2

3.4 POND DIKE SLOPE PROTECTION

Pond dike slope protection is necessary to prevent erosion of the dike and the pond dike seal due to wave action from water in the pond. Protection is also needed from heavy equipment, tree roots, burrowing animals, and sluice pipeline ruptures.

Alternative methods of pond slope wave protection have been investigated in two previous reports: "Slope Protection of Ash Basins," June 1977 by Black & Veatch; and "Investigation of Existing Fly Ash Basin Slope Wave Protection Alternatives," April 1981 by Barr Engineering. These reports each identified riprap as the most economical and durable of the conventional alternative slope wave protection methods. Bottom ash has been proposed for use as a riprap bedding material in place of the bedding used for the existing ponds. With a minor amount of screening, bottom ash is a suitable bedding material. The best way to determine the most economical bedding material would be to permit the bidders to use screened bottom ash bedding or bedding prepared offsite.

The Barr Engineering report also investigated bottom ash-asphalt and fly ash-bottom ash-cement mixes which could be used instead of the conventional riprap. Barr recommended that if mix designs and rapid drawdown analyses confirm their estimates, the two mixes and conventional riprap could all be bid to determine the least expensive method of slope wave protection.

A fourth method of slope wave protection would be to use bottom ash. In the spring of 1981, NSP covered the upper portion of the existing Fly Ash Pond with 24 inches of bottom ash for slope protection. The existing pond will probably not require standard riprap and bedding slope wave protection for the upper half of the embankments. If pond water area and depth are minimized, bottom ash could provide adequate long term slope wave protection.

Of the four slope wave protection methods considered above, the 24-inch bottom ash method is significantly less expensive than the others. This method also creates additional bottom ash storage capacity in the existing Bottom Ash Pond. If this method continues to perform satisfactorily, it

should be used for future ponds. It is recommended that the bottom few feet of the slopes be protected with conventional riprap and bedding since the water surface and depth will permit large waves during initial pond filling.

If bottom ash does not prove to be satisfactory for long term slope wave protection, then one of the other three methods should be used. If the mix designs and rapid drain down analyses confirm that the mixes are competitive, the two mixes and conventional riprap should be competitively bid. These three methods would be installed halfway up the slopes during initial pond construction.

Pond dikes which are sealed with a slope seal require more protection than ponds which are sealed with a core seal. The existing scrubber solids pond has core seals in the dikes. A significant amount of erosion would have to occur before the core seal would be damaged. The new scrubber solids pond will have slope seals which can be damaged more easily by pipeline breaks, tree roots, earthmoving equipment, and burrowing animals. The following measures should be employed to protect the sloping clay seal.

(1) To protect sloping clay seals from erosion due to pipe ruptures, the scrubber solids pipeline should lay in a concrete trench which would drain into the pond.

(2) The embankment fill cover thickness should be 7 feet including slope protection material to provide protection from tree roots, burrowing animals, and earthmoving equipment.

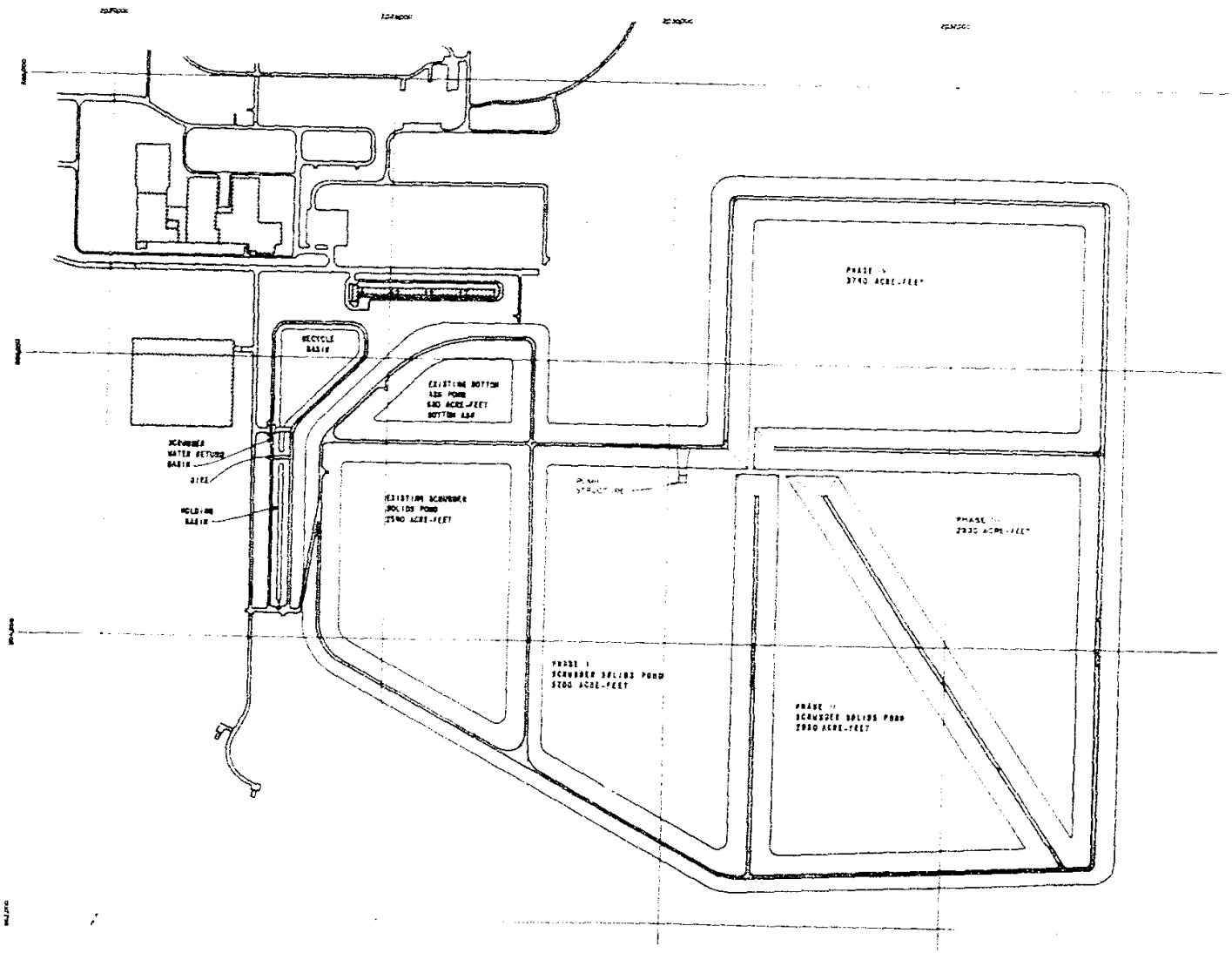
3.5 POND DEVELOPMENT AND WATER RETURN

To determine the most economical method of returning water from the future scrubber solids ponds, it is necessary to create a pond development strategy that will be consistent with the water return method. As determined in "Pond Management and Wastewater Systems Analysis" by Black & Veatch, February 27, 1980, a total storage volume of approximately 15,340 acre/feet will be necessary for the lifetime scrubber solids generation from Units 1, 2, and 3. The pond expansion plan will proceed in the following sequence.

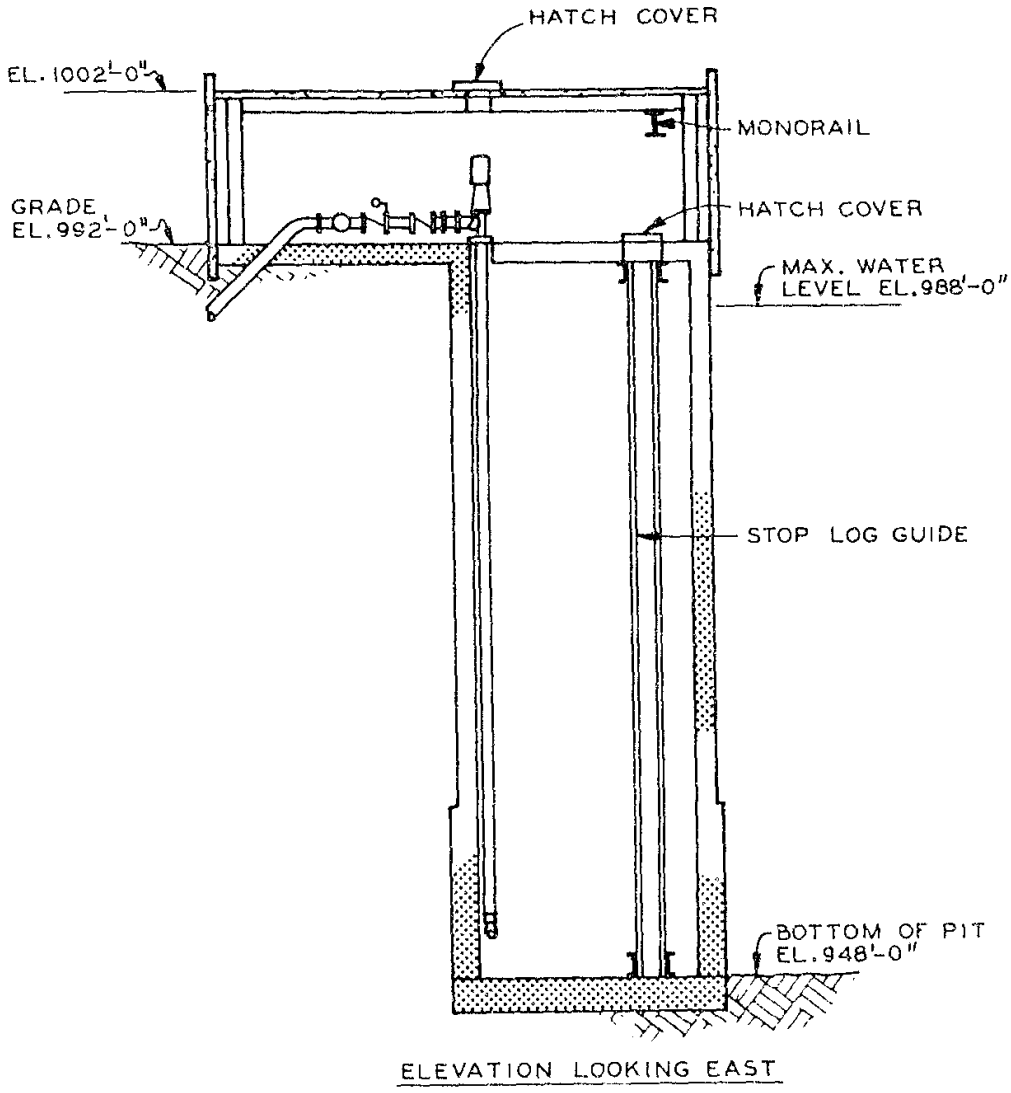
	Acre/Feet
Existing Scrubber Solids Pond	2,540
Phase 1 Future Scrubber Solids Pond	3,200
Phase II Future Scrubber Solids Pond	2,930
Phase III Future Scrubber Solids Pond	2,930
Phase IV Future Scrubber Solids Pond	3,740
Total Useable Storage Volume	15,340

Two methods of returning water from the scrubber solids ponds were considered. These two methods of pond water return will eliminate the use of the scrubber water return basin and provide for direct pumping of return water from the pond to the plant. One method would be to construct a pump structure similar to the existing one on the north embankment of the Phase I pond. The pump structure would be designed to house three vertical pumps. Two 100 per cent capacity pumps would be installed for Units 1 and 2. A third pump would be installed prior to operation of Unit 3 which would provide a minimum redundancy of 50 per cent for 3 units at full load. Figures 3-3 and 3-4 present the pond layout and pump structure for this method of water return. When the Phase I pond is full and the Phase II pond construction is finished, a section of the dike between the two ponds will be removed to allow decant water to flow to the pump structure. This procedure will also be used for the Phase III and Phase IV ponds. Periodic dredging around the pump structure may be necessary. The pond will have to be filled 6 feet above the bottom before the return water pumps can be used.

The other method of returning water from the future ponds would be to install an intake structure in each pond which would feed to a central pump house located outside of the ponds. The pump house would be designed to house three horizontal pumps. Two 100 per cent capacity pumps would be installed with Units 1 and 2. A third pump would be installed prior to operation of Unit 3 which would provide a minimum redundancy of 50 per cent for three units at full load. Figures 3-5 and 3-6 present the pump structure and pond layout for this method of water return. A pressure pipeline passing through the pond dike will supply return water to the pumps. The

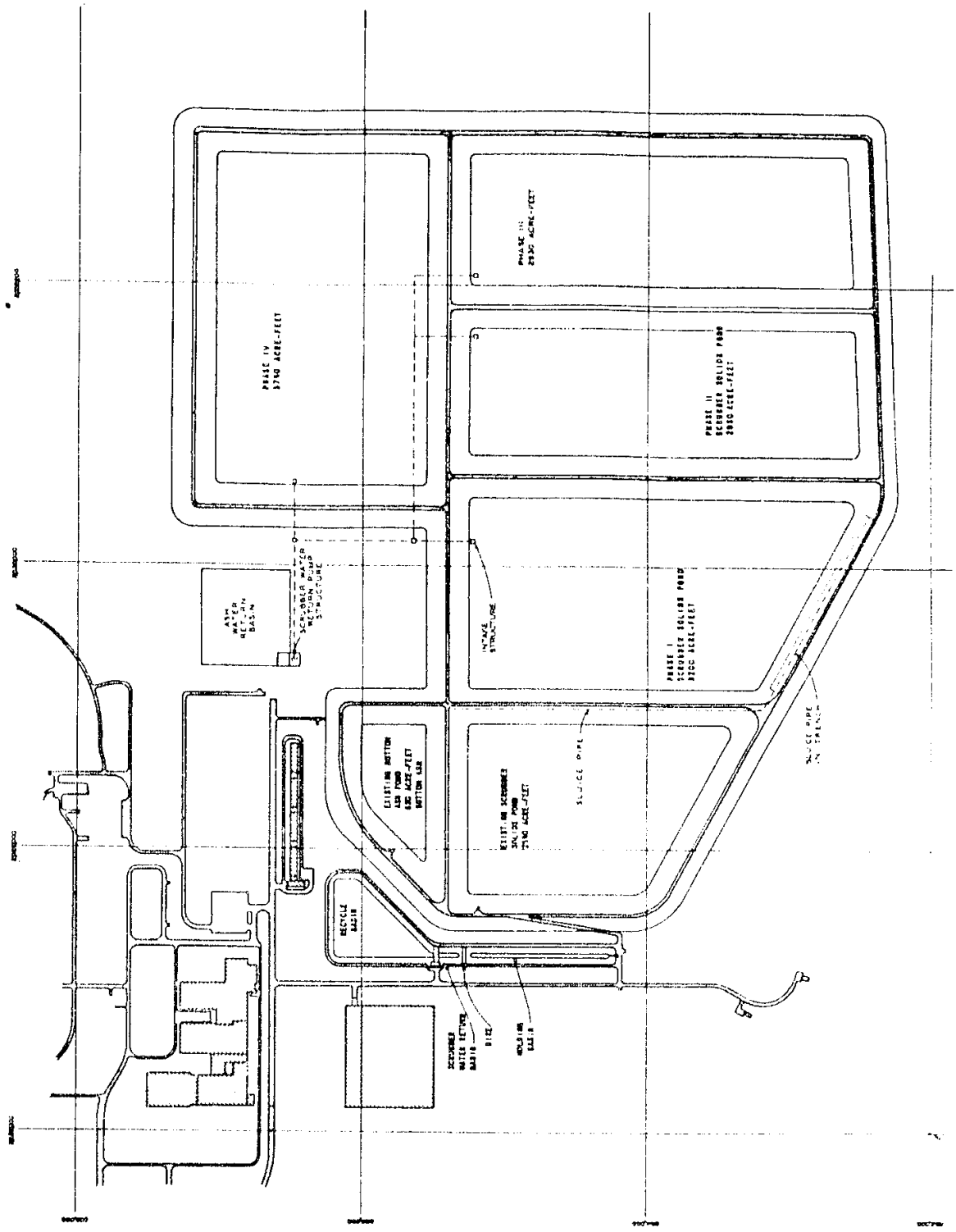


POND ARRANGEMENT FOR
[illegible]

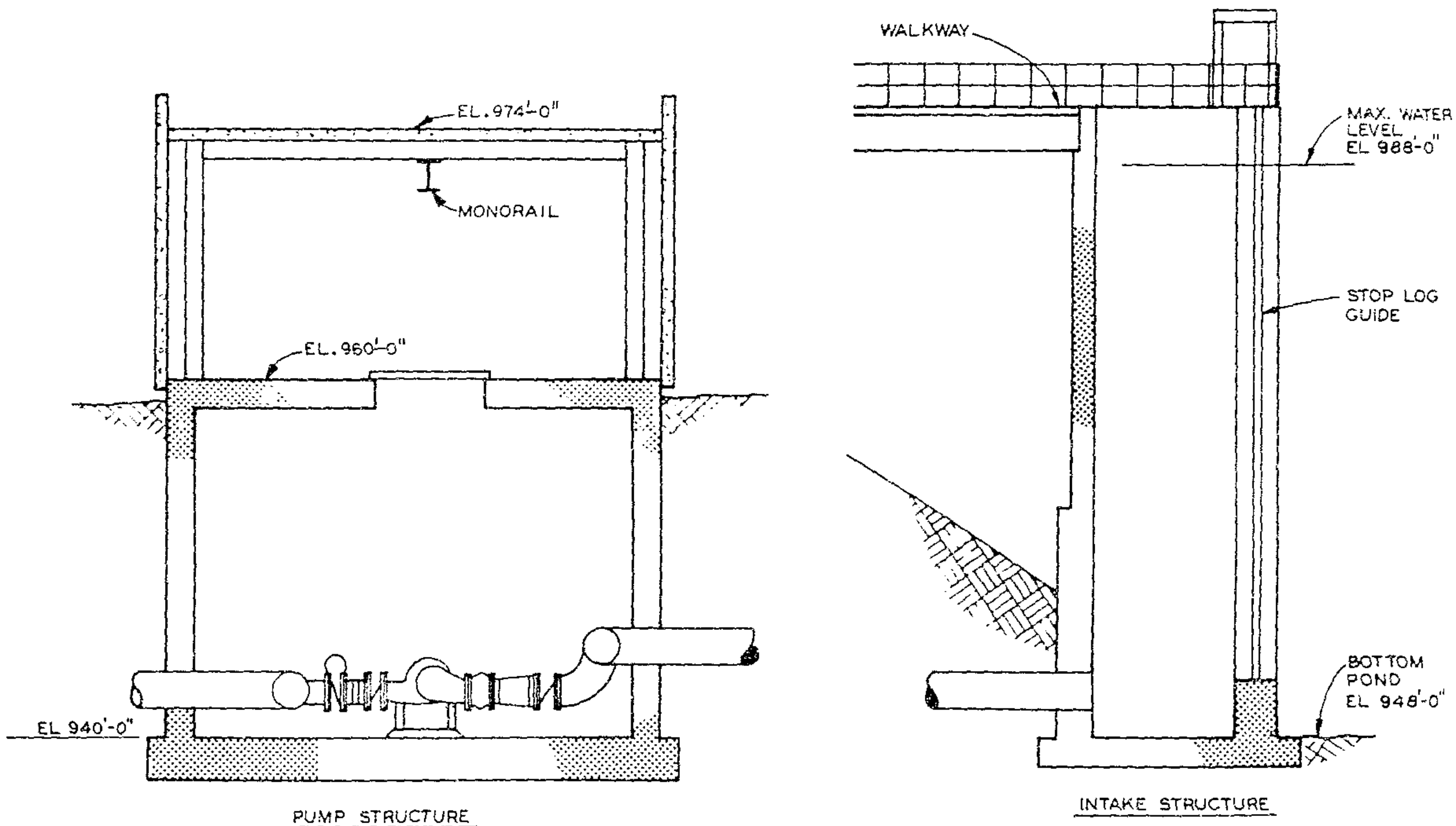


SCRUBBER SOLIDS POND WATER
RETURN PUMP STRUCTURE
(VERTICAL PUMP ARRANGEMENT)

FIGURE 3-4



POND ARRANGEMENT FOR HORIZONTAL PUMP STRUCTURE
FIGURE 3-5



SCRUBBER SOLIDS POND WATER
INTAKE AND RETURN PUMP STRUCTURE
(HORIZONTAL PUMP ARRANGEMENT)

FIGURE 3-6

pond will have to be filled 6 feet above the bottom before the return water pumps can be used.

Table 3-1 presents the capital and annual costs for these two return water methods. The method using a single intake structure in each pond has a lower capital cost, and the horizontal pumps require less frequent maintenance than do the vertical pumps. The differential maintenance cost for vertical pumps over horizontal pumps was obtained from the March 12, 1980 NSP letter comments on the Pond Management and Wastewater Systems Analysis, File A-20C.5800. It was assumed that one of the two pumps installed for Units 1 and 2 would run continuously. The pump installed with Unit 3 would run 75 per cent of the time. The single pumphouse plan with horizontal pumps is recommended for use at the Sherburne County Generating Station.

3.6 SCRUBBER MAKEUP

Makeup water for the scrubber systems will be supplied primarily from cooling tower blowdown. A simplified flow diagram of the scrubber makeup piping is shown on Figure 3-7.

A 24-inch makeup header will be connected to the existing Units 1 and 2 cooling tower blowdown line to convey blowdown water to the suction of the Scrubber Water Return Pumps. The makeup header will include provisions for future connection of blowdown piping from Unit 3 and makeup piping for the future Ash Water Return Basin. The header will also be cross-tied with the existing River Water System to facilitate initial filling of the Scrubber Solids Pond and to supplement the cooling tower blowdown flow, if necessary. The valves for the crossties between the makeup header and the river water and blowdown lines will be located in a valve pit northwest of the Recycle Basin.

The cooling tower blowdown rate under maximum conditions from all three units will be about 5,000 gpm. The makeup header will be sized so the circulating water pumps can convey the 5,000 gpm cooling tower blowdown flow to the scrubber water return pump suction header against the head of the maximum pond level.

If the scrubber solids pond intake structure is out of service, the makeup header must supply the 7,000 gpm estimated three-unit makeup requirements. Under this condition, the static head is reduced and the cooling

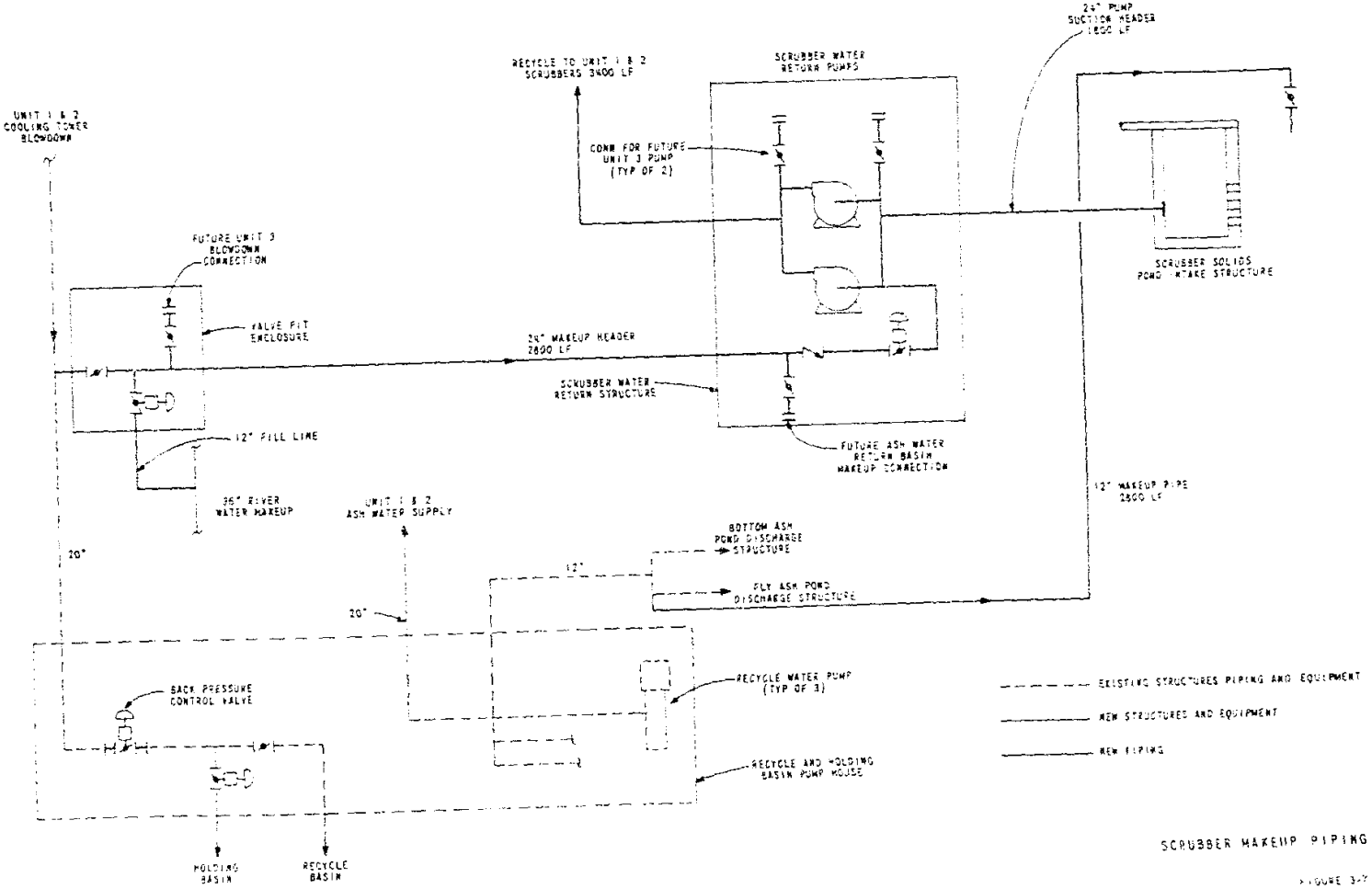
TABLE 3-1. CAPITAL AND ANNUAL COSTS FOR POND WATER RECYCLE PUMPING

1985 INITIAL OPERATION

	One Pump Structure With Vertical Pumps With Dike Cutting $	One Pump House With Horizontal Pumps, One Intake Structure In All Ponds $
Capital Costs		
Pump Houses and Pump Structures	245,000	320,000
Intake Structures*	--	140,000
Makeup Piping	270,000	Base
Pumps, Piping, and Valves**	135,000	150,000
Dike Removal*	150,000	--
Total 1981 Direct Capital Costs	800,000	610,000
Escalation to 1984	265,000	200,000
Indirect Capital Costs at 25 Per Cent	265,000	200,000
Total Comparative Capital Costs for 1985 Operation	1,330,000	1,010,000
Differential Comparative Capital Costs	320,000	Base
Annual Costs		
Differential Levelized Annual Pump Maintenance Cost	75,000	Base
Fixed Charges	173,000	131,000
Total Levelized Annual Costs	248,000	131,000
Differential Levelized Annual Costs	117,000	Base

*For all four pond expansions.

**Includes Unit 3 pumps and piping.



SCRUBBER MAKEUP PIPING

FIGURE 3-7

tower makeup and blowdown can be increased to provide 7,000 gpm. It would also be possible to supplement the normal cooling tower blowdown directly with river water.

A back pressure control valve will be installed in the existing blowdown piping in the Recycle and Holding Basin Pump House to maintain pressure in the makeup header sufficient to overcome piping losses and pond static head. Control valves in the river water crosstie and at the suction of the Scrubber Water Return Pumps will be provided for flow regulation.

In addition to the makeup header, the existing 12-inch deicing pipeline will be extended to transfer water from the Recycle Basin to the Scrubber Solids Pond.

The existing scrubber makeup water pumps in the Recycle and Holding Basins Pumphouse will be left in place and used as backups for the recycle water pumps.

3.7 EFFECT OF INCREASED SULFUR REMOVAL ON POND CHEMISTRY AND SLUDGE PRODUCTION

The increased sulfur dioxide removal efficiency of Units 1 and 2 scrubbers has increased the amount of solids blowdown from the scrubber modules. Correspondingly, this has increased the solids loading to the thickener and decreased pond life. The increase in sulfur dioxide removal efficiency from 65 to 85 per cent has caused the scrubber to blow down approximately 10 per cent more solids. This increase in solids loading should not have significantly affected the effectiveness of the thickener, but it will reduce the pond life by approximately 10 per cent.

It is believed that the pond chemistry will not be appreciably affected by the increased sulfur dioxide removal efficiency. Continued monitoring of the pond chemistry will determine the effect of the increased SO_2 removal efficiency on the pond chemistry.

3.8 PHASE 1 POND EXPANSION COST ESTIMATE

Table 3-2 presents the 1981 direct capital costs that were estimated for a 3,200 acre-feet scrubber solids pond based on the sloping clay seal, pond, and pump layouts presented in Figures 3-2, 3-5 and 3-6. For comparison purposes, Table 3-3 presents the 1981 direct capital costs estimated for a 3,200 acre-feet scrubber solids pond based on the central core clay seal,

TABLE 3-2. PHASE I SCRUBBER SOLIDS POND EXPANSION DIRECT COSTS--SLOPING SEAL

	Cost $
Embankment 1,146,000 cu yd at $2.32/cu yd	2,660,000
Seal 283,000 cu yd at $7.55/cu yd	2,140,000
Clay Material Cost 283,000 cu yd x 1.2 at $.12/cu yd	40,000
Slope Protection	
12" Riprap and 5" Bedding 62,000 sq yd at $4.87/sq yd	300,000
Site Preparation 100 Acres at $1,900/acre	190,000
Roadway 6,400 linear ft at $3.05/linear ft	20,000
Concrete Pipe Trench 1,700 linear ft at $50/linear ft	90,000
Makeup Piping 5,700 linear ft at $137/linear ft	780,000
Recycle Piping 5,600 linear ft at $114/linear ft	640,000
Service Water and Compressed Air 2,600 linear ft at $40/linear ft	100,000
Horizontal Pump House 1 each at $210,000	300,000
Pump House Excavation and Backfill	20,000
Intake Structure	90,000
Slurry Piping 4,400 linear ft at $25/linear ft	110,000
Pumps, Piping, and Valves	120,000
Electrical	300,000
Subtotal	7,900,000
10 Per Cent Contingency	790,000
Engineering Fee	430,000
Total 1981 Direct Capital Costs	9,120,000
Increased Costs for 36-inch Seal	
Extra 18" of clay liner 181,000 cu yd at $7.55/cu yd	1,370,000
Clay Material Cost 181,000 cu yd x 1.2 at $.12/cu yd	30,000
Total Increased Liner Cost	1,400,000
Optional Costs	
12" riprap 62,000 sq yd at $3.57/sq yd	220,000
6" bedding of bottom ash 10,330 cu yd at $2.32/cu yd	24,000
Total Optional Slope Protection Cost	244,000

TABLE 3-3. PHASE I SCRUBBER SOLIDS POND EXPANSION DIRECT COSTS--CORE SEAL

	Costs $
Embankment 1,221,000 cu yd at $2.32/cu yd	2,830,000
Seal 560,000 cu yd at $7.55/cu yd	4,230,000
Clay Material Cost 560,000 cu yd x 1.2 at $.12/cu yd	80,000
Slope Protection-Halfway	
12" Riprap and 5" Bedding 62,000 sq yd at $4.87/sq yd	300,000
Site Preparation 100 Acres at $1,900/acre	190,000
Roadway 6,400 linear ft at $3.05/linear ft	20,000
Makeup Piping 5,700 linear ft at $137/linear ft	780,000
Recycle Piping 5,600 linear ft at $114/linear ft	640,000
Service Water and Compressed Air 2,600 linear ft at $40/linear ft	100,000
Horizontal Pump House 1 each at $210,000	300,000
Pump House Excavation and Backfill	20,000
Intake Structure	90,000
Slurry Piping 4,400 linear ft at $25/linear ft	110,000
Pumps, Piping, and Valves	120,000
Electrical	300,000
Subtotal	10,110,000
10 Per Cent Contingency	1,010,000
Engineering Fee	550,000
Total 1981 Direct Capital Costs	11,670,000
Increased Costs for 36-inch Seal	
Extra 18" of clay liner 181,000 cu yd at $7.55/cu yd	1,370,000
Clay Material Cost 181,000 cu yd at $.12/cu yd	30,000
Total Increased Liner Cost	1,400,000
Optional Costs	
12" riprap 62,000 sq yd at $3.57/sq yd	221,000
6" bedding of bottom ash 10,300 cu yd at $2.32/cu yd	24,000
Total Optional Slope Protection Cost	245,000

pond, and pump layouts presented in Figures 3-1, 3-5, and 3-6. The economic criteria used in this analysis are presented in Appendix 3A. The breakdown of the capital costs are as follows.

3.8.1 Embankment

The embankment will consist of material excavated from the pond area, placed in an embankment, and compacted. Also included in the embankment is an 18-inch thick horizontal drain consisting of crushed rock or gravel. The embankment will provide for a 40 feet deep pond and four feet of freeboard height for a total of 44 feet from pond bottom to top of embankment.

3.8.2 Seal

The seal consists of natural clay excavated from a borrow area offsite, hauled to the embankment, placed, and compacted. The clay will be 18 inches thick on the pond bottom and 3-1/2 feet thick on the dike slopes for the sloping seal. The bottom seal will be 18 inches thick and 4 feet thick under the dike with a 15 to 20 foot thick core for the core seal.

3.8.3 Slope Protection

The slope protection used as a basis for the estimate consists of a 12-inch layer of riprap and a 5-inch bedding layer. The slope protection extends halfway up all around for the core seal and sloping seal estimates.

3.8.4 Site Preparation

Site preparation consists of clearing and grubbing 100 acres to prepare the pond area for excavation and embankment construction.

3.8.5 Roadway

The roadway consists of a 20-foot wide gravel road along the top of the dikes for 6,400 lineal feet.

3.8.6 Concrete Pipe Trench

The concrete pipe trench for the sloping seal estimate consists of 8-foot wide precast concrete channels with 12-inch pipe downcomers to the pond.

3.8.7 Makeup Piping

The makeup piping consists of the 24-inch makeup header, 12-inch makeup pipe, and miscellaneous pipe and valves as indicated on Figure 3-7.

3.8.8 Recycle Piping

The recycle piping consists of the 24-inch pump suction header and the 12-inch recycle pipe to Units 1 and 2 as indicated on Figure 3-7.

3.8.9 Service Water and Compressed Air

The service water and compressed air piping consists of piping and valves from the Unit 1 Cooling Tower Pump House to the new Scrubber Water Return Pump Structure.

3.8.10 Horizontal Pump House

The horizontal pump house consists of reinforced and precast concrete, structural steel, and architectural materials.

3.8.11 Pump House Excavation and Backfill

Pump house excavation and backfill is the structure excavation and backfill necessary to construct the below grade portions of the Scrubber Return Water Pump Structure.

2.8.12 Intake Structure

The intake structure consists of the reinforced concrete tower, stop logs, the walkway to the tower, and the pipeline below the dike for the Phase I pond.

3.8.13 Slurry Piping

The slurry piping consists of the Transol II piping and costs to upgrade the existing slurry pumps.

3.8.14 Pumps, Piping, and Valves

Pumps, piping, and valves consist of two new 3,500 gpm horizontal pumps and the piping and valves in the Scrubber Water Return Pump Structure.

3.8.15 Electrical

The electrical costs include wiring from the existing Unit 1 Cooling Tower Pump House to a new secondary unit substation located at the new pump house. Also included is control wiring from the main control room to the new pump house.

3.8.16 Increased Costs of 36 Inch Bottom Liner

The increased cost for increasing the bottom seal to 36 inches from 18 inches is provided.

3.8.17 Optional Costs

The optional slope protection cost using bottom ash for riprap bedding is provided to indicate the maximum potential savings using bottom ash instead of conventional bedding.

3.9 BOTTOM ASH POND

The existing Bottom Ash Pond at the Sherburne County Generating Plant was constructed with the northeast corner lower than the rest of the enclosure dikes. To fully utilize the potential 600 acre-feet holding volume of the pond, the lowered portion of the dike should be completed by October 31, 1982 when the present capacity will be filled.

3.9.1 Bottom Ash Utilization

NSP estimates that there are about 470,000 cubic yards (290 acre-feet) of bottom ash currently in the pond. Using bottom ash production rates given in Table B-5 of the "Pond Management and Wastewater" Systems Analysis--Revision 1, the Bottom Ash Pond should be full by the end of 1985. Since undetermined amounts of bottom ash have been removed from the Bottom Ash Pond, it is not known how closely the estimated amounts of bottom ash production compare to the actual amounts.

By the end of 1985 it will be necessary to either construct a new bottom ash pond or start removing the accumulated bottom ash from the existing pond. It will be necessary to cover the scrubber solids ponds after they fill to minimize future leachate production due to precipitation. A 3-foot minimum thickness of granular fill was also recommended in the "Evaluation of Scrubber Sludge" by Twin City Testing, Inc. The cover should also be sloped to reduce infiltration of precipitation. A minimum of 480 acre-feet of bottom ash could be used for covering the present Fly Ash Pond after it fills. It is also possible to use up to 90 acre-feet of bottom ash for the 5-1/2 foot clay cover when constructing the new Phase I Scrubber Solids Pond. Compaction and shear strength tests will be required to determine the engineering properties of the bottom ash.

It should not be necessary to construct new bottom ash storage ponds in the future, since bottom ash can be used for pond construction and reclaiming.

3.9.2 Bottom Ash Pond Cost Estimate

Table 3-4 presents the 1981 direct capital costs estimated for completing the Bottom Ash Pond dike.

The embankment consists of onsite soil placed and compacted to form the added dike height and the roadbed for the replacement pond access road.

The 7,500 cubic yard clay core seal will be constructed of natural clay excavated from an offsite borrow area, hauled to the embankment, placed and compacted. The actual clay source has not been determined, but three options are available. The first would be to use a small portion of the 280-acre area currently leased by NSP. Second, it may be possible to obtain clay from the second borrow pit used for the original pond construction. According to the Twin City Testing February 20, 1976 letter, 20,000 cubic yards of clay remain at this site. Third, there may be other clay borrow pits presently in use that could economically provide the relatively small amount of clay required.

The existing scrubber and bottom ash sluice piping passes through the construction area and will have to be removed and then replaced. This involves about 1,900 linear feet of 6-inch pipe and 900 linear feet of 14-inch pipe.

About 2,600 linear feet of 6-inch sluice pipe and 1,700 linear feet of 14-inch sluice pipe will be furnished and installed to bypass the construction area so bottom ash and scrubber sludge sluicing will not be interrupted. The bypass pipe material will be used by plant operations after bottom ash pond construction is completed.

Culverts will be constructed to allow both temporary bypass piping and permanent sluice piping to pass beneath roads.

A total of 1,030 linear feet of aggregate surfaced road will be constructed on top of the completed dike. Another 800 linear feet of aggregate surfaced road will be installed for the pond access road.

Sherco Engineering has placed 15 to 20 feet of bottom ash on the pond slopes for slope protection. They are also modifying and upgrading the bottom ash sluice pumps. Therefore, this report and estimate do not include costs for these items.

TABLE 3-4. BOTTOM ASH POND COMPLETION DIRECT COSTS

Embankment 60,000/cu yd at $2.50/cu yd	150,000
Seal Construction 7,500 cu yd at $10/cu yd	75,000
Clay Material Cost 7,500 cu yd x 1.2 at $.12/cu yd	1,000
Bypass piping 4,300 linear feet at $19.75/linear ft	85,000
Remove and replace existing sluice pipe 2,800 linear ft at $19.60/linear ft	55,000
Culverts 10 each at $1,000 each	10,000
Roadway 1,830 linear ft at $3.80/linear ft	7,000
Subtotal	383,000
10 Per Cent Contingency	38,000
Engineering Fee	30,000
Total 1981 Direct Capital Costs	451,000

3.10 SCHEDULE

Figure 3-8 presents the bar chart construction schedule proposed for completion of the Phase I Scrubber Solids Pond and Bottom Ash Pond. For the 1985 initial Scrubber Solids Pond operation, design engineering and permit activities were assumed to start in 1982. Construction was assumed to occur in 1983 and 1984.

The Bottom Ash Pond was scheduled for completion by October 31, 1982. Design engineering, permit and purchase activities were assumed to start in January 1982. Construction was assumed to occur during the summer and fall of 1982.

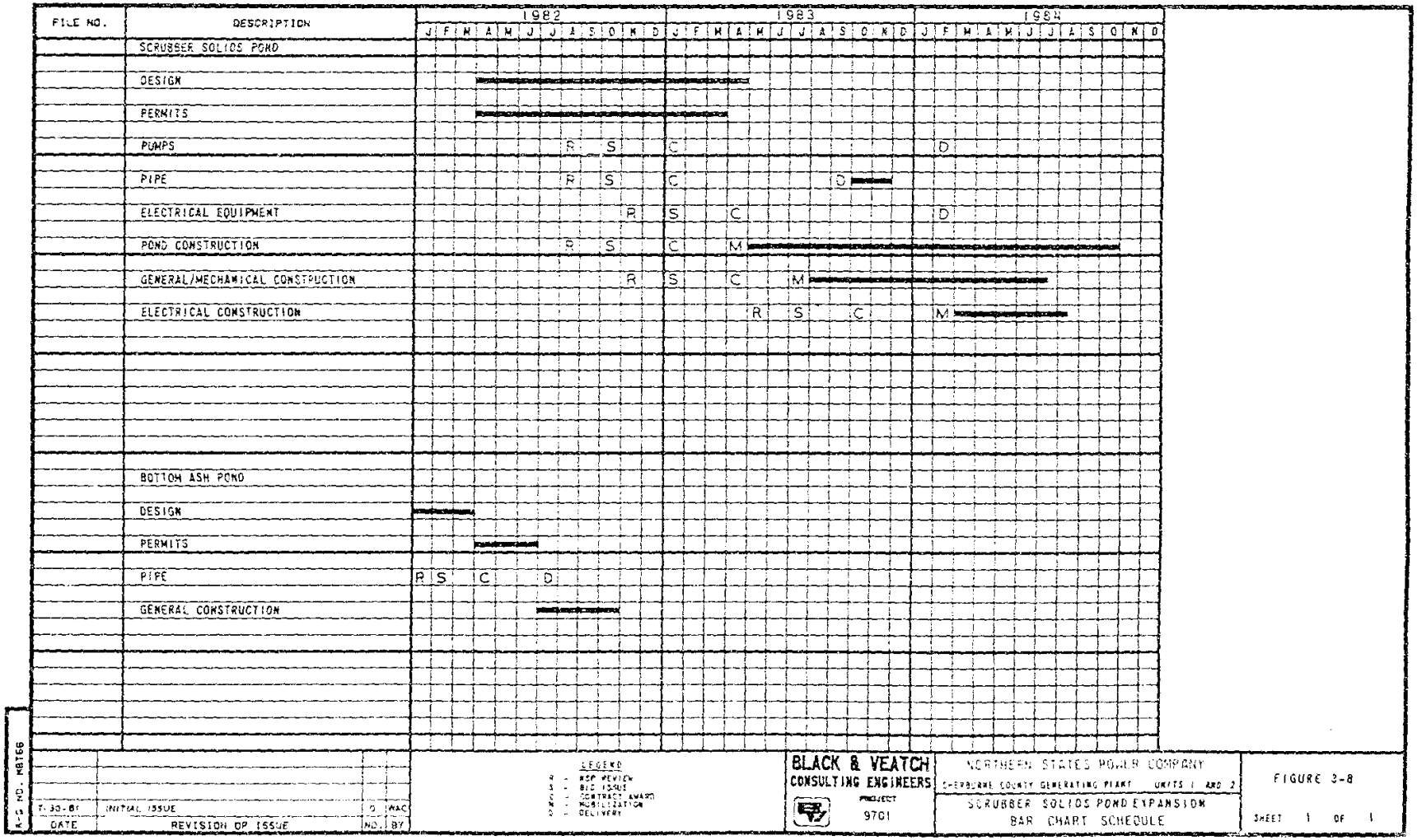
3.11 CONCLUSIONS

The Phase II scrubber solids pond should be constructed with an 18-inch bottom seal and a 3-1/2-foot slope seal. The new pond dikes will be initially riprapped with rock halfway to the top. Sluice piping will be routed in a trough to prevent erosion from pipeline breaks.

Scrubber water will be returned to the plant directly from the Scrubber Solids Pond through the pump house located near the future Ash Water Return Basin. Horizontal pumps will be used. Space will be provided in the pump house for a Unit 3 pump.

The estimated 1981 direct cost for the Phase I Scrubber Solids Pond expansion with 18-inch bottom seal and 42-inch sloped seal is $9,120,000. The 1981 direct cost for the Phase I scrubber solids expansion with a core seal is $11,670,000.

The low portion of the Bottom Ash Pond dike should be raised to provide additional storage volume. The estimated 1981 direct cost to complete the Bottom Ash Pond is $451,000. It should not be necessary to construct a new bottom ash pond.


FILE NO.
DESCRIPTION
1982
1983
1984
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
SCRUBBER SOLIDS POND
DESIGN
PERMITS
PUMPS
PIPE
ELECTRICAL EQUIPMENT
POND CONSTRUCTION
GENERAL/MECHANICAL CONSTRUCTION
ELECTRICAL CONSTRUCTION
BOTTOM ASH POND
DESIGN
PERMITS
PIPE
GENERAL CONSTRUCTION
R S C D M
LEGEND
R - RSP REVIEW
S - BID ISSUE
C - CONTRACT AWARD
M - MOBILIZATION
D - DELIVERY
A-E NO. M8766
T-30-81 INITIAL ISSUE 0 MAC
DATE REVISION OR ISSUE NO. BY
BLACK & VEATCH
CONSULTING ENGINEERS
PROJECT
9701
NORTHERN STATES POWER COMPANY
CHEROKEE COUNTY GENERATING PLANT UNITS 1 AND 2
SCRUBBER SOLIDS POND EXPANSION
BAR CHART SCHEDULE
FIGURE 3-8
SHEET 1 OF 1

APPENDIX 3A
ECONOMIC CRITERIA

APPENDIX 3A
ECONOMIC CRITERIA

The economic criteria used for evaluation in the analysis are listed herein.

(1) Load Model. The load model established for this project is shown on Table 3A-1.

(2) Annual Fixed Charge Rates. The levelized annual fixed charge rates are as follows.

(a) Pollution Control Equipment, 12.99 per cent per year.

(b) Balance-of-plant, 16.74 per cent per year.

(3) Present Worth Discount Rate. The present worth discount rate is 11.25 per cent per year.

(4) Indirect Costs. The indirect cost rate is 25 per cent.

(5) Escalation Factor. The average escalation rate is 10 per cent per year.

(6) Start-up. The new scrubber solids pond is assumed to begin operation in 1985.

(7) Plant Life. The plant life is 25 years.

TABLE 3A-1. LOAD MODEL FOR SHERBURNE COUNTY
UNITS 1 AND 2 ANNUAL OPERATION
MAY 1 TO APRIL 30 YEAR

Per Cent Capacity	Years of Operation				
	1-5	6-10	11-15	16-20	21-35
	Hours of Operation				
100	4,400	4,000	4,000	3,000	2,500
90-99	600	900	1,000	1,300	1,300
80-89	400	400	300	200	200
70-79	200	200	300	200	200
60-69	100	200	200	200	200
50-59	100	200	200	200	200
20-49	700	900	900	700	700
Total Hours On-Line	6,500	6,800	6,900	5,800	5,300
Average Output While On-Line	0.88	0.84	0.83	0.83	0.82
Annual Capacity Factor	0.65	0.65	0.65	0.55	0.50
Average Output While On-Line Over Operating Lifetime				0.834	
Average Annual Capacity Factor Over Operating Lifetime				0.571	

E-82EA01

BA Revision

B400

QA

PRIMARY	SECONDARY	TERTIARY
82EA01	BA REVISION	B400
&		QA
X	CLAY CORE PLACEMENT	
X	EMBANKMENT GRANULAR	
X	SURVEILLANCE RPT SR-544	

82EA01
Bottom Ash Pond
Quality Assurance
Plan

NSP SURVEILLANCE REPORT

1. File No. B400
No. SR- 544
Task No. 286

2. Project Sherco-Bottom Ash Pond Unit 1&2 E. 82EA01 Date
Organization Observed: McCrossan; TCT; NSP PO/SO #
Surveillant(s): J.C. Meier
3. Activities Observed: Clay Core & granular embankment placement.

4. Specific Location: Current Bottom Ash Pond
5. Reference(s): Spec. #10169.71.1000; Dwgs. NF95380A, 79, 78A, 76A & 17A.
6. Person(s) Contacted: Tom Johnson - NSP (operations); Don Young - NSP (PE&C), Dan Larson (TCT); Lloyd Parker and Dennis Rahn (McCrossan)
7. Results *(Use Additional Sheets As Necessary)*: (Site Inspection August 26, 1982)

7.1 Plant operations indicated concerns with the presence of rock in the clay core, and new clay core tie-in with existing clay core. The rock problem was not apparent upon inspection, McCrossan has stated they hand pick large rock when observed. The existing clay core has been prepared per design documents, and the tie of new to old appears to be compliant.

7.2 Twin City Testing (TCT) has one man currently on site to follow soils compaction. Testing equipment is properly calibrated; test records were available; and proctor samples were maintained. No plot plan of soils tests have been prepared todate, but will be provided.

7.3 One field inspector is following the Ash Pond Construction. Approved/released Drawings and specifications are on site. Test records are reviewed daily with TCT.

7.4 McCrossan is using scrapers and sheep foot roller to construct the embankment and dike core. Material placement appears to be in uniform lifts not exceeding specifications. Sand contamination of the core dike appears minimal. Densities are being attained, and with less than the calculated optimum moisture. The tie-in of the and new clay core (dike) appears to be acceptable.

8. Required Actions:
None

(Upon Completion of Required Action, Affected Organization to Signoff Item #10 and Return the Original to the Surveillant.)

9. Distribution:

File (RBA, HKN)
D. Young-Sherco (PE&C)
G.H. Jacobsen-Sherco (Operations) ✓
X Clay core placement +
X embankment ...

ACTION COMPLETE

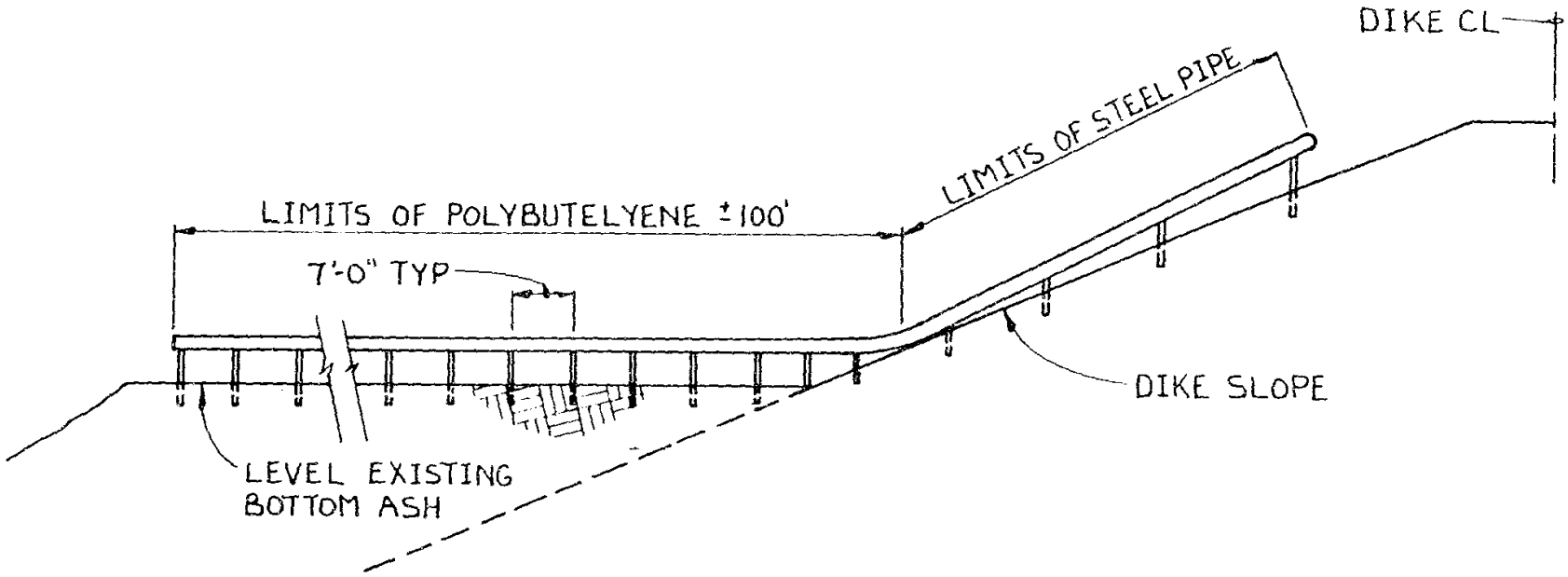
PLANT FILE COPY

10. Affected Organization: ______ Date

11. Surveillant: J.C. Meier 9-1-82 Date

FORM 17-0652

Sheet ____ of ____



NOTES:

1. WITH A TEMPERATURE DIFFERENTIAL OF 200° F THE MOVEMENT OF THE PLASTIC PIPE IS 15"/100'.
2. SUPPORT SHALL BE SET TO LIMIT MAXIMUM TILT TO 7.5" OFF VERTICAL.

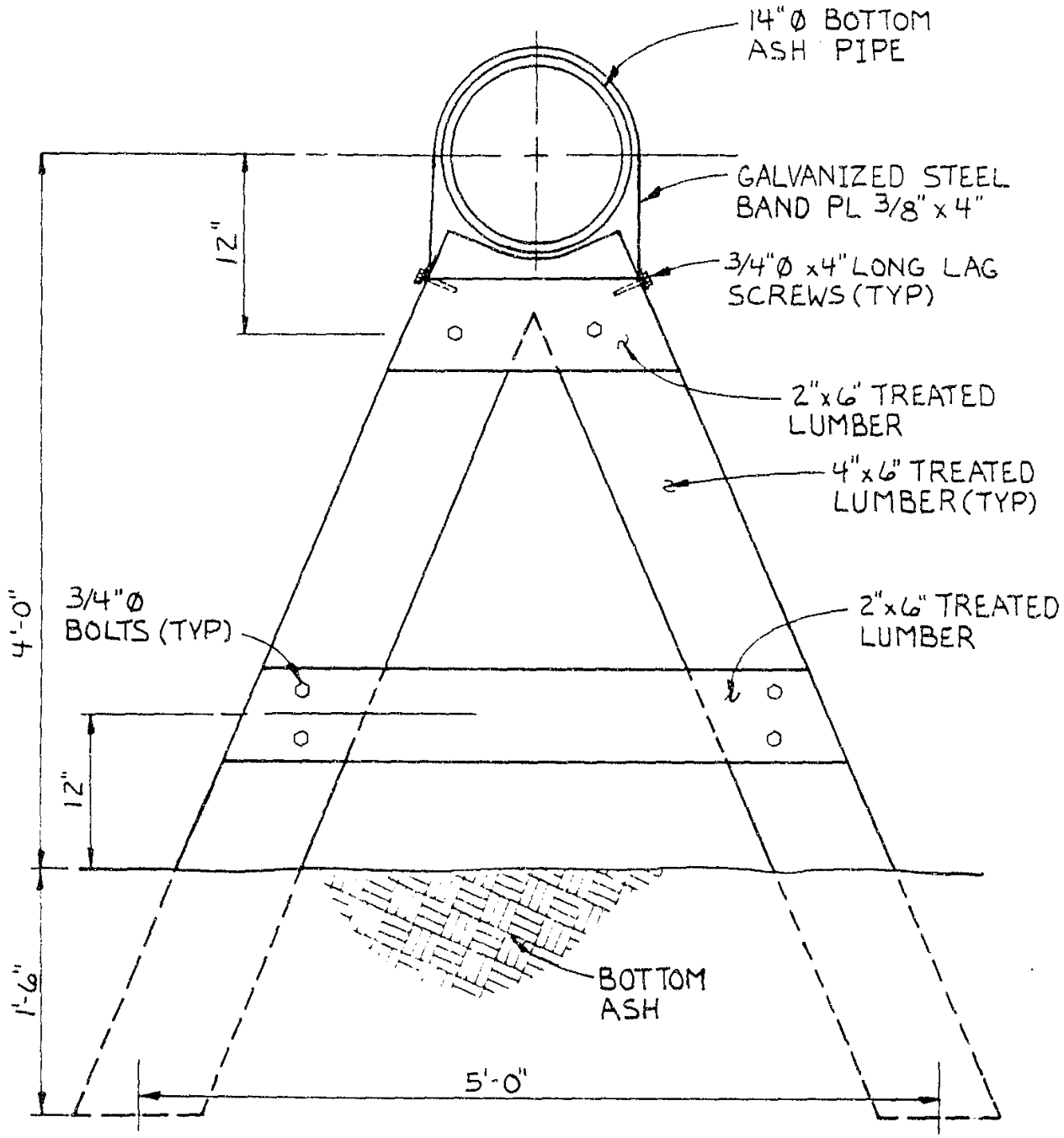
NO.	DATE	REVISION	DWN	CK	ACC	APP

BLACK & VEATCH
CONSULTING ENGINEERS
PROJECT
10169

NORTHERN STATES POWER COMPANY
SHERBURNE COUNTY GENERATING PLANT
UNITS 1 & 2

LAYOUT BOTTOM ASH
POLYBUTELYENE PIPE SUPPORTS

SK-S-070882
-2



TYPICAL ELEVATION
PIPE SUPPORT

BLACK & VEATCH CONSULTING ENGINEERS PROJECT 10169	NORTHERN STATES POWER COMPANY SHERBURNE COUNTY GENERATING PLANT UNITS 1&2	DATE 7-16-82
	BOTTOM ASH POND REVISION	SK-S-070882-1

BLACK & VEATCH
CONSULTING ENGINEERS

TEL. (913) 967-2000
TELEX 42-6263

1500 MEADOW LAKE PARKWAY
MAILING ADDRESS: P.O. BOX NO. 8405
KANSAS CITY, MISSOURI 64114

Northern States Power Company
Sherburne County Generating Plant
Units 1 & 2 (E-82EA01)
Schedule

B&V Project 10169
February 16, 1982

Northern States Power Company
414 Nicollet Mall
Minneapolis, Minnesota 55401

Attention: Mr. A. E. Johnson

Gentlemen:

Enclosed are two copies of Drawing NF-49106 revised to indicate the new pond access road and approximate routing of the ash sluice bypass piping. We estimate that about 2,800 feet of 6 inch and 1,700 feet of 14 inch polybutylene pipe will be required for the bypasses.

It appears that the pipe can be delivered by about July 1, 1982. We estimate that two months will be required for the earthwork construction leaving two months for all of the piping work. Prior to earthwork construction, the bypass pipelines should be installed and the existing Transol pipe removed. After earthwork is mostly completed, the permanent Transol pipe should be reinstalled including new trestles.

Please review the pipeline construction work and layout with the plant personnel to determine if the time available is sufficient.

If you have any questions, please contact Mr. J. M. Horner.

Very truly yours,

BLACK & VEATCH

G Y Gunn by JMH

G. Y. Gunn

JMH:llh
Enclosure

cc: Mr. A. E. Johnson
Mr. R. B. Anderson/with enclosure
Mr. J. T. O'Donnell/with enclosure

PRIMARY	SECONDARY	TERTIARY	DPF SEQ
82EA01	BA REVISION	C000	Z7701800
&		PERMITS & LICENSING	Z7701800
X	CLAY MINING & HAULING		Z7701800
X	COAL STORAGE AREAS		Z7701800
X	COMPACTION CRITERIA		Z7701800
X	COST BASIS DNR		Z7701800
X	DAM SAFETY PERMIT		Z7701800
X	DAMES & MOORE REPORT		Z7701800
X	DESIGN CRITERIA REVIEW		Z7701800
X	DIKE SAFETY ANALYSIS		Z7701800
X	DIKES COAL RETAINING		Z7701800
X	DNR COST BASIS		Z7701800
X	EARTH RETAIN STRUCTURE		Z7701800
X	FILTER BLANKETS		Z7701800
X	GRANULAR SOILS		Z7701800
X	IMPERVIOUS SOILS		Z7701800
X	INSPECT FEES		Z7701800
X	PERMIT APPLICATION MPCA		Z7701800
X	PERMIT APPLICATION NPDES		Z7701800
X	PERMIT INFORMATION DNR		Z7701800
X	PROJECT COMPLETION INFO		Z7701800
X	PROOF ROLLING		Z7701800
X	REPORT B&V 062773		Z7701800
X	REPORT DAMES & MOORE		Z7701800
X	SEEPAGE ANALYSES		Z7701800
X	SETTLEMENTS		Z7701800
X	SLOPE STABILITY		Z7701800
X	SOIL PARAMETERS		Z7701800
X	SPEC REVIEW		Z7701800
X	STABILITY GRAVITY DISCH		Z7701800
X	STABILITY SLOPE		Z7701800
X	STRUCT COAL WTR&ASH STOR		Z7701800
X	SUPPORT PERMIT & REG		Z7701800

File C000 — DNR Permit Information

This letter is in response to your request for DNR permit project completion information.

In our opinion, construction was completed in compliance with project drawings and specifications. The attached inspection testing report from Twin City Testing Company dated 12/22/82 presents results of the soils construction testing.

Our letter of July 30, 1982 presents the pre-construction cost estimate for parts associated with the embankment. Actual post-construction costs are as follows:

	Pre-Constr Estimate	Post Constr Actual
Total embankment construction contract amount	$177,800	$177,800
Add clay cost & associated crop loss	Not Included	2,777
Deduct for items not associated with dam safety, including roads and culverts	(23,800)	(33,968)
Surveying contract	Not Included	1,136
Soils Construction Testing	Not Included	9,380
Net Direct Cost - Earthwork	$154,000	$157,125
Engineering Cost - (Applicable Black & Veatch Charges)	$15,000	$16,630

FILE COPY

RBA020783MFC01

We believe that the drawings previously submitted adequately represent actual project construction, and post-construction photos are probably not necessary.

R B Anderson, P E
Project Engineer

mfc

Enclosure

cc: G H Jacobson
H K Norgaarden
File

RBA020783MFC01

Internal Correspondence

NSP

Date August 9, 1982

From P K Graika, Assistant Env. Engineer — Location General Office 2

To H K Norgaarden, Superintendent — Location General Office 7

COPY

Subject SHERBURNE COUNTY GENERATING PLANT
Bottom Ash Pond Revision

Enclosed is a copy of the Dam Safety Permit for the Bottom Ash Pond Construction at Sherco. The orange permit card should be posted conspicuously at the project site. Please review the permit conditions to be sure we can comply with them as stated. If there are any problems please contact me.

The dam has been classified as a Class II dam (see page 2, item VII of the permit). This requires the DNR to inspect the dam once every two years, and to charge an inspection fee of $30.00 plus an additional charge for square footage. This fee will be decided at the time of the first inspection.

Special Provision XIX requires us to notify the DNR within 90 days of completion of construction that the dam was completed in accordance with the approved design. This statement is also to include a report on construction inspection and quality control, and any photographs or drawings of the dam as built. Please inform me when construction is complete so this provision may be fulfilled.

If you have any questions, please contact me at 330-7645.

Pamela Graika

Pamela Graika
Assistant Environmental Engineer

jk

cc: R B Anderson
E H Schentzel
F G Stemper

FORM 17 3467

RECEIVED

AUG 9 1982

STATE OF MINNESOTA
DEPARTMENT OF NATURAL RESOURCES

BOX , CENTENNIAL OFFICE BUILDING • ST. PAUL, MINNESOTA • 55155

DNR INFORMATION
(612) 296-6157

FILE NO._____

August 6, 1982

Mr. J. L. Bechthold, Manager
Regulatory Compliance and Services
Northern States Power
414 Nicollet Mall
Minneapolis, MN 55401

Dear Mr. Bechthold:

PERMIT 83-3022, NORTHERN STATES POWER CO., BOTTOM ASH POND DAM, SHERBURNE CO.

The technical information submitted with the permit application has been reviewed and found adequate.

Enclosed is a permit authorizing the construction of the northeast corner of the embankment of the existing Bottom Ash Pond Dam to elevation 1000 feet, MSL in connection with the operation of the existing ash disposal facilities of the Sherburne County Generating Plant of the Northern States Power Company.

We acknowledge receipt of the inspection fee in the amount of $3,535.00 which was submitted to this office on August 4, 1982. Your fee computation is based on a dam construction cost including engineering, of $169,000 and is satisfactory.

Should you have any questions concerning the permit, please refer them to Craig A. Regalia, Supervisor of the Dam Safety Unit at: (612)/296-0525.

Sincerely,

DIVISION OF WATERS

Larry Seymour
Director

LS/CR:jl

cc: James F. Cooper
Hedia Rieke, Waters
Ken Haberman, PCA
Region 3 Hydrologist
Sherburne Co. Zoning
Sherburne SWCD
USCE
P.A. 83-3022 File
Dam Safety Unit

AN EQUAL OPPORTUNITY EMPLOYER

31790

W 70 50
Rev 11/70

STATE OF MINNESOTA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WATERS, ~~SOIL AND MINERALS~~
Centennial Office Building, St. Paul, Minnesota, 55101

P.A. No. 83-3022

IN THE MATTER OF THE APPLICATION OF NORTHERN STATES POWER COMPANY

for a PERMIT TO construct the northeast corner of the embankment of the Bottom Ash Pond Dam
Sherburne County

PERMIT

Pursuant to Minnesota Statutes, Chapter 105 and on the basis of statements and information contained in the permit application, letters, maps, and plans submitted by the applicant, and other supporting data all of which are made a part hereof by reference, PERMISSION IS HEREBY GRANTED to Northern States Power Company whose address for the purpose of notices and other communications pertaining to this permit is c/o J.L. Bechthold 414 Nicollet Mall, Minneapolis, MN 55401 which address is subject to change by written notice from the permittee.

To construct the Northeast corner of the embankment of the existing Bottom Ash Pond Dam to elevation 1000 feet, MSL in connection with the operation of the existing ash disposal facilities of the Sherburne County Generating Plant of the Northern States Power Company. The project is further described in the documents, information, maps and plans submitted by the Permittee or by the Permittee's designer on his behalf including engineering report titled "Northern States Power Company. Sherburne County Generating Plant...Earth Retaining Structures for coal, water, and ash storage", prepared by Black & Veath/consulting engineers and dated 7/27/73 and 5/6/82.

PROPERTY DESCRIBED as: SE 1/4 of Sec. 1, T33N, R29W

SHERBURNE COUNTY

for the purpose of disposal of bottom ash tailings

This permit is granted subject to the following GENERAL and SPECIAL PROVISIONS:

GENERAL PROVISIONS

1. This permit is permissive only and shall not release the permittee from any liability or obligation imposed by Minnesota Statutes, Federal Law or local ordinances relating thereto and shall remain in force subject to all conditions and limitations now or hereafter imposed by law.
2. ~~This permit is not assignable except with the written consent of the Commissioner of Natural Resources.~~
3. ~~[illegible]~~
4. No change shall be made, without written permission previously obtained from the Commissioner of Natural Resources, in the hydraulic dimensions, capacity or location of any items of work authorized hereunder.
5. The permittee shall grant access to the site at all reasonable times during and after construction to authorized representatives of the Commissioner of Natural Resources for inspection of the work authorized hereunder.
6. This Permit may be terminated by the Commissioner of Natural Resources, without notice, at any time he deems it necessary for the conservation of the water resources of the state, or in the interest of public health and welfare, or for violation of any of the provisions of this permit, unless otherwise provided in the Special Provisions.

SPECIAL PROVISIONS

I. Construction work authorized under this permit shall be completed on or before July 31, 1984/ unless terminated as hereinafter provided. Upon written request to the Commissioner by the Permittee, stating the reason therefore, an extention of time may be obtained.

II. The excavation of soil authorized herein shall not be construed to include the removal of organic matter does not apply unless the area from which such organic matter is removed is impervious or is sealed by the application of bentonite after excavation.

III. In all cases where the doing by the permittee of anything authorized by this permit shall involve the taking, using, or damaging of any property rights or interests of any other person or persons, or of any publicly owned lands or improvements thereon or interests therein, the permittee, before proceeding therewith, shall obtain the written consent of all persons, agencies, or authorities concerned, and shall acquire all property, rights and interests necessary therefor.

IV. This permit is permissive only. No liability shall be imposed upon or incurred by the State of Minnesota or any of its officers, agents or employees, officially or personally, on account of the granting hereof or on account of any damage to any person or property resulting from any act or omission of the permittee or any of its agents, employees, or contractors relating to any matter hereunder. This permit shall not be construed as estopping or limiting any legal claims or right of action of any person other than the state against the permittee, its agents, employees, or contractors, for any damage or injury resulting from any such act or omission, or as estopping or limiting any legal claim or right of action of the state against the permittee, its agents, employees, or contractors for violation of or failure to comply with the provisions of the permit or applicable provisions of law.

V. No material excavated by authority of this permit nor material from any other source, except as specified herein, shall be placed on any portion of the bed of said waters which lies below does not apply. It shall be the duty of the permittee to determine correctly all pertinent elevations at the site of the work for the purpose of complying with the conditions of this permit.

VI. ~~Any [illegible]~~

ADDITIONAL SPECIAL PROVISIONS

VI. Compliance With Other Laws

The Permittee shall comply with all other Federal, State and local laws and regulations and shall obtain such other permits as may be required including, but not limited to the Minnesota Pollution Control Agency and the U.S. Corps of Engineers.

VII. Hazard Classification

Based on the potential to cause possible health hazard or direct or indirect economic loss to the public due to a shutdown of the generating units by failure or misoperation, the bottom ash pond dam is classified by the Minnesota Department of Natural Resources as a Class II (significant hazard) dam.

Future development in the vicinity of the dam may result in the need for hydraulic and structural upgrading of the dam. The dam owner will be subject to all applicable rules and laws regarding any changed hazard rating.

VIII. Acceptance of Permit

Undertaking or initiating any work or part thereof authorized herein by the Permittee constitutes acceptance of the permit and all its terms and conditions.

IX. Successors

The provisions and terms of this permit shall extend to and bind the successors in authority of the Commissioner and the legally assigned successors in interest of the Permittee.

X. Responsibility for Control

The Permittee in cooperation with the dam's designer, shall be responsible for providing adequate controls on construction activities, and for verifying design, construction and operation assumptions.

XI. Establishment of Soil Protection

The Permittee, as soon as practicable following the construction, shall cover or protect all exposed soil resulting from the construction by placing riprap, sod and/or seed on banks and slopes of said construction for the prevention of soil erosion, sedimentation and lake/stream discoloration.

ADDITIONAL SPECIAL PROVISIONS

XII. Soil Placement

No frozen soil, ice, snow, or other frozen materials shall be placed within the dam during construction.

XIII. Freeboard

The freeboard between the level of the water covering the wastes and the lowest point of the crest of the perimeter dam, shall not be less than 4.0 feet.

XIV. Permanent Markers

A minimum of two (2) permanent markers for vertical and horizontal control shall be established in the natural ground by the Permittee in the vicinity of the dam. The permanent markers for vertical control must be based upon sea level datum. The accuracy of these markers shall be certified by the designer (or his representative), or a registered professional land surveyor. Each marker shall be located so as to be accessible and protected against disturbance throughout the projected life of the ash disposal basin. The Permittee shall within 90 days of the issuance of this permit submit to the Commissioner the locations of these permanent markers, plotted on standard U.S. Geological Survey topographic maps or other more detailed contour maps.

XV. Temporary Reduction or Cessation of Operation

The Permittee shall immediately notify the Director of the Division of Waters in the event of any plant or ash disposal system malfunction or operational change which requires a temporary reduction or modification or cessation of ash disposal system operations. In no case shall the Permittee discharge wastes or process water to areas other than those within the ash disposal basin.

XVI. Maintenance

Maintenance of the dam and reservoir herein authorized in a safe and sound condition shall be the responsibility of the Permittee. Should the dam be abandoned at a future date for any reason, or fall into a state of disrepair, the Permittee shall be responsible for site restoration work which may be ordered by the Commissioner of Natural Resources.

XVII. Emergency Work

If the Permittee finds at any time during construction or operation that, in order to adequately protect the environment or public health, safety or welfare, immediate alterations to the approved plans and

ADDITIONAL SPECIAL PROVISIONS

specifications are required, the alterations may be started, but the Permittee shall promptly notify the Director of the Division of Waters of such requirements. If the alterations are to remain as permanent project features, the Permittee shall, as soon as practicable, revise the plans and specifications and submit the revisions, in writing, to the Commissioner for approval.

XVIII. Unforeseen Conditions

The Permittee shall immediately notify the Director of the Division of Waters of any conditions relating to structural stability discovered during construction or operations which differ from those identified in the approved plans and specifications.

XIX. Actions by the Permittee Following Completion of Construction

Within 90 days following the completion of construction, the Permittee shall notify the Director of the Division of Waters, by certified mail, including a statement of the designer or professional engineer in charge of construction inspection, that to the best of knowledge, the dam was completed in accordance with the approved designs, plans and specifications and any approved revisions thereof. The statement shall include a report on construction inspection and quality control. The Permittee shall also submit to the Director photographs and supplementary drawings or descriptions of the dam as actually constructed and any other items which may be of permanent value bearing on the adequacy and permanency of the dam.

XX. Transfer of Ownership

The owner(s) shall not transfer the ownership of the dam without a written permit from the Commissioner.

XXI. Inspection Fees

Initial and periodic inspection fees required by Dam Safety Rules 6 MCAR 1.5034 shall be submitted in the form of a check payable to the Minnesota State Treasurer.

cc: James F. Cooper
Hedia Rieke, Waters
Ken Haberman, PCA
Region 3 Hydrologist
Sherburne Co. Zoning
Sherburne SWCD
USCE
P.A. 83-3022 File
Dam Safety Unit

Executed at St. Paul, Minnesota
this 6 day of August, 1982

Commissioner of Natural Resources

By: _____
Larry Seymour, Director
Division of Waters

NA-02633-01
(W-147)
Rev. 4/72

PERMIT NO. 83-3022

☐ APPROPRIATION AND USE OF WATER
☐ WORK IN THE BEDS OF PUBLIC WATERS

HAS BEEN ISSUED TO

NSP

(Applicant)

By The COMMISSIONER
MINNESOTA DEPARTMENT OF NATURAL RESOURCES

EXPIRATION DATE July 31, 1984

POST CONSPICUOUSLY AT PROJECT SITE

82 EA 01
Bottom Ash Revision
Permits & Licenses
0000

Internal Correspondence

NSP

Date July 30, 1982

From R B Anderson

Location General Office 7

To P K Graika

Location ERAD - GO 2

Subject SHERBURNE COUNTY GENERATING PLANT UNITS 1 & 2 E-82EA01
Bottom Ash Pond Revision
DNR Cost Basis

Per your request we submit the following cost information to be used in calculation of DNR "inspection" fees.

Total Construction Contract Amount	$177,800
Deduct for items not associated with dam safety, including roads and culverts:	(23,800)
Net Direct Cost - Earthwork	$154,000

We estimate that consultant engineering costs associated with design of the embankment was about $15,000.

ERAD has informed us that DNR inspection fees may be in the range of $3,000 to $4,000 for this project, if the standard formula is used. We suggest that ERAD investigate:

1. Hazard classification for this project, according to DNR designation.

2. Potential negotiation of fee based on factors which differentiate this project from more conventional dam projects.

Our concern is based in part on the upcoming ash pond project where much more money will be involved.

Please call if there are questions.

R B Anderson, P E
Project Engineer

mfc

PLANT FILE COPY

cc: G H Jacobson

X cost basis DNR
X DNR cost basis
X inspect fees

Internal Correspondence

NSP

GH Jacobson

Date June 21, 1982

From R B Anderson

Location PE&C - GO-7

To P K Graika

Location ERAD - GO-2

PLANT FILE COPY

Subject SHERBURNE COUNTY GENERATING PLANT
UNITS 1 and 2 E-82EA01
Bottom Ash Pond Revision
DNR Submittal Materials
File: C000

This letter is to transmit requested materials for review by the Minnesota DNR. Enclosed is:

1. Letter from Black & Veatch, project consulting engineers, to R B Anderson, NSP, dated June 18, 1982.

2. One blueline copy and three microfilm copies of drawings listed in the above letter.

3. Three copies of the applicable portions of the original "supporting analysis" for the fly ash and bottom ash ponds by Black & Veatch, dated June 27, 1973.

4. Three copies of the Dames & Moore second level "Review of Design Criteria and Project Specifications," dated July 17, 1973.

5. Three copies of a Black & Veatch letter, dated June 7, 1982, and an internal memo dated May 24, 1982, documenting a second level review done by a group in Black & Veatch separate from the original design group.

R B Anderson, P.E.
Project Engineer

jr

Encls.

cc (w/1cc each of Encl. #1,3,4 & 5)
E J Cramolini
G H Jacobson

BLACK & VEATCH
CONSULTING ENGINEERS

TELL (913) 967-2000
TELEX 42-6263

1500 MEADOW LAKE PARKWAY
MAILING ADDRESS: P.O. BOX NO. 8405
KANSAS CITY, MISSOURI 64114

Northern States Power Company
Sherburne County Generating Plant
Units 1 & 2 (E-82EA01)
Bottom Ash Pond Revision
Dike Safety Analysis

B&V Project 10169
June 18, 1982

Northern States Power Company
414 Nicollet Mall
Minneapolis, Minnesota 55401

Attention: Mr. R. B. Anderson

Gentlemen:

This letter is in response to your request for supporting data on the design of the bottom ash pond revision for submittal to the Minnesota Department of Natural Resources.

The modification of the bottom ash pond will raise the dike to an elevation equivalent to the dikes around the existing fly ash pond. These ponds have been designed for all loading conditions expected for the life of the ponds.

Supporting analyses are contained in the Black & Veatch report dated June 27, 1973, titled:

> Sherburne County Generating Plant
> Unit No. 1 and Unit No. 2
> Project Outline
> Earth Retaining Structures for Coal,
> Water, and Ash Storage
> Supporting Analysis II-M
> File 5377/5619
> PH12K700, PH12M300

An independent review of the design of the ponds was performed by Dames & Moore Consulting Engineers. Their findings are presented in the following report dated July 17, 1973.

> Report
> Review of Design Criteria and Project Specifications
> Proposed Coal and Ash Storage Area
> Sherburne County Generating Plant - Unit 1
> Sherburne County, Minnesota
> For Northern States Power Company

Dames & Moore's review confirmed the suitability of the design of the ponds.

An in-house independent review of the modification of the bottom ash pond to confirm that the design and specifications are in accordance with the design requirements of the original pond dikes was performed by Black & Veatch. This review was documented by our letter to NSP dated June 7, 1982.

Based on the above, the design is adequate and has a very remote possibility of failure.

The typical inventory of free water in the pond is approximately 60 acre-feet. The water inventory is kept sufficient to provide retention time for ash sedimentation. An excess inventory of water in the pond is undesirable for plant operations and is therefore avoided. The entire surface area of the pond is not submerged. This is to allow reclaiming operations to be performed in the dry by normal earthmoving equipment on the surface of the stored bottom ash during operation of the pond. There is no source of runoff into the pond other than the direct precipitation due to rainfall on the pond area. Therefore, the inventory of water, which is closely controlled by plant operations, can be held relatively constant.

The grade of the site slopes to the southwest toward the Mississippi River. If a breech occurred in the north, east, or west side of the pond dike, the free water would flow around the east or west side of the pond toward the river. If a breech occurred in the south dividing dike, the spill would be confined in the fly ash pond. On the east side of the pond there are borrow pits from construction of the existing pond dikes. The storage volume of these pits is sufficient to contain the water inventory. If the water flows around the west side of the pond, the water would be intercepted by the existing recycle basin and holding basin. These basins, at their maximum operating levels (elevation 950.0 feet), would contain the entire water inventory. These basins would discharge through the existing discharge structure at a maximum rate of 50 cubic feet per second to the river. The median Mississippi River flow past the plant is approximately 5,000 cfs. Therefore, the discharge from the plant would have minimal impact on the quantity of flow in the river.

Based on the above analysis, the unlikely event of a dike breech and spill should not affect the quantity of water in the Mississippi River. A spill would probably shut down Units 1 and 2 due to flooding of the recycle and holding basins pumphouse.

The following drawings show the topography and plant structures existing at the site.

NF-49025	NF-49105
NF-49052	NF-49106
NF-49074	NF-49107
NF-49075	NF-49108
NF-49078	NF-82017
NF-49092	NF-82018

Four prints each of drawings NF-82017 and NF-82018 are enclosed with this letter.

Construction of the replacement fly ash pond will modify the topography on the east side of the bottom ash pond. The effects will be analyzed during design of the replacement pond.

If you have any further questions, please contact us.

Very truly yours,

BLACK & VEATCH

G. Y. Gunn

LJA:bw
Enclosures

cc: Mr. R. B. Anderson

II-M

NORTHERN STATES POWER COMPANY

SHERBURNE COUNTY GENERATING PLANT
UNIT NO. 1 AND UNIT NO. 2
PROJECT OUTLINE
EARTH RETAINING STRUCTURES FOR
COAL, WATER, AND ASH STORAGE
SUPPORTING ANALYSIS II-M
FILE 5377/5619
PH12K700, PH12M300

TABLE OF CONTENTS

LIST OF TABLES

TABLE OF CONTENTS (Cont'd)

LIST OF FIGURES

FOREWORD

Based upon other considerations developed in discussions between NSP and Black & Veatch, this analysis has been revised. The conclusions stated nerein were adopted in the design of eartn retaining structures for coal, water and ash storage.

NSP 6/27/73

NORTHERN STATES POWER COMPANY
SHERBURNE COUNTY GENERATING PLANT
UNIT NO. 1 AND UNIT NO. 2
PROJECT OUTLINE
SUPPORTING ANALYSIS II-M
FILE 5377/5619

EARTH RETAINING STRUCTURES FOR COAL, WATER, AND ASH STORAGE

INTRODUCTION

In order to comply with existing regulations of the Minnesota Pollution Control Agency and to retain storage of water for maximum reuse, seals must be installed in all coal, water, and ash storage areas where the quality of natural ground water could be affected by seepage. Earth structures and seals are to be installed to control seepage from the plant storage areas to limits that will satisfy these requirements.

This study is a design analysis covering earth retaining structures required for coal, water, and ash storage.

SUMMARY OF IMPORTANT INFORMATION

1. The reserve and active coal storage areas are to be sealed with a 12 inch compacted thickness of impervious earth blanket. A 6 inch thick protective on-site soil cover will be provided at the reserve coal storage area and 24 inch soil cover in the active coal storage areas.

2. Sealed surface and subsurface drainage will be provided in the coal storage area.

3. The coal retaining dikes are embankment stabilized fills using on-site SP-SM soils stabilized with soil cement. The relative factors of safety computed by the Bishop method of slope stability are as follows.

Design Factor	Minimum Factor of Safety
Slope stability without earthquake	1.98
Slope stability with earthquake	1.63
Sliding	1.55
Overturning	5.80

4. The area around each of two 200,000 gallon and one 12,000 gallon fuel oil tanks will be confined by earthern dikes sealed with an impervious earth blanket.

5. The recycle and holding basins will be sealed with an 18 inch thick impervious earth blanket and a 12 inch thickness of protective soil cover. Slopes exposed to wave action will receive a 12 inch layer of dumped riprap placed on a 5 inch thick riprap bedding layer. Slopes exposed to erosion due to rainfall runoff will be protected by a stand of native type grasses.

6. The relative factors of safety computed by the Bishop method of slope stability for the recycle and holding basins are as follows:

Condition	Minimum Factor of Safety
After construction (dry basins)	1.98
Rapid drawdown from El 940' to El 942', MSL	1.77

7. The bottom ash and fly ash ponds will be constructed in two phases. Phase I construction will include constructing all dikes to Elevation 1000 feet,

MSL, except the extreme east portion of the north dike and the extreme north portion of the east dike. Phase II bottom and fly ash pond construction will construct Phase II dikes and complete Phase I dikes to Elevation 1000 feet, MSL.

8. The stability of the gravity discharge structures are summarized as follows:

Condition	Minimum Factor of Safety
Overturning	1.89
Sliding	1.50

9. The five cases of slope stability analysis for the bottom ash and fly ash ponds are summarized as follows:

Slope	Condition	Critical Factor of Safety
CASE I - WEST ASH POND DAMS		
Downstream 2-1/2:1	Full Reservoir El 996'	1.83
Downstream 2-1/2:1	Full Reservoir with Earthquake Loading	1.40
Upstream 2-1/2:1	Rapid Drawdown to El 970'	1.39
CASE II - ASH POND DISCHARGE STRUCTURES		1.48
CASE III - EAST ASH POND DIKE - PHASE I		
Downstream 3:1	Full Reservoir	1.53
Downstream 3:1	Full Reservoir with Earthquake Loading	1.10
Upstream 2-1/2:1	Rapid Drawdown to El 970'	1.39

Slope	Condition	Critical Factor of Safety
CASE IV - INTERIOR DIKE		
Downstream 2.75:1	Full Reservoir	1.79
Downstream 2.75:1	Full Reservoir with Earthquake Loading	1.23
Downstream 2.75:1	Full Reservoir (ash and water El 970')	1.69
CASE V - EAST DAM - PHASE II		
Downstream 2-1/2:1	Full Reservoir	1.79
Downstream 2-1/2:1	Full Reservoir with Earthquake Loading	1.31
Upstream 2-1/2:1	Rapid Drawdown to El 970'	1.39

10. Instrumentation to be installed within the bottom ash and fly ash ponds include piezometers and vertical settlement devices.

CONCLUSIONS

The conclusions of this analysis are to incorporate the findings listed in the summary of important information in the final design of earth retaining structures for coal, water and ash storage.

EARTH RETAINING STRUCTURES FOR COAL, WATER, AND ASH STORAGE

A. OBJECTIVE

The objective of this investigation is to determine the most advantageous design for earth retaining structures required for storage of coal, water, and ash at the Sherburne County Generating Plant.

B. REQUIREMENTS

1. Storage basins for wastewater will be provided from which the water will be recycled through the plant systems to the maximum extent practicable, in order to minimize the discharge of wastewaters to the Mississippi River. See SUPPORTING ANALYSIS VI-B-2, WASTEWATER RECLAIM

2. In all storage areas where the quality of natural ground water could be affected by seepage, effective seals are to be installed so that seepage will be reduced to a minimum. The storage areas to be sealed are:

Coal Storage Area
Fuel Oil Storage Area
Recycle Basin
Holding Basin
Bottom Ash Pond
Fly Ash Pond

3. Design features of each storage area are described in APPENDIX A of SUPPORTING ANALYSIS II-K, SEEPAGE CONTROL.

4. The maximum coefficient of permeability of materials selected for sealings are to be as follows:

Areas where water is normally present 1×10^{-6} cm/sec

Areas where water is not normally present 1×10^{-5} cm/sec

NSP 6/27/73

5. the phreatic surfaces and rates of seepage used or considered in this study are based on SUPPORTING ANALYSIS II-K, SEEPAGE CONTROL.

6. Soil parameters used in this analysis are based on field data and laboratory testing performed by Dames & Moore and by Soil Exploration Company, Inc. as given in the following reports:

Report by Dames & Moore:
"Foundation Investigation - Phase III - Proposed Generating Plant - Sherburne County, Minnesota", dated September 30, 1971.

Reports by Soil Exploration Company:
"Final Report of Soil and Bedrock Investigation - Phases I-III, Sherburne County Generating Plant", dated September 15, 1971.

"Final Report - Field Borings and Laboratory Test Results - Clay Borrow Area and Coal Storage Area - Sherburne County Generating Plant", dated June 18, 1973.

Reports by Twin City Testing and Engineering Laboratory, Inc.:
"Geological Investigation of Clay Deposits - Sherburne County Generating Plant", dated Feburary 22, 1972.

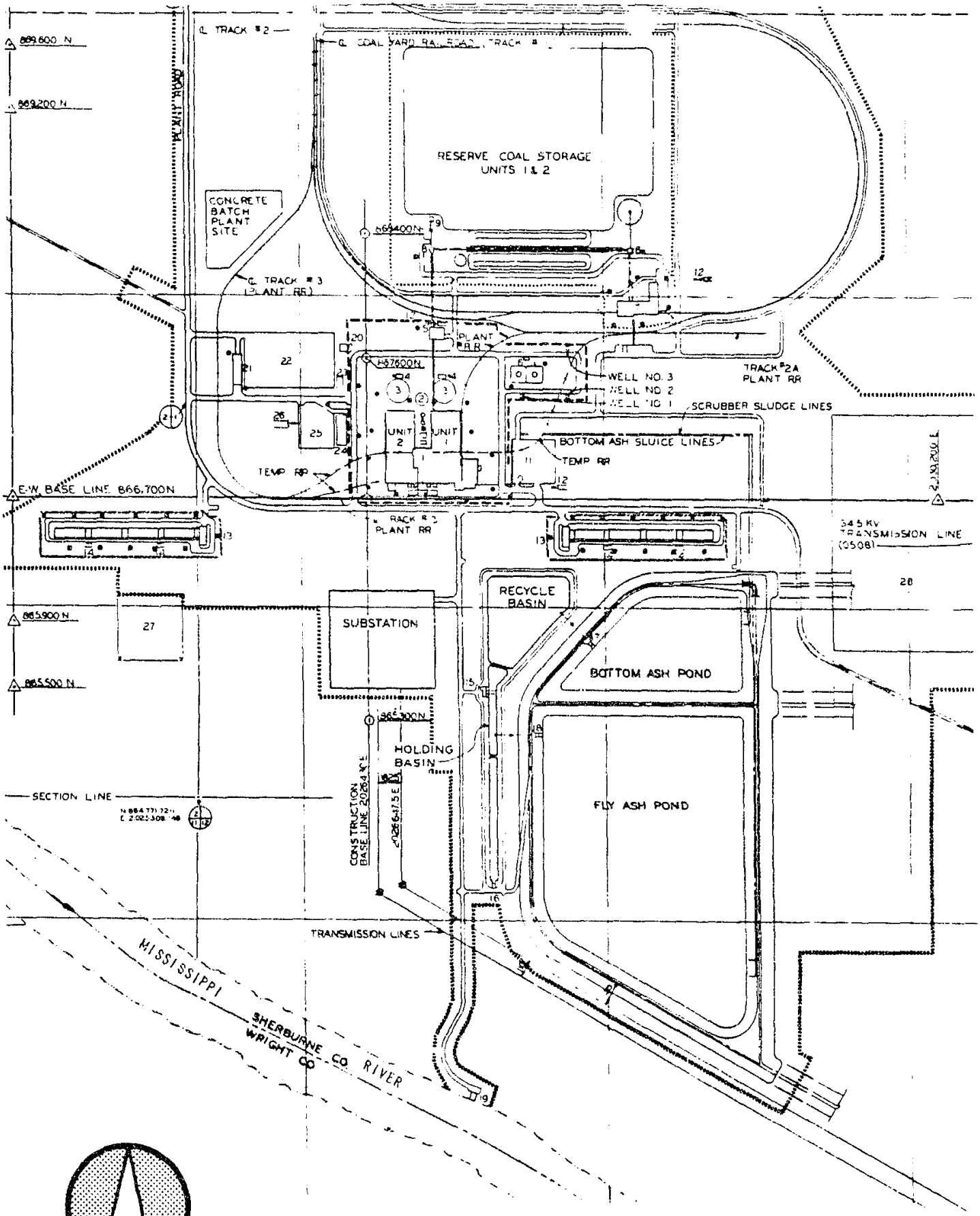
"Report of Clay Sources Investigation - Sherburne County Generating Plant", dated June 26, 1972.

7. Operation and management procedures for water and ash impoundment areas are described in the REPORT ON POND SYSTEM MANAGEMENT.

8. Additional data not included for purposes of this analysis, are given in the plans and specifications for Construction Package 5377 D-4C.

C. ANALYSIS

1. COAL STORAGE AREA. The general arrangement of the plant site facilities is shown on FIGURE 1. The coal storage area is shown on FIGURE 1 to occupy the north portion of the plant site, including space allocation for reserve coal storage, active coal storage, stacker-reclaimer trackage, surface drainage, and coal handling facilities.



GENERAL ARRANGEMENT OF SITE

SCALE: 1" = 800'

FIGURE 1

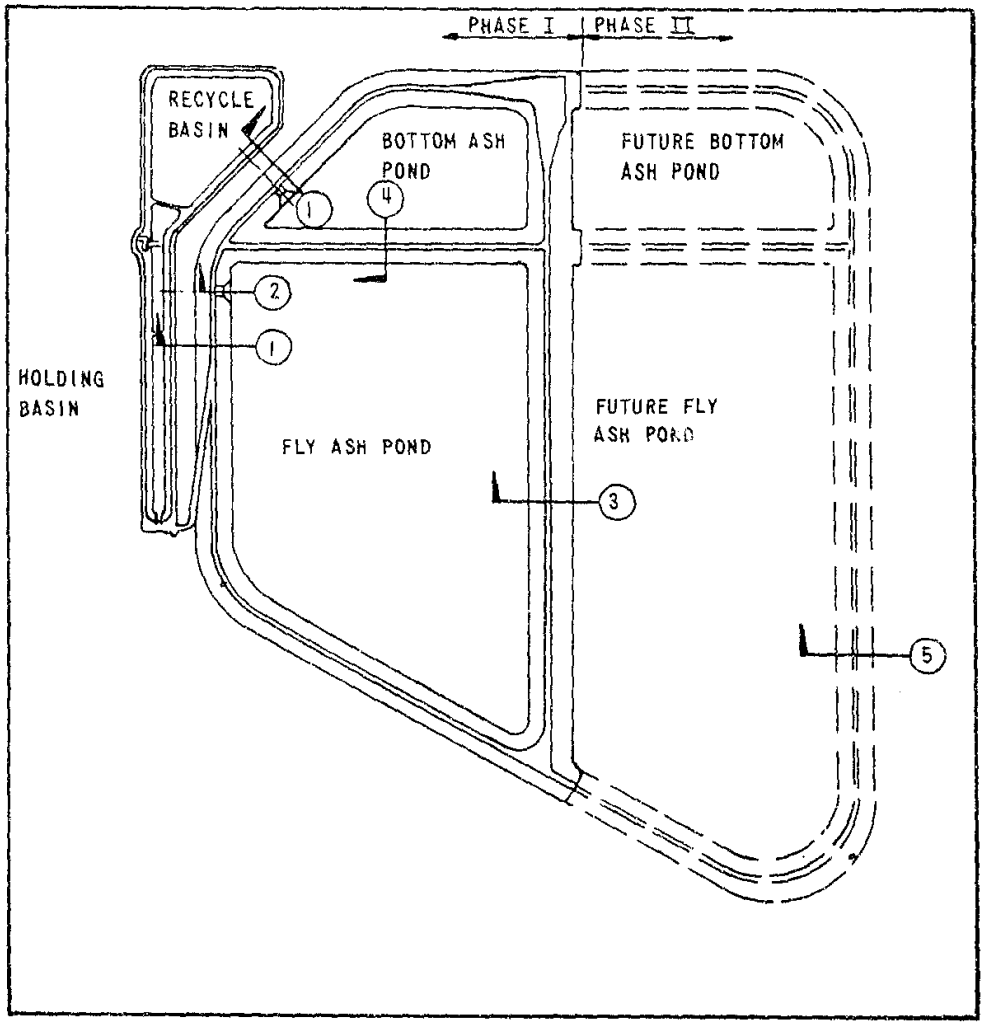
3. RECYCLE AND HOLDING BASINS. The general arrangement of the recycle and holding basins and related facilities are shown on FIGURE 1. The detail arrangement of the recycle and holding basins is shown on FIGURE 5.

a. General Description of Basins. The recycle basin will be used to reclaim bottom ash supernatent and other wastewaters for reuse in the bottom ash system. The recycle basin will have a surge capacity of 9 million gallons to receive discharge from the coal storage area and the plant drainage system. The recycle basin will also receive discharges from the bottom ash pond. The recycle basin design incorporates an emergency overflow to the holding basin to prevent the water level in the recycle basin from exceeding Elevation 950 feet, MSL. Pumps capable of supplying the bottom ash system water requirements are incorporated in the design.

The holding basin will be used to reclaim fly ash and scrubber sludge supernatent and other wastewaters for reuse in the flue gas scrubber system. The basin will hold water for discharge to the river and will provide an average detention of 24 hours at a maximum discharge rate of about 2000 gpm. The holding basin will receive discharge from the recycle basin and from the fly ash pond. A water discharge monitoring facility is provided for monitoring holding basin discharges to the river.

Pertinent finish grades and water surface elevations for the recycle and holding basins are as follows:

Feature	Elevation Feet, MSL
Minimum Operating Water Level	942.0
Normal Operating Water Level	944.0
Maximum Surge Water Level	950.0
Typical Bottom Grade of Basin	936.0
Bottom Grade of Basin at Pump House	933.5



ARRANGEMENT PLAN OF
BOTTOM & FLY ASH PONDS AND RECYCLE & HOLDING BASINS
SCALE 1" = 800'

FIGURE 5

b. Detail Design of Basins. The detail design of the basins discussed herein include excavation, subgrade preparation, impervious earth blanket and protective soil cover, slope protection, and roads. The arrangement plan for the bottom and fly ash ponds and recycle and holding basins is shown on FIGURE 5.

Excavation. Recycle and holding basin construction will require excavation of existing SP-SM (sand-silty sand) soils from existing grades to the finish grades shown on FIGURE 6. No problems should be encountered in excavating to the required finish grades. The existing ground water table is anticipated to be below the deepest excavation required for the recycle and holding basins.

Subgrade Preparation. The subgrade should be thoroughly compacted and proof-rolled prior to placement of the impervious earth blankets. The subgrade should be shaped to the lines, grades, and cross sections shown on FIGURE 6 and compacted to a depth of at least 12 inches to 95 per cent of maximum density at optimum moisture content as determined by ASTM D1557 (Modified Proctor). After compaction, the area should be proof-rolled by a single pass of a vibratory roller to test for uniformity. Any loose soils detected during proof-rolling should be recompacted. No impervious earth blanket material should be placed until the subgrade for that area has been properly prepared, compacted, and proof-rolled.

Impervious Earth Blanket. The impervious earth blanket will be constructed to the lines and grades shown on FIGURE 6. An 18 inch compacted thickness of impervious earth blanket, Type 1, composed of Unified Soil Classification Type CL (clay) material will be used to seal the basins as shown on FIGURE 6. The material for impervious earth blanket construction will be obtained from the impervious earth borrow area. The 18 inch compacted thickness of the compacted earth blanket is a minimum dimension to ensure that seepage quantities from these basins are within acceptable levels as covered in previous analyses. No intermingling of impervious earth blanket material with other material should be permitted.

The impervious earth blanket material should be broken up at the borrow area or at the place of deposition to such maximum size necessary to secure a dense and uniformly compacted blanket. Special care in preparation, placement, and compaction of the impervious earth material will be required to secure an acceptable impervious earth blanket. All parts of the impervious earth blanket will be compacted to 93 per cent of maximum density at optimum moisture content. The allowable moisture content for blanket materials should be maintained within the range from optimum to 3 per

cent greater than optimum. Water should be applied to the sand cover material discussed hereinafter only as necessary to obtain the required compaction.

Protective Soil Cover. A 12 inch thickness of on-site SP-SM material will be placed above the impervious earth blanket as shown on FIGURE 6. The sand cover material should be placed in uniform 6 inch lifts and thoroughly compacted by a vibrating roller or a vibrating tamper to 95 per cent of maximum density at optimum moisture content. Water should be applied to the sand cover material only as necessary to obtain the required compaction.

Slope Protection. Slope protection is required for slopes exposed to water and wave action and for slopes subjected to erosion due to rainfall runoff.

Separate studies indicate the most advantageous protection for the basin slopes subjected to wave action, to be dumped stone riprap with required bedding material. Types of slope protection considered were:

Dumped riprap

Hand-placed riprap

Wire-enclosed riprap

Grouted riprap

Concrete riprap in bags

Concrete slab riprap

The resistance of dumped stone to displacement by moving water depends on:

Weight, size, shape, and composition of the individual stones

The gradation of the stone

The depth of water over the stone blanket

The steepness and stability of the protected slope

The stability and effectiveness of the filter blanket on which the stone is placed

The velocity of the flowing water against the stone

The protection of toe and terminals of the stone blanket

Riprap sizes and thicknesses are determined based on wave heights which are established from the fetch and wind velocity relations given in nomographs published by the Corps of Engineers. Fetch is defined as the open water distance over which the wind can blow and generate waves toward the slopes. Riprap on upstream slopes of dikes or dams impounding water should have a minimum thickness of 12 inches. The maximum fetch of 1200 feet would be applicable to the recycle and holding basins design. A maximum fetch of 1/4 mile and a design wind speed of 70 miles per hour would generate a maximum wave height of 2 feet for a maximum wind duration of about 1/4 hour. A wave height of 2 feet, a specific gravity of the rock of 2.68, and a slope of 2 horizontal to 1 vertical yields a minimum median rock size of 30 pounds with a total riprap thickness of 12 inches. The gradation of the dumped riprap should be as follows:

Riprap Gradation

Stone Size (in pounds)	Per Cent of Total Weight Smaller than Size Given
200	100
80	80
50	50
2 (not to exceed)	10

To provide effective use of locally available quarry run granite riprap an allowance of 5 per cent (by weight) of the stone may be 15 inches in greatest dimension.

A filter blanket is required beneath the riprap cover to prevent the water from removing embankment material through voids in the riprap during wave ride-up and return. Removal of slope embankment material would leave cavities behind the riprap cover and failure of the cover could occur. Bedding or a filter blanket for riprap is required when the following criteria is not met:

$$\frac{D_{15}\ \text{(of riprap)}}{D_{85}\ \text{(existing slope soils)}} \leq 5 \leq \frac{D_{15}\ \text{(of riprap)}}{D_{15}\ \text{(existing slope soils)}} < 40$$

A single filter blanket of 5 inches thickness is required with the following gradation.

Riprap Bedding Gradation

U.S. Standard Sieve Size	Per Cent Passing
3 inch	100
2 inch	85-100
1-1/2 inch	72-90
3/4 inch	50-70
1/2 inch	35-50
No. 3	22-32
No. 6	12-20
No. 10	0-12

The riprap bedding and dumped riprap should be placed to produce a fairly compact riprap protection in which all sizes of material are placed in their proper proportions. A small amount of hand placing will be required to obtain a uniform riprap layer of the required thickness.

Protection of slopes subjected to erosion due to rainfall runoff will be afforded by a good stand of native type grass.

Roads. Access roads around the perimeter of the basins are located as shown on FIGURE 1. A typical access road section is shown on FIGURE 6. A compacted 6 inch thickness of Class 1 or 2 (Minnesota Department of Highways) crushed rock or gravel will be provided for surfacing the basins perimeter road.

c. Slope Stability. The stability of recycle and holding basin slopes were analyzed by computer solution. Factors that influence the design of the basin slopes and the relative factors of safety are as follows.

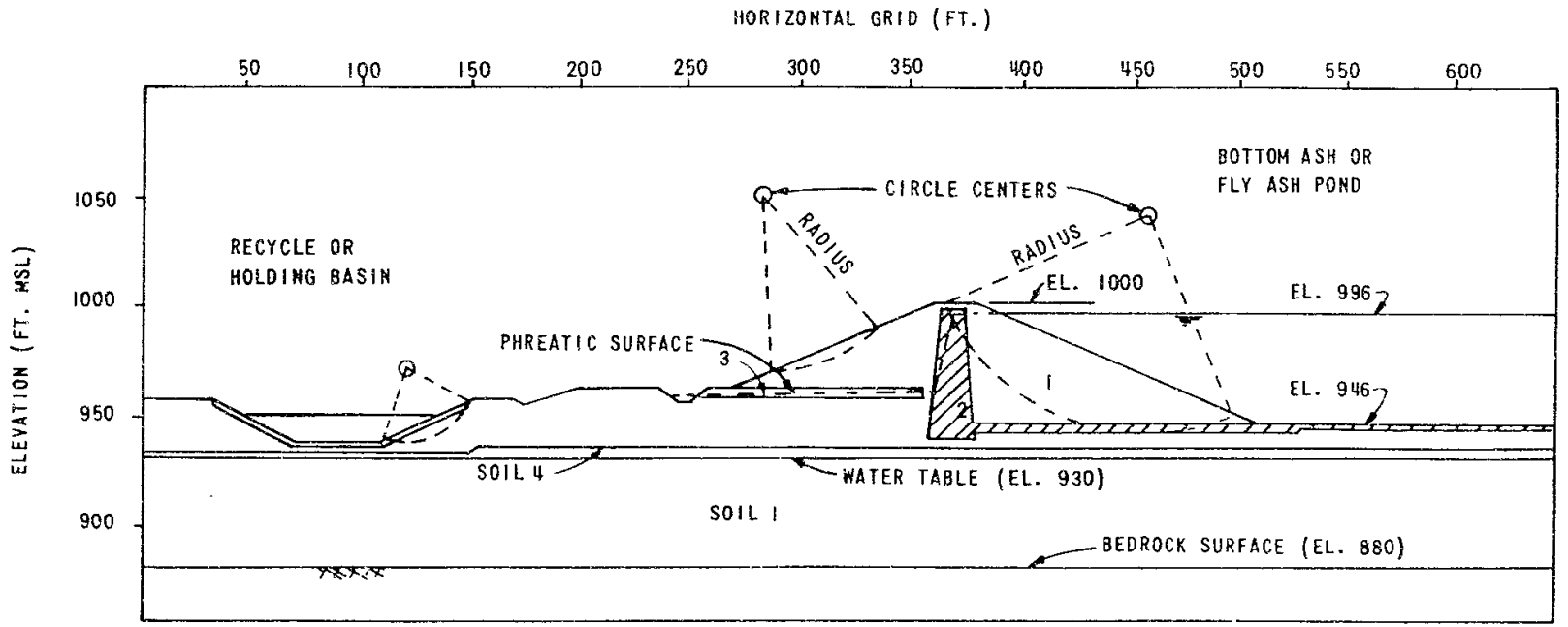
Soil parameter strengths selected for embankment and foundation

Variation in soil strata thickness

Variation in actual seepage pressures as compared to assumed conditions

Steady-state and rapid drawdown conditions

Soil parameters used in this analysis are shown on FIGURE 7 and tabulated below as follows.



SECTION 1. FLY ASH POND WEST DIKE WITH TOE DRAIN AND HOLDING BASIN BERM

SCALE: 1" = 80'

SLOPE	CONDITION	CRITICAL F.S.
DOWNSTREAM MAIN DIKE	FULL RESERVOIR (WATER AT EL 996)	1.83
DOWNSTREAM MAIN DIKE	FULL RESERVOIR WITH EARTHQUAKE LOADING	1.40
UPSTREAM MAIN DIKE	RAPID DRAWDOWN TO EL.970	1.39
UPSTREAM MAIN DIKE	RESERVOIR FILLED WITH ASH AND WATER UP TO EL.971	1.80
HOLDING & RECYCLING BASIN	AFTER CONSTRUCTION (NO WATER)	1.98
HOLDING & RECYCLING BASIN	DRAWDOWN FROM EL.950 TO 942	1.77

SOIL		SOIL PARAMETERS		
NO	IDENTIFICATION	DENSITY PCF	COHESION PSF	FRICTION ANGLE DEGREES
1	SP-SM EMBANKMENT	136	0	35
2	CL CORE	120	1000	0
3	FILTER	120	0	35
4	SP-SM FOUNDATION (RD 60%)	133	0	30

FIGURE 7

Soil No.	Soil Identification	Soil Parameters Density pcf	Cohesion psf	Friction Angle degrees
1	Embankment (SP-SM)	136	0	35
2	Impervious Earth Blanket	120	1000	0
4	Foundation Sands (RD 60%)	133	0	30

The operating water levels for the basins are as previously discussed. The minimum factor of safety as determined by the Bishop method of slope stability for the following conditions, is shown on FIGURE 7 and tabulated below as follows:

Condition	Minimum Factor of Safety
After construction (dry basins)	1.98
Rapid drawdown from El 940' to 942'	1.77

The condition after construction and prior to filling, and under rapid drawdown are the most critical cases. An adequate factor of safety of 1.77 exceeds the satisfactory allowable design factor of safety of 1.5.

4. BOTTOM ASH AND FLY ASH PONDS.

a. General Description. The general arrangement of the bottom ash and fly ash ponds are shown on FIGURE 5. The bottom ash pond is required for the permanent disposal of the residue removed from the bottom ash hoppers. The bottom ash will be removed from the ash hoppers and conveyed for storage in the bottom ash pond periodically by a sluice system. A gravity discharge structure will be located within the west dike of the bottom ash pond as shown on FIGURE 5.

The fly ash pond is required for the permanent disposal of residue removed from the flue gas scrubber system. Sludge and fly ash will be pumped from the thickener units to the fly ash pond. A gravity discharge structure will be located within the west dike of the fly ash pond as shown on FIGURE 5.

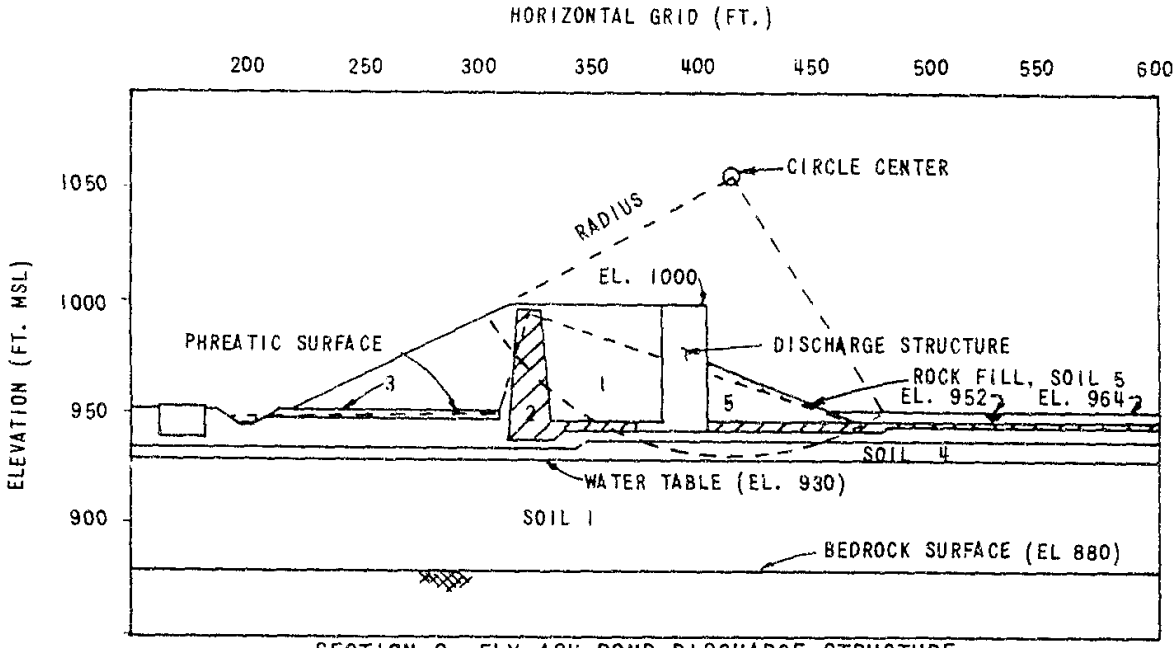
The pertinent design solids and water levels for the ash ponds are as follows:

Feature	Design Elevation - Feet, MSL	
	Bottom Ash Pond	Fly Ash Pond
Top of Dike	1,000	1,000
Operating Floor Level of Discharge Structures	1,000	1,000
Bottom of Pond	946	946
Minimum Design Operating Water Level	952	952
Minimum Design Operating Water Level	996	996
Maximum Design Ash Level	996	996

b. Phases of Construction. The bottom ash and fly ash ponds will be constructed in two phases. Phase I construction will include constructing all dikes to Elevation 1000 feet, MSL, except the extreme cost portion of the north dike and the extreme north portion of the east dike as shown on FIGURE 5.

Phase II bottom and fly ash pond construction will complete the exterior dikes and the interior dike separating the bottom ash and fly ash ponds to Elevation 1000 feet, MSL. The remaining portions of Phase I dikes are to be constructed to Elevation 1000 feet, MSL, at this time. The east dike of Phase I ponds is designed to allow continuation of Phase II construction without adversely affecting the stability of Phase I ash pond dikes. An evaluation of the dam instrumentation data should be made prior to commencement of construction for Phase II dikes. The evaluation should include a comparison of recorded seepage rates and gradients with the design parameters included herein.

c. Stability of Discharge Structures. Gravity discharge structures are located within the upstream slope of the west dikes as shown on FIGURE 8. Excavation for the bottom ash pond and fly ash pond discharge structures will be performed concurrently with excavation for the ash pond impervious earth blanket construction. Excavation to Elevation 941.5 feet, MSL, will be required at the discharge structure locations. Excavation for the discharge structures should not encounter any ground water or other problems.



SECTION 2. FLY ASH POND DISCHARGE STRUCTURE

SCALE: 1" = 80'

	SOIL	SOIL PARAMETERS		
NO.	IDENTIFICATION	DENSITY PCF	COHESION PSF	FRICTION ANGLE DEGREES
1	SP-SM EMBANKMENT	136	0	35
2	CL CORE	120	1000	0
3	FILTER	120	0	35
4	SP-SM FOUNDATION (RD 60%)	133	0	30
5	ROCK FILL	120	0	35

TRIAL NO.	COORDINATES OF CRITICAL CIRCLE CENTER		RADIUS OF CRITICAL CIRCLE (FT.)	FACTOR OF SAFETY
	X	Y		
1	393	1035	97	2.13
2	375	1038	95	2.83
3	450	1028	115	1.81
4	420	1058	125	1.48
5	450	1058	144	1.86

FIGURE 8

The maximum design bearing pressure at the base of the discharge structures is 8070 psf, which is less than the allowable bearing pressure of 10,000 psf.

The critical factor of safety against overturning is calculated to be 1.89, which exceeds the allowable factor of safety of 1.5 based on the following design conditions.

Ash pond level at Elevation 970 feet, MSL

Lateral active pressure on substructure wall, considering the backfill to act as an equivalent fluid with a unit weight as follows:

40 pcf above water surface
85 pcf below water surface

A 7.5 foot deep reinforced concrete key is required at each discharge structure to provide an adequate factor of safety of 1.5 against sliding. The active pressures noted above were used in addition to the following passive pressures.

Lateral passive pressure considering the fill to act as an equivalent fluid with a unit weight as follows:

Rock Fill	Moist, 250 pcf Saturated, 220 pcf
Impervious Earth Blanket	90 pcf
Existing SP-SM Foundation	Moist, 300 pcf Saturated, 270 pcf

A coefficient of friction of 0.3 was used with active and passive pressures noted above to compute an adequate factor of safety of 1.5 against sliding.

Sheet piles are located on the upstream side of the discharge structure to separate the embankment fill from the rock fill within the sheet pile walls. The rock fill between the sheet pile walls is required to provide adequate resistance against sliding for the discharge structures.

d. Embankment Design. The following criteria must be met to ensure satisfactory performance of earth embankments.

The embankment and foundation must be stable under all conditions of construction and reservoir operation.

Seepage through the embankment and foundation must be controlled to prevent excessive uplift pressures, piping, sloughing, removal of material by solution, or erosion of material by loss into cracks, joints and cavities, and to minimize leakage to the ground water supply.

Freeboard must be sufficient to prevent overtopping by waves and include an allowance for settlement of the embankment and foundation.

Outlet capacity must be sufficient to prevent overtopping.

The embankment must be designed so as not to impose excessive stresses upon the foundation.

(1) Stability analyses. Each embankment section was analyzed for slope stability in accordance with general design methods described as the LIMITING EQUILIBRIUM APPROACH as developed by Bishop and adapted to computer solution. Stability analyses were made with and without earthquake loadings. The earthquake loading used in this analysis is a horizontal force with a magnitude expressed as a percentage of gravity. A safety factor of 1.1 is considered acceptable for stability analysis using an earthquake loading of 10 per cent of gravity. The plant site lies in a moderate seismic zone, and an earthquake loading equivalent to 10 per cent of gravitational force is considered adequate.

A discussion of the five basic stability cases for the bottom ash and fly ash ponds includes consideration of the following:

Boundary of different embankment soils

Position of assumed phreatic surface

Existing and modified water table

Reservoir water level causing most critical condition

Soil parameters

Critical failure circle and circle center

Calculated safety factors compared to minimum required safety factor

Stability Cases I through V are shown in TABLES 3 through 7, respectively.

(2) Embankment zoning. The embankment should be zoned to provide an adequate impervious zone, transition zones between the core and the pervious shells, and drainage zones for seepage control. Embankment sections as discussed for Stability Cases I through V are shown on FIGURES 12 and 13.

The central clay core shown on FIGURES 12 and 13 is to be composed of CL (clay) material compacted to 93 per cent of Modified Proctor. During compaction for the clay core, the moisture content should be within a range of 0 to 3 per cent above optimum. The clay core width will vary from 10 feet at the top to 20 feet at the bottom of the core trench excavation. The width of core is not critical except that a core top width of 10 feet is considered to be the minimum width on which earth moving and compaction equipment can operate. The base width of the core,or the core trench,must be equal to or greater than 1/4 times the maximum difference between reservoir and tailwater elevation.

The embankment fill is essentially a homogeneous embankment and is not classified as a zoned embankment. However, the silty sands should be placed near the central clay core and the more pervious materials routed to the

TABLE 3

CASE I - WEST ASH POND DAMS

FIGURE 7 shows a typical section through the holding basin and the west dam of the fly ash pond. FIGURE 7 can be considered applicable for the recycle basin and the bottom ash pond. Soil parameters used for this analysis are shown on FIGURE 7 and tabulated as follows:

Soil		Soil Parameters		
No.	Identification	Density pcf	Cohesion psf	Friction Angle degrees
1	SP-SM Embankment	136	0	35
2	CL Core	120	1000	0
3	Filter	120	0	35
4	SP-SM Foundation (RD 60%)	133	0	30

The factors of safety calculated by the Bishop method for various conditions are as follows:

Slope	Condition	Critical Factor of Safety
Downstream Main Dike	Full Reservoir (water at El 996')	1.83
Downstream Main Dike	Full Reservoir with earthquake loading	1.40
Upstream Main Dike	Rapid drawdown to El 970'	1.39
Upstream Main Dike	Reservoir filled with ash and water up to El 971'	1.80
Holding and Recycle Basin	After construction	1.98
Holding and Recycle Basin	Drawdown from El 950' to El 942'	1.77

NSP 6/27/73

TABLE 4

CASE II - ASH POND DISCHARGE STRUCTURES

FIGURE 8 shows a typical section through the discharge structure and upstream face of west dike. The section shown on FIGURE 8 can be considered applicable for the fly ash and bottom ash pond discharge structures. Soil parameters used for this analysis are shown on FIGURE 8 and tabulated as follows:

Soil No.	Soil Identification	Soil Parameters Density pcf	Cohesion psf	Friction Angle degrees
1	SP-SM Embankment	136	0	35
2	CL Core	120	1000	0
3	Filter	120	0	35
4	SP-SM Foundation (RD 60%)	133	0	30

The calculated factors of safety for various trial circle centers are as follows:

Trial No.	Coordinates of Critical Circle Center X	Y	Radius of Critical Circle feet	Factor of Safety
1	393	1035	97	2.13
2	375	1038	95	2.83
3	450	1028	115	1.81
4	420	1058	125	1.48
5	450	1058	144	1.86

NSP 6/27/73

TABLE 5

CASE III - EAST ASH POND DIKE - PHASE I

FIGURE 9 shows a typical section through the east dike of fly ash pond which separates Phase I and Phase II construction. The same would be applicable for bottom ash pond east dike. Soil parameters used for this analysis are shown on FIGURE 9 and tabulated as follows:

Soil		Soil Parameters		
No.	Identification	Density	Cohesion	Friction Angle
		pcf	psf	degrees
1	SP-SM Embankment	136	0	35
2	CL Core	120	1000	0
3	Filter	120	0	35
4	SP-SM Foundation (RD 60%)	133	0	30

The calculated factors of safety by the Bishop method for various conditions are as follows:

Slope	Condition	Critical Factor of Safety
Downstream Slope (2.5:1)	Full Reservoir (water at El 996')	1.08
Downstream Slope (2.5:1) with berm up to El 953'	Full Reservoir	1.08
*Downstream Slope (3:1)	Full Reservoir	1.53
*Downstream Slope (3:1)	Full Reservoir with Earthquake Loading	1.10
*Upstream Slope (2.5:1)	Rapid Drawdown to El 970'	1.39

*Used in this analysis.

NSP 6/27/73

TABLE 6

CASE IV - INTERIOR DIKE

FIGURE 10 shows a typical section through the interior dike which separates the fly ash storage pond from the bottom ash storage pond. The soil parameters used for this analysis are shown on FIGURE 10 and tabulated as follows:

Soil		Soil Parameters		
No.	Identification	Density	Cohesion	Friction Angle
		pcf	psf	degrees
1	SP-SM Embankment	136	0	35
2	CL Core	120	1000	0
3	Filter	120	0	35
4	SP-SM Foundation (RD 60%)	133	0	30

The calculated factors of safety by the Bishop method for various conditions are as follows:

Slope	Condition	Critical Factor of Safety
Downstream Slope (2.5:1)	Full Reservoir (Water El 996' on upstream and El 952' on downstream side)	1.65
Downstream Slope (2.5:1)	Full Reservoir with Earthquake Loading	1.19
*Downstream Slope (2.75:1)	Full Reservoir	1.79
*Downstream Slope (2.75:1)	Full Reservoir with Earthquake Loading	1.23
*Downstream Slope (2.75:1)	Full Reservoir (Ash and water on downstream side at El 970')	1.69
Downstream Slope (3:1)	Full Reservoir	1.81
Downstream Slope (3:1)	Previous Condition with Earthquake Loading	1.30

*Used in this analysis.

TABLE 7

CASE V - EAST DAM - PHASE II

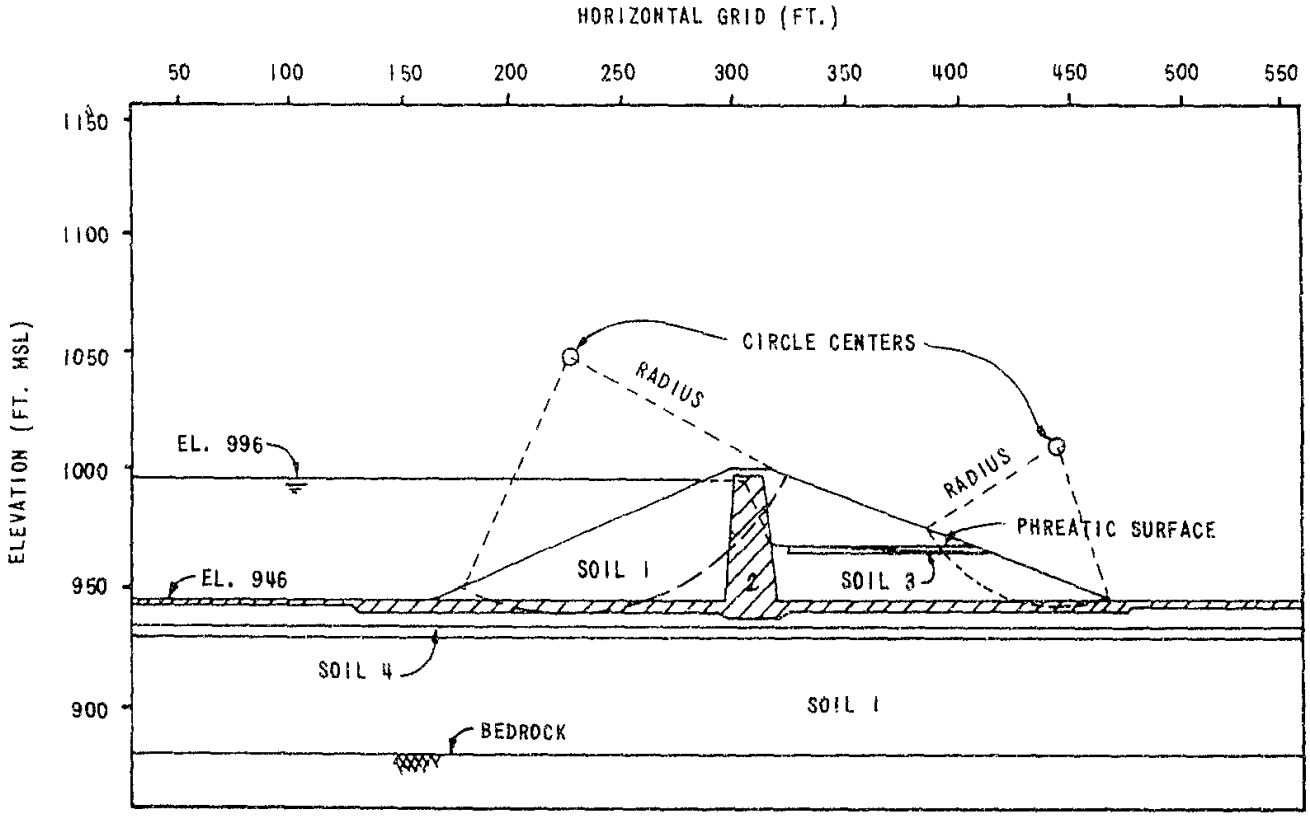
FIGURE 11 shows a typical section through the east dam to be constructed in Phase II. Soil parameters used for this analysis are shown on FIGURE 11 and tabulated as follows:

Soil No.	Soil Identification	Soil Parameters		
		Density pcf	Cohesion psf	Friction Angle degrees
1	SP-SM Embankment	136	0	35
2	CL Core	120	1000	0
3	Filter	120	0	35
4	SP-SM Foundation (RD 60%)	133	0	30

The calculated factors of safety by the Bishop method for various conditions are as follows:

Slope	Condition	Critical Factor of Safety
Downstream Slope	Full Reservoir (water at El 996')	1.79
Downstream Slope	Full Reservoir (with earthquake loading)	1.31
Upstream Slope	Rapid Drawdown to El 970'	1.39

NSP 6/27/73



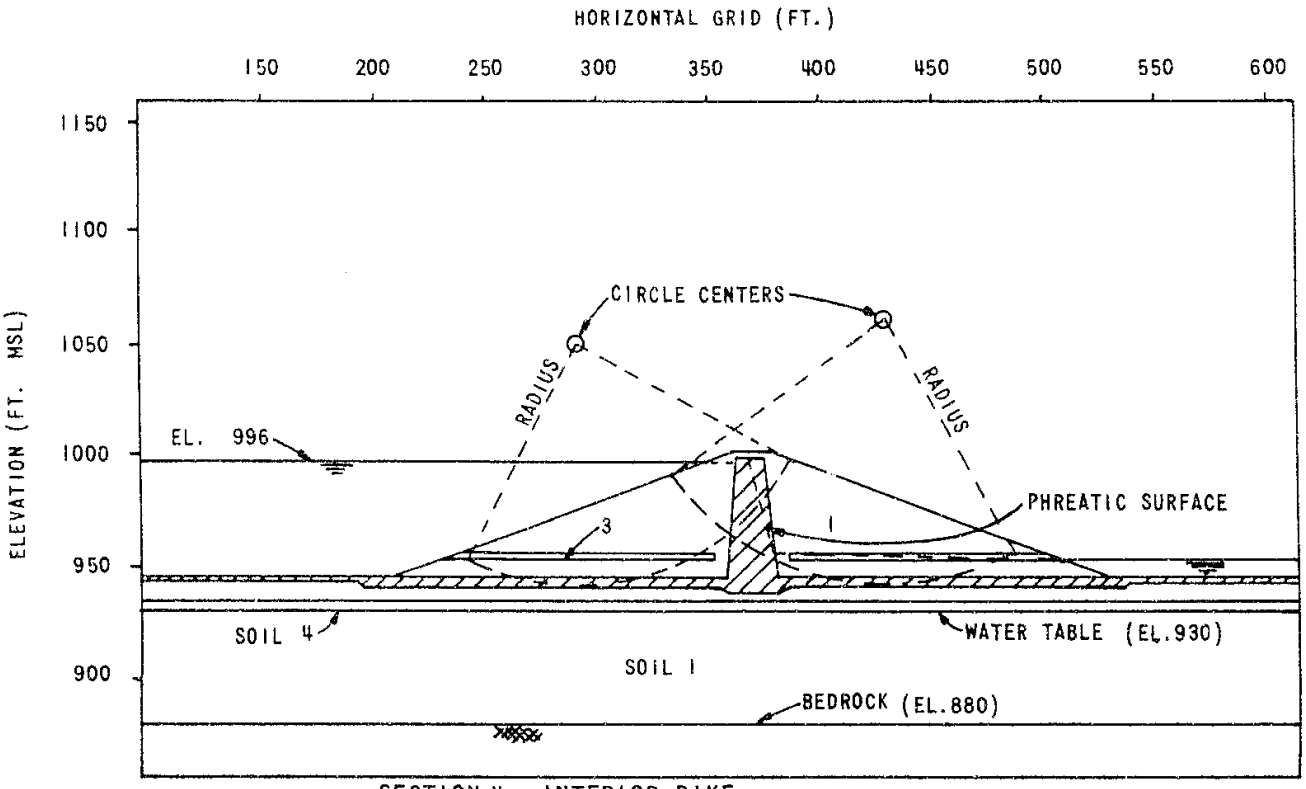
SECTION 3. EAST DIKE-PHASE I

SCALE 1"=80'

SOIL		SOIL PARAMETERS		
NO.	IDENTIFICATION	DENSITY PCF	COHESION PSF	FRICTION ANGLE DEGREES
1	SP-SM EMBANKMENT	136	0	35
2	CL CORE	120	1000	0
3	FILTER	120	0	35
4	SP-SM FOUNDATION	133	0	30

SLOPE	CONDITION	CRITICAL FACTOR OF SAFETY
DOWNSTREAM SLOPE (2.5:1)	FULL RESERVOIR (WATER AT EL. 996)	1.08
DOWNSTREAM SLOPE (2.5:1) WITH BERM UP TO EL. 953	FULL RESERVOIR	1.08
DOWNSTREAM SLOPE (3:1)	FULL RESERVOIR	1.53
DOWNSTREAM SLOPE (3:1)	FULL RESERVOIR WITH EARTHQUAKE LOADING	1.10
UPSTREAM SLOPE (2.5:1)	RAPID DRAWDOWN TO EL. 970	1.39
DOWNSTREAM SLOPE (3:1)	FAILURE SURFACE THROUGH CL CORE AND EARTH BLANKET	1.73

FIGURE 9



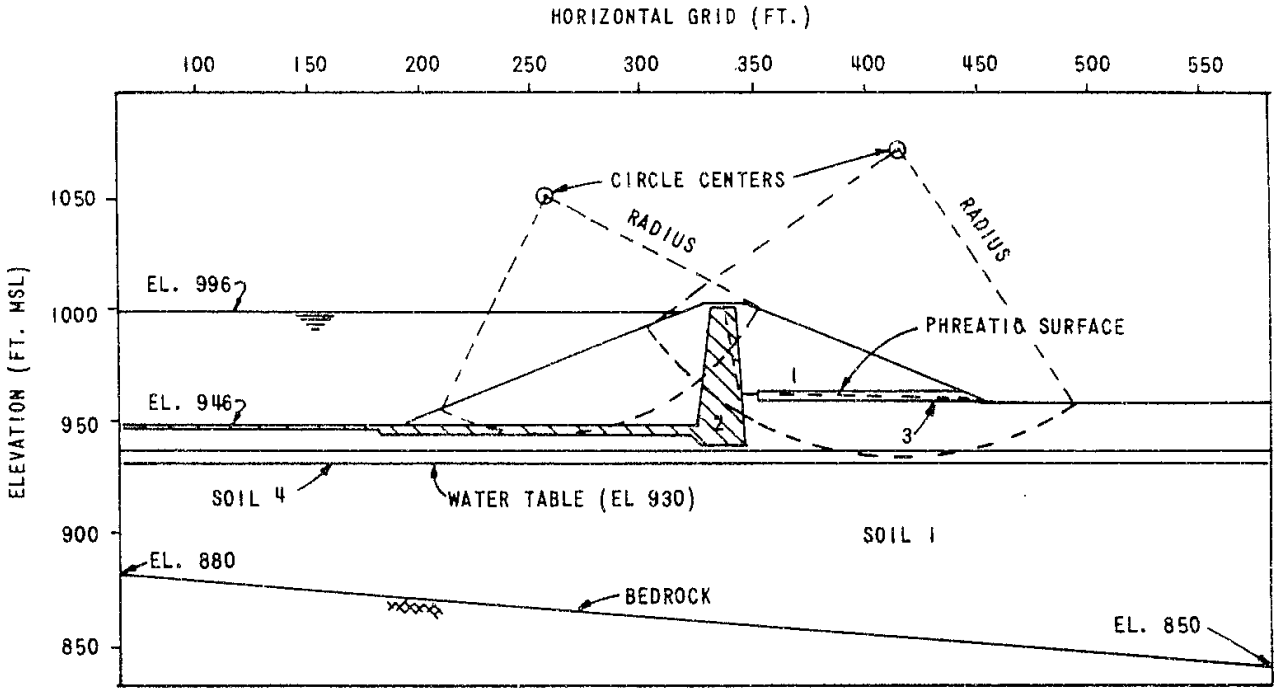
SECTION 4. INTERIOR DIKE

SCALE: 1" = 80'

SOIL		SOIL PARAMETERS		
NO.	IDENTIFICATION	DENSITY PCF	COHESION PSF	FRICTION ANGLE DEGREES
1	SP-SM EMBANKMENT	136	0	35
2	CL CORE	120	1000	0
3	FILTER	120	0	35
4	SP-SM FOUNDATION (RD 60%)	133	0	30

SLOPE	CONDITION	CRITICAL F.S.
DOWNSTREAM SLOPE (2.5:1)	FULL RESERVOIR (WATER EL. 996 ON U.S.SIDE AND EL. 952 ON D.S.SIDE)	1.65
DOWNSTREAM SLOPE (2.5:1)	FULL RESERVOIR WITH EARTHQUAKE LOADING	1.19
DOWNSTREAM SLOPE (2.75:1)	FULL RESERVOIR	1.79
DOWNSTREAM SLOPE (2.75:1)	FULL RESERVOIR WITH EARTHQUAKE LOADING	1.23
DOWNSTREAM SLOPE (2.75:1)	FULL RESERVOIR (ASH AND WATER ON DOWNSTREAM SIDE AT EL. 970)	1.69
DOWNSTREAM SLOPE (3:1)	FULL RESERVOIR	1.81
DOWNSTREAM SLOPE (3:1)	FULL RESERVOIR (WITH EARTHQUAKE LOADING)	1.30
DOWNSTREAM SLOPE (2.75:1)	FAILURE SURFACE THROUGH CL CORE AND EARTH BLANKET	1.58

FIGURE 10



SECTION 5. EAST DAM PHASE II

SCALE: 1" = 80'

	SOIL	SOIL PARAMETERS		
NO.	IDENTIFICATION	DENSITY PCF	COHESION PSF	FRICTION ANGLE DEGREES
1	SP-SM EMBANKMENT	136	0	35
2	CL CORE	120	1000	0
3	FILTER	120	0	35
4	SP-SM FOUNDATION (RD 60%)	133	0	30

SLOPE	CONDITION	CRITICAL FACTOR OF SAFETY
DOWNSTREAM SLOPE	FULL RESERVOIR (WATER AT EL. 996)	1.79
DOWNSTREAM SLOPE	FULL RESERVOIR WITH EARTHQUAKE LOADING	1.31
UPSTREAM SLOPE	RAPID DRAWDOWN TO EL. 970	1.39

FIGURE 11

outer portions of the embankment. The more pervious upstream shell will afford stability against end of construction, rapid drawdown, earthquake and other loading conditions. The downstream shell will act as a drain that controls the line of seepage and provides stability under high reservoir levels and during earthquakes. In addition, the control of seepage is provided by internal drains discussed hereinafter.

(3) Embankment drainage. A horizontal embankment drain should be provided as shown on FIGURES 12 and 13.

The principal purposes of drains acting as seepage control measures are to ensure that seepage forces will not endanger the stability of the downstream slope or cause internal movement of soil particles that might clog filters and drains or result in piping.

The horizontal drain section shown on FIGURES 12 and 13 provides drainage from the downstream edge of the central clay core to the toe drain ditch. The horizontal drain employs a 3 foot length of on-site silty sand material located adjacent to the clay core draining to a Type I filter material which in turn drains through Type II filter material to exit at the downstream toe drain ditch. The gradation of the filter material should be as follows:

Filter Material Type	U.S. Standard Sieve	Per Cent Passing
I	3 inch	100
	2 inch	85-100
	1-1/2 inch	72-90
	3/4 inch	50-70
	1/2 inch	35-50
	No. 3	22-32
	No. 6	12-20
	No. 10	0-12

Filter Material Type	U.S. Standard Sieve	Per Cent Passing
II	6 inch	100
	4 inch	72-86
	2 inch	32-65
	1-1/2 inch	20-32
	1 inch	0-20

(4) Settlement. The total settlement of the embankment and foundation, based on the elastic method of analysis, is expected to be about 2-1/2 inches. Virtually all settlement will be complete at the end of construction and no long-term settlement is expected. No camber or settlement allowance is necessary for the embankment.

(5) Slope protection. Slope protection for the bottom ash and fly ash ponds is identical to that previously discussed for the recycle and holding basins.

(6) Freeboard. The freeboard must be sufficient to prevent overtopping of the dam by wind setup, wave action, and earthquake effects. A freeboard of 4 feet is provided with the top of dam located at Elevation 1000 feet, MSL with a maximum water surface at Elevation 996 feet, MSL. This freeboard is based on a maximum wave height of 2 feet with a wave runup height of (1.5 times 2 feet) 3 feet. Additional safety can be provided by operating the ponds at water surface levels somewhat below Elevation 996 feet, MSL.

(7) Embankment alignment. Sharp changes in alignment in the upstream direction of an earth embankment must be avoided. Downstream deformation of the embankment would tend to produce tension zones in the downstream shell at the change in alignment, thereby tending to cause concentration of seepage and possibly cracking. A maximum radius of curvature for exterior dikes of 200 feet is included to provide protection against cracking.

July 17, 1973

Northern States Power Company
414 Nicollet Mall
Minneapolis, Minnesota 55401

Attention: Mr. Pete A. Johnson
Senior Civil Engineer

Gentlemen:

Eight copies of our "Report of Review of Design Criteria and Project Specifications, Proposed Coal and Ash Storage Area, Sherburne County Generating Plant - Unit 1, Sherburne County, Minnesota for Northern States Power Company" are herewith submitted.

The scope of our services were planned in collaboration with Messrs. Jerry Zylkowski, Roger Hartzberg, Pete Johnson, and Richard McGinnis of Northern States Power Company and were outlined in our proposal dated February 22, 1973. This work was authorized by your purchase order No. C-86459.

Preliminary copies of the project specifications, construction drawings, supporting analyses, boring logs, and laboratory test data were submitted for review by Black & Veatch, Consulting Engineers. Following our review of the preliminary project plans and documents, a joint meeting attended by representatives of Northern States Power Company, Black & Veatch, and Dames & Moore was held in Minneapolis on May 1, 1973. During the meeting, agreement was reached regarding certain modifications of the project documents and the need for additional laboratory tests to substantiate assumptions used in the supporting analyses.

Subsequent to the May 1 meeting, additional laboratory tests were performed and Black & Veatch prepared final versions of the project documents. We have completed our review of these documents and are in agreement with the final version. However, we have noted that the revised gradation requirements and lift thickness for filter blankets and proof-rolling of the clay blankets prior to filling had not been incorporated in the project specifications at the time of our review. All modifications noted in Memorandum 519 by Black & Veatch, dated June 18, 1973 should be incorporated in the specifications before issuing the project documents in final form.

Please do not hesitate to contact us if you have any questions pertaining to the contents of this report. It has been a pleasure to be of service to you on this project.

Yours very truly,

DAMES & MOORE

William G. Paratore
Partner

WGP:RWC:sb

REPORT

REVIEW OF DESIGN CRITERIA AND PROJECT SPECIFICATIONS

PROPOSED COAL AND ASH STORAGE AREA

SHERBURNE COUNTY GENERATING PLANT - UNIT 1

SHERBURNE COUNTY, MINNESOTA

FOR

NORTHERN STATES POWER COMPANY

INTRODUCTION

This report presents the results of our review of design criteria and project specifications performed for the proposed coal and ash storage area for the Sherburne County Generating Plant - Unit 1 in Sherburne County, Minnesota.

The purposes of our engineering studies were as follows:

1. To review the design and supporting analysis, including stability, settlement, and seepage, for the Proposed Coal and Ash Storage Area submitted by Black & Veatch, Consulting Engineers.
2. To review the project specifications and construction drawings for the proposed construction.
3. To provide an evaluation of the design, supporting analysis, project specifications, and construction drawings for the proposed construction.

DESIGN CRITERIA

SOIL PARAMETERS

The relevant soil parameters for design of the earth retaining structures for the coal and ash storage facilities include:

1 - In-Situ Natural Soils and On-Site Cohesionless Embankment Fill Material

- Density
- Angle of Internal Friction
- Permeability

2 - Impervious Core and Impervious Blanket

- Density
- Shear Strength
- Permeability

3 - Filter Blankets

- Density
- Gradation
- Angle of Internal Friction
- Permeability

Soil parameters used in the analyses are based on the results of field and laboratory tests performed on the in-situ natural soils and borrow materials by Dames & Moore and by Soil Exploration Company, Inc. as documented in the report of "Supporting Analysis II-M" by Black & Veatch dated

June 27, 1973. The borrow materials selected for construction of the dikes, impervious core and blankets, filter blankets, and slope protection are suitable for the proposed construction. The soil parameters used for the analyses are, in each case, reasonable and consistent with conservative practice.

SETTLEMENT

The natural granular soils underlying the embankments are relatively incompressible and free-draining. Settlements may be expected to be relatively minor and will occur simultaneously with the application of the loads. A maximum settlement of approximately two inches under the dikes was computed. The compression parameters used in the calculations and the magnitude of settlement have been verified by independent calculations performed by Dames & Moore.

SEEPAGE

The coefficients of permeability of the embankment and foundation soils used in the seepage analyses appear to be conservative but reasonable in view of possible unforeseen variations in the natural soils and compacted fill. The seepage calculations have been verified by Dames & Moore. The computed seepage losses are well within tolerable limits. Filter blankets have been provided to control seepage paths and to carry seepage water to collection ditches. The gradation characteristics, permeability, and thickness requirements of the filter blankets have been checked and found to be adequate.

SLOPE STABILITY

Stability analyses of the slopes have been performed for all conditions which could be reasonably anticipated during the service life of the structures. The soil parameters and loading conditions used in these analyses have been conservatively chosen. Selected critical cases, including full reservoir with earthquake loading, have been verified by Dames & Moore. Those cases which were not specifically verified are less critical and the computed factors of safety appear to be reasonable and consistent.

The factors of safety for the slopes used in the design are adequate to ensure the safety of the structures. Moreover, the computed factors of safety probably represent lower bound values in view of the conservative assumptions of soil parameters and loading conditions used in the analyses.

CONSTRUCTION

COMPACTION CRITERIA

Granular Soils. It is specified that granular soils will be compacted to at least 95 percent of the maximum dry density as determined by the ASTM 1557 Method of Compaction. This compaction requirement is considered satisfactory for the proposed construction and is consistent with the density, permeability, and shear strength parameters used in the supporting analyses.

Impervious Soils. The clay core and impervious earth blankets will be compacted to at least 93 percent of the maximum dry density as determined by the ASTM 1557 Method of Compaction at a moisture content between optimum and three percent wet of optimum. This degree of compaction should be obtainable under field conditions and is consistent with the permeability and shear strength parameters used in the analyses of seepage losses and slope stability.

PROOF-ROLLING

Proof-rolling of the exposed natural soils to a dry density of at least 95 percent of the maximum prior to construction of the dikes and impervious earth blankets is required. This compaction criterion is sufficient to restore the exposed natural soils to a condition equal or superior to the in-situ condition and should be readily obtainable in the field.

Proof-rolling of the clay blankets within the ash ponds immediately prior to filling is also required to knead the surface and close any shrinkage cracks that may develop. This requirement is essential for the prevention of excessive seepage losses and piping.

PLACEMENT OF FILTER BLANKETS

The required thickness of filter blankets is 18 inches. This thickness is adequate to carry the anticipated seepage quantities, if it is properly constructed. Placement of the

filter blankets should be closely supervised to ensure that particle size segregation and contamination of the filter material by the adjacent embankment fill material is prevented and that proper compaction is achieved. The filter material should be placed in lifts no greater than 12 inches in thickness.

--oOo--

If you have any questions concerning the information contained in this report, please do not hesitate to contact us.

Respectfully Submitted,

DAMES & MOORE

William G. Paratore
Partner

Richard W. Christiansen
Project Engineer

WGP:RWC:sb

Eight Copies Submitted

Internal Correspondence

NSP

82 EA01
Bottom Ash Revision
0002

Date May 13, 1982

From R. B. Anderson — Location GO 7

To P. K. Gieszler — Location ERAD - GO 2

Subject E-82EA01 SHERBURNE COUNTY GENERATING PLANT
UNITS 1 and 2
Bottom Ash Pond Revision
MPCA, NPDES Permit Application

This letter is to transmit the technical spec for the bottom ash pond revision project for permit purposes. This should complete submittal of necessary materials to the MPCA. A set of drawings was initially sent to the MPCA from ERAD on April 14, 1982. Let us know if you have any questions.

R. B. Anderson, P. E.
Project Engineer

mfc

cc: E. J. Cramolini
G. H. Jacobson
File E-82EA01

Note: Three copies of spec sent separately on May 12, 1982.

PLANT FILE COPY

X MPCA
X NPDES

TELEPHONE COMMUNICATIONS RECORD

E-Number E-82EA01 A/E Project

Plant Sherburne County Generating Plant Units 1 & 2 A/E File #

Project Bottom Ash Pond Revision Date 4/21/82

NSP File # A610 P.O. #

Date of Conversation 4/21/82 Time 8:30 a.m.

Subject Clay Mining and Hauling Permits

From Jim Alders (JA)	To Roger Anderson (RA)
Phone 6732	Phone 6962
Company NSP - ERAD	Company NSP - PE&C
Position Administrator	Position Civil Engineer

Item	Subject	Action Required
JA	We have received permit for clay borrow and hauling. Paperwork will follow. On clay borrow site, the Soil Conservation Service has installed some drain tile across the mine entrance. They were assured that NSP would repair any tile damaged due to clay haul traffic.	

PLANT FILE COPY

Distribution: H. K. Norgaarden
G. H. Jacobson
E. J. Cramolini
File
+ Clay mining & hauling

By: R. B. Anderson

FORM 17-2690(4-80)

Internal Correspondence

NSP

82EA01 Bottom ash pond permits

Date January 25, 1982

From R. B. Anderson - Civil Engineer Location GO 7

To J. L. Bechthold - Manager, Regulatory Compliance Location GO 2

Subject SHERBURNE COUNTY GENERATING PLANTS UNITS 1 and 2 - E-82EA01
Bottom Ash Pond Revision
Permitting and Regulatory Support

This letter is to formally request aid from ERAD in obtaining all state, federal and local permits required to construct the above project. The project is scheduled for a construction start in July 1982. Project objective is to increase existing bottom ash pond capacity by raising embankments on two sides. Estimated total project expenditure is $400,000. Objectives include licensing upcoming clay mining and hauling operations. We feel that clay mining and hauling permits should be obtained for this project, and the "Replacement Fly Ash Pond" project (E-80E004) in combination and kept valid until the end of 1986. We anticipate mining clay for the two projects from an area northwest of Becker for the next three construction seasons (1982, 1983 and 1984). Based on records from the previous clay mining and hauling operations, some attention must be devoted to:

1. Obtaining a conditional permit from Sherburne County.

2. Addressing public concerns regarding noise, safety, potential damage to existing road surfaces and possible others.

Mr. D. W. King of St. Cloud Division Office is aware that this project is coming up and we presume ERAD would deal with Sherburne County and other local governments through him. Mr. King will be gone most of February 1982 on vacation so he should be contacted soon.

We would like a response from ERAD listing permits required, permit duration requirements, proposed approach and items needed from us to fulfill permit application needs.

Please call if there are questions.

R. B. Anderson, P. E.
Civil Engineer

A. E. Johnson

A. E. Johnson, P. E.
Project Engineer

PLANT FILE COPY

mfc
cc: D. W. King (St. Cloud Div. Office), E. J. Cramolini, G. H. Jacobson
R. A. Holmberg, J. E. Kettner

FORM 17-3467

PRIMARY	SECONDARY	TERTIARY	DPF SEQ
82EA01	BA REVISION	E100	
&		SPEC	Z7701810
X	ADDENDUM 1 REVIEW PKG		Z7701810
X	GRADING SPEC 10169		Z7701810
			Z7701810

E- 82EA01
BA Revision
Spec
E100

Northern States Power Company

414 Nicollet Mall
Minneapolis, Minnesota 55401
Telephone (612) 330-5500

June 9, 1982

Mr. G. Y. Gunn
Black and Veatch Consulting Engineers
Post Office Box 8405
Kansas City, Missouri 64114

SHERBURNE COUNTY GENERATING PLANT E-82EA01
Units 1 and 2
Bottom Ash Pond Revision
Addendum Package Comments
File E000

Dear Mr. Gunn:

This letter is to document NSP comments to Addendum 1 Review Package issued to NSP on May 21, 1982. These comments were given to Mr. Horner previously by telecon.

The specification comments are as follows:

1. We would prefer to see NSP drawing numbers used rather than a mixture of NSP numbers and B&V numbers; e.g., M2500.

2. Page 1A-2, Part 1A.3.1 - Here and on the applicable drawing, it should be noted that the Type III concrete pipe support is an existing pipe support.

3. Part 1B.2 - NSP drawings and B&V drawings should be listed on separate columns.

4. Section 2G, Part 2G.1 - "General" should describe the concrete structures to be provided. These sections should also have a short description of concrete testing. Concrete testing will be supplied by the Owner.

5. Section 2H - More detail should be given on the "plastic" bypass pipe. A better description of the "Type III" pipe support should be provided. The drawings and specifications do not reflect if this Type III support is precast concrete or other material.

PLANT FILE COPY

Drawing comments are as follows:

1. NF-95380 - The statement is made in the notes that temporary bypass piping and supports shall be removed under Spec 10169.71.10000. The plan should indicate areas where pipe encasement would be left in place, for instance, the bottom ash pipe bypass line encasement area. The drawings should clearly show materials used for all elbows. The location and description is needed for "trench" referenced in the Type III detail. Detail D "Concrete Pipe Encasement" should be referenced to the Type II pipe encasement. Detail B should show a 6 foot radius on the 6-inch elbows and flanges at the end of each elbow curvature. Section 1 should indicate that the steel pipe is not "encased" but timber protected. Note 2 refers to washers installed with all bolts and nuts. This note should be more specific describing what the bolts are used for and how many washers are required for each bolt. Note 7 "stagger pipe flanges on snaked piping" should indicate how far apart flanges should be staggered minimum.

2. NF-95379 - Edges of construction on the plan view are referenced as "PVIs". These can be indicated with a simple north and east coordinate. The reference note for existing culverts to note 4 seems unnecessary. On section 3 existing culverts should be shown as dashed in section. The pipe encasement detail would be more meaningful if a plan view were provided. An east-west and north-south dimension is required as a minimum.

3. NF-95381 - Plan view should have a north arrow. Plan view should indicate that the Type III support is an existing support and that support details for the east-west runs of bottom ash lines are provided on other drawings. Note 9 needs more clarification.

4. NF-49682 - Section 5 should indicate flanges on the end of the sluice pipes and that the lower part of the pipe is parallel to the slope. The reference to drawing NF-49047 on detail D and detail H should be revised since that drawing has been superseded.

5. NF-77218 - Note should be made that this drawing supersedes a previous underground utility drawing. Significant numbers should be placed on the plan. References to other drawings should include the NSP NF drawing number. Boundaries of the contractor's work should be shown on this drawing.

6. NF-77219 - Same comments as on previous drawing.

7. NF-49683 - No comments.

Per plant personnel request, B&V will provide a sketch of wooden A-frame type supports for bottom ash polybutylene lines inside the bottom ash pond. The pipe should be 5 to 6 feet above bottom ash level, and provide continuous support. Design live load should be 425 plf. Construction will be by plant personnel.

If you have any questions, please call.

Very truly yours,

R. B. Anderson, P. E.
Project Engineer

mfc

cc: E. J. Cramolini
G. H. Jacobson
File E000

G N Jacobson

Northern States Power Company

414 Nicollet Mall
Minneapolis, Minnesota 55401
Telephone (612) 330-5500

April 30, 1982

Mr. G. Y. Gunn
Black and Veatch Consulting Engineers
Post Office Box 8405
Kansas City, Missouri 64114

SHERBURNE COUNTY GENERATING PLANT E-82EA01
UNITS 1 and 2
Bottom Ash Pond Revision
Specification and Drawing Comments - File E100

Dear Mr. Gunn:

This letter is to document NSP comments to the first review issue of Specification No. 10169.71.1000 "Bottom Ash Pond Revision" and associated preliminary drawings. These comments have been given to Mr. Horner previously by telecon. After the package is finalized we would like to have five copies of technical spec for permit purposes. We will be in touch with you regarding the number of contract bid packages to send to us. Specification comments are as follows:

1. Title Page - Should use "Unit 1 and 2" rather than Unit 3. Title should be "Bottom Ash Pond Revision". Inquiry number should be E-82EA01.

2. Page A-1, Part A.3 - Delete the requirement that bidders return copies of all contract documents with proposals.

3. Page A-3 and Page B-1 - Letters to Purchasing should be addressed to Mr. J. A. Noer.

4. Page A-4, Part A.7 - H. K. Norgaarden's title should be project manager.

5. Page A-5, Part A.10 - Delete references to Units 1, 2 and 3. To make such soil boring logs and location plans available to bidders at the plant site, we request that Black and Veatch prepare a listing of all necessary information such that NSP can have necessary information available.

6. Page SC-6, Part SC.20 - Delete reference to MPCA requirements and regulations being available for an examination at the company's site office.

COPY

7. Page 1A-1, Part 1A.3 - Categorize the work included items into work on Sherco site and work in the clay borrow area. Delete reference to bottom ash fill. Delete reference to razing structures and note that all fencing removed shall be replaced by the contractor. Delete reference to providing erosion protection in the clay borrow area.

8. Page 1A-2, Part 1A.4 - Under work not included, include removal of existing permanent ash sluice piping and removal of bypass piping. Also include reinstallation of culvert pipes shown on drawing S1150 and described in the culvert schedule.

9. Page 1A-3 - Delete part 1A.5 "Contour verification".

10. Part 1A.6.1 - Revise this section as required based on deletion of Part 1A.5.

11. Page 1A-5, Part 1A.7 - Change completion date to November 1, 1982.

12. Page 1E-2, Part 1E.3.3 - Note that the company will supply a 480 volt three-phase pole mounted source in the general work vicinity.

13. Part 1E.3.6 - Note that the contractor shall also provide his own pumps for construction water.

14. Page 1E-3 - Delete Part 1E.6 "Railroad".

15. Page 1F-1, Section 1F "Receiving, Handling and Storage" - Unless B & V is aware of special handling needs for contractor furnished materials and equipment, delete this entire section.

16. Page 2A-2, Part 2A.2.1, second sub-item - Reword this sentence such that the contractor will only be required to clear and grub that portion of the clay borrow area which is required for his mining operation. Also reword third subheading, clarifying clearing and grubbing of toe drain ditches.

17. 2A.2.2 - Clarify what definition of a "non-combustible" is. Note that in the clay borrow area, according to our contract with the landowner, the contractor will be required to bury all large size rocks on the clay borrow site property where designated by NSP.

18. Part 2A.3 - Reword saying that the contractor will not be required to remove all fences within the limit of the clay borrow area but will be required to replace after completion of his borrow area work.

19. Page 2B-1, Part 2B.5 - Note that the contractor will cut all trees which are removed to 8' long logs for removal by others.

20. Page 2B-2, Part 2B.10 - Add a statement requiring the contractor to provide a net haul weight of a typical truck each hauling day to the company.

21. Page 2B-3, Part 2B.13 - Since this site will probably be used as a clay borrow area in 1983, we should not require this contractor to seed, fertilize and mulch his finished area. A minimal amount of recontouring will be required and a reasonable amount of replacement of unsatisfactory material back into excavated areas, erosion control, etc.

22. Page 2C-1, Part 2C.1 - Reword the first four paragraphs to clearly define the various pieces of work.

23. Page 2C-3, Part 2C.7 - Verify that a maximum density method of compaction control is satisfactory for compaction of materials below an excavated surface.

24. Page 2C-4, Parts 2C.7.1 and 2C.7.3 - Various portions of these two sections are repetitive. These two sections should be combined.

25. Page 2C-8, Part 2C.9.4 - Eight inches of uncompacted thickness should probably be specified here rather than nine to be consistent with previous statements. Statements regarding location of various grades of sand in the downstream embankment should be clarified with regard to the strictness of placement control. Statements referring to use of bottom ash should be deleted since it has been determined that this material will not be used in the embankment.

26. Page 2C-9, Part 2C.9.5 - Per your recommendations, delete statements about control of moisture content in the embankment fill. A 90% density requirement for clay compaction seems appropriate, based on construction history of the existing ponds. We request that B & V research applicable soils reports, construction testing records, and project correspondence to verify that installation requirements are consistent with project needs and previous findings, and that clay used for upcoming projects is sufficiently similar to previously used clay to draw parallels. We request a follow-up letter summarizing your findings, and discussing assumed clay properties. This effort will be of use for the "Fly Ash Pond Modification project as well.

27. Page 2C-11, Part 2C.10.5 - The first paragraph of the section should be rewritten to clarify material classification, areas in borrow pit excavation depth and designation by the company of placement of each type of material. The only designation of placement location NSP should make is 1) in the clay core, or 2) in the downstream slope drain ditches.

    Per our discussion B & V will redo part 2C.10 covering impervious core construction in more detail, combining some of the material now included under the "Impervious Earth Blanket Construction".

28. Page 2C-12, Part 2C.10.6 - As we have discussed delete the second paragraph which refers to sand cover material.

29. Page 2D-2, Part 2D.5.3 - The second sentence should require test reports before delivery and not before pipe manufacture for this contract.

30. Page 2E-1, Part 2E.1 - The old MDH (or Minnesota Department of Highways) is now called Minnesota Department of Transportation or (MnDOT).

31. Delete part 2E.2, the portion which refers to dust palliative. Make appropriate change on the next page with regard to the same subject.

The following comments refer to the drawings.

1. Drawing No. S1150 (B&V No.) - On the plan view, add coordinate reference lines, revise "PVI" as we have discussed. Show culverts in plan with dash lines. On section 3 show the new location of culverts, as well as existing culverts and revise culvert pipe schedule wording per our discussion.

2. No comments on B & V drawings S-1142, and S-1141. On drawing S-1140, indicate that the ditch running north from the initial sedimentation area is not needed for the initial bottom ash project work.

3. On NSP drawing NF-82017 - enlarge the fill borrow area to provide sufficient fill for the total project and indicate a maximum excavation depth.

If you have any questions, please call.

Very truly yours,

R. B. Anderson, P. E.
Project Engineer

mfc
cc: E. J. Cramolini, G. H. Jacobson, File E100

NORTHERN STATES POWER COMPANY
SHERBURNE COUNTY GENERATING PLANT
UNITS 1 AND 2

BOTTOM ASH POND REVISION

SPECIFICATION 10169.71.1000
INQUIRY NO. E-82EA01

ADDENDUM 1
May 21, 1982

Each bidder shall note these revisions to the Specifications and Documents and incorporate these revisions in his proposal. Each bidder shall attach a signed acknowledged copy of this entire addendum in the front of the specifications submitted with his proposal.

This addendum consists of this page and the following attachments. Vertical lines in the right-hand margins of the revised and new page identify text revisions, additions, or deletions except for Sections 2G and 2H which are new sections not previously issued.

Revised Pages - B-1, B-2, B-3, C-3, 1A-2, 1A-3, 1A-4, and 1B-1

Unrevised Page - 1A-1

New Page - 1B-2

New Sections - 2G and 2H

Revised Drawings - NF-49093 and M2500 which were reference drawings are now construction drawings

New Drawings - NF-49682, NF-49683, A2115, and A2116

BLACK & VEATCH
Consulting Engineers

* * * * * * * * * * * * * * *

ACKNOWLEDGMENT

The undersigned bidder hereby certifies that the revisions set forth in this addendum have been incorporated in his bid and are a part of the contract documents.

Signed _____

_____

Date _____

PROPOSAL

Northern States Power Company
414 Nicollet Mall
Minneapolis, Minnesota 55401

Attention: Mr. J. A. Noer

PROPOSAL FOR BOTTOM ASH POND REVISION
SHERBURNE COUNTY GENERATING PLANT - UNITS 1 AND 2

Gentlemen:

The undersigned bidder having read and examined the specifications and associated contract documents for the Bottom Ash Pond Revision work which will be incorporated in the Sherburne County Generating Plant, does hereby propose to perform the construction and provide the services set forth in this Proposal.

The undersigned hereby declares that any and all variations from, and exceptions to, the requirements of the contract documents have been listed in the Proposal Data section and that, otherwise, it is the intent of this Proposal that the work will be performed in strict accordance with the contract documents.

B.1 LUMP SUM PRICE. The undersigned bidder hereby proposes to furnish equipment and materials; labor, skilled, semiskilled and unskilled; labor supervision; construction tools and equipment; construction services and utilities; as required to perform the Bottom Ash Pond Revision work in accordance with the specifications and associated contract documents as defined in GENERAL CONDITIONS, Article GC.3 except the work associated with the temporary bypass and permanent ash sluice piping for the following firm lump sum price.

_____

_____ ($)
(Price in Words)

B.2 LUMP SUM PRICE ADDITION. In addition to the above stated lump sum price (Article B.1), and subject to the option of the Company, the undersigned bidder hereby proposes to perform the work on the temporary bypass and permanent ash sluice piping in accordance with the specifications as described in Article IA.3.2 and associated contract documents as defined in GENERAL CONDITIONS, Article GC.3 for the following firm lump sum price:

_____

_____ ($)
(Price in Words)

B.3 BOND. Lump sum price for furnishing Performance and Labor and Materials Payment Bond in the amount of 100 per cent of the Item B.1 lump sum price.

_____

_____ ($)
(Price in Words)

B.4 UNIT ADJUSTMENT PRICES. The following unit prices will be used to adjust the above listed lump sum price to compensate for differences between the quantities indicated on the drawings and those actually constructed under the contract documents. It is further understood that these unit prices will be used for either additions to or deletions from the lump sum price. Each unit adjustment price shall include all costs for furnishing and installing the unit complete and shall apply only to the specific material designated.

"Excavated Materials" as defined in Article 1A.5.1, per cubic yard	$_____
"Core Trench Excavation" as defined in Article 1A.5.2, per cubic yard	$_____
"Impervious Clay Core Fill" as defined in Article 1A.5.3, per cubic yard	$_____
"Impervious Earth Blanket" as defined in Article 1A.5.4, per cubic yard	$_____
"Embankment Fill" as defined in Article 1A.5.5, per cubic yard	$_____
"Type 21 Pipe Supports" as defined in Article 1A.6.6, each	$_____
"Road Surfacing" as defined in Article 2E.3, per square yard	$_____

B.5 SUBCONTRACTORS. The undersigned proposes that he will perform the majority of the work with his own forces and that specific portions of

the construction work not performed by the undersigned will be subcontracted by the following subcontractors.

Work Subcontracted	Name of Subcontractor
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

B.6 DECLARATIONS AND SIGNATURES. The undersigned hereby certifies that he has visited the site of the proposed work and has familiarized himself with the conditions affecting the work.

The undersigned hereby declares that only the persons or firms interested in the Proposal as principal or principals are named herein, and that no other persons or firms than herein mentioned have any interest in this Proposal or in the contract to be entered into; that this Proposal is made without connection with any other person, company, or parties likewise submitting a bid or proposal; and that it is in all respects for and in good faith, without collusion or fraud.

The undersigned hereby agrees that the Proposal shall be valid for a period of _____ days after the date proposals are due.

The prices stated in this Proposal include all taxes of any nature which may become due or payable by the Contractor in connection with the proposed work, except Minnesota sales, use, and excise taxes applicable to the equipment and materials which are to be permanently incorporated into the work.

If this Proposal is accepted, the undersigned hereby agrees to enter into contract and to furnish an acceptable Performance Bond if required by the Company.

_____
(Bidder's Name)

State name and address of concrete culvert pipe manufacturer

_____

_____

Name of crushed rock or gravel surfacing supplier

_____

Name of seed and fertilizer supplier

_____

Contractor's earth moving equipment:

Describe each type and the number proposed to be utilized of each type; also state dates equipment will be available.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(Trim Line)

Ready mixed concrete supplier

Rebar supplier

Treated wood supplier

Section 1A - GENERAL DESCRIPTION AND SCOPE OF THE WORK

1A.1 GENERAL. This section covers the general description of Units 1 and 2 at the Company's Sherburne County Generating Plant and the scope and general requirements for the work under these specifications designated Bottom Ash Pond Revision.

1A.2 PROJECT DESCRIPTION. The Sherburne County Generating Plant is located in Becker, Minnesota. Units 1 and 2 of the Sherburne County Generating Plant are existing complete operating units of 700 megawatts each. A railroad siding is available for the delivery of equipment and materials.

1A.3 WORK INCLUDED UNDER THESE SPECIFICATIONS. The work under these specifications shall include furnishing all equipment and materials; providing all labor, supervision, administration and management; and supplying all construction equipment, materials, and services necessary to perform the Bottom Ash Pond Revision work for Units 1 and 2 complete in accordance with the provisions of the contract documents defined in Article GC.3 of the GENERAL CONDITIONS, except as specifically excluded herein under "Company-furnished Equipment and Materials" and WORK NOT INCLUDED UNDER THESE SPECIFICATIONS.

Major components of the work under these specifications for Bottom Ash Pond Revision include the following.

Work at the Plant Site

Clearing and grubbing

Removal of ash sluice pipe culverts

Perform earthwork required for the bottom ash pond embankments and access road.

Place impervious earth for the bottom ash pond dike core and toe drain ditch.

Furnish and install culverts.

Furnish materials and construct crushed rock or gravel surfaced roads.

Perform finish grading.

Provide erosion slope protection including seeding, fertilizing, and mulching.

Work at the Impervious Earth Borrow Area

Clear, grub, and remove fencing.

Provide construction drainage to the sedimentation pond.

Excavate, classify and haul impervious earth materials to the designated locations within the plant site area.

Provide haul road maintenance.

Finish grade the borrow area including permanent drainage.

Replace fencing.

Additional Work at the Ash Sluice Piping Area

Sh. C. maint ?

Reinstallation of ash sluice pipe culverts

Installation of permanent ash sluice piping including supports

Removal of temporary bypass ash sluice piping

The above explanations and listings are intended to give a general definition of the scope of the work under these specifications, and shall not be construed to be an itemized listing of each element of work required. The Contractor shall be responsible for construction of complete facilities, conforming in all respects to the details and requirements of the contract documents.

1A.3.1 Company-furnished Materials. The Company will furnish the following listed items of material for installation under these specifications.

All permanent ash sluice piping and fittings

25 Type 21 timber pipe supports ? (who?)

1 Type 3 concrete pipe support ? (who?)

1A.3.2 Contractor-furnished Materials, Manpower, and Services. The Contractor shall provide all materials and equipment which will be permanently incorporated in the work and which are not specifically designated to be furnished by the Company; all labor, supervision, technical direction, administration and management; and all construction plant and services.

In addition, the Contractor shall provide engineering data in accordance with the requirements of Section 1C and a quality assurance program in accordance with the requirements of Section 1D.

1A.4 WORK NOT INCLUDED UNDER THESE SPECIFICATIONS. In addition to the work under these specifications for Bottom Ash Pond Revision, the Company will be performing the following work which will be directly associated with the work under these specifications.

Installation of temporary bypass ash sluice piping

Removal of permanent ash sluice piping including supports

If the lump sum price addition is not accepted, the Company will perform the additional work described in Article 1A.3.

Part of the work listed hereinbefore will be in progress concurrently with the work under these specifications. The Contractor shall coordinate his activities and cooperate with the other contractors and the Company in the best interest of the project.

1A.5 LUMP SUM PRICING. The lump sum prices stated in the Proposal shall include all costs for performing the work in accordance with the contract documents.

1A.5.1 Lump Sum Price. The lump sum Proposal Article 8.1 shall include all work under these specifications and as indicated on the drawings, except removal of the temporary bypass piping and installation of the permanent ash sluice piping.

1A.5.2 Lump Sum Price Addition. The lump sum addition Proposal Article 8.2 shall include all work under these specifications and as indicated on the drawings for removal of the temporary bypass piping and installation of the permanent ash sluice piping.

1A.6 UNIT ADJUSTMENT PRICES. The unit adjustment prices stated in the Proposal shall be used to adjust the contract sum for additions to or deductions from the items of work specified hereinafter. The unit adjustment price in each case shall include all costs for furnishing and installing complete units of work. Adjustments shall take into consideration the contours existing at the time the Contractor was notified of the revisions to the work.

1A.6.1 Excavated Materials. As used hereinafter, the term "excavated materials" shall mean either material removed by cutting or material deposited as fill.

The unit adjustment price for "excavated materials" shall apply only to each cubic yard of the finish cut or final in-place fill, whichever quantity is larger.

The quantity will be the net difference in cubic yards of "excavated materials" added to or deducted from the work by revision of the contract drawings.

The quantities shall be calculated by the average end area method.

"Excavated materials" are unclassified material and shall include all materials encountered.

1A.6.2 Core Trench Excavation. The unit adjustment price for core trench excavation shall apply to each cubic yard of material added to or deducted from the work by revision of the contract drawings as amended or confirmed through original contour verification. This unit adjustment price shall include dewatering, excavating, transportation, and storing of this material whether it is or is not stockpiled for reuse.

1A.6.3 Impervious Clay Core Fill. The unit adjustment price for impervious clay core fill designated "clay core" shall apply to each cubic yard of material added to or deducted from the work by revision of the contract drawings. This unit adjustment price shall include excavating and transporting from the impervious earth stockpile area indicated on the drawings to the place of use, placement, compaction, watering, rolling, and discing of the material in place complete as specified in Section 2C.

1A.6.4 Impervious Earth Blanket. The unit adjustment price for impervious earth blanket fill shall apply to each cubic yard of material added to or deducted from the work by revisions of the contract drawings. This unit adjustment price shall include excavating and transportation from the impervious earth stockpile area indicated on the drawings to the place of use, placement, compaction, watering, rolling, and discing of the material in place complete as specified in Section 2C.

1A.6.5 Embankment Fill. The unit adjustment price for embankment fill shall apply to each cubic yard of material added to or deducted from the work by revision of the contract drawings. This unit adjustment price shall include the transportation, compaction, watering, rolling, and discing of the material in place complete as specified in Section 2C.

Adjustment quantities will be determined by the Company using field measurements. The unit adjustment price in each case shall include all costs for complete units of work.

1A.6.6 Type 21 Pipe Supports. The unit adjustment price for Type 21 pipe supports shall be applied to each support added to or deducted from the number of Company-furnished supports listed in Article 1A.3.1. This unit adjustment price shall include materials, fabrication, and transportation to the plant site.

1A.7 SCHEDULE. The work to be performed under these specifications shall begin on or before August 1, 1982 and shall be completed by December 3, 1982.

Complete dike construction	October 15, 1982
Complete permanent ash sluice pipe installation	November 12, 1982
Complete removal of bypass piping	November 24, 1982

Section 1B - DRAWING LIST

1B.1 GENERAL. This section lists the drawings which have been prepared for the work covered by these specifications and which shall be a part of the contract documents.

1B.2 CONSTRUCTION DRAWINGS.

Drawing No.	Rev No.	Title
NF-49025	K	GENERAL SITE ARRANGEMENT
NF-49093	F	FOUNDATIONS AND MISCELLANEOUS GRADING SECTIONS AND DETAILS
NF-49682	F	YARD PIPING BOTTOM ASH & SCRUBBER SLUDGE - DETAILS AND SECTIONS
NF-49683	E	YARD PIPING BOTTOM ASH & SCRUBBER SLUDGE - SUPPORT DETAILS
A2115	-	UNDERGROUND UTILITIES PLAN SHEET 15
A2116	-	UNDERGROUND UTILITIES PLAN SHEET 16
S1006	A	AREA GRADING PLAN SHEET VI
S1140	A	IMPERVIOUS EARTH BORROW AREA SHEET 1
S1142	-	IMPERVIOUS EARTH BORROW AREA SITE PLAN AND SECTIONS
S1150	B	BOTTOM ASH POND MODIFICATION PLAN, SECTIONS AND DETAILS
M2500	A	YARD PIPING BOTTOM ASH AND SCRUBBER SLUDGE BYPASS PIPING

1B.3 REFERENCE DRAWINGS. This article lists the drawings or lists which are associated with this work but are not part of this Contract.

Drawing No.	Rev No.	Title
NF-49074	I	DETAIL GRADING PLAN SHEET 7
NF-49089	C	ASH STORAGE AREA SECTIONS AND DETAILS
NF-49090	D	ASH STORAGE AREA SECTIONS AND DETAILS
NF-49106	F	SITE ARRANGEMENT PLAN SHEET VI

Section 2G - CAST-IN-PLACE CONCRETE

2G.1 GENERAL. This section covers cast-in-place concrete, including reinforcing steel, forms, finishing, curing, anchor bolts, and other work appurtenant thereto.

2G.2 MATERIALS.

Cement	ASTM C150, Type I, II, or III
Fine aggregate	Clean natural sand, ASTM C33
Coarse aggregate	Crushed stone, washed gravel, or other acceptable inert granular material conforming to ASTM C33
Water	Clean and free from mud, oil, organic matter, or other deleterious substances
Reinforcing steel bars	ASTM A615

2G.3 PRELIMINARY REVIEW. The source and quality of concrete materials and the concrete proportions proposed for the work shall be submitted to the Engineer for review before the concrete work is started.

2G.4 LIMITING REQUIREMENTS.

Cement content	Not less than 500 pounds per cubic yard for a 28 day compressive strength of 3,000 psi
Total water content	Not more than 6 gallons per 100 pounds of cement
Coarse aggregate size	1 inch to No. 4
Consistency	Workable, without segregation, with slump not more than 4 inches when concrete is placed
Mixing	Thoroughly in a mechanical mixer for not less than 1-1/2 minutes

2G.5 BATCHING AND MIXING. Batching and mixing shall conform to ASTM C94, except as otherwise specified herein.

2G.6 PLACEMENT. Concrete shall be conveyed to the point of final deposit and placed by methods which will prevent the separation or loss of the ingredients. During and immediately after depositing, all concrete shall be thoroughly compacted, worked around all reinforcements and embedments, and worked into the corners of the forms. Unless otherwise authorized, immersion type vibrators shall be used for compaction.

Concrete shall be placed within one hour and 30 minutes after introduction of the cement to the aggregates.

2G.7 REINFORCEMENT. Reinforcements shall be accurately formed and positioned, and shall be maintained in proper position while the concrete is being placed and compacted.

2G.8 FORMS. Forms shall be designed to produce hardened concrete having the shape, lines, and dimensions indicated on the drawings. Forms shall be substantial and sufficiently tight to prevent leakage of mortar and shall be maintained in proper position and accurate alignment. Forms shall be thoroughly cleaned and oiled before concrete is placed and shall not be removed until the concrete has hardened sufficiently to support all loads without damage.

2G.9 EMBEDMENTS. Materials that are to be embedded in the concrete shall be accurately positioned and securely anchored. Embedments shall be clean when they are installed. After installation, surfaces not in contact with concrete shall be cleaned of all concrete spatter and other foreign substances.

2G.10 FINISHING. Fins and other surface projections shall be removed from all formed surfaces except exterior surfaces that will be in contact with earth backfill. Surface voids and recesses resulting from removal of form ties shall be filled with mortar.

Unformed surfaces shall be given a float finish.

2G.11 CURING. Concrete shall be protected from loss of moisture for at least 72 hours.

2G.12 ANCHOR BOLTS. Anchor bolts furnished under these specifications shall be as indicated on the drawings. Sleeves and anchor plates shall be provided where indicated on the drawings. Each bolt without a sleeve shall be furnished with two nuts and sufficient threads to permit a nut to be installed on each side of the concrete form or template. Fabrication details for all anchor bolts shall comply with ASTM A307 unless otherwise indicated on the drawings.

All anchor bolts indicated on the drawings shall be furnished and installed by the Contractor.

All anchor bolts 3/4 inch and larger shall be fabricated from ASTM A36 steel rods and shall have heavy hexagon nuts conforming to ASTM A563 Grade A. Anchor bolts smaller than 3/4 inch shall conform to ASTM A307 Grade A with hexagon heads and shall have hexagon nuts conforming to ASTM A563 Grade A.

All anchor bolts, nuts, and washers shall be hot-dip galvanized after fabrication, threads being undercut to provide a tolerance equal to ANSI Class 2A. Galvanizing shall conform to ASTM A153.

Section 2H - PIPING INSTALLATION

2H.1 GENERAL. This section covers the installation of the bottom ash transport and scrubber sludge piping from the junction of the temporary piping to the ash pond. In addition, the Contractor shall install the pipe supports, culverts, special supports in pipe culverts, Dresser couplings and all other support requirements at the ash pond and remove temporary plastic bypass pipe, posts, and piping restraints as indicated on the drawings.

2H.2 PIPING. The Contractor shall remove from the Company storage area and transport to the work site and install the permanent Company-furnished 14 inch bottom ash transport and 6 inch scrubber sludge pipe as indicated on the drawings. The piping will be Transol II pipe furnished in random lengths of approximately 32 feet as manufactured by Jones and Laughlin Steel Corporation. Some of the pipe will be used pipe from the present installation. The remainder will be new pipe.

The Contractor shall coordinate with the Company's plant operations in the switchover from the temporary plastic bypass piping to the permanent steel piping.

2H.3 COUPLINGS. The Company will furnish the Dresser Style 38 couplings in the necessary quantities to join the pipe.

The couplings shall be assembled on the jobsite in a manner to ensure permanently tight joints under all reasonable conditions of expansion, contraction, shifting, and settlement of the pipe.

2H.4 SUPPORTS AND ACCESSORIES. The Company will provide one Type 3 and 25 Type 21 pipe supports to be installed by the Contractor. The remaining pipe supports shall be furnished and installed by the Contractor as indicated on the drawings. The Contractor-furnished supports shall include U-bolts, straps, and shields for mounting the pipe on the supports.

Pipe supports shall be as indicated on the drawings.

2H.5 EARTHWORK. Excavation, embedment, and backfilling shall be in accordance with the requirements stated in Section 2C of these specifications.

2H.6 REMOVAL AND STORAGE OF TEMPORARY PIPE. The Contractor shall remove the temporary plastic bypass piping after the installation of the permanent steel bottom ash transport and scrubber sludge pipe.

Also, the Contractor shall remove all posts and piping restraints except reinforced concrete, and material embedded in concrete as indicated on the drawings. The Contractor shall fill all post holes with tamped earth.

All temporary bypass piping, supports, and miscellaneous materials shall be transported to the Company storage area for storage as directed by the Company.

SPECIFICATIONS
AND
DOCUMENTS

NORTHERN STATES POWER COMPANY
SHERBURNE COUNTY GENERATING PLANT
UNIT 3

BOTTOM ASH POND MODIFICATION

SPECIFICATION 10169.71.1000
INQUIRY NO. SHERCO

Issued: APR 6 1982

I hereby certify that this specification was prepared by me or under my direct supervision and that I am a duly Registered Professional Engineer under the laws of the State of Minnesota.

.....

Date.....Reg. No.....

BLACK & VEATCH
Consulting Engineers
Kansas City, Missouri

1982

NORTHERN STATES POWER COMPANY

SHERBURNE COUNTY GENERATING PLANT
UNIT 3

SPECIFICATIONS AND DOCUMENTS
FOR
BOTTOM ASH POND MODIFICATION

SPECIFICATION 10169.71.1000

TABLE OF CONTENTS

INSTRUCTIONS TO BIDDERS

A.1 GENERAL. Proposals are requested by the Northern States Power Company, hereinafter referred to as the "Company," for the construction work set forth in the attached specifications. All proposals shall be prepared and submitted in accordance with these instructions and the letter transmitting these specifications and documents.

A.2 GENERAL PROJECT DESCRIPTION. The specified construction will be incorporated into the Company's Sherburne County Generating Plant. Units 1 and 2 of the Sherburne County Generating Plant are existing complete operating units. Section 1A, bound herewith, defines the scope of work to be included in the proposal.

A.3 PROPOSALS. Five copies of each proposal shall be prepared and submitted, each copy containing a bound copy of these contract documents. Proposals which are not prepared and submitted in accordance with these instructions will imply that the bidder does not intend to comply with all of the contract conditions and such proposals will be considered irregular.

If the prospective bidder declines to bid, he shall return all bidding documents and give written notice to the Engineer and the Company not later than the date bids are due.

A.3.1 Preparation. Each proposal shall be carefully prepared using the bidding forms provided. Entries on the bidding forms shall be typed, using dark black ribbon, or legibly written in black ink. All prices shall be stated in words and figures except where the forms provide for figures only.

The bidder shall staple or otherwise bind, with each copy of the proposal submitted, a signed copy of each addendum issued for the contract documents during the bidding period. The bidder shall assemble all drawings, catalog data, and other supplementary information necessary to thoroughly describe materials and equipment covered by the proposal, and shall attach such supplemental information to the proposal.

A.3.2 Exceptions. Each bidder shall list as provided in the variations and exceptions part of the Proposal Data section all exceptions or conflicts between his proposal and the specifications and documents. If more space is required for this listing, additional pages may be added. If the bidder takes no exceptions, he shall write "None" in the space provided.

If the bidder takes exception, then all such exceptions shall be specific in nature and carefully referenced to the applicable page number, article number, and title of the specifications and documents. If the bidder proposes deletion of specification language and substitution of revised language, then such deletion and substitution shall be carefully presented by typing complete paragraphs or articles of the original specification language and incorporating the substitute language. Proposed deletions shall be set off by parentheses, thus: (delete this language), and proposed substitute language shall be indicated by underlining, thus: substitute this language. Exceptions which are general, which make reference to the bidder's standard terms and conditions, or which make reference to the bidder's descriptive information as a whole will not be acceptable. Proposals which do not comply with these requirements for the presentation of exceptions will not be acceptable and may be rejected.

Bidders are advised that the General Conditions included herein are standard Company contract conditions; therefore, exceptions to these conditions shall be limited to those which involve cost to the bidder.

In the event a proposal includes express or implied exceptions that are not listed as required, the requirements of the specifications and documents shall govern. The bidder shall not alter any part of the specifications and documents in any way, except by stating his exceptions.

A.3.3 Signatures. Each bidder shall sign the proposal with his usual signature and shall give his full business address.

Bids by partnerships shall be signed with the partnership name followed by the signature and designation of one of the partners or other authorized representative. A complete list of partners shall be included with the proposal.

Bids by a corporation shall be signed in the official corporate name of the corporation, followed by the signature and designation of the president, secretary, or other person authorized to bind the corporation. The names of all persons signing should also be typed or printed below the signature.

A bid by a person who affixes to his signature the word "president," "secretary," "agent," or other designation without disclosing his principal will be rejected. Satisfactory evidence of the authority of the officer signing in behalf of the corporation shall be furnished. Bidding corporations shall designate the state in which they are incorporated and the address of their principal office.

The bidder's name stated on the proposal shall be the exact legal name of the firm.

A.3.4 Submittal. Proposals shall be submitted not later than the date and time stipulated as follows.

The original and three copies to:

Northern States Power Company
414 Nicollet Mall
Minneapolis, Minnesota 55401

Attention: Mr. (Later)

One copy of the proposal to:

Black & Veatch, Consulting Engineers
P.O. Box 8405
Kansas City, Missouri 64114

Attention: Mr. G. Y. Gunn

A.4 INFORMATION TO BE SUBMITTED WITH PROPOSAL. Each bidder shall submit with his proposal pertinent information concerning proposed equipment and materials and proposed construction organization. Each bidder shall also submit any requested descriptive quality assurance program materials.

A.4.1 Equipment and Materials. In addition to the information submitted on the proposal and data forms, each bidder shall submit all specifications, preliminary drawings, and similar descriptive information necessary to describe completely the equipment and materials he proposes to furnish.

The proposal shall be based on new equipment and materials which comply with specifications in every respect unless the bidder takes specific exception as provided hereinbefore. If alternate equipment or materials are indicated in the proposal, it shall be understood that the Company will have the option of selecting any one of the alternates so indicated and such selection shall not be a cause for extra compensation or extension of time.

A.4.2 Bidder's Field Organization. Each bidder shall submit with his proposal an organization chart showing the names of field management, supervisory, and technical personnel, and the details of the management, supervisory, and technical organization which he proposes to use for this project. The successful bidder's organization will be subject to the review and acceptance of the Company. The experience record of the bidder's field superintendent shall be submitted with the bid.

A.4.3 Bidder's Financial Data. Each bidder shall submit with his proposal, the financial data listed on the Bidder's Financial Data form attached hereto.

A.5 TAXES, PERMITS, AND LICENSES. The bidder's attention is directed to the General Conditions regarding taxes, permits, and licenses.

Each bidder shall be responsible for determining the applicable taxes, permits, and licenses. If the bidder is in doubt as to whether or not a tax, permit, or license is applicable, he shall state in his proposal whether this item has been included in his bid price and the amount of the applicable tax, permit, or license in question.

A.6 TIME OF COMPLETION. The time of completion of the work is of the essence of the contract. The proposal shall be based upon completion of the work in accordance with the specified schedule. It will be necessary that the bidder satisfy the Company of his ability to complete the work within the stipulated time.

In this connection, attention is called to the provisions of the General Conditions relative to delays and extensions of time.

A.7 LOCAL CONDITIONS. Each bidder shall visit the site of the work and thoroughly inform himself of all conditions and factors which would affect the work and the cost thereof, including the arrangement and conditions of existing or proposed structures affecting or affected by the proposed work, the procedure necessary for maintenance of uninterrupted operation, the availability and cost of labor, and facilities for transportation, handling, and storage of materials and equipment.

Bidders may visit the site by making advance arrangements with the Northern States Power Company by contacting the Project Superintendent - Mr. H. K. Norgaarden, Phone (612)330-6904. Bidders shall not trespass on the site without the Company's permission.

It must be understood and agreed that all such factors have been investigated and considered in the preparation of every proposal submitted. No claims for financial adjustment to any contract awarded for the work will be permitted by the Company which are based on lack of such prior information or its effect on the cost of the work.

A.8 INTERPRETATION OF SPECIFICATIONS. If any bidder is in doubt as to the true meaning of any part of the contract documents, he may submit a written request to the Engineer for an interpretation. The person submitting the request will be responsible for its prompt delivery. Any interpretation of the documents will be made only by addendum mailed or

delivered to each person receiving a set of such documents. The Engineer will not be responsible for any other explanations or interpretations of the proposed documents.

It shall be the bidder's responsibility to advise the Engineer, before the bid opening date, of conflicting requirements or omissions of information which require clarification. Those questions not resolved by addenda shall be listed in the space provided in the proposal form, together with statements of the basis upon which the proposal is made as affected by each question.

A.9 BOND. The contractor to whom the work is awarded may, at the option of the Company, be required to furnish a Performance and Labor and Materials Payment Bond (American Institute of Architects Form A-311) in an amount equal to 100 per cent of the contract amount.

The bond shall be executed on the forms stipulated, signed by a surety company authorized to do business in the State of Minnesota and acceptable as surety to the Company. Copies of "Power of Attorney," certified to include the date of the bond, shall be filed with the bond.

The cost of the bond shall be stated as a separate item in the proposal form.

A.10 SUBSURFACE CONDITIONS. Each bidder shall be responsible for determining the types of subsurface materials which will be found. Test borings have been made on the site. A soils investigation has been conducted for the impervious earth borrow area. Locations and logs of test borings for Units 1, 2, and 3 are available for review at the plant site and at the offices of the Engineer.

Information on subsurface materials made available shall not be a part of the contract documents and there is no expressed or implied guarantee of the data given nor of the interpretation thereof.

A.11 USE OF MINORITY AND LOCAL SUPPLIERS AND SUBCONTRACTORS. In the event that subcontractors or material suppliers are required, the Company desires that qualified or qualifiable minority and local firms in its service area shall be included by bidders in their request for proposals from subcontractors and suppliers. It is the intent of the Company to review with the successful bidder his list of subcontractors and major material suppliers.

A.12 ACCEPTANCE AND REJECTION OF BIDS. The Company reserves the right to reject any and all bids and to waive irregularities and informalities in any bid that is submitted.

All proposals shall become the property of the Engineer and the Company.

A.13 PROPOSAL PRICING. Firm price proposals are requested.

APPENDIX

ACCOUNTING BREAKDOWN
P.O. SHERCO
BOTTOM ASH POND MODIFICATION

		NSP Accounting Identification Number	Quantity	Unit Price	Total Price
1.	Ash ponds	S1PH12M300	_____LS	_____	_____
2.	Landscaping	S1PH11A400	_____SY	_____	_____
3.	Roads	S1PH11A810	_____SY	_____	_____

PROPOSAL

Northern States Power Company
414 Nicollet Mall
Minneapolis, Minnesota 55401

Attention: Mr. H. E. Bray

PROPOSAL FOR BOTTOM ASH POND MODIFICATION
SHERBURNE COUNTY GENERATING PLANT - UNIT 3

Gentlemen:

The undersigned bidder having read and examined the specifications and associated contract documents for the Bottom Ash Pond Modification work which will be incorporated in the Sherburne County Generating Plant, does hereby propose to perform the construction and provide the services set forth in this Proposal.

The undersigned hereby declares that any and all variations from, and exceptions to, the requirements of the contract documents have been listed in the Proposal Data section and that, otherwise, it is the intent of this Proposal that the work will be performed in strict accordance with the contract documents.

B.1 LUMP SUM PRICE. The undersigned bidder hereby proposes to furnish equipment and materials; labor, skilled, semiskilled and unskilled; labor supervision; construction tools and equipment; construction services and utilities; as required to perform the Bottom Ash Pond Modification work in accordance with the specifications and associated contract documents as defined in GENERAL CONDITIONS, Article GC.3 for the following firm lump sum price.

_____

_____ ($)
(Price in Words)

B.2 BOND. Lump sum price for furnishing Performance and Labor and Materials Payment Bond in the amount of 100 per cent of the Item B.1 lump sum price.

_____

_____ ($)
(Price in Words)

B.3 UNIT ADJUSTMENT PRICES. The following unit prices will be used to adjust the above listed lump sum price to compensate for differences between the quantities indicated on the drawings and those actually constructed under the contract documents. It is further understood that these unit prices will be used for either additions to or deletions from the lump sum price. Each unit adjustment price shall include all costs for furnishing and installing the unit complete and shall apply only to the specific material designated.

"Excavated Materials" as defined in Article 1A.6.1, per cubic yard	$_____
"Core Trench Excavation" as defined in Article 1A.6.2, per cubic yard	$_____
"Impervious Clay Core Fill" as defined in Article 1A.6.3, per cubic yard	$_____
"Impervious Earth Blanket" as defined in Article 1A.6.4, per cubic yard	$_____
"Embankment Fill" as defined in Article 1A.6.5, per cubic yard	$_____
"Bottom Ash Fill" as defined in Article 1A.6.6, per cubic yard	$_____
"Road Surfacing" as defined in Article 2E.3, per square yard	$_____

The undersigned proposes that he will perform the majority of the work with his own forces and that specific portions of the construction work

not performed by the undersigned will be subcontracted by the following subcontractors.

Work Subcontracted	Name of Subcontractor

The undersigned hereby certifies that he has visited the site of the proposed work and has familiarized himself with the conditions affecting the work.

The undersigned hereby declares that only the persons or firms interested in the Proposal as principal or principals are named herein, and that no other persons or firms than herein mentioned have any interest in this Proposal or in the contract to be entered into; that this Proposal is made without connection with any other person, company, or parties likewise submitting a bid or proposal; and that it is in all respects for and in good faith, without collusion or fraud.

The prices stated in this Proposal include all taxes of any nature which may become due or payable by the Contractor in connection with the proposed work, except Minnesota sales, use, and excise taxes applicable to the equipment and materials which are to be permanently incorporated into the work.

If this Proposal is accepted, the undersigned hereby agrees to enter into contract and to furnish an acceptable Performance Bond if required by the Company.

The undersigned further agrees that the work will be prosecuted to completion in accordance with the specified schedule.

Dated at _____ this _____ day of _____, 19__.

Bidder _____

By _____

_____
(Typed)

Title _____

Attest:

_____

Business Address of Bidder _____

_____

State of Incorporation _____

Address of Principal Office _____

_____

PROPOSAL DATA

C.1 GENERAL. Each bidder shall furnish information about the equipment and materials he proposes to furnish for specific phases of the work and his program for securing an adequate supply of labor for the work, by filling in the data listed on the following pages.

Unless otherwise stated in the Proposal, it will be assumed that the bidder's intention is to meet all specifications and job requirements and that to his best knowledge and belief the materials and equipment described in this Proposal Data will meet all specifications and job requirements.

In the event that any materials and equipment listed by the successful bidder are later found, either before or after contract award, to be unsuitable, materials and equipment which are suitable shall be substituted. Substitutions shall be made only with the approval of the Company, and such substitutions shall not be cause for additional financial compensation nor shall they invalidate the Contract in any way.

Materials and equipment described herein which meet all specifications and job requirements shall be furnished exactly as described.

Bidders shall write all entries boldly with black ink or type entries using dark black ribbon. Ball point pens shall not be used.

C.2 VARIATIONS AND EXCEPTIONS. Bidders shall list any and all variations from and exceptions to the requirements of the contract documents in the manner described in the article entitled Exceptions of the Instructions to Bidders. Additional pages may be added following this page if required. If there are no variations or exceptions, bidders shall write the word "NONE."

_____
(Bidder's Name)

State name and address of concrete culvert pipe manufacturer

_____

_____

Name of crushed rock or gravel surfacing supplier

_____

Name of seed and fertilizer supplier

_____

Contractor's earth moving equipment:

Describe each type and the number proposed to be utilized of each type; also state dates equipment will be available.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(Trim Line)

Seeding subcontractor:

Describe the types of equipment to be used for seedbed preparation, fertilizing, mulching, and seeding

_____
(Bidder's Name)

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(Trim Line)

BIDDER'S FINANCIAL DATA

SUBMITTED BY:

NAME: _____

ADDRESS: _____

PRINCIPAL OFFICE: _____

(Note: Attach Separate Sheets As Required)

1. List name of project, owner, architect, contract amount, per cent complete and scheduled completion of the major construction projects your organization has in process on this date:

2. Bank References:

3. Name of Bonding Company and name and address of agent:

   3.1 What is the bonding capacity of your Company?

   3.2 What portion of the bonding capacity was committed prior to submission of this Proposal?

4. Attach Statement of Financial Conditions, including bidder's latest audited regular dated financial statement or balance sheet which must contain the following items:

Current Assets: (Cash, joint venture accounts, accounts receivable, notes receivable, accrued interest on notes, deposits, and materials and prepaid expenses), not fixed assets and other assets.

Current Liabilities: (Accounts payable, notes payable, accrued interest on notes, provision for income taxes, advances received from owners, accrued salaries, accrued payroll taxes), other liabilities, and capital (capital stock, authorized and outstanding shares par values, earned surplus).

Date of statement or balance sheet:

Name of firm preparing statement:

PART III - CONTRACT REGULATIONS

TABLE OF CONTENTS

GC.1 DEFINITIONS. Words, phrases, or other expressions used in the Contract Documents shall have a meaning as follows.

1. "Contract" or "Contract Documents" shall include the items enumerated below under CONTRACT DOCUMENTS.

2. "Company," "Owner" or "NSP" shall mean Northern States Power Company, a Minnesota corporation, and its duly authorized agents and employees. The address of the Company's General Office is 414 Nicollet Mall, Minneapolis, Minnesota 55401.

3. "Contractor" shall mean the corporation, company, partnership, firm or individual who has entered into this Contract for the performance of the Work covered thereby, and its, his, or their employees and representatives.

4. "Subcontractor" shall mean a corporation, partnership, or individual having a direct contract with the Contractor for performing Work, and its, their or his employees and representatives.

5. "Engineer" shall mean the Architect/Engineer (A/E) named in the Instructions to Bidders retained by NSP acting within the scope of the particular duties entrusted to the A/E.

6. The "Work" shall mean all labor, equipment, supplies, or materials, and related services necessary to provide the construction required by or reasonably inferable from the Contract Documents, and the carrying out of all obligations imposed by the Contract Documents.

7. The "Project" shall mean Sherburne County Generating Plant Units 1 and 2, Becker, Minnesota, being worked on and in connection with which the Work is to be furnished under this Contract.

8. "Commercial Operation" shall mean the condition of operation in which the complete steam electric generating unit is officially declared by the Company to be available for continuous operation at variable loads up to and including rated capacity.

9. "Site" refers to the contiguous land upon which the various facilities comprising the Project are located.

GC.2 COMPLETE AGREEMENT. The Contract Documents constitute the sole and entire agreement between the parties hereto and supersede any previous written or oral agreements. Contractor's bid Proposal is incorporated in and made a part of this Contract only to the extent it is consistent with the requirements of the remaining Contract Documents. No other terms or conditions shall be binding upon the Company unless accepted by it in writing in the manner prescribed in Article GC.3 CONTRACT DOCUMENTS. No modification or amendment of the Contract shall be valid unless reduced to writing signed by both parties.

GC.3 CONTRACT DOCUMENTS.

GC.3.1 Identification of Contract Documents. The Contract Documents are those enumerated in the Contract Agreement and include these General Conditions together with Instructions to Bidders, Proposal, Proposal Data, Special Conditions, Quality Assurance Requirements, Specifications, Drawings, Addenda, and Change Orders issued by the Company. The Work shall be done in accordance with the Contract Documents. Any additional terms proposed, or exceptions taken by Contractor to any provision of the Contract Documents shall become part of the Contract only upon written acceptance by the Company.

GC.3.2 Interpretation. The various parts of the Contract Documents are intended to supplement, but not necessarily duplicate, each other. Any Work exhibited in one and not in another shall be executed as if it had been set forth in both, so that the Work will be constructed according to the complete design. Should anything necessary for a clear understanding of the Work be omitted from the Contract Documents, or should any requirements thereof appear to conflict, NO MATTER HOW SEEMINGLY INSIGNIFICANT the apparent omission or conflict, the Contractor shall, promptly upon discovery thereof, so notify the Company in writing and shall secure written instructions from the Company before proceeding with the Work affected thereby.

GC.3.3 Responsibility for Cost Estimates. By executing the Contract, the Contractor represents that it:

1. Has visited the site,

2. Has taken such other steps as may be necessary to ascertain the nature and location of the Work, and the general and local conditions which can affect the Work or the cost thereof, and

3. Has examined all Contract Documents in relation to the site, the structure and condition of the ground, the obstacles which may be encountered and all other conditions having a bearing upon the performance of the Work, superintendence of the Work, time of completion and all other relevant matters.

Failure to take such steps shall not relieve the Contractor from responsibility for having estimated properly the difficulty or cost of successfully performing the Work. The Contractor acknowledges that the Company assumes no responsibility for any understandings or representations concerning conditions, made by any of its agents, representatives, or employees prior to the execution of the Contract, unless included in the Contract Documents.

GC.3.4 Organization of Specification Sections. The organization of the specifications into divisions, sections and articles, and the arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

GC.3.5 Return of Drawings. All Drawings, Specifications and copies thereof furnished by the Company are and shall remain its property. They are not to be used on any other project, and are to be returned to the Company on request at the completion of the Work.

GC.4 CONTRACTOR'S STATUS.

GC.4.1 Independent Contractor. Contractor represents that it is fully experienced and properly qualified to perform the Work provided for herein, and that it is properly licensed, equipped, organized and financed to perform the Work. Contractor shall act as an independent Contractor and not as the agent or co-venturer of the Company in performing the Contract, maintaining complete control over its employees and all of its Subcontractors. The Contractor shall supervise and direct the Work, using its best skill and attention. It shall be solely responsible for all construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work in complying with this Contract.

GC.4.2 Contractor's Responsibilities.

1. Unless otherwise specifically noted, the Contractor shall provide and pay for all labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation and other facilities and services necessary for the proper execution and completion of the Work. The Contractor shall at all times enforce strict discipline and good order among its employees and shall not employ on the Work any unfit person or anyone not skilled in the task assigned to him.

2. Work assignments and the settlement of jurisdictional disputes shall conform with either the Rules, Regulations and Procedures of the Plan for Settlement of

Jurisdictional Disputes in the Construction Industry, and any successor agreement thereto, or any other mutually established method of determining work assignments and settling jurisdictional disputes.

3. Contractor shall comply with and shall cooperate with the Company in enforcing jobsite conditions and job work rules which directly affect the performance of the Work including but not limited to starting and quitting time, smoking regulations, check-in and check-out procedures, jobsite safety regulations and security regulations, emergency plans and procedures, and daily cleanup. Contractor shall further comply and cooperate with the provisions of any project agreement entered into by the building trades and the Company.

GC.4.3 Superintendence. The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site at all times during the progress of the Work. The superintendent shall represent the Contractor and have full authority to make binding and enforceable decisions on behalf of Contractor. All communications given to the superintendent shall be as binding as if given to the Contractor.

GC.4.4 Security. The Contractor shall at all times conduct all operations under the Contract in a manner to avoid the risk of loss, theft, or damage by vandalism, sabotage, or other means to the Company's property. Contractor shall promptly take all reasonable precautions which are necessary and adequate against any conditions which involve a risk of loss, theft or damage to its and the Company's property. Contractor shall continuously inspect all its Work, materials, equipment and facilities to discover and determine such a condition and shall be solely responsible for discovery, determination and correction of all such conditions.

Contractor shall comply with the project security program for the Site and all applicable laws and regulations. Contractor shall cooperate with the Company on all security matters and shall promptly comply with any project security requirements established by the Company. Such compliance with these security requirements shall not relieve Contractor of its responsibility for maintaining proper security for the above noted items, nor shall it be construed as limiting in any manner Contractor's obligation to undertake reasonable action as required to establish and maintain secure conditions for Contractor's Work at the Site.

Contractor shall prepare and maintain accurate reports of incidents of loss, theft or vandalism and shall furnish these reports to the Company in a timely manner or as may be prescribed in the Company's project security program.

GC.5 ASSIGNMENTS. The Contractor shall not assign the Contract or any part thereof, without the previous written consent of the Company. In case the Contractor is permitted to assign monies due or to become due under this Contract, the instrument of assignment shall contain a clause subordinating the claim of the assignee to all claims or liens for services rendered or materials supplied for the performance of the Work.

GC.6 SUBCONTRACTING.

GC.6.1 Responsibility for Subcontractors. Contractor and his sureties shall be fully responsible and accountable for the acts and omissions of Contractor's Employees, Suppliers, Subcontractors, and any persons employed by them. Nothing contained in this Contract shall be deemed to create any contractual obligations on the part of the Company to any person or entity other than the Contractor.

GC.6.2 Approval of Subcontractors. If after award the Company requires a change of any proposed Subcontractor or person or organization previously accepted by it, the Contract Sum shall be increased or decreased as agreed between the Company and the Contractor and an appropriate Change Order shall be issued. Contractor shall provide proof acceptable to Company of such increase or decrease occasioned by such a change. The Contractor shall not: contract with any Subcontractor or any person or organization (including those who are to furnish materials or equipment fabricated to a special design) who is not on the listed Subcontractors listed in the Proposal Data or who has been rejected by the Company; and, shall not make any substitution for any proposed Subcontractor or person or organization who has been accepted by the Company unless the substitution is acceptable to the Company and will result in no change in Contract Sum.

GC.6.3 Subcontract Requirements. All subcontracts shall have physically attached thereto all Contract Documents pertaining to the Subcontractor's portion of the Work including without limitations the General Conditions and the Special Conditions and shall specifically require each Subcontractor to abide by the requirements of the attachments. The Contractor shall ensure that the Subcontractor abides by the schedule requirements. In addition, each subcontract shall contain provisions which:

1. Preserve and protect the rights of the Company under the Contract with respect to the Work to be performed under the subcontract so that the subcontracting thereof will not prejudice such rights.

2. Require that such Work be performed in accordance with the requirements of the Contract Documents.

3. Require that all claims for additional costs, extensions of time, or otherwise with respect to subcontracted portions of the Work shall be submitted to the

Contractor (via any Subcontractor where appropriate) in sufficient time so that the Contractor may comply in the manner provided in the Contract Documents for like claims by the Contractor upon the Company.

4. Waive all rights the contracting parties may have against one another for damages caused by fire or other perils covered by the property insurance described in the Contract Documents.

GC.7 SEPARATE CONTRACTS.

GC.7.1 Right to Award Separate Contracts. The Company reserves the right to award other contracts to separate contractors and suppliers in connection with other portions of the Project under these or any other conditions of the Contract.

GC.7.2 Mutual Responsibility of Contractors. Contractors under separate contract to the Company shall be responsible to each other as follows.

1. The Contractor shall afford other contractors reasonable opportunity for the introduction and storage of their materials and equipment and the execution of their work, and shall properly connect and coordinate his Work with theirs.

2. The Contractor shall not endanger any work of any other contractors by cutting, fitting, patching, excavating or otherwise altering any work of any other contractor except with the written consent of the Company. Any costs to the Company or other contractors caused by defective or ill-timed work by the Contractor shall be borne by the Contractor.

3. If any part of the Contractor's Work depends for proper execution or results upon the work of any other separate contractor, the Contractor shall inspect and promptly report to the Company any apparent discrepancies or defects in such work that render it unsuitable for such proper execution and results. Failure of the Contractor to inspect and report shall constitute an acceptance of the other contractor's work as fit and proper to receive his Work, except as to defects which may develop in other separate contractor's work after the execution of the Contractor's Work or which are latent or undetectable at the time of acceptance.

4. If a dispute arises between separate contractors as to their responsibility for cleaning up as required by the Contract Documents, the Company shall determine such responsibility and the decision shall be final.

5. Should Contractor's Work or property be damaged by acts or neglects of any separate contractor(s), or should the Contractor cause damage to the work or property of any separate contractor(s) on the Project, the Contractor shall, upon due notice, separately litigate or settle directly with such other contractor(s) without involving the Company in any way and without impeding his or another contractor's performance of the Work.

GC.8 TAXES. Unless otherwise specified in this contract document, the Contractor shall pay all sales, use, and other taxes that are lawfully assessed against the Company or Contractor in connection with the work included in this Contract.

Sales, use and excise taxes of the State of Minnesota, applicable to the equipment and materials furnished by the Contractor which become property of the Company, shall not be included in the Proposal or contract price. The Contractor shall pay these taxes and will be reimbursed by the Company.

The Contractor shall be guided with regard to the payment of Minnesota sales and use tax and in the submission of invoices to the Company by the following.

1. Charges for freight or shipping and for labor or technical assistance which occur after the sale are not subject to Minnesota sales and use tax, and the actual amount of Minnesota sales and use tax paid by the Contractor shall be shown as separate items on all invoices. Where freight and shipping charges exceed $5,000.00, Contractor shall include with invoices copies of shipping bills to verify actual transportation costs. Where separately stated labor or technical assistance exceeds $5,000.00, Contractor shall include with invoices copies of time records and of major expenses.

2. For an item of equipment purchased installed in place, complete, upon the Company's property and for which both the manufacturing and the field assembly are accomplished by the same Contractor, for all purposes the continuation of manufacturing, Minnesota sales and use tax apply only to the portion of the contract price that is applicable to material. Invoices to the Company, therefore, shall show separately the amount for material and equipment purchased by the Contractor from the amount for shop manufacturing labor.

GC.9 PERMITS. Contractor shall give all notices and shall obtain and pay for all licenses, permits, and inspections required for the Work unless the Contract Documents specifically provided otherwise. The Company shall obtain all necessary easements and permits involving rights-of-way along public roads, streets, public or private property, and the general building permit, unless otherwise stated in the Contract Documents.

GC.10 PATENTS. Royalties and fees for patents covering materials, articles, apparatus, devices, equipment, or processes used in the Work, shall be included in the contract price. The Contractor shall satisfy all demands that may be made at any time for such royalties or fees and he shall be liable for any damages or claims for patent infringements. The Contractor shall, at his own cost and expense, defend all suits or proceedings that may be instituted against the Company for alleged infringement of any patents involved in the Work and, in case of an award of damages, the Contractor shall pay such award. Final payment to the Contractor by the Company will not be made while any such suit or claim remains unsettled.

GC.11 LAWS AND REGULATIONS. Contractor and its employees, representatives, and Subcontractors shall at all times comply with all applicable codes, laws, ordinances, statutes, rules or regulations. If during the term of this Contract there are any changes of or additions to laws, ordinances, codes or regulations not known or foreseeable at the time of signing this Contract which affect the cost or time of performance of the Contract, Contractor shall immediately notify the Company in writing and submit detailed documentation of such effect in terms of both time and cost of performing the Contract. Upon concurrence by the Company as to the effect of such changes or additions, an equitable adjustment in the compensation and time of performance will be made by appropriate change order. Disagreement concerning the responsibility for or the amount of any such adjustment shall be a dispute within the meaning prescribed in Article GC.23 DISPUTES. If any discrepancy or inconsistency should be discovered between the Contract and any law, ordinance, code, regulation, order or decree, Contractor shall immediately report the same in writing to the Company who will issue such further instructions as may be necessary. Contractor will proceed with Work affected by a discrepancy or inconsistency at his own risk, unless the Company has issued instructions hereunder.

GC.12 PROTECTION OF PERSONS AND PROPERTY. The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. The Contractor shall designate a responsible member of its organization at the Site whose duty shall be the prevention of accidents. This person shall be the

Contractor's superintendent unless otherwise designated in writing by the Contractor to the Company. When the use or storage of explosive or other hazardous materials or equipment is necessary for the execution of the Work, the Contractor shall exercise the utmost care and shall carry on such activities under the supervision of properly qualified personnel. Contractor shall protect the Work and any adjacent private or public property. He shall keep his work areas and roadways free from material or rubbish and upon completion of the Work remove all surplus material and rubbish, leaving his work areas in as good a condition as found. All damage or loss of any property caused in whole or in part by the Contractor, a Subcontractor or anyone directly or indirectly employed by them, or by anyone for whose acts they may be liable, shall be remedied by the Contractor.

The Contractor shall take all reasonable precautions for safety of, and shall provide all reasonable protection to prevent damage, injury or loss to:

1. Contractor's employees performing the Work and all other persons who may be affected thereby;

2. All Work and all materials and equipment to be incorporated therein, whether in storage on or off the Site, under the care, custody or control of the Contractor or any of its Subcontractors; and

3. Other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

The Contractor shall comply with all applicable laws, ordinances, rules, regulations and lawful orders of any public authority having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss. He shall erect and maintain, as required by existing conditions and progress of the Work all reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent utilities. The Contractor agrees to hold harmless and indemnify the Company against all claims, fines, losses and expenses (including reasonable attorneys' fees) arising out of or resulting from the Contractor's failure to comply with legal or practical safety requirements and safeguards.

In any emergency affecting the safety of persons or property, the Contractor shall act, at his discretion, to prevent threatened damage, injury or loss. Any additional compensation or extension of time claimed by the Contractor on account of emergency work shall be determined as provided in Article GC.16 CHANGES AND EXTRAS.

GC.13 WARRANTY. Unless otherwise provided elsewhere in the Contract, all materials and equipment incorporated into any Work covered by the Contract shall be new and, where not specified, of the most suitable grade of their respective kinds for their intended use. All workmanship shall be in accordance with the best construction practices and shall be of a quality acceptable to the Company. Unless a greater period of time is imposed elsewhere in the Contract, Contractor warrants all equipment, materials, and labor furnished or performed under this Contract against defects in materials and workmanship for a period of 18 months from and after final acceptance under the Contract, or one year from and after the date when the Project is first placed in full Commercial Operation, whichever occurs later, regardless of whether the same were furnished or performed by Contractor or by any of its Subcontractors of any tier. Upon receipt of written notice from the Company of any defect in any such equipment, materials or labor discovered during the applicable warranty period, the affected item or parts thereof shall be repaired or replaced by Contractor at a time acceptable to the Company. This warranty is in addition to and not in lieu of any other remedies the Company may have under the Contract or at law.

GC.14 INSPECTION AND CORRECTION OF WORK.

GC.14.1 Right to Inspect. All Work shall be subject to inspection by the Company at all reasonable times and at all places. Any such inspection is for the sole benefit of the Company and shall not relieve the Contractor of the responsibility for providing quality control measures to assure that the Work strictly complies with the Contract requirements. No inspection by the Company shall be construed as constituting or implying either a waiver or acceptance. Inspection shall not relieve the Contractor of responsibility for damage to or loss of the material prior to acceptance, nor in any way affect the continuing right of the Company after acceptance of the completed work.

GC.14.2 Correction of Defective Work. The Contractor shall, without charge, replace any material or correct any workmanship found by the Company not to conform to the Contract requirements. The Contractor shall promptly segregate and remove rejected material from the premises. The Contractor shall bear all costs of making good all work of another contractor's work damaged in the removal or replacement of such defective or nonconforming Work.

GC.14.3 Remedies for Failures to Cure. If the Contractor does not promptly replace rejected material or correct rejected workmanship, the Company:

1. May, by contract or otherwise, replace such material or correct such workmanship and charge to the Contractor the cost thereof together with any resulting damages; or

2. May terminate the Contractor's right to proceed under Article GC.22 TERMINATION FOR DEFAULT.

GC.14.4 Inspection Facilities and Cost. The Contractor shall furnish promptly, without additional charge, all facilities, labor, and material reasonably needed for performing such safe and convenient inspection as may be required by the Company. All inspection by the Company shall be performed in such manner as not unnecessarily to delay the Work. The Company reserves the right to charge to the Contractor any additional cost of inspection when material or workmanship is not ready at the time specified by the Contractor for inspection or when reinspection is necessitated by prior rejection.

GC.14.5 Uncovering Work. If any Work should be covered contrary to the instructions of the Company, it must, if required by the Company, be uncovered for observation and replaced, at the Contractor's expense. If any other Work has been covered which the Company has not specifically requested to observe prior to being covered, the Company may request to see such Work and it shall be uncovered by the Contractor. If such Work is found to be in accordance with the Contract Documents, the cost of uncovering and replacement shall, by approved change order, be invoiced to the Company. If such Work is found to be not in accordance with the Contract Documents the Contractor shall pay such costs of uncovering, removing, and correcting unless it is found that this condition was caused by others.

GC.14.6 Nonwaiver. The making or failure to make any inspection of, or payment for or the occupancy or acceptance of the Work, shall in no way impair the Company's right to reject or revoke its acceptance of nonconforming Work, or to avail itself of any other remedies to which it may be entitled, notwithstanding the Company's knowledge of the nonconformity, its substantiality or the ease of its discovery.

GC.15 RESPONSIBILITY FOR WORK. Except to the extent that such damage or loss is actually covered by the Property Insurance carried by the Company, as described in Article GC.33.2 Company's Property Insurance, Contractor shall be responsible for and shall bear any and all risk of loss or damage to Contractor's Work in progress, all Company and Contractor's materials delivered to the Site until completion and final acceptance of this Contract, unless such loss or damage results from the sole active negligence of the Company.

GC.16 CHANGES AND EXTRAS.

GC.16.1 Orders for Changes and Extras. The term "change," as used in the Contract, means substitutions, additions, or deletions within the scope of the Contract. The term "extra work," as used in the Contract, means work outside the scope of the Contract. The Company may, at any time, without invalidating the Contract and without notice to the Contractor's sureties, by written order make changes within the scope of the Contract and may request Contractor to perform extra work. If the order so directs, the Contractor shall proceed immediately to perform the changed or extra work. Otherwise, Contractor shall perform changed or extra work only upon receipt of the Company's agreement to the price proposal submitted in connection herewith and required below.

GC.16.2 Price Proposals. If any order for a change or extra work causes an increase or decrease in the cost of, or the time required for, the performance of any part of the Work under this Contract, an equitable adjustment shall be made in the contract price or time of completion, or both, and the Contract shall be modified in writing accordingly by a written change order. Upon receipt of the Company's order for a change or extra work, Contractor shall, within 10 calendar days following receipt of such order, (or within such longer period as the Company's written order may state), submit in writing to the Company a proposal for accomplishing such changed or extra work, which proposal shall reflect the increase or decrease, if any, in cost of and completion time for performing Work in comparison to what the cost or time would have been, had such changed or extra work not been ordered. The proposal shall state the basis of compensation and time for the Work involved in the change or extra work. If the change or extra work causes a decrease in the cost of performing Work under the Contract, the amount of such decrease (including direct costs and overhead and anticipated profit on any deleted Work) shall be stated. Sufficient detail shall be given in the proposal to permit thorough analysis of the proposal.

GC.16.3 Computing Price Adjustments. Unless otherwise agreed to in advance in writing, adjustments to the contract price by reason of any changes or extra work shall be determined as follows.

1. By unit prices stated in the Contract or if not so stated, by unit prices or lump sums subsequently agreed upon. Unit or lump sum prices shall be deemed to include an allowance for all Contractor's expense, overhead and profit.

2. By actual cost to which is applied the applicable percentage fee hereinafter provided. The proposed value of the change or extra work shall be determined by Contractor by initially listing and thereafter

segregating and documenting for each pay estimate the cost of the following, where applicable.

a. Material Costs (indicating identifications, quantities and unit prices), which shall include the costs of transportation, must accompany the billing.

b. Direct Labor Cost (indicating hours and rates by trades) for actual labor cost including the cost of field supervision, but excluding salary of the Contractor's superintendent and general office expenses. Time sheets for each change or extra work shall be submitted to and approved by the Company each workday.

c. No charge shall be made for tools, equipment, with a new cost of one thousand dollars ($1,000.00) or less, each, or for expendable supplies.

d. Increased or decreased insurance costs payable by reason of the change or extra work.

e. Equipment Costs. Payment for the rental and operation of the construction equipment furnished and used by Contractor shall be made for all such construction and automotive equipment except equipment or tools with a new cost at point of origin of one thousand dollars ($1,000.00) or less each.

Equipment time charged to changes and extra work will be subject to daily approval of the Company and no charges will be accepted unless evidence of such approval is submitted with Contractor's billing.

The equipment rental and operation rates include costs for rental, fuel, oil, grease, repair parts, service and maintenance of any kind and necessary attachments. Such charges shall not include costs for operating labor and transportation to and from the location of the change or extra work. If the Contract contains equipment rental rates, these shall apply to Contractor's equipment used on changes or extra work. When equipment is used for changes and extra work which does not reasonably resemble any of the equipment

having rental rates in the price and bid data section of this Contract, the rental rate shall be negotiated and agreed upon in writing prior to performance of the change or extra work.

If Contractor-owned equipment is not available and equipment is rented from outside sources, payment will be computed on the basis of actual invoice cost. Rental rates for nonowned equipment must be approved in advance by the Company.

When the operated use of equipment is infrequent and, as determined by the Company, such equipment need not remain at the site of the Work continuously, payment shall be limited to actual hours of use. Equipment not operating but retained at the location of changes or extra work at the Company's direction shall be paid for at a mutually acceptable rate if not specifically covered by the Contract Documents.

Unless otherwise provided in the Contract, all equipment rental rates shall be agreed upon in writing before commencing any change or extra work.

Transportation costs for bringing equipment to the jobsite and for returning equipment to the point of origin, exclusively for use on Cost-Plus work, will be reimbursed to Contractor based on invoices, provided that prior written approval has been given by the Company to Contractor.

f. Payment of fringe benefits required to labor organizations under existing labor agreements.

g. A maximum of 15 per cent of the total of items a through f as compensation for all other costs and expenses including, without limitation, supervision, administrative overhead, and profit.

h. Work performed by Subcontractors, computed as outlined in this article, items a through g.

i. A maximum of 5 per cent of item h (applicable only where the Work performed by Subcontractors) as compensation for all other costs and expenses including, but not limited to supervision, administrative overhead, and profit.

GC.16.4 Contractor Claims for Changes. Any change order providing for price or time adjustments or relief will be made in accordance with the procedures established in this article and such adjustment or relief shall be granted only upon compliance with the requirements (including timely specific written notice) established herein. Any written or oral order, direction, interpretation, instruction or determination or act of the Company, or other circumstance which Contractor regards as causing a change or extra work shall be treated as a change order provided that the Contractor, within 10 days after receipt or discovery of such order, act, or circumstance, gives the Company written notice stating with particularity, the date, circumstance and source of the order or act, stating that the Contractor regards the order, act or circumstance as requiring a change or extra work, and giving his proposal for price and time adjustment in accordance with Article GC.16.2 Price Proposals. The Company reserves the right to dispute whether the subject of the written notice is a change.

GC.16.5 Notices Required. This Article GC.16 CHANGES AND EXTRAS sets forth the Contractor's exclusive remedy for claims alleging that he was required to perform changed or extra work. Requests for additional payments or extension of time by Contractor by reason of any claimed change or extra work shall not be granted unless authorized in writing by the Company and timely specific written notice of claim has been given in strict accordance with the provisions of this Article GC.16 CHANGES AND EXTRAS. Disagreement regarding entitlement to or amounts of any price or time adjustments hereunder shall be disputes within the meaning of Article GC.23 DISPUTES. However, nothing in this Contract shall excuse the Contractor from proceeding with the Work as changed by the Company directions.

GC.17 BILLING FOR CHARGES IN ADDITION TO THE CONTRACT PRICE. All claims or charges in addition to the contract price (whether for changed or extra work, suspension, optional termination or as otherwise provided for in this Contract) shall be shown separately on Contractor's pay estimates or invoices, and not included with amounts applicable to the main contract price. Further, any invoices covering additions to the Contract must refer to the specific Change Order or similar written authorization issued by the Company, approving such additions, and will not be honored unless such reference is included.

GC.18 DIFFERING SITE CONDITIONS.

GC.18.1 Changed Conditions. The Contractor shall promptly and before such conditions are disturbed, notify the Company in writing of:

1. Subsurface or latent physical conditions at the Site differing materially from those indicated in this Contract, or

2. Unknown physical conditions at the Site, of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in Work of the character provided for in this Contract.

The notice shall include a detailed price proposal for performing the differing or extra work required by such changed conditions. The Company will investigate the conditions, and if it finds that such conditions do materially so differ and cause an increase or decrease in the Contractor's cost of, or the time required for, performance of any part of the Work under this Contract, whether or not changed as a result of such conditions, an equitable adjustment shall be made and the Contract modified in writing accordingly. In any event, the Contractor shall proceed with performing the Work only as the Company directs.

GC.18.2 Notices Required. This article sets forth the Contractor's exclusive remedy for claims relating to changed conditions or variations in estimated quantities. All such claims by Contractor shall be barred unless Contractor complies with the written notice requirements of this article. Disagreements concerning entitlement to or the amount of any adjustments to the contract price or time shall be disputes within the meaning of Article GC.23 DISPUTES.

GC.19 SCHEDULES, DELAYS AND TIME EXTENSIONS.

GC.19.1 Time of the Essence. The Work under this Contract will be incorporated into the Project as a whole and must be performed so as not to interfere with timely completion of Project. Accordingly, the Company's Project Schedule must be adhered to. The Contractor acknowledges that the Contract time, and his obligations to perform according to the Project Schedule are of the essence of this Contract. Contractor will commence work within 10 days after receipt from the Company of a Notice of Award of the Contract.

GC.19.2 Schedules.

1. Project Schedule. The Company shall prepare a Project Schedule indicating the dates for the starting and completion of the various stages of construction. The schedule shall be revised as required by the Company in accordance with conditions on the Project. From the

Company's Project Schedule, the Contractor shall prepare a detailed work plan for approval by the Company. The Contractor shall strictly adhere to the Company's Project Schedule.

2. Coordination of Work. The Contractor understands that the Company and other contractors may be working at the site of the Work during the performance of this Contract. Contractor shall coordinate his Work with the work of all separate contractors and suppliers. The Company reserves the right to direct Contractor to reschedule from time to time the order and rate of performance of Contractor's Work hereunder so as not to interfere with the performance of work by the Company and other contractors.

GC.19.3 Maintenance of Progress. If at any time during the performance of Work, Contractor's actual progress as measured by the Project Schedule does not keep pace with the requirements of the Contract or is insufficient to assure that the Contract completion dates can be met, the Company may order Contractor in writing to take steps to improve his progress. Such steps may include without limitation an increase in Contractor's labor force, or the number of shifts, or overtime operations, or additional days of work per week, or similar measures, all without additional cost to the Company. Neither such notice by the Company nor the Company's failure to issue such notice shall relieve Contractor of his obligation to achieve the quality of Work, rate of progress or other requirements of this Contract. Failure of Contractor to comply with the notice of the Company may be grounds for determination by the Company that Contractor is not prosecuting his Work with such diligence as will assure completion within the times specified. Upon such determination, the Company may terminate Contractor's right to proceed with the performance of the Contract, or any separable part thereof, for default.

GC.19.4 Force Majeure. Provided that timely written notice thereof is given to the Company, Contractor shall not be liable for delays in performance of the Work or failure to timely complete it due to causes not reasonably foreseeable by Contractor or its Subcontractors, which are beyond Contractor's or his Subcontractor's reasonable control, such as acts of God, acts of civil or military authorities, Government priorities, fires, strikes, floods, epidemics, war or riot. In the event of any such delay, Contractor's sole remedy shall be a time extension for the date of completion, for the period equal to the time after receipt of notice by the Company, actually lost by reason of the excusable delay. Delays caused by unfavorable weather, unsuitable ground conditions, inadequate construction force, or the failure of the Contractor to place orders for equipment or materials sufficiently in advance to ensure delivery when needed shall not be considered an excusable delay. Disagreement concerning the amount of time for which any completion date should be extended shall be a dispute within the meaning of Article GC.23 DISPUTES.

GC.19.5 Contractor Claims for Delay. Should performance of the Work be delayed, hindered, or disrupted by any wrongful act or neglect of the Company, Contractor may make claim therefor by written notice to the Company, setting forth with particularity the act or neglect complained of. Such notice shall in any event be given within 10 days after discovery of the act or neglect causing the delay. The Company shall have a period of 15 days after receipt of such notice in which to cure such claimed act or neglect, by performing the neglected act or rescinding or reversing its wrongful act. If the Company, within such period, so performs or rescinds, Contractor shall, as its sole remedy, be entitled to an equitable extension in the applicable Contract completion date. Should the Company wrongfully fail or refuse within such 15 day period to correct the claimed wrongful act or perform the neglected act specified in Contractor's notice, the affected portion of the Work shall be deemed to have been suspended from the date of expiration of the above 15 day period for the remaining duration of the delay. Contractor shall then, as its exclusive remedy be entitled to the relief set forth in Subparagraphs B and C of Article GC.20 SUSPENSION. Failure to agree to the responsibility for, or amounts due Contractor under this article shall be a dispute within the meaning of Article GC.23 DISPUTES. The Company shall not be responsible for the granting of any adjustment of the contract price, completion time, or for any other claim relating to any claimed delay or interference except as provided for in this article and then only where timely specific written notice has been given by Contractor as set forth herein.

GC.20 SUSPENSION. The Company may, at its sole option, by notice in writing to Contractor suspend at any time the performance of all or any portion of Work to be performed under the Contract. Upon such notice of suspension of Work, Contractor will designate in writing the amount and type of labor and equipment to be committed to a standby status. During the period of suspension, Contractor shall use its best efforts to utilize its labor and equipment in such a manner as to minimize costs associated with suspension.

A. Upon receipt of any such notice, Contractor shall, unless the notice requires otherwise:

1. Immediately discontinue Work on the date and to the extent specified in the notice;

2. Place no further orders or subcontracts for materials, services, or facilities with respect to suspended Work other than to the extent required in the notice;

3. Promptly make every reasonable effort to obtain suspension upon terms satisfactory to the Company of all orders, subcontracts and rental agreements to the extent they relate to performance of Work suspended, and

4. Continue to protect and maintain the Work including those portions on which work has been suspended.

B. As full compensation for such suspension, Contractor shall be reimbursed for the following costs, reasonably incurred, without duplication of any item, to the extent that such costs directly result from such suspension of Work.

1. A standby charge to be paid to Contractor during the period of suspension of Work which standby charge shall be sufficient to reimburse Contractor for its actual costs for keeping, to the extent required in the notice, its organization and equipment committed to the Work in a standby status;

2. All reasonable costs associated with mobilization and demobilization of Contractor's forces and equipment;

3. An equitable amount to reimburse Contractor for the cost of maintaining and protecting that portion of the Work upon which Work has been suspended;

4. If, as a result of any such suspension of Work, the cost to Contractor of subsequently performing Work is increased or decreased, an equitable adjustment will be made in the cost of performing the remaining portion of Work.

C. Upon receipt of notice to resume suspended Work, the Contractor shall immediately resume performance of the suspended Work to the extent required in the notice. Any claim on the part of Contractor for time or compensation shall be made in writing within 10 calendar days after receipt of notice to resume Work and Contractor shall submit for review a revised Construction Schedule. Failure to agree to the amounts, if any, due under the provisions of this article shall be a dispute within the meaning of Article GC.23 DISPUTES. No compensation or extension of time shall be granted under this article if and to the extent that suspension results from Contractor's noncompliance with the requirements of this Contract, nor for such periods where Work would have been suspended for reasons other than the Company's suspension order.

GC.21 OPTIONAL TERMINATION. The Company may, at its option, terminate the Contract in whole or from time to time in part at any time by written notice thereof to Contractor, whether or not Contractor is in default. Upon any such termination, Contractor agrees that he shall have no claim for damages (including without limitation loss of anticipated profits and engineering services and shop space dedicated for the work but not used) on account thereof. The sole right and remedy of Contractor shall be payment in accordance with Subparagraph B below, provided, however, that those provisions of the Contract which by their very nature survive final

acceptance under the Contract shall remain in full force and effect after such termination.

A. Upon receipt of any such notice, Contractor shall unless the notice requires otherwise:

1. Immediately discontinue Work on the date and to the extent specified in the notice;

2. Place no further orders or subcontracts for materials, services, or facilities, other than as may be necessary or required for completion of such portion of Work under the Contract that is not terminated;

3. Promptly make every reasonable effort to obtain cancellation upon terms satisfactory to the Company of all orders and subcontracts to the extent they relate to the performance of Work terminated or assign to the Company those orders and subcontracts, and revoke agreements specified in such notice;

4. Assist the Company as specifically requested in writing in the maintenance, protection and disposition of property acquired by the Company under the Contract; and

5. Deliver to the Company or dispose of, as the Company may direct, all materials, supplies or Work-in-process or raw material identified to the Contract.

B. Upon such termination, the Company will pay to Contractor an amount determined in accordance with the following (without duplication of any item).

1. All amounts due and not previously paid to Contractor for Work completed in accordance with the Contract prior to such notice, and for Work thereafter completed as specified in such notice. No amount will be paid for Work, material, or items not identified to the Contract or which are otherwise part of Contractor's regular manufacturing or sales inventories.

2. The cost of settling and paying claims arising out of the termination of Work under subcontracts or orders as provided in Subparagraph A.3 of this article.

3. The reasonable costs incurred pursuant to Subparagraph A.4 of this article.

4. Any other reasonable costs incidental to such termination of Work.

The foregoing amounts shall include a reasonable sum, under all of the circumstances, as profit for all Work satisfactorily performed by Contractor. Disagreements concerning any amounts due or payable under this article shall be disputes within the meaning of Article GC.23 DISPUTES.

GC.22 TERMINATION FOR DEFAULT. The Company may, by written notice of default to the Contractor, terminate the whole or any part of this Contract in any one of the following circumstances.

1. If the Contractor fails or refuses to supply sufficient and properly skilled workmen or equipment, or materials of proper quality and quantity, or does not perform any of the provisions of this Contract, or fails for non-excusable causes to make progress so as to endanger timely completion of performance of any part of this Contract in accordance with its terms, and in any of these circumstances does not cure such failure within a period of 10 days (or such longer period as the Company may authorize in writing) after receipt of notice from the Company specifying such failure.

2. If the Contractor should become insolvent or unable to meet his payroll or other current obligations, or be adjudicated a bankrupt, have an involuntary Petition in Bankruptcy filed against him, make an assignment for benefit of creditors, file a petition for an arrangement, composition or compromise with his creditors under any applicable laws, or have a trustee or other officer appointed to take charge of his assets.

In the event the Company terminates this Contract in whole or in part as provided in the first paragraph of this article, the Company may take possession of all on "Site" materials, equipment, tools and appliances belonging to or under control of the Contractor, and may take over and complete the terminated Work by whatever method it deems expedient, including the hiring of other contractors under such form of contract as the Company may deem advisable. In such case, Contractor shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the amount to be paid on the Contract shall exceed the sum of the expense of finishing the work, compensation for additional managerial and administrative services, and such other incidental and consequential costs and damages as the Company may suffer, such excess shall be paid to Contractor. If such expense, compensation, costs, and damages shall exceed such unpaid balance, Contractor and his sureties, if any, shall be liable for and shall pay the difference to the Company. Failure of the Company to exercise any of the rights given it under this paragraph shall not excuse Contractor or his sureties from responsibility

for compliance with the provisions of this Contract nor prejudice any other rights or remedies of the Company. The Contractor shall continue the performance of this Contract to the extent not terminated under the provisions of this article.

If, after notice of termination of this Contract under the provisions of this article, it is determined for any reason that the Contractor was not in default under the provisions of this article, or that the default was excusable under the provisions of this Contract, the Contractor's sole remedy shall be the same as if the notice of termination had been issued pursuant to Article GC.21 OPTIONAL TERMINATION.

The rights and remedies of the Company provided in this article shall not be exclusive and are in addition to any other rights and remedies provided by law or under this Contract.

GC.23 DISPUTES. The parties recognize that the subject matter and principal purpose of the Contract pertains to the construction of the Project; and further that the Contractor's Work will be closely related to and affect work, material, labor and services of contractors, suppliers and other parties who will likewise be engaged in work at the site. Such parties are likely to have an interest in any dispute between the Company and the Contractor. Since the domiciles, residences and principal places of business of the large number of persons and entities engaged on the Project are expected to be in several differing jurisdictions, the Project site is recognized as the only common forum or jurisdiction with which all such parties are expected to have contacts. The Project site is also the most likely location of any physical evidence affecting any dispute between the parties. Accordingly, the Company and the Contractor agree that the following procedures will govern disputes:

1. The rights and obligations of the parties shall be determined in accordance with the laws of the State in which the Project is located.

2. The Contractor hereby consents to the exercise of personal jurisdiction over him by the State and Federal courts of general jurisdiction in the State where the Project is located.

3. All disputes which arise in connection with, or are related to the Project or the Contract or any claimed breach thereof, shall be resolved, if not sooner settled, by litigation only in the court having general jurisdiction for the county of the Project site, (or the federal court otherwise having territorial jurisdiction over the dispute) and not elsewhere, subject only to the authority of the court in question to order changes of venue. To this end, the Contractor waives

any rights he might have to insist that litigation to which he is a party be had in any venue other than the site of the Project, and covenants not to sue the Company in any court other than the above courts with respect to any Project or contract related dispute.

4. Pending the final decision of the court of a dispute hereunder, the Contractor shall diligently proceed with the performance of any portion of the Contract for which the Company has not previously given written notice of termination under Article GC.21 OPTIONAL TERMINATION and Article GC.22 TERMINATION FOR DEFAULT, or which is not then suspended by written suspension order under Article GC.20 SUSPENSION.

5. The Contractor's undertakings in this Article GC.23 are each severable independent covenants and shall survive termination or completion of the Contract.

GC.24 USE OF COMPLETED PORTIONS OF WORK. Whenever, as determined by the Company, any portion of Work performed by Contractor is in a condition suitable for use, the Company may take possession of or use such portion. Such use by the Company shall in no case be construed as constituting final acceptance, and shall neither relieve Contractor of any of its responsibilities under the Contract, nor act as a waiver by the Company of any of the conditions thereof, provided, that Contractor shall not be liable for the cost of repairs, rework, or renewals which may be required due to ordinary wear and tear resulting from such use by the Company.

GC.25 FINAL INSPECTION AND ACCEPTANCE. When Contractor considers that all work under the Contract is complete, Contractor shall so inform the Company in writing. When the results of inspection and testing satisfy the Company that all Work under the Contract is completed and in accordance with the requirements of this Contract, the Company shall notify Contractor in writing of final acceptance of his work under this Contract.

GC.26 SUBMITTAL OF COST DATA. The Contractor shall submit to the Company when required, following the award of the Contract, an itemized schedule of quantities and values of the various classes of Work involved and aggregating the total sum of the Contract.

The Company will furnish to the Contractor a system of accounts for segregating the cost of various parts of the Work as required by the Company and the Contractor shall use these accounts when submitting his itemized cost breakdown. In addition, as required in the Special Conditions, these accounts will be related to the Project Schedule in order that progress payments to the Contractor will be approved according to work accomplished during the billing period.

GC.27 PAYMENTS. Progress Payments and Final Payment shall be made as provided in the Contract Agreement and Special Conditions. Payments otherwise due may be withheld on account of defective work not remedied, liens filed, damage by the Contractor to the Company or other claims not resolved, or failure to make payments properly to Subcontractors or for material or labor, reasonable evidence that the Work cannot be completed for the balance of the contract price remaining unpaid or any other failure to perform the Contract in accordance with its terms.

GC.28 RELEASE OF LIABILITY. Acceptance by the Contractor of final payment shall constitute a release of the Company and all its officers, directors, employees and agents, from all claims and liability for anything done or furnished in connection with the Work, or for any act or neglect of the Company or of any entity or person for whom the Company may have responsibility relating to or affecting the Work.

GC.29 AUDIT BY THE COMPANY. Requests for payments by the Contractor to the Company which are based on actual cost or progress of the Work may be subject to an audit by the Company. The Contractor shall maintain adequate supporting records for verification of such actual costs or progress, in such form as the Company may direct or, absent direction, in accordance with generally accepted accounting procedures consistently applied. During the period of performance and the 2 year period following final payment, Contractor shall preserve such records and allow access to them by auditors appointed by the Company.

GC.30 LIENS.

GC.30.1 Bills to be Kept Current. The Contractor shall hold and apply all amounts received under this Contract as a constructive trust to be utilized first for the payment of all labor provided under this Contract, together with applicable federal and state withholding taxes, and for the payment of all materials, equipment rentals, and Subcontractors procured in the performance of the requirements of this Contract. The Contractor shall promptly pay each Subcontractor, upon receipt of payment from the Company, the amount allowed by the Company on each invoice or progress payment on account of such Subcontractor's Work. Contractor shall also promptly pay its material suppliers for any materials which the Company has included within and allowed on any progress payment. Contractor shall pay all its other materialmen and suppliers, including equipment rentals on a current basis, after receipt of each progress payment. The Contractor shall, by an appropriate agreement with each Subcontractor, also require each Subcontractor to make payments to his Sub-Subcontractors, and suppliers in a similiar manner.

GC.30.2 Lien Waivers for Payments. Prior to making payment on any progress payment the Company in its sole discretion may require Contractor to furnish consents of surety, or lien waivers or receipts from any laborers, subcontractors, suppliers, equipment lessors or materialmen showing that Contractor has complied with the foregoing requirements

through the date of any previous progress payments. The Contractor shall deliver to the Company prior to final payment, a complete waiver or release of all claims or liens arising out of the Work together with the consent of its surety. At the Company's sole option, receipts in full from all Subcontractors or materialmen may be accepted in lieu thereof. Contractor shall also furnish an acceptable affidavit stating that so far as he has knowledge or information, the releases and receipts include all the labor, services and material for which a lien could be filed. The Contractor may, if any Subcontractor, supplier, laborer, or materialman refuses to furnish a release or receipt in full, furnish a bond, satisfactory to the Company, to indemnify the Company against any lien. If any lien remains unsatisfied after all payments are made, the Contractor and his surety shall immediately take all steps necessary to obtain the release of such liens. If the Company is compelled to pay or defend a lien claim arising out of the Work, Contractor and his surety shall reimburse the Company for all costs and expenses associated therewith, including reasonable attorney's fees.

GC.31 INDEMNITY. The Contractor shall defend, indemnify, and hold the Company harmless against any and all claims, demands, and causes of action of every kind and character arising in favor of any person, including both Company's and Contractor's employees, on account of personal or bodily injuries or death, or damages to property occurring, growing out of, incident to, or resulting directly or indirectly from the work to be performed by Contractor under this Contract or any amendment or alteration thereof, whether such loss, damage, injury or liability, or claim thereof, arises from or is contributed to by the negligence of the Company, its employees or another party. Notwithstanding the foregoing, the Contractor shall not be obligated to indemnify the Company or hold the Company harmless from injury, damage or other costs and expenses, where the same arises out of the sole negligence of the Company; provided, however, Contractor's assumption of the defense of the Company shall constitute a waiver of the provisions of this sentence. If the Contractor, or the Contractor's insurer, refuses to assume the defense of the Company against any claim, demand or cause of action on the basis that the same arose out of the sole negligence of the Company or that for any other reason this Article GC.31 does not apply, the Company shall provide for its own defense; but if it is subsequently determined or agreed that the Company was not solely negligent or that this Article GC.31 otherwise applies, the Contractor shall indemnify and hold the Company harmless as heretofore provided and reimburse the Company for all costs and expenses, including attorney's fees (which may include the reasonable value of work performed by attorneys in the employ of the Company), paid or otherwise incurred in defense of the Company and in any related or subsequent proceedings to enforce the provisions of this Article GC.31. The foregoing indemnity provisions shall be deemed independent covenants, and shall survive the completion of, or any termination or cancellation of, the Contract or any claimed breach thereof.

GC.32 NO THIRD PARTY BENEFICIARY RIGHTS. No provision of these General Conditions shall in any way inure to the benefit of any third person (including the public at large) so as to constitute any such person a third party beneficiary of this Contract or of any one or more of the terms hereof, or otherwise give rise to any cause of action in any person not a party hereto.

GC.33 INSURANCE.

GC.33.1 Contractor's Liability Insurance. The Contractor shall maintain such insurance as will protect him and the Company from claims under workmen's compensation acts and from claims for damages because of bodily injury, including death, and property damage, which may in any way arise out of or be in any way remote or proximate manner connected with the performance of this Contract, whether such claim arises out of the act or failure to act of Contractor or the Company or of the direct or indirect delegee, appointee or employee of either of them. This insurance shall be written in the kinds and minimum limits of liability specified below.

1. Workmen's Compensation Statutory -
   Employer's Liability Limit - $100,000 each employee

2. Comprehensive General Liability Insurance -

   a. Operations

Bodily Injury -	$250,000 each person $500,000 each occurrence
Property Damage -	$500,000 each occurrence $500,000 aggregate

   b. Contractor's Protective

Bodily Injury -	$250,000 each person $500,000 each occurrence
Property Damage -	$500,000 each occurrence $500,000 aggregate

   c. Completed Operations

Bodily Injury -	$250,000 each person $500,000 each occurrence $500,000 aggregate
Property Damage -	$500,000 each occurrence $500,000 aggregate

d. Contractual to include coverage for Hold Harmless Agreement in Article GC.31 INDEMNITY

Bodily Injury -	$250,000 each person $500,000 each occurrence
Property Damage -	$500,000 each occurrence $500,000 aggregate

e. Elevators

Bodily Injury -	$250,000 each person $500,000 each occurrence
Property Damage -	$500,000 each occurrence $500,000 aggregate

3. Comprehensive Automobile Liability -

Bodily Injury -	$250,000 each person $500,000 each accident
Property Damage -	$100,000 each accident

The foregoing limit requirements may be complied with through purchase of underlying coverage alone in the specified amounts or by obtaining lesser limits for underlying coverages and an umbrella excess liability policy bringing total cover up to the limit specified. The specification of liability coverages and limits herein shall not relieve or limit the responsibilities of Contractor under the Contract. The Contractor is solely responsible for determining whether additional coverages or greater limits are required to protect his interests from hazards or claims in excess of the specified minimum insurance. Where special or unusual hazards peculiar to this Project are foreseeable, the Contractor shall take such steps as are necessary to insure himself against such hazards and be responsible for any damage, including water, which results from the occurrence of such hazards in connection with this Project.

By proper endorsements, Contractor's Comprehensive General Liability Insurance shall be extended to protect the insured against hazards of explosion, collapse or underground property damage, and the use of explosives and pile driving. Also, the Property Damage Coverage shall be provided for on the Broad Form on an occurrence basis with no deductible.

No later than 10 days after award of Contract, but in any event prior to the execution of the Contract, the Contractor shall file a complete "Package" of certificates of insurance signed by the insurer or certificates of the aforementioned insurance shall be filed with the Company on the Standard Minnesota AIA-AGC Joint Committee Form AA-701, or other form acceptable to the Company. None of the insurance required hereunder

shall be canceled, changed or allowed to lapse until the Contract has been completed and the Work accepted or until such later specific date or time which is required for certain parts of the specified coverage. In the event of cancellation, change, or expiration, 30 days notice shall be given the Company by the insurance company or companies validated by an authorized representative of the insurer. Each policy of insurance shall contain a clause, which provides in the event of cancellation or expiration of the policy or of any change in the policy of any nature, 30 days advance written notice will be sent to the Company. No Work under the Contract will be started until insurance certificates or policies have been filed and approved nor shall any progress payment become due and payable until such certificates or policies have been filed and approved.

GC.33.2 Company's Property Insurance.

1. The Company shall effect and maintain fire and extended coverage insurance upon the entire Project on which the Work of this Contract is to be performed and upon all material stored at the Site and intended for use thereon to at least 90 per cent of the insurable value thereof. The insurance shall cover labor and materials in place and materials to be used as a permanent part of the construction, including surplus materials and miscellaneous supplies necessary to the Work. The insurance shall not cover any tools, construction equipment and temporary facilities owned or rented by Contractor or Subcontractors or their employees or agents.

2. The Company and Contractor waive all rights against each other for damages caused by fire or other perils to the extent insured by the policy described in the preceding paragraph except for such rights as the Company may have to the proceeds of such insurance. The Contractor shall require similar waivers by Subcontractors.

GC.33.3 Company-furnished Transit and Installation Insurance. The Company will provide transit and installation insurance providing protection against physical loss or damage during the physical process of installation, including hoisting, lowering, or any other movement, and also while awaiting installation, while in transit via land or air conveyances, or elsewhere, for all materials and equipment furnished hereunder which are to become a part of the permanent plant or consumed in construction. Such transit and installation insurance shall be for the full value of the materials and equipment in accordance with the standard provisions of a typical all-risk policy; and deductible amounts shall be for the account of the Company. The Contractor, its Subcontractors or suppliers of any tier will be covered as additional insured as their

interests may appear. Contractor shall not include costs for such insurance in the contract price.

GC.34 BONDS. Where required elsewhere in the Contract Documents, the Contractor shall furnish a bond, covering the faithful performance of the Contract and the payment of all obligations arising thereunder in the amount of 100 per cent of the Contract Sum, on the form required by the Contract Documents, with such sureties as may be agreeable to the parties. Contractor shall deliver the required bond to the Company not later than the date of execution of the Contract (or prior to commencement of any Work if the Work is commenced prior thereto in response to a notice to proceed).

GC.35 CLAIMS FOR DAMAGES. Contractor agrees not to assert or pursue any claim against the Company for damages or for any other compensation not otherwise provided for specifically in the Contract unless written notice thereof shall have been given with reasonable particularity to the Company within 10 days after the occurrence giving rise thereto.

GC.36 NOTICES. Notices provided for in this Contract shall be deemed to have been sufficiently given to either party if given by registered or certified mail, or by telex or telegram, addressed to the party in question at the address shown for such party in the Contract Documents.

GC.37 PUBLICATIONS AND PHOTOGRAPHS. Contractor shall not make any announcement or release any information concerning this Contract or the Project or any part thereof to any member of the public, press or any official body, unless prior written consent is obtained from the Company, except that information may be given to an official body as required by law or regulations to obtain necessary permits.

GC.38 WAIVER. None of the conditions of the Contract shall be considered waived by the Company unless such waiver is given in writing by the Company. No such written waiver shall be a waiver of any past or future default, breach or modification of any of the conditions of the Contract unless expressly stipulated in such waiver.

GC.39 WARRANTY CONCERNING PROHIBITED TRANSFERS. Contractor and its Subcontractors or suppliers of any tier have not transferred, and will not transfer anything of value to any employee, agent or other representative of the Company, where such transfer is or was made with the understanding or under circumstances indicating that it was in any way intended:

1. To obtain favorable treatment in securing this Contract; or

2. To obtain concessions in performing the Work; or

3. To pay for such business secured or concessions obtained in the past.

Transfers prohibited by this warranty include any payment, gift, loan or other individual benefit to any Company agent, employee or representative, and any payment, loan, gift or benefit made to others for the individual benefit of any Company agent, employee or representative.

For breach or violation of this warranty, the Company shall have, in its sole discretion, the right to:

1. Annul this Contract without liability; or

2. To terminate it for default; or

3. To deduct from the contract price or otherwise recover from the Contractor the amount of any prohibited transfer.

GC.40 EQUAL EMPLOYMENT OPPORTUNITY OFFICE OF FEDERAL CONTRACT COMPLIANCE CLAUSES. The E.E.O/O.F.C.C. Clauses found in Appendix I, as attached, are incorporated into and made a part of these General Conditions.

APPENDIX I

EQUAL EMPLOYMENT OPPORTUNITY, OFFICE OF FEDERAL CONTRACT COMPLIANCE CLAUSES

For the purpose of this Appendix I, the definitions for the following terms are found in the rules and regulations of the Office of Federal Contract Compliances, or the Secretary of Labor, or his designee:

1. Administering agency.

2. Agency.

3. Applicant.

4. Compliance agency.

5. Construction work.

6. Contract.

7. Contracting agency.

8. Contractor.

9. Director.

10. Subcontract.

11. Subcontractor.

I. EQUAL OPPORTUNITY CLAUSE
(Applicable to all contracts or purchase orders in excess of $10,000)

Supplier/Contractor shall be bound by and agrees to the following provisions as contained in Section 202 of Executive Order 11246 to wit:

1. The Supplier/Contractor will not discriminate against any employee or application for employment because of race, color, religion, sex, or national origin. The Supplier/Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion, or transfer, recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Supplier/Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the contracting officer setting forth the provisions of this nondiscrimination clause.

2. The Supplier/Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Supplier/Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

3. The Supplier/Contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided by the agency contracting officer, advising the labor union or workers' representative of the Supplier's/Contractor's commitments under Section 202 of Executive Order 11246 of September 24, 1965, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

4. The Supplier/Contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.

5. The Supplier/Contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the contracting agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

6. In the event of the Supplier's/Contractor's noncompliance with the nondiscrimination clauses of this Contract or with any of such rules, regulations, or orders, this Purchase Order/Contract may be canceled, terminated or suspended in whole or in part and the Supplier/Contractor may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

7. The Supplier/Contractor will include the provisions of paragraphs (1) through (7) in every Subcontract or Purchase Order unless exempted by rules, regulations or order of the Secretary of Labor issued pursuant to Section 204 of the Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each Subcontractor or Vendor. The Supplier/Contractor will take such action with respect to any Subcontract or Purchase Order as the contracting agency may direct as a means of enforcing such provisions including sanctions for noncompliance: Provided, however, that in the event the Supplier/Contractor becomes involved in, or is threatened with, litigation with a Subcontractor or Vendor as a result of such direction by the contracting agency, the Supplier/Contractor may request the United States to enter into such litigation to protect the interests of the United States.

II. CERTIFICATION OF NONSEGREGATED FACILITIES

Supplier/Contractor certifies that he does not maintain or provide for his employees any segregated facilities at any of his establishments, and that he does not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. He certifies further that he will not maintain or provide for his employees any segregated facilities at any of his establishments, and that he will not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. The bidder, offeror, applicant, or subcontractor agrees that a breach of this certification is a violation of the Equal Opportunity Clause in this Contract. As used in this certification, the term "segregated facilities" means, but is not limited to any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms, and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation and housing facilities provided for employees which are segregated by explicit direction or are in fact segregated on the basis of race, creed, color, or national origin, because of habit, local custom, or otherwise. He further agrees that (except where he has obtained identical certifications

from proposed subcontractors for specific time periods) he will obtain identical certifications from proposed subcontractors prior to the award of subcontracts exceeding $10,000 which are not exempt from the provisions of the Equal Opportunity Clause; that he will retain such certification in his files; and that he will forward the following notice to such proposed subcontractors (except where the proposed subcontractors have submitted identical certifications for specific time periods).

> "NOTICE TO PROSPECTIVE SUBCONTRACTORS OF REQUIREMENT FOR CERTIFICATIONS OF NONSEGREGATED FACILITIES.
>
> A Certification of Nonsegregated Facilities, as required by the 9 May 1967 order on Elimination of Segregated Facilities, by the Secretary of Labor (32 Fed. Reg. 7439, 19 May 1967), must be submitted prior to the award of a subcontract exceeding $10,000 which is not exempt from the provisions of the Equal Opportunity Clause. The certification may be submitted either for each subcontract or for all subcontracts during a period (i.e. quarterly, semi-annually or annually)."

III. EMPLOYER INFORMATION REPORT (EEO-1, STANDARD FORM 100)

If Supplier/Contractor has 50 or more employees and is required under Section 60-1.7 of Title 41 of the Code of Federal Regulations to file Employer Information Report, EEO-1, (Standard Form 100), Supplier/Contractor hereby certifies that it has done so or if not agrees that it will file such report in accordance with the applicable instructions and will continue to file such report unless or until Supplier/Contractor is not required by law or regulation to so file.

IV. AFFIRMATIVE ACTION COMPLIANCE PROGRAM

Supplier/Contractor may be required under Section 60-1.40 of Title 41 of the Code of Federal Regulations to develop a written Affirmative Action Compliance Program, if Supplier/Contractor has 50 or more employees and the contracts of sale amount to $50,000 or more. If Supplier/Contractor is so required, it agrees to do so not later than 120 days after the effectiveness of the first of the contracts of sale and maintain such Program until such time as it is no longer required by law or regulations.

V. LISTING OF EMPLOYMENT OPENINGS
(Applicable to all contracts or purchase orders for $2,500 or more)

Supplier/Contractor shall be bound by and agrees to the provisions of 38 U.S.C. Section 2012 and Executive Order 11701 38 F.R. 2675 to wit:

(a) The Supplier/Contractor, to provide special emphasis to the employment of qualified disabled veterans and veterans of the Vietnam era, agrees that all suitable employment openings of the Contractor which exist at the time of the execution of this Contract and those which occur during the performance of this Contract, including those not generated by this Contract and including those occurring at an establishment of the Supplier/Contractor other than the one wherein the contract is being performed but excluding those of independently operated corporate affiliates, shall be offered for listing at an appropriate local office of the State employment service system wherein the opening occurs and to provide such reports to such local office regarding employment openings and hires as may be required: PROVIDED, that if the contract is for less than $10,000 or if it is with a State or local government the reports set forth in paragraphs (c) and (d) of this clause are not required.

(b) Listing of employment openings with the employment service system pursuant to this clause shall be made at least concurrently with the use of any other recruitment service or effort and shall involve the normal obligations which attach to the placing of a bona fide job offer, including the acceptance of referrals of veterans and non veterans. The listing of employment openings does not require the hiring of any particular job applicant or from any particular group of job applicants, and nothing herein is intended to relieve the Supplier/Contractor from any requirements in any Executive Orders or regulations regarding nondiscrimination in employment.

(c) The reports required by paragraph (a) of this clause shall include, but not be limited to, periodic reports which shall be filed at least quarterly with the appropriate local office or where the Supplier/Contractor has more than one establishment in a State, with the central office of that State employment service. Such reports shall indicate for each establishment (1) the number of individuals who were hired during the reporting period, (2) the number of those hired who were disabled veterans, and (3) the number who were non disabled veterans of the Vietnam era. The Supplier/Contractor shall submit a report within 30 days after the end of each reporting period wherein any performance is made on this Contract. The Supplier/Contractor shall maintain copies of the reports submitted until the expiration of one (1) year after final payment under the

contract, during which time they shall be made available, upon request, for examination by any authorized representatives of the contracting officer or of the Secretary of Labor.

(d) Whenever the Supplier/Contractor becomes contractually bound to the listing provisions of this clause, he shall advise the employment service system in each State wherein he has establishments of the name and location of each such establishment in the State. As long as the Supplier/Contractor is contractually bound to these provisions and has so advised the State system there is no need to advise the State system of subsequent contracts. The Supplier/Contractor may advise the State systems when it is no longer bound by this contract clause.

(e) This clause does not apply to the listing of employment openings which occur and are filled outside of the 50 States, the District of Columbia, Puerto Rico, Guam, and the Virgin Islands.

(f) This clause does not apply to openings which the Supplier/Contractor proposes to fill from within his own organization or to fill pursuant to a customary and traditional employer union hiring arrangement. This exclusion does not apply to a particular opening once an employer decides to consider applicants outside of his own organization or employer union arrangement for that opening.

(g) As used in this clause:

(1) "All suitable employment openings" includes, but is not limited to, openings which occur in the following job categories: Production and nonproduction, plant and office; laborers and mechanics; supervisory and nonsupervisory; technical; and executive, administrative, and professional openings which are compensated on a salary basis of less than $18,000 per year. This term includes full-time employment, temporary employment of more than three (3) days' duration, and part-time employment. It does not include openings which the Supplier/Contractor proposes to fill from within his own organization or to fill pursuant to a customary or traditional employer-union hiring arrangement. Under the most compelling circumstances an employment opening may not be suitable for listing, including such situations where the needs of the Government cannot reasonably be otherwise supplied, where listing would be contrary to national security, or where the requirement of listing would otherwise not be for the best interest of the Government.

(2) "Appropriate office of the State employment service system" means the local office of the Federal-State national system of public employment offices with assigned responsibility for serving the area where the employment opening is to be filled, including the District of Columbia, Guam, Puerto Rico, and the Virgin Islands.

(3) "Openings which the Supplier/Contractor proposes to fill from within his own organization" means employment openings for which no consideration will be given to persons outside the Supplier's/Contractor's organization (including any affiliates, subsidiaries, and the parent companies) and includes any openings which the Supplier/Contractor proposes to fill from regularly established "recall" or "rehire" lists.

(4) "Openings which the Supplier/Contractor proposes *** to fill pursuant to a customary and traditional employer-union hiring arrangement" means employment openings for which no consideration will be given to persons outside of a special hiring arrangement, including openings which the Supplier/Contractor proposes to fill from union halls, which is part of the customary and traditional hiring relationship which exists between the Supplier/Contractor and representatives of his employees.

(5) "Disabled veteran" means a person entitled to disability compensation under laws administered by the Veterans' Administration for disability rated at 30 per centum or more, or a person whose discharge or release from active duty was for a disability incurred or aggravated in line of duty.

(6) "Veteran of the Vietnam era" means a person (1) who (i) served on active duty for a period of more than 180 days, any part of which occurred after August 5, 1964, and was discharged or released therefrom with other than a dishonorable discharge, or (ii) was discharged or released from active duty for service-connected disability if any part of such duty was performed after August 5, 1964, and (2) who was so discharged or released within the 48 months preceding his application for employment covered under this part.

(h) The Supplier/Contractor agrees to place this clause, excluding this paragraph (h), in any subcontract of $2,500 or more directly under this Contract. This clause shall apply to any subcontract entered into by Supplier/Contractor in carrying out any contract for the procurement of personal property and nonpersonal services (including construction) for the United States.

VI. UTILIZATION OF MINORITY BUSINESS ENTERPRISES
(Applicable to all contracts or purchase orders in excess of $5,000, except contracts for services which are personal in nature.)

(a) It is the policy of the Government that minority business enterprises shall have the maximum practicable opportunity to participate in the performance of Government contracts.

(b) The Supplier/Contractor agrees to use his best efforts to carry out this policy in the award of his subcontracts to the fullest extent consistent with the efficient performance of this Contract. As used in this Contract, the term "minority business enterprise" means a business, at least 50 per cent of which is owned by minority group members, or, in case of publicly owned businesses, at least 51 per cent of the stock of which is owned by minority group members. For the purposes of this definition, minority group members are Negroes, Spanish-speaking American persons, American-Orientals, American-Indians, American Eskimos, and American-Aleuts. Contractors may rely on written representations by subcontractors regarding their status as minority business enterprises in lieu of an independent investigation.

VII. MINORITY BUSINESS ENTERPRISES SUBCONTRACTOR PROGRAM
(Applicable to all contracts or purchase orders in excess of $500,000.)

(a) The Supplier/Contractor agrees to establish and conduct a program which will enable minority business enterprises (as defined in the clause entitled "Utilization of Minority Business Enterprises") to be considered fairly as subcontractors and suppliers under this Contract. In this connection, the Supplier/Contractor shall -

(1) Designate a liaison officer who will administer the Supplier/Contractor's minority business enterprises program.

(2) Provide adequate and timely consideration of the potentialities of known minority business enterprises in all "make-or-buy" decisions.

(3) Assure that known minority business enterprises will have an equitable opportunity to compete for subcontracts, particularly by arranging solicitations, time for the preparation of bids, quantities, specifications, and delivery schedules so as to facilitate the participation of minority business enterprises.

(4) Maintain records showing (i) procedures which have been adopted to comply with the policies set forth in this clause, including the establishment of a source list of minority business enterprises, (ii) awards to minority business enterprises on the source list, and (iii) specific efforts to identify and award contracts to minority business enterprises.

(5) Include the Utilization of Minority Business Enterprises clause in subcontracts which offer substantial minority business enterprises subcontracting opportunities.

(6) Cooperate with the Contracting Officer in any studies and surveys of the Supplier's/Contractor's minority business enterprises procedures and practices that the Contracting Officer may from time to time conduct.

(7) Submit periodic reports of subcontracting to known minority business enterprises with respect to the records referred to in subparagraph (4), above, in such form and manner and at such time (not more often than quarterly) as the Contracting Officer may prescribe.

(b) The Supplier/Contractor further agrees to insert, in any subcontract hereunder which may exceed $500,000, provisions which shall conform substantially to the language of this clause, including this paragraph (b), and to notify the Contracting Officer of the names of such subcontractors.

VIII. EMPLOYMENT OF THE HANDICAPPED
(Applies to all contracts or purchase orders for $2,500 or more.)

Supplier/Contractor shall be bound by and agrees to the provisions of Section 503 of the Rehabilitation Act of 1973, and all regulations, rules, and orders promulgated thereunder, to wit:

(a) The Supplier/Contractor will not discriminate against any employee or applicant for employment because of physical or mental handicap in regard to any position for which the employee or applicant for employment is qualified. The Supplier/Contractor agrees to take affirmative action to employ, advance in employment and otherwise treat qualified handicapped individuals without discrimination based upon their physical or mental handicap in all employment practices such as the following: employment, upgrading, demotion or transfer, recruitment, advertising, layoff or termination, rates of pay or other forms of compensation, and selection for training including apprenticeship.

(b) The Supplier/Contractor agrees to comply with the rules, regulations, and relevant orders of the Secretary of Labor issued pursuant to the Act.

(c) In the event of the Supplier's/Contractor's noncompliance with the requirements of this clause, actions for noncompliance may be taken in accordance with the rules, regulations and relevant orders of the Secretary of Labor issued pursuant to the Act.

(d) The Supplier/Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices in a form to be prescribed by the Director, provided by or through the Contracting Officer. Such notices shall state the Supplier's/Contractor's obligation under the law to take affirmative action to employ and advance in employment qualified handicapped employees and applicants for employment, and the rights of applicants and employees.

(e) The Supplier/Contractor will notify each labor union or representative of workers with which it has a collective bargaining agreement or other contract understanding, that the Supplier/Contractor is bound by the terms of Section 503 of the Rehabilitation Act of 1973, and is committed to take affirmative action to employ and advance in employment physically and mentally handicapped individuals.

(f) The Supplier/Contractor will include the provisions of this clause in every subcontract or purchase order of $2,500 or more unless exempted by rules, regulations, or orders of the Secretary issued pursuant to Section 503 of the Act, so that such provisions will be binding upon each Subcontractor or Vendor. The Supplier/Contractor will take such action with respect to any subcontract or purchase order as the Director of the Office of Federal Contract Compliance Programs may direct to enforce such provisions, including action for noncompliance.

SPECIAL CONDITIONS

SC.1 GENERAL. These SPECIAL CONDITIONS are nontechnical in nature and shall supplement the GENERAL CONDITIONS in the administration and regulation of the work performed under these specifications.

SC.2 SUPPLEMENTAL DEFINITIONS. Supplementing the definitions listed in Article GC.1, these additional words, phrases, or other expressions used in the contract documents shall have meanings as follows.

1. "Engineer" in addition to the definition listed in Article GC.1, shall mean the firm of Black & Veatch, Consulting Engineers, 1500 Meadow Lake Parkway, mailing address P.O. Box 8405, Kansas City, Missouri 64114, or its duly authorized agents, such agents acting within the scope of the particular duties entrusted to them in each case.

2. "Date of contract," or equivalent words, shall mean the date written in the Contract Agreement.

3. "Day" or "days," unless herein otherwise expressly defined, shall mean a calendar day or days of 24 hours each.

4. "Drawings" or "plans" shall mean all (a) drawings furnished by the Company as a basis for proposals, (b) supplementary drawings furnished by the Company to clarify and to define in greater detail the intent of the contract drawings and specifications, (c) drawings submitted by the successful bidder with his proposal, provided such drawings are acceptable to the Company, (d) drawings furnished by the Company to the Contractor during the progress of the work, and (e) engineering data and drawings submitted by the Contractor during the progress of the work, provided such drawings are acceptable to the Company.

5. Whenever in these documents the words "as ordered," "as directed," "as required," "as permitted," "as allowed," or words or phrases of like import are used, it shall be understood that the order, direction, requirement, permission, or allowance of the Company or Engineer is intended only to the extent of judging compliance with the terms of the contract. None of these terms shall

imply that the Company or the Engineer has any authority or responsibility for supervision of the Contractor's forces or construction operations, such supervision and the sole responsibility therefor being strictly reserved for the Contractor.

6. Similarly the words "approved," "reasonable," "suitable," "acceptable," "proper," "satisfactory," or words of like effect and import, unless otherwise particularly specified herein, shall mean approved, reasonable, suitable, acceptable, proper, or satisfactory in the judgment of the Company or Engineer, to the extent provided in "5" above.

7. Whenever in these documents the expression "it is understood and agreed" or an expression of like import is used, such expression means the mutual understanding and agreement of the Company and the Contractor.

8. "Official acceptance" or "final acceptance" shall mean the Company's written acceptance of all work performed under the contract, based on final inspection.

SC.3 LEGAL ADDRESSES. All notices, letters, and other communication to the Contractor will be mailed or delivered to either the Contractor's business address listed in the Proposal or the Contractor's office in the vicinity of the work, with delivery to either of these addresses being deemed as delivery to the Contractor. The address of the Company appearing on Page GC-1 of the GENERAL CONDITIONS is hereby designated as the place to which all notices, letters, and other communication to the Company shall be mailed or delivered. Either party may change his address at any time by an instrument in writing delivered to the Engineer and to the other party.

SC.4 REFERENCE STANDARDS. Reference to the standards of any technical society, organization, or association, or to codes of local or state authorities, shall mean the latest standard, code, specification, or tentative standard adopted and published at the date of taking bids, unless specifically stated otherwise.

SC.5 CONTRACTOR TO CHECK DRAWINGS AND SCHEDULES. The Contractor shall check all dimensions, elevations, and quantities indicated on the drawings and schedules furnished to him by the Engineer. The Contractor shall notify the Engineer of any discrepancy between the drawings and the conditions at the site, or any error or omission in drawings, or in the layout as given by stakes, points, or instructions, which he may discover in the course of the work. The Contractor will not be allowed to take

advantage of any error or omission in the drawings or contract documents. Full instructions will be furnished by the Engineer should such error or omission be discovered, and the Contractor shall carry out such instructions as if originally specified.

SC.6 FIGURED DIMENSIONS TO GOVERN. Dimensions and elevations indicated on the drawings shall be accurately followed even though different from scaled measurements. No work indicated on the drawings, the dimensions of which are not indicated, shall be executed until necessary dimensions have been obtained from the Engineer.

SC.7 INDEMNITY. Supplementing the requirements of Article GC.31, in case any action in court is brought against the Engineer, or any officer or agent thereof, for the failure, omission, or neglect of the Contractor to perform any of the covenants, acts, matters, or things by this Contract undertaken; or for injury or damage caused by the alleged negligence of the Contractor or his subcontractors or his or their agents, or in connection with any claim based on lawful demands of subcontractors, workmen, material men, or suppliers; the Contractor shall defend, indemnify and save harmless the Engineer and its officers and agents, from all losses, damages, costs, expenses, judgments, or decrees arising out of such action.

SC.8 ENGINEER'S DRAWINGS AND SPECIFICATIONS. The Contractor will be furnished 10 sets of all drawings including revisions thereto and 10 copies of the specifications without charge. Additional sets of drawings and revisions thereto and additional copies of specifications may be obtained upon written request to the Company at no charge to the Contractor. All drawings and specifications shall be returned to the Company upon completion of the work.

SC.9 PROJECT MANAGEMENT. The coordination of all field construction will be under the direction of the Company.

Schedule meetings of the Company and all contractors at the site will be held at the time and place designated by the Company. The purpose of these meetings will be for the scheduling and coordination of each contractor's work within the requirements of the overall project. In the event conflicts arise between contractors concerning scheduling or coordination, the Company will make the final decision resolving the conflict. The Contractor's superintendent shall attend each weekly meeting.

The Company will not be responsible for the assignment of personnel, or obtaining materials or supplies, or for any other services to the Contractor except the coordination of work between contractors and as specifically set forth in the contract documents.

SC.10 CONTRACTOR'S OFFICE AT SITE OF WORK. During the performance of this Contract, the Contractor shall maintain a suitable office at or near the site of the work which shall be the headquarters of a representative authorized to receive drawings, instructions, or other communication or articles. Any communication given to the said representative, or delivered at the Contractor's office at the site of the work in his absence, shall be deemed to have been delivered to the Contractor.

Copies of items listed under FIELD RECORDS shall be kept at the Contractor's office at the site of the work, available for use at all times.

SC.11 FIELD RECORDS. The Contractor shall maintain at his office at the site up-to-date copies of all drawings, specifications, and other contract documents and supplementary data, complete with latest revisions thereto. In addition, the Contractor shall maintain a continuous record of all field changes and, at the conclusion of the work, shall incorporate all such changes on the drawings and other engineering data and shall submit two copies thereof to the Company.

The Contractor's records consisting of marked drawings, engineering data, and sketches shall be submitted prior to official acceptance, but no later than 60 days after completion of the work covered by this Contract.

SC.12 CONTRACTOR'S SUPERVISION AT THE SITE. Supplementing the requirements of Article GC.4, the Contractor shall furnish adequate management, supervisory, and technical personnel on the site to ensure expeditious and competent handling of the work.

The Contractor's field organization shall include an experienced staff of qualified technical personnel to handle onsite engineering, planning, Project Management Control System (PMCS) requirements, and direction of all field work. The field organization shall also include a staff to handle timekeeping, employment, accounting, purchasing and expediting, stores and warehouses, stock and tool rooms, and security.

SC.13 SUBCONTRACTS. Supplementing the requirements of Article GC.6, it is the intent of these specifications that the Contractor shall perform the majority of the work with his own forces and under the management of his own organization. Specific portions of the work may be subcontracted only by subcontractors who have been listed in the Proposal and who are accepted by the Company.

SC.14 METHODS OF FIELD OPERATION. The Contractor shall inform the Company in advance concerning his plans for carrying out each part of the field work. Review by the Company of any plan or method of work proposed by the Contractor shall not relieve the Contractor of any responsibility therefor, and such review shall not be considered as an assumption of any

risk or liability by the Company or any officer, agent or employee thereof. The Contractor shall have no claim because of the failure or inefficiency of any plan or method so reviewed.

Any method of work suggested by the Company, but not specified, shall be used at the risk and responsibility of the Contractor, and the Company will assume no responsibility therefor. The Contractor alone shall be responsible for the safety, adequacy, and efficiency of his plant, equipment, and methods. This requirement will apply continuously and not be limited to normal working hours.

SC.15 LINES AND GRADES. All work shall be done to the lines, grades, and elevations indicated on the drawings. The Contractor shall provide suitable equipment and competent workmen who shall locate and lay out the work.

Basic horizontal and vertical control points will be established or designated by the Company. These points shall be used as datum for work under this Contract.

Measurements shall also be made from permanent base lines and elevation reference datum previously established on the site, as applicable. In addition, measurements shall be coordinated with existing building column lines and floor elevations.

The Contractor shall provide experienced instrument men, competent assistants, and such instruments, tools, stakes, and other materials required to complete survey, layout, and measurement work. In addition, the Contractor shall furnish, without charge, competent men from his force, and such tools, stakes, and other materials as the Company may require in establishing or designating control points, in establishing construction easement boundaries, or in checking survey, layout, and measurement work performed by the Contractor.

The Contractor shall keep the Company informed, a reasonable time in advance, of the times and places at which he wishes to do work, so that horizontal and vertical control points may be established and any checking deemed necessary by the Company may be done with minimum inconvenience to the Company and minimum delay to the Contractor.

Any work done without being properly located may be ordered removed and replaced at the Contractor's expense.

SC.16 PRESERVATION OF MONUMENTS AND STAKES. The Contractor shall carefully preserve all monuments, bench marks, reference points, and stakes. The Contractor will be charged with the expense of replacement of any such items destroyed, and shall be responsible for any mistake or loss of

time that may be caused. Permanent monuments or bench marks which must be removed or disturbed shall be protected until they can be properly referenced for relocation. The Contractor shall furnish materials and assistance for the proper replacement of such monuments or bench marks.

SC.17 LOSSES FROM NATURAL CAUSES. All loss or damage arising out of the nature of the work, or from the action of the elements, or from floods or overflows, or from ground water, or from any unusual obstruction or difficulty, or any other natural or existing circumstance either known or unforeseen which may be encountered in the prosecution of the work, shall be sustained and borne by the Contractor at his own cost and expense.

SC.18 SUNDAY, HOLIDAY, AND NIGHT WORK. Sunday, holiday, and night work at the site shall be coordinated with the Company.

SC.19 UNFAVORABLE CONSTRUCTION CONDITIONS. During periods of unfavorable weather, wet grounds, or other unsuitable construction conditions, the Contractor shall confine his operations to work which will not be affected adversely thereby. No portion of the work shall be constructed under conditions which would affect adversely the quality or efficiency thereof, unless special means or precautions are taken by the Contractor to perform the work in a proper and satisfactory manner.

SC.20 CLEANLINESS. The Contractor shall give special attention to keeping the work site clean and free from trash and debris.

Trash, debris, and waste materials shall not be allowed to accumulate, but shall be disposed of offsite at the Contractor's expense.

The Contractor shall conduct his operations in conformance with the requirements of the Minnesota Pollution Control Authority. A copy of these regulations will be available for examination in the Company's office at the site.

Promptly upon completion of the construction work, all Contractor-owned facilities, materials, and construction plant shall be removed from the site. All surfaces damaged by deposits of foreign materials such as oil, grease, weld spatter, and paint shall be restored to their original conditions.

SC.21 PURCHASE ORDERS. The Contractor shall submit to the Company two copies of each purchase order for all materials and equipment furnished under these specifications for incorporation in the permanent construction. Each purchase order shall indicate the vendor's name, manufacturer's name, materials, type, model number, size, quantity, accessory list, and requested delivery date of the material and equipment ordered. The purchase order copies shall be submitted to the Company before or at the time when they are issued to the vendor.

SC.22 SOURCE OF MATERIALS AND REPAIR PARTS. Equipment, materials, and accessories shall be produced, manufactured, and fabricated by suppliers qualified as acceptable suppliers to the Company. The procedure established by the Company for qualifying suppliers considers the following.

a. Evaluation of the product by the Company's Research Department, Testing Laboratory, and Standardization Committee

b. Analysis of past performance including price, delivery, and service

c. Evaluation of the responsibility, capability, and integrity of the supplier

Foreign suppliers may qualify as acceptable suppliers provided they meet all of the Company's requirements including those listed above, and that a reasonable opportunity exists for United States suppliers to sell like products in the country in which the foreign supplier is located.

SC.23 SECURITY. Supplementing the requirements of Article GC.4.4, the Company will provide uniformed guard service 24 hours per day, 7 days per week. Guard service will include gate operations for admissions and departures from the construction site and a patrol that will cover the entire construction site using a detex key system.

The Contractor's personnel working on the construction site shall display an identification badge. The identification badge will be issued and controlled by the Company. Contractor's personnel will not be granted admission to the construction site without this identification badge. Contractor's licensed vehicles will not be authorized to enter the construction site unless the Contractor's name or logo is displayed on the vehicle and the vehicle is registered with the guard.

Contractor's personnel and vehicles shall enter and leave the construction site at the designated construction entrance gate. Unauthorized personnel will not be allowed on the construction site. The main guardhouse will control all access to the Sherburne County plant site. After regular working hours the gates to the construction site will be closed and locked.

The guards will inspect vehicles leaving the construction site for removal of unauthorized material. Material removal passes will be required to remove material from the site.

SC.24 CONSTRUCTION AREA LIMITS. The Company will designate the boundary limits of access roads, parking areas, storage areas, and construction

areas, and the Contractor shall not trespass in or on areas not so designated. The Contractor shall be responsible for keeping all of his personnel out of areas not designated for the Contractor's use; except, in the case of isolated work located within such areas, the Company will issue permits to specific Contractor personnel to enter and do the work.

The Contractor's employees shall park their automobiles, trucks, and other vehicles in the assigned construction personnel parking area.

SC.25 FOOD SERVICES. No food services will be permitted on the construction site.

SC.26 PERMITS AND INSPECTION. The Contractor shall make arrangements for inspection by insurance, city, and state representatives, when required, and shall render all necessary assistance to aid these representatives in making inspections.

SC.27 TESTING AND INSPECTION BY CONTRACTOR. The Contractor shall provide as a part of his forces adequate testing and inspection to ensure complete compliance with the specifications. Such testing and inspection shall not imply acceptance of the work by the Company. The Contractor shall provide adequate and competent supervisory personnel to ensure compliance with the specifications. All costs for such testing and inspection shall be paid for by the Contractor.

In addition to the above testing and inspection the Company will provide independent testing as specified in the technical sections of these specifications.

SC.28 COOPERATION WITH COMPANY. The performance of construction work which affects the operation of the Company's system facilities shall be scheduled to be performed only at times acceptable to the Company.

In the event that it is necessary to either interrupt the power supply or to impose abnormal operating conditions on the Company's utility system, such procedure must be acceptable to the Company and a complete understanding and agreement must be reached by all parties concerned well in advance of the time scheduled for such operation, and such understanding shall be definite as to date, time of day, and length of time required. All work shall be scheduled to suit the Company's convenience, taking into consideration the facilities and requirements at all times during construction.

SC.29 CONSTRUCTION PLANT AND TEMPORARY FACILITIES. Except as otherwise specified, the Contractor shall furnish all construction plant, utilities and temporary facilities and all materials, equipment and supplies which are required for prosecution of the work but which will not be incorporated in the completed work.

Detailed instructions covering construction services to be provided by the Contractor and/or the Company are included in Part/Division 1 of these specifications.

SC.30 RECEIVING, HANDLING, AND STORAGE. The Contractor shall receive from carriers at the plant site, check, unload, handle and store all materials and equipment which are to be incorporated in the construction under these specifications.

The Contractor shall be responsible for the prompt unloading of materials and equipment and shall pay any demurrage.

The Contractor shall provide all storage facilities. Storage areas on the site shall be limited to those areas so designated by the Company.

Detailed instructions covering receiving, handling, and storage of Company-furnished and Contractor-furnished equipment and materials are included in Part/Division 1 of these specifications.

SC.31 UNDERGROUND INSTALLATIONS. Underground installations constructed under separate specifications such as pipelines, electrical duct banks, and buried structures are indicated on the drawings at their design locations. The locations of these underground items, as built, may vary from the locations indicated.

There is no guarantee as to the accuracy or completeness of the work constructed under separate specifications.

The Contractor shall be responsible for locating all existing underground installations by prospecting in advance of excavating or trenching in accordance with the requirements of the Company's Safety System. The Contractor shall correlate this information with the underground information indicated on the drawings and shall not rely only upon the information indicated on the drawings.

Any delay, additional work, or extra cost to the Contractor caused by existing underground installations shall not constitute a claim for extra work, additional payment, or damages.

SC.32 HAUL OF IMPERVIOUS EARTH. The Company has leased property located as indicated on the drawings which the Contractor shall utilize for the impervious earthfill material required for the clay core and impervious earth blanket construction.

The transportation of the required impervious earth material from the borrow to the place of disposition at the plant site will require travel over local roads, highway, and railroad crossing not owned by the Company.

All Contractor vehicular travel within the limits of local road, highway, and railroad rights-of-way shall be in conformity with the requirements and under the control of the authority owning, or having jurisdiction over and control of, the right-of-way in each case.

SC.32.1 Route. The Contractor shall use the haul route designated on the drawings unless otherwise authorized by the Company. The Contractor may propose an alternate haul route; however, this must be stipulated in the Proposal.

SC.32.2 Permits. The Contractor shall obtain all permits required from the authorities having jurisdiction over local road, highway, and railroad rights-of-way to be used as part of the haul route. Copies of such permits including provisions and limitations imposed by the authorities shall be submitted to the Company prior to use of the haul route.

SC.32.3 Traffic Control. The Contractor shall conduct his vehicular operations along the haul route so as to interfere with other vehicular traffic as little as possible.

The Contractor shall provide flagmen, signs, warning lights, traffic signals, or other similar traffic control devices and methods acceptable to the authorities having jurisdiction of the local road, highway, and railroad crossing rights-of-way. All haul route crossings at local roads, highway, and railroad shall be provided with one or more of the above traffic control devices as required by the authorities having jurisdiction thereover.

SC.32.4 Maintenance. The Contractor shall be responsible for maintenance of the haul route outside the Company's property limits. Such maintenance shall include dust control to the satisfaction of local authorities and the repair of the roadway to keep it in its original condition before hauling was started.

SC.32.5 Schedule. In addition to the requirements of Article SC.18, the Contractor shall not schedule any hauling operations crossing Highway 10 on Friday afternoons or evenings, or on days preceding holidays.

SC.33 BLASTING. No blasting or other use of explosives for excavation will be permitted.

SC.34 COST CONTROL. The Contractor shall furnish the cost control information specified hereinafter.

SC.34.1 Cost Breakdown. Within 30 days after award of contract, the Contractor shall submit to the Company an accounting breakdown of the contract price. Such breakdown shall be based on the itemized listing in

the accounting breakdown furnished separately as an appendix to the specifications and documents. This listing is in accordance with the Company's interpretation of the Federal Energy Regulatory Commission requirements for a uniform system of accounts.

The dollar values listed in the Contractor's breakdown shall accurately reflect fair and reasonable amounts for each item, including appropriate profit and overhead. The sum of the dollar values listed shall equal the contract lump sum price.

An unbalanced assignment of dollar values providing a basis for overpayment on work items to be performed first will not be acceptable.

The Contractor's cost breakdown shall be revised and resubmitted as appropriate to reflect changes to the contract.

SC.34.2 PMCS Accounting Input. For the performance of the work, the Contractor shall provide the accounting information specified herein for the Company's Project Management Control System (PMCS) issued as an appendix to the specifications and documents.

The Company will develop a Project Schedule by the CPM method as detailed in the PMCS Appendix. The Contractor will be given a list of activities from this schedule. Within a reasonable time after receipt of this list, the Contractor shall assign dollar values to each activity so that the value of all activities equals the totals of each account in the Company's classification of accounts. The dollar values given shall be balanced to equal the value stated in the appropriate divisions of the classification of accounts. The amounts given shall accurately reflect fair and reasonable amounts for the completion of each activity.

Upon acceptance by the Company of the Contractor's assigned values, the information submitted will be incorporated in the Project Schedule. This information and the percentage of completion for each activity determined each month will be the basis for monthly field work progress payments. Payment of progress payments after the first payment will not be made until the detailed activity cost breakdowns are approved.

SC.35 ESTIMATES AND PAYMENTS. Payment for the work will be in accordance with Section IX of the Project Management Control System.

The Company will pay to the Contractor 90 per cent of the value of approved invoices, less any previous payments; provided, that if the monies retained reach the sum of $100,000 for the work covered by the approved estimates, no further retainage will be withheld.

Payments for materials stored on the site shall be based only upon the actual cost of such materials to the Contractor and shall not include any overhead or profit to the Contractor.

SC.35.1 Final Payment. After official acceptance of the work by the Company, the Contractor shall prepare and submit to the Company a final estimate of the work done under this Contract. The final estimate shall not be prepared until the requirements of Article GC.30, LIENS, have been met and a Release of Surety has been received by the Company if the work has been bonded. The Company will, within 30 days thereafter, pay the entire balance due after deducting all amounts to be retained under any provision of this Contract.

SC.36 LABOR RELATIONS.

SC.36.1 Labor Relations Information. To provide the Company advance notice of potential labor relations issues that may affect the project, the Contractor shall give to the Company prompt notice in writing of (1) every demand for collective bargaining (under the provisions of the Labor-Management Relations Act as amended) made upon the Contractor or any of his subcontractors by any labor organization as soon as such demand may come to the Contractor's attention; and (2) any labor dispute, which may reasonably be expected to affect performance of the work under this Contract by the Contractor or any of his subcontractors or the final cost of such work to the Company.

SC.36.2 Contractor Participation in Local Bargaining. In addition to Contractor's legal obligations under the Labor-Management Relations Act, as amended in the event the Contractor is a subscriber to a multi-employer bargaining association or group, the Contractor shall, if the Company so directs, participate in the collective bargaining of that group with any of those labor organizations claiming jurisdiction over any portion of the work under this Contract or any subcontract.

SC.36.3 Action in Event of Strike. In the event of a labor dispute which threatens adversely to affect the progress or cost of the work hereunder, the Company reserves the right to restrict additional hiring of employees, to suspend or discontinue the work of the Contractor and any subcontractors, or in Company's sole discretion to terminate this Contract. This paragraph shall be applicable whether or not the Contractor or any subcontractor is directly involved in said labor dispute.

SC.36.4 Conformance with Existing Contracts. The Contractor shall exercise his management rights either specifically detailed in or not expressly limited by applicable collective bargaining agreements. Such management rights shall be deemed to include, but shall not be limited to the right to hire, discharge, promote, and transfer employees, to select

and remove foremen or other levels of supervision, to establish and enforce reasonable standards of production, to introduce to-the-extent-feasible labor saving equipment and materials, to determine the number of craftsmen necessary to perform a task, job, or project, and to establish, maintain, and enforce rules and regulations conducive to efficient and productive operations.

The Contractor shall conduct his labor relations in accordance with established labor agreements and shall advise the Company, prior to making any new commitments, of the negotiation of new agreements or understandings with local or national labor organizations as they affect the work.

SC.36.5 National Agreements. Prior to the start of work, the Contractor shall advise the Company of the status and provisions of any national agreements to which the Contractor is signatory. The Contractor shall supply to the Company, copies of national agreements to which he is a party.

No later than five (5) days before the expiration of any local agreement, which may affect the work, the Contractor shall meet with the Company for the purpose of discussing the appropriate course of action.

SC.36.6 Jurisdictional Disputes. Contractor agrees that in the event any of its employees, or union representing such employees, breach the labor agreement between Contractor and the union representing Contractor's employees, Contractor shall exercise all legal remedies to which it is entitled under state and federal law, including, by way of example only, unfair labor practice charges with the National Labor Relations Board, requests for temporary restraining orders and injunctions under state and federal law, and suits for damages against the union representing the employees of the Contractor. Further, in the event the employees of Contractor, or the labor organization representing such employees, engage in jurisdictional disputes, Contractor will institute appropriate legal actions as required by the labor agreement between Contractor and the labor organization involved, and whatever legal remedies are available under federal and state law to the Contractor.

SC.36.7 Scheduled Overtime. It is agreed that Contractor shall work field labor (workmen at the work site) at straight-time wage rates only; however, Contractor may use spot or casual overtime, such as that required to complete a concrete placement or to leave the work site in a safe condition. Contractor shall not work field labor at other than straight-time wage rates without Company's prior written approval.

SC.36.8 Labor Supply. The Contractor shall determine the actual number of craftsmen who are presently available for the work in the appropriate

geographical area, and will project such availability throughout the term of the contract. Further, Contractor shall determine the number of journeymen, apprentices, and trainees Contractor will require on a month-by-month basis until project completion. Contractor shall also devise a course of action to enable Contractor to perform the work, especially during periods of projected labor shortages. The program may include, but shall not be limited to, shift work, methods of recruitment, training, and/or apprentice programs, or hiring journeymen directly when the unions' referral arrangements fail to provide journeymen under the applicable labor agreement(s).

SC.36.9 Use of Apprentices. The Contractor shall maintain the maximum complement of subjourneymen, apprentices, or helpers in the field work force as permitted by the local collective bargaining agreements. Subjourneymen, apprentices, and helpers shall perform journeyman work as qualified. If the relevant building trades unions are unable or refuse to supply the subjourneymen, apprentice, or helper manpower required, the Contractor shall join with the Company to implement a program to employ personnel from whatever source is available to perform work normally handled by subjourneymen, apprentices, and helpers.

SC.36.10 Use of Prefabricated Materials. The Contractor shall purchase materials, equipment, and prefabricated or factory assembled units to obtain the best cost/quality alternative consistent with the specifications, unless the material in question is covered by a work preservation clause of the applicable collective bargaining agreement.

Contractor shall install prefabricated or preassembled equipment where specified or purchased by the Company or otherwise where it is deemed to be the most economic alternative, whether or not fabricated in a union shop and without unnecessary change or rework.

SC.37 PRODUCTIVITY, ACCOUNTABILITY AND WORK SAMPLING. The Contractor shall establish and/or participate in a program for measuring the productivity of his crews by various acceptable work sampling and monitoring procedures to determine that (1) the expected productivity levels are or are not being achieved and (2) whether corrective action is required.

The Contractor shall also establish productivity reporting procedures for his Supervision, General Foremen and Foreman, and they in turn shall be accountable for progress or lack of progress and therefore, shall be subject to remedial or corrective action.

SC.38 SAFETY SYSTEM. To facilitate the Company's administration of the Contract, particularly in regard to the Contractor's obligations under Article GC.12, PROTECTION OF PERSONS AND PROPERTY, the Contractor shall be required to comply with the Safety System, attached hereto and made a part hereof.

PART 1 - GENERAL REQUIREMENTS

TABLE OF CONTENTS

Section 1A - GENERAL DESCRIPTION AND SCOPE OF THE WORK

1A.1 GENERAL. This section covers the general description of Units 1 and 2 at the Company's Sherburne County Generating Plant and the scope and general requirements for the work under these specifications designated Bottom Ash Pond Modification.

1A.2 PROJECT DESCRIPTION. The Sherburne County Generating Plant is located in Becker, Minnesota. Units 1 and 2 of the Sherburne County Generating Plant are existing complete operating units of 700 megawatts each. A railroad siding is available for the delivery of equipment and materials.

1A.3 WORK INCLUDED UNDER THESE SPECIFICATIONS. The work under these specifications shall include furnishing all equipment and materials; providing all labor, supervision, administration and management; and supplying all construction equipment, materials, and services necessary to perform the Bottom Ash Pond Modification work for Units 1 and 2 complete in accordance with the provisions of the contract documents defined in Article GC.3 of the GENERAL CONDITIONS, except as specifically excluded herein under "Company-furnished Equipment and Materials" and WORK NOT INCLUDED UNDER THESE SPECIFICATIONS.

Major components of the work under these specifications for Bottom Ash Pond Modification include the following.

Clear and grub the bottom ash pond and access road areas.

Perform earthwork required for the bottom ash pond road and sitework.

Excavate, dewater, and place bottom ash fill.

Furnish materials and install culverts.

Provide road maintenance.

Clear, grub, and raze structures within the impervious earth borrow area.

Furnish material and construct the siltation pond including construction drainage.

Excavate, classify and haul all impervious materials to the designated locations within the plant site area including the stockpiling of impervious materials on the plant site.

Finish grade all borrow areas including permanent drainage.

Provide erosion protection for the impervious earth borrow area including seeding, fertilizing, and mulching.

Remove from plant site stockpile and place impervious earth blanket for the bottom ash pond and access road.

Furnish materials and construct crushed rock or gravel surfaced roads.

Perform the finish grading.

Provide erosion slope protection including seeding, fertilizing, and mulching.

The above explanations and listings are intended to give a general definition of the scope of the work under these specifications, and shall not be construed to be an itemized listing of each element of work required. The Contractor shall be responsible for construction of complete facilities, conforming in all respects to the details and requirements of the contract documents.

1A.3.1 Contractor-furnished Materials, Manpower, and Services. The Contractor shall provide all materials and equipment which will be permanently incorporated in the work and which are not specifically designated to be furnished by the Company; all labor, supervision, technical direction, administration and management; and all construction plant and services.

In addition, the Contractor shall provide engineering data in accordance with the requirements of Section 1C and a quality assurance program in accordance with the requirements of Section 1D.

1A.4 WORK NOT INCLUDED UNDER THESE SPECIFICATIONS. In addition to the work under these specifications for Bottom Ash Pond Modification, the Company will be performing the following work which will be directly associated with the work under these specifications.

Installation of temporary bypass ash sluice piping

Reinstallation of permanent ash sluice piping

Part of the work listed hereinbefore will be in progress concurrently with the work under these specifications. The Contractor shall coordinate his activities and cooperate with the other contractors and the Company in the best interest of the project.

1A.5 CONTOUR VERIFICATION. As specified hereinafter, the earthwork quantities for bidding and contract purposes shall be based on the contract issue of the drawings which indicate existing contours and elevations obtained by aerial surveys and other methods.

After the areas subject to the earthwork have been cleared and before the original ground or existing grades have been disturbed, the Contractor shall verify the contours indicated on the drawings by making field surveys. The Contractor shall then furnish the Company with a certified and signed document stating that the existing contours as indicated on the drawings are accepted by the Contractor as indicating the true existing site grades, or make a claim to the Company for adjustment on the basis of his field ground surveys. The Contractor's field ground surveys will be verified by the Company before commencing earthwork construction. Such claim shall include a copy of all relevant drawings clearly marked to indicate the Contractor's survey elevations of existing grades, in sufficient detail on all appropriate drawings, profile, or section to accurately establish the quantities of each category of earthwork for which there is a specified unit adjustment price.

1A.6 UNIT ADJUSTMENT PRICES. The unit adjustment prices stated in the Proposal shall be used to adjust the contract sum for additions to or deductions from the items of work specified hereinafter. The unit adjustment price in each case shall include all costs for furnishing and installing complete units of work. Adjustments shall take into consideration the contours existing at the time the Contractor was notified of the revisions to the work.

1A.6.1 Excavated Materials. As used hereinafter, the term "excavated materials" shall mean either material removed by cutting or material deposited as fill.

The unit adjustment price for "excavated materials" shall apply only to each cubic yard of the finish cut or final in-place fill, whichever quantity is larger, determined as follows.

(a) The net difference in cubic yards of "excavated material" subject to adjustment under CONTOUR VERIFICATION Article 1A.5. The net difference shall be the quantity in cubic yards, addition or deduction, between the volume calculated using the finish and existing contours indicated on the drawings and the volume calculated using the finish contours indicated on the drawings and the existing contours determined by the field surveys as specified under CONTOUR VERIFICATION Article 1A.5.

(b) The net difference in cubic yards of "excavated materials" added to or deducted from the work by revision of the contract drawings

The quantities in (a) or (b) above shall be calculated by the average end area method.

"Excavated materials" are unclassified material and shall include all materials encountered.

1A.6.2 Core Trench Excavation. The unit adjustment price for core trench excavation shall apply to each cubic yard of material added to or deducted from the work by revision of the contract drawings as amended or confirmed through original contour verification. This unit adjustment price shall include dewatering, excavating, transportation, and storing of this material whether it is or is not stockpiled for reuse.

1A.6.3 Impervious Clay Core Fill. The unit adjustment price for impervious clay core fill designated "clay core" shall apply to each cubic yard of material added to or deducted from the work by revision of the contract drawings. This unit adjustment price shall include excavating and transporting from the impervious earth stockpile area indicated on the drawings to the place of use, placement, compaction, watering, rolling, and discing of the material in place complete as specified in Section 2C.

1A.6.4 Impervious Earth Blanket. The unit adjustment price for impervious earth blanket fill shall apply to each cubic yard of material added to or deducted from the work by revisions of the contract drawings. This unit adjustment price shall include excavating and transportation from the impervious earth stockpile area indicated on the drawings to the place of use, placement, compaction, watering, rolling, and discing of the material in place complete as specified in Section 2C.

1A.6.5 Embankment Fill. The unit adjustment price for embankment fill shall apply to each cubic yard of material added to or deducted from the work by revision of the contract drawings. This unit adjustment price shall include the transportation, compaction, watering, rolling, and discing of the material in place complete as specified in Section 2C.

Adjustment quantities will be determined by the Company using field measurements. The unit adjustment price in each case shall include all costs for complete units of work.

1A.6.6 Bottom Ash Fill. The unit adjustment price for bottom ash fill shall apply to each cubic yard of material added to or deducted from the work by revision of the contract drawings. This unit adjustment price

shall include the dredging, stockpiling, transportation, compaction, watering, rolling, and discing of the material in place complete as specified in Section 2C.

Adjustment quantities will be determined by the Company using field measurements. The unit adjustment price in each case shall include all costs for complete units of work.

1A.7 SCHEDULE. The work to be performed under these specifications shall begin on or before August 1, 1982 and shall be completed by October 1, 1982.

Section 1B - DRAWING LIST

1B.1 GENERAL. This section lists the drawings which have been prepared for the work covered by these specifications and which shall be a part of the contract documents.

1B.2 CONSTRUCTION DRAWINGS.

Drawing No.	Rev No.	Title
NF-49025	Later	GENERAL SITE ARRANGEMENT
S1006	Later	AREA GRADING PLAN SHEET VI
S1140	Later	IMPERVIOUS EARTH BORROW AREA SHEET 1
S1141	Later	IMPERVIOUS EARTH BORROW AREA SHEET 2
S1142	Later	IMPERVIOUS EARTH BORROW AREA SITE PLAN AND SECTIONS
S1150	Later	BOTTOM ASH POND MODIFICATION PLAN, SECTIONS AND DETAILS

1B.3 REFERENCE DRAWINGS. This article lists the drawings or lists which are associated with this work but are not part of this Contract.

Drawing No.	Rev No.	Title
NF-49074	Later	DETAIL GRADING PLAN SHEET 7
NF-49089	Later	ASH STORAGE AREA SECTIONS AND DETAILS
NF-49090	Later	ASH STORAGE AREA SECTIONS AND DETAILS
NF-49106	Later	SITE ARRANGEMENT PLAN SHEET VI

Drawing No.	Rev No.	Title
NF-49093	Later	FOUNDATION AND MISCELLANEOUS GRADING SECTIONS AND DETAILS
M2500	-	YARD PIPING BOTTOM ASH AND SCRUBBER SLUDGE BYPASS PIPING

Section 1C - ENGINEERING DATA

1C.1 GENERAL. This section stipulates the requirements for engineering data which the Contractor shall submit to the Engineer for design information and review.

Engineering data covering all equipment and fabricated materials to be furnished under this Contract shall be submitted to the Engineer for review. These data shall include drawings and descriptive information in sufficient detail to show the kind, size, arrangement, and dimensions needed for installation and correlation with other materials. Data submitted shall include drawings showing essential details of any changes proposed by the Contractor and all required wiring and piping layouts.

All engineering data, regardless of origin, shall be stamped with the approval of the Contractor. The Contractor's stamp of approval will be a representation to the Company that the Contractor has assumed full responsibility for determining and verifying all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data, and that he has reviewed or coordinated each submittal with the requirements of the contract documents.

The Engineer will accept engineering data submittals only from the Contractor.

1C.2 CORRESPONDENCE. Correspondence forwarding engineering data shall be addressed to the Engineer as follows.

Black & Veatch, Consulting Engineers
P.O. Box 8405
Kansas City, Missouri 64114

Attention: Mr. G. Y. Gunn

A letter of transmittal shall accompany all submittals of engineering data. The letter shall be identified by the Northern States Power Company Sherburne County Generating Plant, the unit number, the name of the material or equipment, and the Black & Veatch project number and specification number.

1C.3 REVIEW OF ENGINEERING DATA. The Engineer's review of engineering data will cover only general conformity of the data to the specifications and documents, external connections, and interfaces with equipment and materials furnished under separate specifications. The Engineer's review does not indicate a thorough review of all dimensions, quantities, and

details of the material, or item indicated or the accuracy of the information submitted; nor shall review by the Engineer be construed as relieving the Contractor from any responsibility for errors or deviations from the requirements of the contract documents.

All engineering data submitted, after final processing by the Engineer and acceptance by the Company shall become a part of the contract documents and the work indicated or described thereby shall be performed in conformity therewith unless otherwise required by the Company.

1C.4 DRAWINGS. Drawings shall be in sufficient detail to indicate the kind, size, arrangement; the dimensions needed for installation and correlation with other materials; and other information specifically requested herein.

A drawing index listing all drawings to be submitted for each item of material for which drawings are required shall be included with the initial submittal of drawings. The drawing list shall be resubmitted as required to indicate revisions to the list.

All drawings shall be fully completed and certified by the Contractor as to the compliance of the information contained thereon with the requirements of these specifications.

Each drawing submitted shall be clearly marked with the name of the project, the specification title, the specification number, the Engineer's assigned number when so advised, and the Contractor's name. If catalog pages are submitted, the applicable items shall be indicated.

1C.4.1 Initial Drawing Submittal. Six prints of each drawing shall be submitted. Prints shall be black line on white background (preferred) or blue line on white background. Print size shall not exceed 34 inches by 44 inches.

The Engineer may use a 35 mm microfilm system in processing all drawings. All drawings shall be suitable for microfilming. Drawing and lettering practices shall be in general accordance with the requirements of Military Standard Engineering Drawing Practices, MIL-STD-100B. Prints submitted which are not suitable for microfilming will not be accepted.

1C.4.2 Drawing Processing. A copy of each drawing reviewed will be returned to the Contractor as stipulated herein. Copies of drawings returned to the Contractor will be in the form of a print with the Engineer's marking, or a print made from a microfilm of the marked up drawing.

Drawings reviewed by the Engineer will be returned to the Contractor marked RETURNED FOR CORRECTION, EXCEPTIONS NOTED, NO EXCEPTIONS NOTED, or RECEIVED FOR DISTRIBUTION.

When drawings are returned marked RETURNED FOR CORRECTION or EXCEPTIONS NOTED, the changes noted thereon shall be made and the drawing resubmitted for review as described under the article entitled Initial Drawing Submittal.

When the drawings are returned marked NO EXCEPTIONS NOTED or RECEIVED FOR DISTRIBUTION, such drawings shall be considered final and the work shall proceed in accordance therewith. The Contractor shall submit additional drawings for final distribution as specified hereinafter under the article entitled Final Drawings.

No work shall be performed in connection with the fabrication or manufacture of equipment and materials until the drawings and data therefor have been reviewed by the Engineer except at the Contractor's own risk and responsibility. Work may proceed when drawings have been returned marked EXCEPTIONS NOTED, provided the work is performed in accordance with the Engineer's notations.

If changes are made to the equipment at the project site to correct for manufacturing errors, due to design changes or wiring revisions, revised drawings incorporating the changes made shall be prepared and submitted to the Engineer.

1C.4.3 Final Drawings. Upon receipt from the Engineer of drawings marked NO EXCEPTIONS NOTED or RECEIVED FOR DISTRIBUTION, the Contractor shall transmit 14 copies of all drawings to the Engineer. In addition, the Contractor shall submit reproducible drawings as specified hereinafter.

Section 1D - CONTRACTOR'S QUALITY ASSURANCE PROGRAM

1D.1 GENERAL. This section covers the minimum requirements for the Contractor's Quality Assurance Program which shall be implemented for the equipment, materials, and services furnished under this Contract.

The Contractor shall impose these requirements upon all subcontractors.

1D.2 PROGRAM REQUIREMENTS. In implementing his Quality Assurance Program, the Contractor shall comply with the requirements of the following consecutively numbered articles.

1.0 ORGANIZATION.

1.1 The Contractor shall have an identified organization responsible for establishing and executing the Quality Assurance Program.

2.0 QUALITY ASSURANCE PROGRAM.

2.1 The Contractor shall have a documented Quality Assurance Program capable of providing assurance that all involved equipment, materials and services meet contract specification requirements.

3.0 DESIGN CONTROL. Deleted

4.0 PROCUREMENT DOCUMENT CONTROL.

4.1 Procurements made by the Contractor or his subcontractor to support his scope of supply shall be accomplished with procurement documents that include the applicable quality requirements in these specifications.

5.0 INSTRUCTIONS, PROCEDURES, AND DRAWINGS.

5.1 The Contractor shall provide written instructions for special processes, including welding and nondestructive examination, and final inspection/testing.

6.0 DOCUMENT CONTROL. Deleted

7.0 CONTROL OF PURCHASED MATERIALS, EQUIPMENT AND SERVICES.

7.1 The Contractor shall have a system to maintain identity and integrity of purchased items. The Contractor is responsible to assure himself that material conforms to the procurement documents.

8.0 IDENTIFICATION, CONTROL OF MATERIALS, PARTS AND COMPONENTS. Deleted

9.0 CONTROL OF SPECIAL PROCESSES. Deleted

10.0 INSPECTION.

10.1 The Contractor shall have a written inspection program to evaluate and control his work and subcontracted work. The program shall establish the responsibilities, and identify the method, scope, and sequence of inspection.

11.0 TEST CONTROL.

11.1 The Contractor shall provide the Company documented test reports as required by contract specifications.

12.0 CONTROL OF MEASURING AND TEST EQUIPMENT.

12.1 The Contractor shall provide measures to assure that tools, gages, instruments, and other measuring and testing devices used in inspection and quality control activities are properly controlled, calibrated, and adjusted at specified periods to maintain accuracy within necessary limits.

13.0 HANDLING, STORAGE AND SHIPPING. Deleted

14.0 INSPECTION AND TEST STATUS.

14.1 The Contractor's inspection and test programs shall have provisions to readily identify the status of the programs.

15.0 NONCONFORMING MATERIALS, PARTS AND COMPONENTS.

15.1 Materials that do not conform to requirements of the contract specifications shall be identified and segregated from the acceptable materials. Disposition of these materials shall be readily identifiable.

16.0 CORRECTIVE ACTIONS.

16.1 The Contractor shall promptly notify the Company of corrective actions taken to correct items found not to be in conformance with requirements of the contract specifications.

17.0 QUALITY ASSURANCE RECORDS.

17.1 Receiving Inspection. The Contractor shall maintain a record of all items and materials received. Records of receipt inspections shall be available for audit by the Company or its designated agent.

18.0 AUDITS.

18.1 The Company reserves the right of reasonable access to the Contractor's facilities and records for audit and inspection.

Section 1E - CONSTRUCTION SERVICES

1E.1 GENERAL. This section covers the requirements for construction plant, temporary facilities and construction services which the Contractor shall provide and those services which will be furnished by the Company in the prosecution of the work under these specifications.

All construction plant, facilities and services provided by the Contractor shall comply with and be coordinated with the Company's Safety System manual issued as an appendix to these specifications.

1E.2 CONSTRUCTION PLANT AND TEMPORARY FACILITIES. The Contractor shall furnish all construction plant, utilities, temporary facilities, equipment, materials, and supplies required for prosecution of the work but which will not be incorporated in the completed work, unless otherwise specified herein.

All temporary structures and facilities furnished by the Contractor shall remain the property of the Contractor and shall be maintained throughout the construction work. When the construction work is completed, all such temporary structures and facilities shall be removed from the site and the area shall be restored to its original condition.

All construction plant and facilities shall be in first-class condition and shall be of the proper type and size to perform the work. The plant and facilities shall be regularly and systematically maintained throughout the work to ensure proper, efficient operation. Plant and facilities which are inadequate or improperly maintained shall be promptly modified, repaired, or removed from the site and replaced.

The Contractor shall furnish adequate warehouse space to provide protection for all Contractor-furnished equipment and materials consistent with the requirements of Section 1F. The Contractor shall also provide space for all prefabrication operations.

1E.2.1 Temporary Structures. All temporary structures for offices, change houses, warehouses, and other uses for the Contractor or his subcontractors, whether located exterior to or within permanent buildings, shall be of fireproof design using materials and construction acceptable to the Company. Temporary structures shall be placed in locations as directed by the Company. Suitable construction trailers may be used in lieu of temporary structures when acceptable to the Company.

Temporary structures which exceed 100 square feet floor area and which are located within permanent buildings shall be provided with an automatic fire extinguishing system acceptable to the Company.

All temporary structures shall be separated by a minimum clear space of at least 30 feet and shall be protected from damage by vehicles by means of physical barriers or by adequate distance from roadways.

Where temporary structures are used for storage of equipment and materials, the following conditions shall apply.

a. Framing materials shall be either noncombustible or Class A Fire Retardant Pressure Impregnated wood.

b. Tarpaulins and other flexible covering materials shall be flameproofed.

1E.3 CONSTRUCTION UTILITIES. Construction utilities shall be provided by the Contractor or will be furnished by the Company as specified herein.

1E.3.1 Telephone. The Contractor shall provide his own telephone service.

1E.3.2 Compressed Air. The Contractor shall provide all air compressors, fuels, lubricants, hoses, piping, and other apparatus required for supplying compressed air required for prosecution of his work.

1E.3.3 Construction Power. The Contractor shall provide his own construction electric power and all power distribution facilities. All temporary power facilities shall conform to applicable safety and code requirements.

1E.3.4 Temporary Lighting. The Contractor shall furnish and install all temporary lighting required in the prosecution of his work. Conductors for lighting and receptacles shall be not less than 12 AWG copper and insulated for 600 volts. A fuse shall be provided for the protection of each circuit.

1E.3.5 Welding Facilities. The Contractor shall furnish all welding machines and welding equipment required for his use. Electric power may be obtained from the construction power source or engine driven welding machines may be used. The Contractor shall furnish all fuel required if engine driven machines are used.

1E.3.6 Water. Water for construction use and drinking will be furnished by the Company at no charge at a source designated by the Company. The Contractor shall provide piping, valves, and hoses as required to distribute the water for his and his subcontractor's use.

The Contractor shall provide sanitary drinking water facilities for his employees including coolers, ice, disposable cups, and a trash barrel at

each water cooler. Each dispenser shall be emptied, cleaned and refilled at the start of each day, and personnel shall be assigned to assure maintenance of the water supply.

1E.3.7 Heat. The Contractor shall provide all heating facilities required for the efficient prosecution of his work, and as required to prevent freeze damage to equipment under his custody. The method of heating shall be acceptable to the Company.

Salamanders, open fires, or other methods which constitute a hazard to personnel or property shall not be used. All heating equipment shall be provided with adequate safeguards.

1E.3.8 Sanitary Facilities. The Contractor shall furnish and maintain sanitary facilities, including chemical toilets, for the use of all persons engaged in work under this Contract.

The Contractor shall comply with all regulations of agencies having jurisdiction with respect to sanitation. Any facilities or methods failing to meet these requirements shall be corrected immediately.

1E.3.9 Consumable Gases. The Contractor shall supply all consumable gases required for the prosecution of his work.

1E.4 TRASH DISPOSAL. The Contractor shall dispose of trash off the site at his own expense.

1E.5 ACCESS ROADS, PARKING AREAS, AND STORAGE AREAS. The Company will maintain completed roads, parking areas, and main roads of storage areas only. The Contractor shall provide maintenance on all additional roads and storage areas required for the prosecution of his work.

The Contractor may construct and shall maintain additional access roads as required to effectively prosecute his work. The location and type of construction of all such additional access roads shall be acceptable to the Company. When no longer required, such temporary access roads shall be removed by the Contractor. Surfacing shall be removed and the area restored to its natural condition. Restoration shall include clearing of all trash and construction debris, and grading to blend with the adjacent contours to provide effective natural drainage. Any surfacing materials such as gravel or bituminous materials shall be disposed of as directed by the Company.

1E.6 RAILROAD. The Company will provide railroad spurs to the construction storage areas. The spurs will be used by all contractors and their usage by the Contractor shall not interfere with plant operations or the operations of other contractors at the site.

The Company will provide a car mover and operator for moving cars.

Section 1F - RECEIVING, HANDLING, AND STORAGE

1F.1 GENERAL. This section covers the requirements for receiving, handling, and storage of all Contractor-furnished materials and equipment.

Storage areas on the site will be allocated for the Contractor's use by the Company. When requested by the Company and before unloading any materials or equipment, the Contractor shall prepare and submit to the Company a drawing indicating the proposed layout and utilization of his storage areas. Storage areas shall be utilized in accordance with the layout indicated on the drawing and as acceptable to the Company. This drawing shall be kept current and shall indicate the location and description of all stored items for which the Contractor is responsible. Revised copies of this drawing shall be submitted to the Company as they are made.

1F.2 RECEIVING AND HANDLING. The Contractor shall be responsible for the prompt unloading of all equipment or material to be unloaded under these specifications and shall pay all demurrage incurred.

The Contractor shall handle all equipment and materials carefully to prevent damage or loss, shall store them in an orderly manner, shall keep adequate and convenient records of their location, and shall keep a continuously accurate inventory.

The use of bare wire rope slings for unloading and handling materials and equipment is prohibited except with the specific permission of the Company.

1F.3 STORAGE. Stored equipment and materials shall be adequately supported and protected to prevent damage.

Stored materials and equipment shall not be allowed to contact the ground. In warehouses that do not have dry concrete or suspended floors, materials and equipment shall be stored on platforms or shoring.

All platforms, enclosures, shoring, and weatherproof coverings for storage use shall remain the property of the Contractor and shall be removed upon completion of the work.

1F.3.1 Indoor Storage Facilities. Indoor storage furnished by the Contractor shall consist of buildings of fireproof construction as specified in Section 1E, and shall be weathertight, well ventilated, and secure against theft and vandalism. The buildings or enclosures shall be situated and constructed so that they will not be subject to flooding. Drainage shall be provided to intercept storm or surface water and divert it from the building. Equipment and materials shall be placed on pallets

or shoring to permit air circulation under the stored item. Access doors shall be adequate to accommodate the movement and handling of materials and equipment to be stored and shall be equipped with secure locks.

Indoor storage facilities shall be acceptable to the Company.

Construction trailers or portable enclosures acceptable to the Company may be used in lieu of the indoor storage facilities described above.

1F.3.2 Open Platforms. Open platforms shall be constructed from sound lumber not less than 2 inches nominal thickness. Open platforms shall be adequately constructed to support the loads imposed by the stored materials and equipment. Platforms shall be level, shall be supported on concrete block piers, and shall be not less than 18 inches above grade.

Shoring for storage of materials and equipment shall utilize sound timbers not less than 6 inches by 8 inches nominal size. Shoring shall be arranged to provide 8 inches of clearance above grade.

1F.3.3 Coverings. Weatherproof coverings for outdoor storage shall utilize a waterproof flame resistant type of sheeting. Sheeting widths shall be the maximum practicable and, if necessary, widths may be built up by using waterproof taped splices. The sheeting shall be carefully placed and tied down to prevent moisture from entering the laps and to prevent wind damage to the coverings.

1F.3.4 Storage Schedules. Except as otherwise specified hereinafter, the storage method to be used for various materials and equipment shall be determined as follows.

All small loose items which could be easily lost, stolen, broken, or misused shall be stored indoors.

All other equipment and materials shall be stored on open platforms or shoring.

All storage methods and schedules shall be acceptable to the Company.

PART 2 - TECHNICAL REQUIREMENTS

TABLE OF CONTENTS

Section 2A - CLEARING, GRUBBING, AND RAZING

2A.1 GENERAL. This section covers clearing, grubbing, and razing for the bottom ash pond, access road, and impervious earth borrow areas within the limits indicated on the drawings.

The Contractor will be required to remove only those abandoned underground utilities, or parts thereof, which interfere with the work under these specifications. Underground utilities removed by the Contractor shall be removed from the Company's property or disposed of in an acceptable manner.

All excavations made by grubbing or removal of existing structures which are below indicated final grade shall be backfilled and compacted in accordance with Section 2B.

Before clearing work is accepted, any regrowth of vegetation or tree shoots which have grown after initial cutting shall be cut and removed as specified hereinafter. Tree shoots shall be removed to the level specified for tree removal in that area. All regrowth of vegetation shall be mowed, raked, and burned. The cleared area at the time of final acceptance shall be completely cleared and grubbed as specified herein and as indicated on the drawings.

2A.2 CLEARING AND GRUBBING. Clearing shall include clearing and removing all trees and stumps within the construction area limits; the cutting and removal of all brush, shrubs, debris, and all vegetation to approximately flush with the ground surface; and the disposal of all cuttings and debris. Mowing will be considered adequate for the cutting of light vegetation.

Grubbing shall include the removal and disposal of all stumps and roots larger than 2 inches in diameter, including matted roots regardless of size. Grubbing shall extend to a depth of 12 inches below the natural surrounding ground surface.

The Contractor shall not remove or damage trees outside the construction area limits specified to be cleared or grubbed. The Company may wish to preserve certain trees or groups of trees within the limits of the work specified hereinafter. The Company will designate the trees which are to be preserved within the clearing limits, and the Contractor shall mark such trees by clearly visible means which will not damage the tree.

Clearing operations shall be conducted without damage to trees which are designated to remain and without blocking existing roads. Equipment utilized in the clearing and grubbing work shall be kept within the specified construction area limits.

2A.2.1 Limits of Work. The limits of the clearing and grubbing under this section shall include all areas of cut or fill within the limits of construction as indicated on the drawings including but not limited to the following.

Clearing and grubbing of all areas to be occupied by access road and embankment construction

Clearing and grubbing of the entire area lying within the initial impervious earth borrow area

Clearing and grubbing of the areas to be occupied by drainage ditches

2A.2.2 Disposal of Waste. Logs, trees, stumps, roots, brush, tree trimmings, and other materials resulting from clearing and grubbing operations shall become the property of the Contractor and shall be entirely removed from the site or shall be stacked and burned at locations acceptable to the Company. Upon completion of the disposal, the area shall be entirely void of all loose stumps, trimmings, brush, vegetation, and other debris.

Materials to be burned shall be piled and when in suitable condition shall be burned completely to ashes. Piling of materials for burning shall be done in such a manner and location to prevent the spread of fire. Fire guards of adequate width shall be provided by removing, burying, or backfiring all surface vegetation within the fire guard limits. Vegetation shall not be burned when the direction or velocity of the wind would cause the fire to be carried to adjacent areas. Burning shall comply with all government or statutory regulations relative to fire prevention.

Burning of waste materials shall be performed under favorable atmospheric conditions, at a time and in a manner to minimize smoke and air pollution to meet the requirements of regulatory authorities.

The disposal of noncombustible materials shall be the responsibility of the Contractor. The Company will provide a landfill area on the plant site for noncombustibles. The Contractor shall haul plant site noncombustibles to the landfill area designated on the drawings. The Company will perform the disposition of these materials within the landfill area. The Contractor shall remove and dispose of all noncombustibles from the impervious earth borrow area.

2A.3 EXISTING FENCES. All existing fences within the limit of the impervious earth borrow area and construction shall be removed. Removal shall include the complete removal of posts and wire. Metal and wood

posts and wire shall be disposed of as specified in Article 2A.2.2. Post holes shall be filled with tamped earth.

2A.4 EXISTING ROADS. Designated roads which are within the Company's property limits shall be used as construction roads.

Section 2B - IMPERVIOUS EARTH BORROW WORK

2B.1 GENERAL. This section covers stockpiling; excavating as required; the classification, handling, blending, transportation and storage of all material; dewatering as required; site restoration; landscaping; and other related work for the impervious earth borrow work. The impervious earth borrow shall be utilized in the construction of the clay core for the dam embankment of the drainage ditch and the impervious earth blankets for the bottom ash pond. All work performed under this section, including delivery of all impervious earth material to the plant site shall be performed under the LUMP SUM.

2B.2 IMPERVIOUS EARTH BORROW SITE. The borrow site is located northeast of the Sherburne County Generating Plant site as indicated on the drawings.

2B.3 CLEARING, GRUBBING, AND RAZING. Clearing, grubbing, and razing shall comply with the requirements of Section 2A.

Organic topsoil which is free of trash, vegetation, rocks, and roots shall be stockpiled as directed by the Company for later use in the site restoration.

2B.4 CLASSIFICATION OF EARTH MATERIALS. The classification of excavated impervious earth materials shall be in accordance with Table 1 of the Unified Soil Classification System bound at the end of Section 2C. Only the classification and types of soils listed herein shall be hauled to the plant site.

Material Classified as Specified	Unified Soil Classification	Designated Use at Plant Site
Clay core	CL, CL-SC, SC-CL	Embankment at bottom ash pond
Impervious earth blanket	CL, CL-SC, SC-CL, SC	Toe drain ditch liner

2B.5 PRESERVATION OF TREES. Trees outside the boundaries of excavations shall be preserved and protected as much as possible. Consideration will be given to the removal of additional trees only where essential, in the opinion of the Company, for the safe, effective execution of the work.

Trees left standing shall be adequately protected from permanent damage caused by construction operations. Trimming of standing trees, where required, shall be as directed by the Company.

2B.6 UNAUTHORIZED EXCAVATION. Any materials excavated below the elevations indicated on the drawings shall be replaced and compacted to the density of adjacent undisturbed materials. The excavation of unauthorized material and subsequent replacement and compaction shall be by and at the expense of the Contractor.

2B.7 REMOVAL OF WATER. The Contractor shall provide and maintain adequate dewatering equipment to remove and dispose of all surface and ground water entering excavations. Excavations shall be developed in a manner that will assure positive drainage of the complete excavation area at all times without impounding water.

2B.8 TESTING. All field and laboratory testing required to assure the Company that the Contractor has complied with excavation and compaction requirements of this section will be provided by the Company. The Contractor shall cooperate as necessary to assist the Company's field testing representatives to accomplish their work. The Contractor will be furnished one copy of the test results.

The Company will designate where the types of impervious earth materials are located within the borrow site.

2B.9 EXCAVATION. Clay core and impervious earth blanket materials will be required for the bottom ash pond. The Contractor shall propose a method and sequence of excavation that is satisfactory to the Company.

The size, shape, depth, and drainage of the borrow area shall be acceptable to the Company. Borrow areas shall be regular in shape, with finish graded surfaces when completed. Side slopes shall not be steeper than three horizontal to one vertical for the entire length of any one side unless indicated otherwise on the drawings.

2B.10 HAULING REPORTS. The Contractor shall submit hauling reports to the Company at the end of each day's work. These reports shall indicate the number of trucks and size of load; the number of round trips each made; and the location at which the impervious earth material was deposited.

2B.11 MAINTENANCE OF HAUL ROADS. The haul route maintenance shall be as specified in the SPECIAL CONDITIONS.

2B.12 SEDIMENTATION POND. A temporary sedimentation pond shall be constructed at the borrow area as indicated on the drawings. Any dikes required shall be constructed of onsite material and shall be compacted as specified in Article 2C.7.

2B.13 SITE RESTORATION. The borrow site shall be restored to a condition acceptable to the Company. The borrow area shall be regraded to meet the drainage requirements and finish grades generally as indicated on the drawings and acceptable to the Company. Seeding, fertilizing, and mulching shall be as specified in Section 2F.

Section 2C - EARTHWORK

2C.1 GENERAL. This section covers stripping, excavating, hauling, stockpiling, spoiling, mixing, blending, placing, wetting, compacting, and other earthwork required for the construction of the access road, earth dam embankments, and impervious earth blanket construction.

Dam embankment is defined as the containment facilities for the bottom ash pond.

Impervious earth blanket construction is required for the bottom ash pond dike toe drain ditches.

This section also covers toe drains.

Construction of the dam embankment and impervious earth blanket shall not be performed during freezing weather except by permission of the Company. No embankment materials or impervious earth blanket shall be placed on frozen surfaces. Frozen materials, snow, or ice shall not be placed in the dam embankment.

The Contractor is advised that water requirements may vary depending on soil conditions, weather, and the time required for soil manipulation prior to compaction.

Compaction of the embankment material within the specified range of moisture content is an essential requirement for the stability of the dam embankment. Improper moisture content at the time of compaction will be sufficient cause for rejection of a lift.

Compaction of the impervious earth blanket within the specified range of moisture content is an essential requirement for the adequacy of the blanket for seepage control.

2C.2 TESTING. All field and laboratory testing required to determine compliance with the requirements of this section will be provided by the Company. The Contractor shall cooperate with the Company in this respect. The Contractor will be furnished one copy of test reports.

Maximum density for the compacted materials placed under this section will be determined in accordance with ASTM D1557, Method A or C. The terms "maximum density" and "optimum moisture content" shall be as defined in ASTM D1557, Method A or C.

At least one field density test will be made for each 2,000 cubic yards of compacted material. Sampling and testing will be more frequent at the start of embankment construction and when soil type is changing.

2C.3 CLASSIFICATION OF EXCAVATED EARTH MATERIALS. No classification of earth dam materials will be made for payment purposes except as provided for in the Proposal and Section 1A. However, earth materials will be classified as specified in Article 2C.9 for construction purposes.

Dam embankment construction shall include the removal and subsequent handling of all materials excavated or otherwise removed in performance of the contract work, regardless of type, character, composition, or condition thereof.

2C.4 CLEARING AND STRIPPING. Major clearing and grubbing work on the dam site shall be performed as described in Section 2A. Clearing and grubbing under this section shall include all other clearing and grubbing required to perform the work covered by this section.

All stripping of topsoil and surface vegetation for construction of the dam embankment and impervious earth blankets shall be performed under this section.

Topsoil which is free of trash, vegetation, rocks, and roots shall be stock-piled for later use as specified hereinafter.

The areas to be occupied by the dam embankment and impervious earth blanket construction shall be cleared of all objectionable materials and debris. In addition, subgrades shall be cleared and stripped of all surface vegetation, sod, topsoil, and other organic material. All deposits of material such as roadway embankments shall be completely removed. All combustible and other waste materials shall be removed from the dam embankment and impervious earth blanket sites and disposed of by and at the expense of the Contractor as specified in Section 2A. Fire regulations and other safety precautions shall be observed when waste materials are burned.

All stripping work at the dam embankment site shall be completed prior to the excavation of the core trench and prior to the placement of any embankment material.

2C.5 TEMPORARY TOPSOIL STOCKPILE. The Contractor shall store topsoil removed under these specifications. The Contractor shall use the stock-piled topsoil as required to comply with the requirements of these specifications.

2C.6 BORROW AREAS. Materials necessary to complete the embankments except for clay core and impervious earth blankets shall be obtained from areas indicated on the drawings.

Material for construction of the embankment clay core and impervious earth blankets shall be obtained entirely from the impervious earth borrow site.

The size, shape, depth, drainage, and surfacing of all borrow areas shall be acceptable to the Company. Borrow areas, except for bottom ash excavation, shall be regular in shape, with finish grade surfaces when completed. Side slopes shall not be steeper than two horizontal to one vertical, and shall be uniform for the entire length of any one side.

2C.7 ROADWAY ROADBEDS. Roadway roadbed construction shall include excavation, subgrade preparation, and fills where required. Fills shall be constructed as specified hereinafter. In excavated roadbed areas, overburden shall be removed and the subgrade shall be shaped to line, grade, and cross section and compacted to a depth of at least 12 inches to 97 per cent of maximum density at optimum moisture content. This operation shall include any scarifying, reshaping, and wetting required to obtain proper compaction. Soft, organic, and otherwise unsuitable material shall be removed from the subgrade and replaced with suitable material.

All material in the upper 24 inches of the subgrade, in both cut and fill sections, shall be material with compaction characteristics equal to clean sand. This material shall be classified as Group SM or SP in accordance with the Unified Soil Classification chart bound at the end of this section.

In all cases, roadway roadbed shall have not less than the top 12 inches of subgrade compacted as specified hereinbefore.

The subgrade shall be compacted and finished to a true surface and no depression shall be left that will hold water or prevent proper drainage. The subgrade shall be finished to within 0.1 of a foot of the elevation indicated on the drawings. Any deviation of the subgrade surface in excess of one inch as indicated by a 16 foot straightedge, or template cut to typical section, shall be corrected by loosening, adding or removing material, reshaping, and recompacting.

Ditches and drains along the subgrade shall be maintained as required for effective drainage. Whenever ruts of 2 inches or more in depth are formed, the subgrade shall be brought to grade, reshaped, and recompacted. Storage or stockpiling of materials on the subgrade will not be permitted except as indicated on the drawings or specifically authorized by the Company.

Roadway subgrades shall be maintained throughout the work under these specifications. Roadway surfacing is covered in Section 2E.

2C.7.1 Fills. To the maximum extent available, suitable earth materials obtained from excavation shall be used for the construction of fills. Additional material shall be obtained from borrow pits as designated on the drawings. After preparation of the fill site, the subgrade shall be scarified, leveled, and rolled so that surface materials of the subgrade will be compact and well bonded with the first layer of the fill. All material deposited in fills shall be free from rocks or stones, brush, stumps, logs, roots, debris, and organic or other objectionable materials. Fills shall be constructed in horizontal layers not exceeding 8 inches in uncompacted thickness. Material deposited in piles or windrows by excavating and hauling equipment shall be spread and leveled prior to compaction.

Each layer shall be uniformly compacted using equipment and methods which will achieve the densities specified hereinafter. The compacted density of each layer for roadbeds and other areas as designated on the drawings shall be at least 95 per cent of the maximum density at optimum moisture content. If the material fails to meet the density specified, compaction methods shall be modified as required to attain the specified density.

2C.7.2 Subgrade Preparation. After preparation of the fill site, the subgrade shall be leveled and rolled so surface materials of the subgrade will be as compact and well bonded with the first layer of the fill as specified for subsequent layers.

2C.7.3 Placement and Compaction. All fill materials shall be placed in approximately horizontal layers not to exceed 8 inches in uncompacted thickness, except if deemed by the Company that the Contractor's compaction equipment is adequate to compact at greater depths and passing test results are obtained. Material deposited in piles or windrows by excavating and hauling equipment shall be spread and leveled before compaction.

Each layer of material being compacted shall have the best practicable uniform moisture content to ensure satisfactory compaction. The Contractor shall add water and harrow, disc, blade, or otherwise work the material in each layer as required to ensure uniform moisture content and adequate compaction. Each layer shall be thoroughly compacted by rolling or other acceptable methods to 95 per cent of maximum density at optimum moisture content unless otherwise specified. If the material fails to meet the density specified, compaction methods shall be altered.

2C.8 EMBANKMENT SITE AND FOUNDATION PREPARATION. The entire area to be covered by the dam embankment shall be cleared and stripped as specified in Article 2C.4.

The core trench shall be excavated to the lines and grades indicated on the drawings. Suitable material excavated from the core trench shall be stockpiled for later use as backfill and embankment material.

Prior to placement of the clay core or embankment material, the subgrade shall be thoroughly compacted and proof rolled. The subgrade shall be shaped to the lines, grades, and cross sections indicated on the drawings, and compacted to a depth of at least 12 inches to 95 per cent of maximum density. This operation shall include any scarifying, reshaping, and wetting required to obtain proper compaction. After compaction, the areas shall be proof rolled by a single pass of a vibratory roller on the existing embankment fill and a sheepsfoot roller on the existing clay core to test for uniformity and any loose soils detected shall be recompacted as specified.

No material shall be placed in any portion of the dam embankment until the subgrade has been properly prepared and acceptable to the Company.

2C.9 EMBANKMENT CONSTRUCTION. The dam embankment which includes the horizontal embankment drains and clay core shall be constructed to the lines and grades indicated on the drawings. General requirements, the order of the sources of materials, and the deposit and compaction of all excavated materials shall be as specified herein.

The Contractor shall set grade stakes to indicate the plane of intersection between the core and other fill materials, and the depth of fill to be made at various points on the site. As the work proceeds, the Contractor shall set contour stakes in the slopes of the embankment. These stakes shall be set on 5 foot contours, or less if required, on both faces of the embankment, and will be located in cross planes as desired by the Contractor, at regular distances of 50 feet. The Contractor shall keep all slopes dressed as the embankment work proceeds, so that when the top is reached only fine grading will be necessary.

The finish grades indicated on the drawings shall be provided to allow for shrinkage or settlement after construction is complete. The grades indicated shall be rechecked at the time the road base material is placed on the embankment. Additional embankment material shall be placed and compacted as required to restore the grades indicated on the drawings before any road base material is placed thereon.

2C.9.1 Materials. All materials placed in the dam embankment shall be free from brush, stumps, logs, roots, and other deleterious material. Materials for the embankment proper, designated embankment fill, shall be obtained from borrow pits as indicated on the drawings and the bottom ash ponds. Materials for clay core and impervious earth blanket shall be obtained from the impervious earth borrow area designated on the drawings.

The embankment materials will be classified by the Company by testing and visual inspection and in accordance with Table 1 of the Unified Soil Classification System bound at the end of this section.

Classification of materials obtained from the impervious earth borrow area will be determined as follows.

Material Designation as Specified	Unified Soil Classification	Location
Clay core	CL, CL-SC, SC-CL	Clay core
Impervious earth blanket	CL, CL-SC, SC-CL, SC	Toe drain ditch liner
Embankment fill	SM, SP, SW	Remainder of dam embankment, excluding filter material outside of the clay core
Bottom ash fill	None	Remainder of the dam embankment inside the clay core

The drawings indicate the detailed limitations for the placement of the clay core and impervious earth blanket, embankment fill material, and bottom ash fill material.

Filter materials for use in the horizontal embankment drains at locations indicated on the drawings shall be crushed rock, gravel, or natural sand meeting the following gradations.

Type	US Standard Sieve	Per Cent Passing
I	3 inch	100
	2 inch	85-100
	1-1/2 inch	72-90
	3/4 inch	50-70
	1/2 inch	35-50
	No. 3	22-32
	No. 6	12-20
	No. 10	0-12

Type	US Standard Sieve	Per Cent Passing
II	6 inch	100
	4 inch	72-86
	2 inch	32-65
	1-1/2 inch	20-32
	1 inch	0-20

2C.9.2 General Requirements. The suitability of each part of the foundation for placing foundation materials thereon and of all materials for use in embankment construction shall be acceptable to the Company.

It should be feasible to transport a large portion of the borrow materials which are suitable for embankment construction directly to the embankment at the time of making the excavations. However, the Contractor shall not be entitled to additional compensation for excavation of the material involved by reason of it being necessary, or required by the Company, for any reason, that such excavated materials be deposited in temporary storage piles prior to being placed in the embankment.

Excavation of material accepted for use in the dam embankment shall be performed in a manner that will segregate materials of different character. Suitable precautions shall be taken to assure that the classified materials are placed to avoid intermingling them. Materials of differing classification which are intermingled in the embankment shall be removed and replaced. The cost of all such corrective work shall be borne by the Contractor.

Dimensions indicated on the drawings for thickness of clay core, impervious earth blanket, and filter material are minimum dimensions. No intermingling of materials will be permitted within these dimensions.

2C.9.3 Equipment. Maximum compaction of the embankment subgrade as prepared, and of each layer or lift of the fill, shall be obtained through the use of equipment operated such that the finished embankment shall be uniformly stable and compacted as specified. Isolated operations shall be provided with sufficient equipment to permit the work to be carried to completion in a continuous and efficient manner.

2C.9.4 Placing and Compacting Embankment Material. Except as otherwise acceptable to the Company, the entire body of the fill, including upstream and downstream portions, shall be placed and carried up at the same rate, provision being made to bond the layers of adjoining sections together. Where it is impractical, in the opinion of the Company, to carry up each layer of fill over the entire area at the same time or the

slope of any existing fill against which new fill material is placed, shall be cut or plowed into benches having level beds and vertical sides, and each layer of new fill shall terminate in such a bench. In no case shall the horizontal width of the bench be less than the depth of the layer of fill to be bedded therein nor shall the vertical side of the bench be greater in height than one foot.

All fill material shall be placed in the embankment parallel to the axis of the embankment in approximately horizontal layers not to exceed 9 inches in uncompacted thickness over the prepared foundation or fill. The downstream embankment shell fill onsite material shall be constructed by placing the silty sand (SM) material adjacent to the clay core, the poorly-graded sand (SP) material in the intermediate portion of the embankment, and the well-graded sand (SW) material in the outer slopes of the embankment and around the horizontal filter drains. The upstream shell shall be constructed of bottom ash removed from the pond interior after allowing for drainage of excess water from the material. Proper equipment shall be used on each lift to remove mounds and ridges caused by dumping operations and to obtain uniform thickness prior to compacting, as well as to provide a reasonably smooth riding surface for equipment. After each layer has been properly spread, it shall be sprinkled or wetted if necessary to provide the required amount of water for proper compaction and working to ensure uniform moisture content, after which the layer shall be compacted to the required density before the next layer is placed thereon. Combined excavation, hauling, and placing operations shall be such that the materials, when compacted in the embankment, will be blended sufficiently to secure the best practicable degree of compaction, impermeability, and stability.

The Contractor will be required to break up the earthfill materials, either at the place of excavation or on the embankment, to such maximum size as is determined necessary by the Company to secure specified density of the material in the embankment. Equipment on the embankment shall spread out and not track each other to such an extent as to make ruts. The top surface of the fill shall be kept crowned, with grades not to exceed 2 per cent, to ensure free drainage toward the slopes. The rolled surface of each lift shall be roughened or loosened by scarifying to the satisfaction of the Company, before the succeeding layer is placed thereon, in order to provide the necessary bond between each lift.

Prior to and during the compacting operations, the material in each layer of the embankment shall have the best practicable moisture content, and the moisture content shall be uniform throughout the layer. To obtain the best practicable moisture content, the Contractor will be required to perform such operations as are necessary. Supplementary water, as required, shall be added to the material on the earthfill. If the fill material in borrow areas or other excavations contains an excess of

moisture prior to excavation, the Contractor will be required to excavate drainage channels or perform such work as may be necessary to reduce the moisture content of the material. Working of the material on the embankment may be required to produce the required uniformity of water content.

Water required to bring the material to the moisture content necessary for maximum compaction shall be evenly applied and it shall be the Contractor's responsibility to secure a uniform moisture content throughout the layer by such methods as may be necessary. Compaction shall commence immediately after the layer has been brought to the uniform moisture content required, and shall continue, with or without additional watering, until each layer has been uniformly compacted to not less than the specified density. Density tests will be made as necessary. If the material fails to meet the density specified, the compaction methods shall be altered, if necessary, to obtain the specified density.

In restricted areas, successive passes of the compaction equipment need not overlap but uniform compaction is required. Where new material abuts old material or embankment fill, the old material shall be cut or broken by machine or hand methods until it shows the characteristic color of undried materials. The compaction equipment shall then work on both materials, bonding them together.

2C.9.5 Compaction and Moisture Requirements. Compacted earth materials shall meet the following compaction and moisture requirements.

All parts of the dam embankment, excluding the clay core and impervious earth blanket, shall be compacted to 95 per cent of maximum density. During compaction for the embankment fill, the moisture content shall be within a range of 2 per cent plus or minus of optimum. The clay core and impervious earth blanket shall be compacted to 90 per cent of maximum density within a range of 0 to 5 per cent above optimum.

Filter material shall be placed in horizontal layers not more than 6 inches in thickness and shall be thoroughly compacted to 100 per cent of maximum density. Increased layer thickness may be permitted if the Contractor demonstrates to the satisfaction of the Company that the specified compacted density will be obtained. Water shall be applied to the filter material as necessary to obtain the required compaction.

2C.10 IMPERVIOUS EARTH BLANKET CONSTRUCTION. The entire area to be covered by an impervious earth blanket shall be cleared and stripped.

2C.10.1 Subgrade Preparation. Prior to placement of the impervious earth blanket, the subgrade shall be thoroughly compacted and proof rolled. The subgrade shall be shaped to the lines, grades, and cross sections indicated on the drawings and compacted to a depth of at least

12 inches to 95 per cent of maximum density at optimum moisture content. This operation shall include scarifying, reshaping, and wetting required to obtain proper compaction. After compaction, the area shall be proof rolled to test for uniformity and any loose soils detected shall be re-compacted as specified.

No impervious earth blanket material shall be placed until the subgrade for that portion has been properly prepared and accepted by the Company.

2C.10.2 Impervious Earth Blanket Construction. The impervious earth blankets shall be constructed to the lines and grades indicated on the drawings. General requirements, the order of excavation, and the sources of materials shall be as specified herein.

2C.10.3 Materials. All materials placed in the impervious earth blankets shall be free from brush, stumps, logs, roots, and other deleterious material. All material for the impervious earth blanket construction required under the LUMP SUM shall be obtained from the impervious site borrow area designated on the drawings.

The impervious earth blanket material will be classified by the Company by testing and visual inspection and in accordance with Table 1 of the Unified Soil Classification System bound at the end of this section.

Classification of materials obtained from the impervious earth borrow area for the bottom ash pond shall be as specified in Article 2B.4.

The drawings indicate the detailed limitations for the placement of impervious earth blanket material.

2C.10.4 General Requirements. The suitability of each part of the foundation for placing foundation materials thereon and of all materials for use in impervious earth blanket construction shall be acceptable to the Company.

Dimensions indicated on the drawings for thickness of impervious earth blanket material are minimum dimensions. No intermingling of material will be permitted within these dimensions.

2C.10.5 Equipment. Maximum compaction of the natural ground as prepared, and of each layer or lift of the fill, shall be obtained through the use of equipment so operated that the finished embankment shall be uniformly stable and compacted. Isolated operations shall be provided with sufficient equipment to permit the work to be carried to completion in a continuous and efficient manner. Prime movers used for pulling equipment shall have sufficient power to pull the equipment satisfactorily when fully loaded. The loading and operation of equipment shall be subject to adjustment as required to produce the specified compaction.

The Company will determine the areas of the borrow pits from which the various classifications of material are to be obtained and also the depth of excavation in the borrow pits. The Company will also determine the location in the dam where each type of material will be placed in accordance with the classification of materials specified hereinbefore under "Materials."

The Contractor will be required to break up the earthfill materials, either at the place of excavation or on the embankment, to such maximum size as is determined necessary by the Company to secure specified density of the material in the embankment. Equipment on the embankment shall spread out and not track each other to such an extent as to make ruts. The compacted surface of each lift shall be roughened or loosened by scarifying to the satisfaction of the Company, before the succeeding layer is placed thereon, in order to provide the necessary bond between each lift.

Prior to and during the compacting operations, the material in each layer of the impervious earth blanket shall have the best practicable moisture content, and the moisture content shall be uniform throughout the layer. To obtain the best practicable moisture content, the Contractor will be required to perform such operations as are necessary. Supplementary water, as required, shall be added to the material on the earthfill. If the fill material in borrow areas or other excavations contains an excess of moisture prior to excavation, the Contractor will be required to excavate drainage channels or perform such work as may be necessary to reduce the moisture content of the material. Working of the material on the embankment may be required to produce the required uniformity of water content.

Water required to bring the material to the moisture content necessary for maximum compaction shall be evenly applied and it shall be the Contractor's responsibility to secure a uniform moisture content throughout the layer by such methods as may be necessary. Compaction shall commence immediately after the layer has been brought to the uniform moisture content required, and shall continue, with or without additional water, until each layer has been uniformly compacted to not less than the specified density. Density tests will be made as necessary. If the material fails to meet the density specified, the compaction methods shall be altered, if necessary, to obtain the specified density.

In restricted areas, successive passes of the compaction equipment need not overlap, but uniform compaction is required. Where new material abuts old material or embankment fill, the old material shall be cut or broken by machine or hand methods until it shows the characteristic color of undried materials. The compaction equipment shall then work on both materials, bonding them together.

2C.10.6 Compaction and Moisture Requirements. Compacted earth materials shall meet the following compaction and moisture requirements.

All parts of the impervious earth blanket shall be compacted to 90 per cent of maximum density at optimum moisture content. During compaction, the moisture content of each of these materials shall be maintained within the range from optimum to 5 per cent greater than optimum.

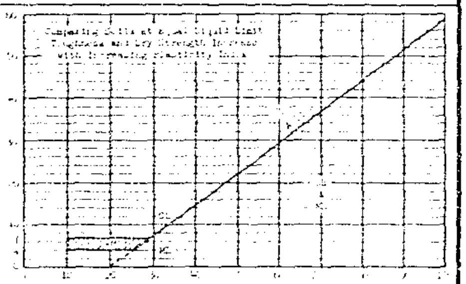
Sand cover material shall be placed in horizontal layers not more than 6 inches in thickness and shall be thoroughly compacted to 95 per cent of maximum density. Water shall be applied to the sand cover material only as necessary to obtain the required compaction.

2C.11 DISPOSAL OF WASTE AND EXCESS EXCAVATED MATERIALS. All unsuitable materials excavated in connection with stripping operations, all materials excavated and determined by the Company to be unsuitable for use, and excess excavated materials which are not needed shall be disposed of on the site at the location(s) designated by the Company.

Table 1

UNIFIED SOIL CLASSIFICATION
(Including Identification and Description)

Major Divisions (1)	(2)		Group Symbols (3)	Typical Names (4)	Field Identification Procedures (Excluding particles larger than 3 inches and basing fractions on estimated weights) (5)			Information Required for Describing Soils (6)	Laboratory Classification Criteria (7)	
Coarse-grained Soils: More than half of material is *larger* than No. 200 sieve size. The No. 200 sieve size is about the smallest particle visible to the naked eye.	Gravels: More than half of coarse fraction is larger than No. 4 sieve size. (For visual classification, the 1/4-in. size may be used as equivalent to the No. 4 sieve size)	Clean Gravels (Little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines.	Wide range in grain sizes and substantial amounts of all intermediate particle sizes.			For undisturbed soils add information on stratification, degree of compactness, cementation, moisture conditions and drainage characteristics.	Determine percentages of gravel and sand from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size) coarse-grained soils are classified as follows: Less than 5%: GW, GP, SW, SP; More than 12%: GM, GC, SM, SC; 5% to 12%: *Borderline* cases requiring use of dual symbols.	$C_u = \frac{D_{60}}{D_{10}}$ Greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between one and 3
			GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines.	Predominantly one size or a range of sizes with some intermediate sizes missing.					Not meeting all gradation requirements for GW
		Gravels With Fines (Appreciable amount of fines)	GM	Silty gravels, gravel-sand-silt mixtures.	Nonplastic fines or fines with low plasticity (for identification procedures see ML below).			Give typical name; indicate approximate percentages of sand and gravel, max. size; angularity, surface condition, and hardness of the coarse grains; local or geologic name and other pertinent descriptive information; and symbol in parentheses.		Atterberg limits below "A" line or PI less than 4. Above "A" line with PI between 4 and 7 are *borderline* cases requiring use of dual symbols.
			GC	Clayey gravels, gravel-sand-clay mixtures.	Plastic fines (for identification procedures see CL below).					Atterberg limits above "A" line with PI greater than 7
	Sands: More than half of coarse fraction is smaller than No. 4 sieve size.	Clean Sands (Little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines.	Wide range in grain size and substantial amounts of all intermediate particle sizes.					$C_u = \frac{D_{60}}{D_{10}}$ Greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between one and 3
			SP	Poorly-graded sands, gravelly sands, little or no fines.	Predominantly one size or a range of sizes with some intermediate sizes missing.			Example: *Silty sand*, gravelly; about 20% hard, angular gravel particles 1/2-in. maximum size; rounded and subangular sand grains coarse to fine; about 15% nonplastic fines with low dry strength; well compacted and moist in place; alluvial sand; (SM).		Not meeting all gradation requirements for SW
		Sands With Fines (Appreciable amount of fines)	SM	Silty sands, sand-silt mixtures.	Nonplastic fines or fines with low plasticity (for identification procedures see ML below).					Atterberg limits below "A" line or PI less than 4. Above "A" line with PI between 4 and 7 are *borderline* cases requiring use of dual symbols.
			SC	Clayey sands, sand-clay mixtures.	Plastic fines (for identification procedures see CL below).					Atterberg limits above "A" line with PI greater than 7
Fine-grained Soils: More than half of material is *smaller* than No. 200 sieve size.					Identification Procedures on Fraction Smaller than No. 40 Sieve Size: Dry Strength (Crushing characteristics)	Dilatancy (Reaction to shaking)	Toughness (Consistency near PL)		Use grain-size curve in identifying the fractions as given under field identification.	
	Silts and Clays	Liquid limit less than 50	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.	None to slight	Quick to slow	None	Give typical name; indicate degree and character of plasticity, amount and maximum size of coarse grains, color in wet condition, odor if any, local or geologic name, and other pertinent descriptive information; and symbol in parentheses.		
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.	Medium to high	None to very slow	Medium			
			OL	Organic silts and organic silty clays of low plasticity.	Slight to medium	Slow	Slight			
	Silts and Clays	Liquid limit greater than 50	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.	Slight to medium	Slow to none	Slight to medium	For undisturbed soils add information on structure, stratification, consistency in undisturbed and remolded states, moisture and drainage conditions.		
			CH	Inorganic clays of high plasticity, fat clays.	High to very high	None	High			
			OH	Organic clays of medium to high plasticity, organic silts.	Medium to high	None to very slow	Slight to medium	Example: *Clayey silt*, brown, slightly plastic, small percentage of fine sand, numerous vertical root holes, firm and dry in place, loess, (ML).		
Highly Organic Soils			Pt	Peat and other highly organic soils.	Readily identified by color, odor, spongy feel and frequently by fibrous texture.					



LIQUID LIMIT

PLASTICITY CHART

For laboratory classification of fine-grained soils

(1) *Boundary classifications:* Soils possessing characteristics of two groups are designated by combinations of group symbols. For example GW-GC, well-graded gravel-sand mixture with clay binder. (2) All sieve sizes on this chart are U. S. standard.

FIELD IDENTIFICATION PROCEDURES FOR FINE-GRAINED SOILS OR FRACTIONS

These procedures are to be performed on the minus No. 40 sieve size particles, approximately 1/64 in. For field classification purposes, screening is not intended, simply remove by hand the coarse particles that interfere with the tests.

Dilatancy (Reaction to shaking)

After removing particles larger than No. 40 sieve size, prepare a pat of moist soil with a volume of about one-half cubic inch. Add enough water if necessary to make the soil soft but not sticky.

Place the pat in the open palm of one hand and shake horizontally, striking vigorously against the other hand several times. A positive reaction consists of the appearance of water on the surface of the pat which changes to a livery consistency and becomes glossy. When the sample is squeezed between the fingers, the water and gloss disappear from the surface, the pat stiffens, and finally it cracks or crumbles. The rapidity of appearance of water during shaking and of its disappearance during squeezing assist in identifying the character of the fines in a soil.

Very fine clean sands give the quickest and most distinct reaction whereas a plastic clay has no reaction. Inorganic silts, such as a typical rock flour, show a moderately quick reaction.

Dry Strength (Crushing characteristics)

After removing particles larger than No. 40 sieve size, mold a pat of soil to the consistency of putty, adding water if necessary. Allow the pat to dry completely by oven, sun, or air drying, and then test its strength by breaking and crumbling between the fingers. This strength is a measure of the character and quantity of the colloidal fraction contained in the soil. The dry strength increases with increasing plasticity.

High dry strength is characteristic for clays of the CH group. A typical inorganic silt possesses only very slight dry strength. Silty fine sands and silts have about the same slight dry strength, but can be distinguished by the feel when powdering the dried specimen. Fine sand feels gritty whereas a typical silt has the smooth feel of flour.

Toughness (Consistency near plastic limit)

After removing particles larger than the No. 40 sieve size, a specimen of soil about one-half inch cube in size, is molded to the consistency of putty. If too dry, water must be added and if sticky, the specimen should be spread out in a thin layer and allowed to lose some moisture by evaporation. Then the specimen is rolled out by hand on a smooth surface or between the palms into a thread about one-eighth inch in diameter. The thread is then folded and rerolled repeatedly. During this manipulation the moisture content is gradually reduced and the specimen stiffens, finally loses its plasticity, and crumbles when the plastic limit is reached.

After the thread crumbles, the pieces should be lumped together and a slight kneading action continued until the lump crumbles.

The tougher the thread near the plastic limit and the stiffer the lump when it finally crumbles, the more potent is the colloidal clay fraction in the soil. Weakness of the thread at the plastic limit and quick loss of coherence of the lump below the plastic limit indicate either inorganic clay of low plasticity, or materials such as kaolin-type clays and organic clays which occur below the A-line.

Highly organic clays have a very weak and spongy feel at the plastic limit.

Adopted by Corps of Engineers and Bureau of Reclamation, January 19[illegible]

[illegible]

Section 2D - CULVERT PIPE

2D.1 GENERAL. This section covers materials, manufacture, and installation for concrete culvert pipe.

2D.2 LAWS AND REGULATIONS. All drainage piping work shall be performed in accordance with all applicable codes and ordinances, and laws and regulations of the State of Minnesota which pertain to such work. In the case of conflict between these specifications and any law or ordinance, the latter shall govern.

2D.3 DRAWINGS AND DATA. Drawings, specifications, and other data showing complete details of the design, fabrication, and construction of pipe and fittings, together with complete data covering all materials proposed for use in connection therewith, shall be submitted for review and acceptance as set forth in Section 1C.

2D.4 MATERIALS. Culvert pipe shall conform to the following requirements.

Reinforced concrete pipe

Pipe, fittings, and specials	ASTM C76, Wall B (minimum) except as modified hereinafter; class of pipe as indicated on the drawings. Minimum pipe section length 6 feet with precast flared end sections as indicated on the drawings
Joints	As specified hereinafter

2D.5 MANUFACTURE. Reinforced concrete pipe manufacture shall conform to the following requirements.

Fine aggregate shall consist of natural sand composed of clean, hard, durable, uncoated, well rounded (not flat or sharply angular) grains of siliceous material. Cement shall conform to ASTM C150.

Each pipe, fitting, or special section shall have plainly and permanently marked thereon: pipe class, date of manufacture, and manufacturer's name or trademark. Markings shall be indented in the pipe or painted on the pipe with waterproof paint.

No concrete pipe shall be delivered to the site of the work until concrete control cylinders representing such pipe shall have attained a compressive strength of at least 80 per cent of the specified minimum 28 day strength.

Each control cylinder compressive strength test report shall be certified by a qualified person who actually conducted or observed the test.

2D.5.1 Joints. Concrete culvert pipe shall be provided with rubber gasketed joints. Joints and gaskets shall conform to ASTM C443.

Each concrete pipe joint shall be designed to withstand, without cracking, the gasket compression plus a differential load across the joint equal to 4,000 pounds per foot of internal diameter.

2D.5.2 Reinforcement. Circumferential reinforcement shall be full-circle type. Elliptical or part-circle reinforcement will not be acceptable. The total area of longitudinal steel shall be not less than 0.2 per cent of the concrete cross-sectional area. Longitudinal steel shall be spaced uniformly around the pipe and shall consist of at least eight wires or bars in each cage.

At least three circumferential bars shall be provided in each pipe bell. The bars shall be placed within 1-1/2 times the socket depth from the end of the pipe and shall be equal in area to an equivalent length of the outside cage in the pipe barrel. The end circumferential bar shall be placed one inch from the face of the bell. The inside cage in the pipe barrel shall be extended to within one inch of the end of the spigot.

2D.5.3 Preliminary Acceptance Tests. All tests for preliminary acceptance shall be made at the Contractor's expense. Test reports covering the following tests on each size and class of pipe shall be submitted and accepted before any pipe is manufactured for this Contract.

Joint leakage	ASTM C443, Section 8
Joint shear	Suitable arrangement to apply the specified loads
Three-edge bearing	ASTM C497, indicating load required for first visible crack and for ultimate destruction

The specified tests for joint leakage, joint shear, and three-edge bearing are for proof of design only. It is not required that such tests be made on pipe manufactured specifically for this Contract. Reports covering

tests made on other pipe of the same size, class, and design and manufactured at the same plant will be acceptable.

2D.6 TRENCH EXCAVATION. The alignment and grade or elevation of each culvert shall be fixed and determined by means of batter boards and offset stakes. With the Engineer's approval, laser beam equipment or surveying instruments will be permitted in maintaining the alignment and grade.

Where necessary to reduce earth load on trench banks to prevent sliding and caving, banks may be cut back on slopes which shall not extend lower than one foot above the top of the pipe.

Trenches shall be excavated not less than 4 inches below the bottom of the culvert for the installation of granular embedment pipe foundation material below the underside of the pipe in earth and 6 inches in rock.

2D.7 EMBEDMENT. Granular embedment material shall be placed not less than 4 inches below and not less than 1/6 of the outside pipe diameter above the bottom of the culvert. The remainder of the trench shall be backfilled with material composed of earth or sand only and shall contain no wood, grass, roots, broken concrete, stones, trash, or debris of any kind.

Granular embedment material shall be crushed rock or gravel which shall have a gradation such that 95 per cent of the material shall pass a 1/2 inch sieve and not more than 5 per cent shall pass a No. 4 sieve.

Sand embedment material shall be clean sand which shall have a gradation such that 95 per cent of the material shall pass a No. 4 sieve and not more than 5 per cent shall pass a No. 100 sieve.

Embedment material shall be deposited and compacted uniformly and simultaneously on each side of the culvert to prevent lateral displacement. Embedment material shall be placed in layers of 8 inches or less and each layer shall be uniformly compacted. Granular embedment and sand embedment shall be compacted to 90 per cent of maximum density.

Embedment materials shall be placed in uniform layers and shall have a moisture content which will ensure that maximum density will be obtained with the compaction method used. Sand shall be wet, not just damp, when compacted. Vibrating compactors shall be used to compact sand, crushed rock, and gravel.

2D.8 HANDLING. Pipe, fittings, and accessories shall be handled in a manner that will ensure installation in sound, undamaged condition. Equipment, tools, and methods used in loading, unloading, reloading, and

hauling pipe and fittings shall be such that the pipe and fittings are not damaged. Hooks inserted in the ends of pipe shall have broad, well padded contact surfaces and shall not come in contact with joint surfaces.

2D.9 CLEANING. The interior of all pipe and fittings shall be thoroughly cleaned of all foreign matter before being installed and shall be kept clean until the work has been accepted. Such surfaces shall be wire brushed, if necessary, and wiped clean and dry and free from oil and grease before the joints are assembled. All joint contact surfaces shall be kept clean until jointing is completed.

Every precaution shall be taken to prevent foreign material from entering the pipe while it is being installed. No debris, tools, clothing, or other materials shall be placed in the pipe.

2D.10 LAYING PIPE. Under no circumstances shall pipe be laid in water and no pipe shall be laid under unsuitable weather or trench conditions.

Pipe shall be laid with the bell ends facing upstream except when making closures.

Culvert pipes shall be laid on the prepared bed starting at the outlet end with sections firmly joined.

2D.11 JOINTING. Rubber gasketed joints for reinforced concrete pipe shall be installed in strict accordance with the pipe manufacturer's recommendations. Immediately before jointing the pipe, the outside of the spigot and gasket and the inside of the receiving bell shall be thoroughly cleaned and coated with a suitable lubricant.

Section 2E - AGGREGATE SURFACING

2E.1 GENERAL. This section covers the materials and construction for aggregate surfaced access roads indicated on the drawings.

Unless otherwise specified herein, the materials, application of aggregate surfacing, and the sampling and testing of aggregates shall comply with Sections 2118 and 2211 of the Minnesota Department of Highways (MDH) "Standard Specifications for Highway Construction."

Major earthwork for subgrades to be surfaced shall be as specified in Section 2C.

All aggregate surfaced areas constructed under these specifications shall be maintained by the Contractor until final acceptance of the work by the Company.

2E.2 MATERIALS. Materials for gravel or crushed rock base course and surface course shall conform to the requirements of MDH Section 3138, Class 5 or 6.

Dust palliative

Medium curing liquid asphalt	AASHTO M82, Grade MC-30 or Grade MC-70
Slow curing liquid asphalt	AASHTO M141, Grade SC-70
Emulsified asphalt	AASHTO M140, Grade SS-1

2E.3 APPLICATION. The aggregate shall be placed upon an acceptable subgrade in layers of uniform thickness not exceeding 3 inches in compacted depth. The aggregates for each course shall be handled and spread in a manner that will prevent segregation of sizes. When vibrating or other acceptable types of special compacting equipment are used, acceptance may be given to increasing the permissible thickness to 6 inch layers, provided the ability of such equipment to achieve acceptable compaction to the full layer depth is demonstrated.

When the aggregate surfacing is constructed in more than one layer, the previously constructed layers shall be cleaned of loose and foreign matter. The water content of the material shall be maintained during placement to ensure maximum compaction at optimum moisture content. Moisture content shall be maintained at ±1-1/2 per cent of optimum.

While at optimum moisture content, the aggregate shall be compacted to not less than 97 per cent of the maximum laboratory density as determined by ASTM D1557, Method D. In-place density shall be measured by ASTM D2167.

The top surface of the compacted aggregate base course shall be finished by blading or with automated equipment especially designed for the purpose and rolled with a steel-wheeled roller. In no case shall thin layers of fine materials be added to the top layer of the base course in order to meet the grade.

The surface of the completed aggregate base shall not deviate more than 1/2 inch when tested with a 10 foot straightedge. The completed compacted thickness of any course shall be within plus 3/4 inch and minus 1/2 inch of indicated thickness, and the average thickness shall not be less than the design thickness indicated on the drawings.

2E.4 DUST PALLIATIVE. Liquid asphalt material shall be applied to the roads, parking areas, and other areas indicated on the drawings to serve as a dust palliative. The asphalt material shall be either slow curing, medium curing, or emulsified type, and shall be applied as directed by the Company. If slow curing or medium curing asphalt is used, it shall be applied at a rate not to exceed 0.5 gallon per square yard. If emulsified asphalt is used, it shall be diluted with at least 5 parts of water by volume.

2E.5 MAINTENANCE. Maintenance of crushed rock or gravel surfaced roads shall consist of inspection and periodic maintenance operations by the Contractor throughout the period utilized to complete the work under these specifications. Maintenance operations shall include loosening, adding, and removing material, grading, reshaping, recompacting, and dust control as required to keep the surfaced areas in first class condition.

Section 2F - EROSION CONTROL

2F.1 GENERAL. This section covers the furnishing of materials and equipment, and the performance of all operations in connection with establishing turf in accordance with these specifications as indicated on the drawings.

Soil erosion control work shall include preparation of the soil surface, fertilizing, planting of seed, compacting, mulching, watering, and maintenance.

All soil erosion control work shall be performed by a contractor who is experienced and regularly engaged in the type of work required under these specifications and whose work is acceptable to the Company.

The work shall be performed using acceptable equipment manufactured expressly for its intended purpose such as a seed drill equipped with coulter openers and depth bands spaced not more than 6 inches apart, a mulch blower for the application of hay or straw mulch, mulch puncher or straight serrated disc weighted to anchor the mulch into the soil a minimum of 2 inches, and a cultipacker.

When operating standard equipment such as seed drills and mulching machines on slopes of 2 feet horizontal to one foot vertical or steeper, provisions shall be made to prevent the equipment from sliding by cabling the equipment to a heavy anchor vehicle at the top of the slope or by other suitable means.

The Contractor shall not start erosion protection or preparatory work until notified by the Company and until excavation and trenching, backfill, embankments, rough grading, surfacing and paving are completed in the vicinity of the erosion protection work.

2F.2 MATERIALS. Unless otherwise specified herein, the materials and workmanship shall comply with Section 2575 of the Minnesota Department of Highways (MDH) "Standard Specifications for Highway Construction."

2F.2.1 Topsoil. Topsoil for planting operations shall be fertile, friable, natural loam containing a liberal amount of humus, and shall be capable of sustaining vigorous plant growth. Topsoil shall be free of subsoil and shall be reasonably free of stone, lumps, clods of hard earth, plants, or their roots, stalks, and other extraneous matter.

2F.2.2 Commercial Fertilizer. Fertilizer shall be a commercial mixture containing the following percentages by weight.

10 per cent nitrogen

20 per cent phosphoric acid

20 per cent potash

The fertilizer shall be inorganic or a combination of inorganic and organic substances. The methods used to determine the various elements shall be those adopted by the Association of Official Agricultural Chemists.

Fertilizer shall be uniform in composition, free flowing and suitable for application with acceptable equipment. Fertilizer shall be delivered to the site in standard size bags indicating weight, analysis and name of manufacturer. Fertilizer shall be stored in a weatherproof place in such a manner that it will be kept dry and its effectiveness will not be impaired.

2F.2.3 Nitrogen Fixing Bacteria. All leguminous seed shall be inoculated with the proper quantity of nitrogen fixing bacteria, not more than one year old. The containers of inoculant shall be plainly marked with the expiration date for use and the manufacturer, and directions for inoculating leguminous seed of the type specified.

2F.2.4 Seed. All seed shall meet the requirements of the seed laws of the State of Minnesota, and the requirements of the following specifications.

All seeds shall equal or exceed the percentage of sproutable seeds as indicated in the tabulation which follows. The percentage of either germination or purity may vary slightly from those indicated, provided the product of per cent germination times per cent purity shall not fall below the specified minimum sproutable seed. The germination and purity of all seeds used shall be determined by accepted laboratory test methods as employed by the State Seed Laboratory. All grass seed shall be of South Dakota, North Dakota, Nebraska or Montana origin.

MINIMUM SPROUTABLE SEED

Seed	Per Cent Purity	Per Cent Germination	Per Cent Sproutable Seed
Legumes			
Bird's-foot Trefoil, var. Empire (Lotus corniculatus)	97	85	82.4

Seed	Per Cent Purity	Per Cent Germination	Per Cent Sproutable Seed
White Dutch Clover (Trifolium repens)	99	92	91.1
Grasses			
Side Oats Grama var. Pierre or Killdeer (Boutoloua carpentendula)	50	65	32.5
Creeping Red Fescue, var. Illake or Pennlawn (Festuca rubra)	97	80	77.6

The balance of material in an acceptable seed mixture (other than specified pure live seed) shall, for the most part, consist of nonviable seed, chaff, hulls, live seeds of crop plants and harmless inert matter. The percentage of weed seed shall not exceed one per cent by weight for the mixture.

The seed mixture furnished shall be mixed by the vendor and shall be delivered in standard size bags of the vendor, showing weight, analysis and vendor's name. Seed that is wet or moldy or that has been otherwise damaged in transit or storage will not be acceptable.

2F.2.5 Vegetative Mulch. Straw or hay mulch shall consist of wheat straw, oat straw, Sudan grass hay or prairie hay. The prairie hay shall consist of bluegrass hay, switch grass, Indian grass or other desirable grasses that are adaptable for use in a blower mulcher. The material shall be relatively free of seed-bearing stalks of noxious grasses or weeds as defined by the rules and regulations of Minnesota Department of Agriculture.

2F.3 PREPARATION AND APPLICATION. The preparation of the soil and the application of seed and mulch shall conform to the following requirements.

2F.3.1 Preparation of Soil. The area to be planted shall be thoroughly tilled to a depth of at least 3 inches by discing, harrowing, or other acceptable methods until the soil is well pulverized. After completion of the tilling operation, the surface shall be cleared of all stones, stumps, or other objects larger than 1-1/2 inches in thickness or diameter, and of roots, wire, grade stakes, and other objects that might be a hindrance to maintenance operations. Any undisturbed areas with a satisfactory cover of native grasses shall be left uncultivated and unplanted.

The spreading of topsoil shall be completed over the entire area indicated on the drawings before the beginning of soil preparation.

Any objectionable undulations or irregularities in the surface resulting from tillage or other operations shall be removed before planting operations are begun. Soil preparation shall be performed only during periods when satisfactory results are likely to be obtained. When results are not satisfactory because of drought, excessive moisture, or other causes, the work shall be stopped until such conditions have been corrected to the satisfaction of the Company.

2F.3.2 Fertilizing. Commercial fertilizer of the type specified shall be distributed uniformly over the entire planting area at the rate of 800 pounds per acre. The fertilizer shall be applied with a fertilizer drill before the beginning of the mulching operation as a part of the soil preparation or if a seed drill with a fertilizer attachment is used, fertilizer may be applied with the seeding operation following the mulching.

2F.3.3 Seeding. Seed shall be applied uniformly at rates specified hereinafter. Drills shall deliver seeds uniformly in each drill furrow so that seeds are covered not to exceed 1/2 inch deep. When drilling seed, provisions shall be made by markers or other acceptable means to assure that successive planted strips will overlap or be separated by a space not greater than the space between rows planted by the equipment being used. If inspection during planting operations, or after there is a show of green, indicates that strips wider than the space between planted rows have been left or other areas skipped, additional seed shall be planted in all such areas.

On slopes too steep for the practical operation of power drawn equipment, grass seed shall be broadcast uniformly by hand methods and raked into the surface.

Seeding and fertilizing shall be performed between the dates of August 1 and August 15 for fall planting and April 1 and June 10 for spring planting unless otherwise acceptable to the Company. Seeding and fertilizing shall not be done during periods of such severe drought, high winds, or excessive moisture, as determined by the Company, that satisfactory results are not likely to be obtained.

Seed shall be applied at the rate of 33 pounds per acre for the mixture stipulated below.

	Spring Planting (Per Cent by Weight)	Fall Planting (Per Cent by Weight)
Creeping Red Fescue	60	65

	Spring Planting (Per Cent by Weight)	Fall Planting (Per Cent by Weight)
Side Oats Grama	10	13
Dutch White Clover	10	-
Bird's-foot Trefoil	20	22
	100	100

2F.3.4 Compacting. Immediately after the seeding operations have been completed, the entire area shall be compacted by means of a cultipacker, roller, or other acceptable equipment weighing 60 to 90 pounds per linear foot of roller. If the soil is of such type that a smooth or corrugated roller cannot be operated satisfactorily, a pneumatic roller (not wobble-wheel) shall be used. The pneumatic roller shall have tires of sufficient size so that complete coverage of the soil surface is obtained. When a cultipacker or similar equipment is used, the final rolling shall be at right angles to the existing slopes to prevent water erosion or at right angles to the prevailing wind to prevent wind erosion.

The areas that have been seeded by hand and areas where the use of mechanical equipment is impractical shall be compacted by hand immediately after seeding by using a commercial hand tamper, roller, or other method acceptable to the Company.

2F.3.5 Mulching. Mulching shall be performed within 24 hours after seeding, but shall not be done during windy or rainy weather or when such weather is imminent. If the seedbed has become crusty or eroded or disturbed by the Contractor's operations before mulching, the Contractor shall rework the soil and reseed in these areas. Mulching shall be started at the windward side of relatively flat areas or at the upper part of steep slopes and shall continue uniformly until each area is covered.

Alternate methods of placing vegetative mulching follow. The first method utilizes an emulsified asphalt sprayed simultaneously with the vegetative mulch. The second method physically mixes the vegetative mulch with the soil to hold it in place. Either method is acceptable.

2F.3.5.1 Sprayed Mulch. Vegetative mulch may be applied with an asphalt tack in a mixture of 2 tons of mulch per acre with 75 to 150 gallons of emulsified asphalt per ton of mulch.

The mulch and asphalt mixture shall be placed with conventional mechanical equipment which will distribute the mulch uniformly by blowing it onto the area.

Baled straw or hay shall be broken up and loosened sufficiently before being fed into the blower hopper to avoid the placing of matted or unbroken clumps. The use of wet straw or hay is prohibited.

The equipment shall be provided with jet nozzles spaced in the muzzle of the blower through which the asphalt is ejected simultaneously with the mulch, coating the mulch uniformly with a spray of asphalt. Small areas may be mulched by hand by spreading the mulch in a loose, fluffy condition after which the emulsified asphalt shall be sprayed over the surface of the mulch.

2F.3.5.2 Disc or Punched Mulching. Vegetative mulching material without emulsified asphalt may also be used provided that it is disced or punched into the soil, at the rate of 2 tons per acre to a depth of 2 to 3 inches, so that it is partially covered. Several passes may be required, if a straight disc is used, in order to mix the mulching material with the topsoil sufficiently to ensure protection from erosion by either wind or water. The mulch tilling operation shall be performed parallel to the ground contours.

Under some circumstances, it may become desirable to apply mulch and anchor it into the soil on steep slopes to prevent erosion as soon as construction of the slopes is completed as determined by the Company.

Even though it is not the proper season to plant grass seed, vegetative mulch may be applied first and the seed may then be drilled in on top of the mulch at the proper seeding time. By applying mulch immediately following construction, and anchoring it into the soil, the normal seedbed preparation procedure may not be required, depending on the tilth of the soil, as determined by the Company. In such cases, the fertilizer shall be applied at the time of seeding.

2F.4 WATERING. Watering will be required to promote the establishment of healthy turf. Areas which have been seeded shall be watered such that water will penetrate 2 inches into the soil.

Additional applications of water will be required until the grass is well established after planting.

Water will be supplied by the Company at the plant site. All pipes, pumps, hoses, sprinklers, and all other necessary materials to apply water shall be furnished by the Contractor.

2F.5 MAINTENANCE AND PROTECTION. The Contractor shall maintain and protect all planted areas until final acceptance of the work. Final acceptance will not be made until an acceptable uniform stand of grass is obtained, except that portions of the seeding may be accepted at various times. Upon acceptance by the Company of a planted area, the Company will assume responsibility for maintenance of that portion.

Any portions of the areas of planting which fail to show a uniform stand of grass shall be replanted as before, except that commercial fertilizer shall be applied at one-half the original rate. Planting shall be repeated until an acceptable stand of grass is provided.

Care shall be taken to avoid overwatering on the sloped areas to prevent erosion. Any areas which have become eroded shall be regraded and replanted. Topsoil shall be added if required.

The grass height shall be maintained between 1-1/2 inches and 2-1/2 inches. Maintenance shall include mowing until new grass areas are accepted by the Company.

One application of weed spray shall be performed if so directed by the Company.

2F.6 GUARANTEE. The Contractor shall guarantee all work and materials for a period of one year after completion of the seeding work. During the guarantee period, all turf which dies shall be replaced by and at the expense of the Contractor. Replacement made under the Contractor's guarantee shall be covered by a like guarantee for a period of one year after completion of the replacement.