

Considered: _____

WATER PERMIT NO. 1509-1

Phone: 605 374-3592

Name of Applicant: USDA, Forest Service

Post Office Address: PO Box 390, Lemmon SD 57638

Amount of Water Claimed: 87 AF Total Acres: NA

Source of Water Supply: drainage-South Fork Grand River

Water to be used for: fish & wildlife habitat County: Perkins

About 11 miles N, 3W of Bison

PROOF OF PUBLICATION: Received _____ Not Received _____

APPLICATION: Approved _____ Subject to _____

F.F. & C/.L. Adopted _____ Not Approved _____ Deferred _____

PRIORITY _____ Date Received: 1-22-91 Fee: _____ Remarks _____

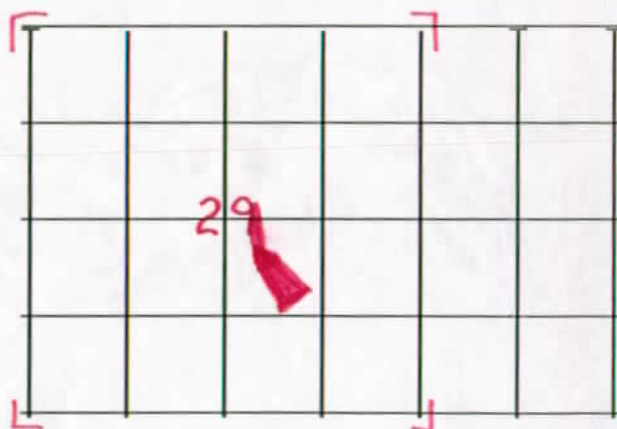
Corrected Application Received _____ Period of Annual Use Jan 1- Dec 31

WATER QUALITY APPROVAL RECEIVED NA APPROVED/CONDITIONAL (Circle one)

WI-1 Description same as Application YES _____ NO _____ REMARKS _____

Diversion Point: NW 1/4 SE 1/4 29-20N-13E

Land to be Irrigated: _____



Well Log: Driller: _____ Licensed YES _____ NO _____

Depth of Well: _____ REMARKS _____

Type of Map: topo PREPARED BY: Roger Smith Reviewed and the Number

Assigned on 2-19-91 By Karen Schlaak

No. 1509-1 Hydrologic Unit 10130302
 Map No. _____ Basin Moreau River
 Newspaper The Bison Courier, Box 429, Bison, SD

523 E. Capitol
 Pierre, SD 57501
 (605) 773-3352

(Wed)

Application For Permit To Appropriate Water Within The State Of South Dakota

Check use of water: Industrial ☐ Commercial ☐ Municipal ☐ Other Common Distribution System ☐
 Rural Water System ☐ Suburban Housing ☐ Geothermal Heat ☐ Institutional ☐ Recreational ☒
 Domestic ☐ (above 18gpm) Other ☐

Type of Application: Check one or more of the following

New ☒ Vested Right ☐ Future Use ☐ Change Use ☐☐ Amend Permit No. _____ with old priority date retainedChange diversion point(s) ☐ Add diversion point(s) ☐ Other ☐ _____☐ Application to: Change diversion point(s) ☐ Add diversion point(s) ☐ on Permit No. _____☐ Construction to use water reserved by Future Use Permit No. _____

- Name of Applicant USDA, Forest Service Phone No. 605-374-3592
 Post Office Address P.O. Box 390, Lemmon State South Dakota 57638
(Street, RR or Box) (City) Zip Code
- Amount of water claimed (~~xxx~~) 87 Acre Feet
- Source of water supply Intermittent side drainage of the South Fork Grand River
- Location of point of diversion ~~XXXX~~ Section 29, T20N, R13E
NW 1/4 SE 1/4
 _____ County Perkins
- Counties where water will be used Perkins
- Annual period during which water is to be used January 1 - December 31

- Give a brief description of proposed project. When available include any preliminary engineering report or other reports or information that will help explain the project. (Attach sheet if more space is needed)

The South Fork Impoundment Project is a waterfowl habitat enhancement dam and reservoir designed by Ducks Unlimited Inc. The major uses of this reservoir will be to provide habitat for ducks and geese, warmwater fish habitat, and recreational use. See attached "Design Report" and blueprint.

Attachments: Attach Form 2A if diversion from a well or dugout, or if storage of water, is proposed. Attach map (see instruction)

STATE OF SOUTH DAKOTA)
 County of Perkins)^{ss}

I, Darryl Jones the applicant, certify that I have read this application, have examined the attached map and that the matters stated are true and that I intend, and am able to complete the necessary construction.

Signed Darryl JonesSubscribed and sworn to before me this 14th day of January 1991Mary Harsand

Notary Public

my commission expires presently may 1993

**SOUTH DAKOTA
WATER PERMIT No. 1509-1**

Date of first receipt of application January 22, 1991.

Date of return to applicant for corrections, amendments or changes
February 6, 1991.

Date of receipt of corrected application February 19, 1991.

The Chief Engineer, on behalf of the Water Management Board, issues Water Permit No. 1509-1 to USDA, Forest Service, PO Box 390, Lemmon SD 57638 authorizing the construction of the water use system and the placing of water to beneficial use subject to the following limitations, conditions and qualifications:

1. Water Permit No. 1509-1 appropriates 87 acre-feet of water by constructing a dam in a intermittent tributary of the South Fork Grand River. The dam site is to be located in the NW 1/4 SE 1/4 and water may also be impounded in the SW 1/4 NE 1/4; all in Section 29-T20N-R13E. Water is to be stored annually to an approximate elevation of 2510 feet mean sea level.
2. The water appropriated shall be used for the purpose of providing wildlife habitat and may not exceed the amount of water needed for beneficial use for wildlife propagation and recreational use.
3. The water is to be used during the following described annual period: January 1 - December 31.
4. The date of approval of Permit No. 1509-1 is May 1, 1991.
5. The date from which applicant may claim right is January 22, 1991.
6. One-fifth of the construction is to be completed on or before November 1, 1993.
7. All construction is to be completed on or before May 1, 1996.
8. Water is to be put to beneficial use on or before May 1 2000.
9. Water rights obtained in compliance with the laws of the State of South Dakota may not be unlawfully impaired by this appropriation.

QUALIFICATIONS

1. Low flows as needed for downstream domestic use, including livestock water and prior water rights must be by-passed.

(continued)

Water Permit No. 1509-1

Page 2

2. Flows of the Grand River proposed for use under this permit are included under U.S. Withdrawal No. 594-1 for storage in Shadehill Reservoir. Restrictions on the use of water granted under this permit may be necessary, if the Bureau of Reclamation develops the Shadehill Unit Irrigation Project as proposed under such withdrawal.
3. Approval of Permit No. 1509-1 authorizes storage of up to 87 acre-feet annually.

WATER MANAGEMENT BOARD

By: _____


Chief Engineer, Water Rights Division
Department of Water and Natural Resources

SEP 26 1991

(date)

Supplemental Information

(type or print in ink)



1. Well Information - Proposed construction

- a) Drill Hole Diameter _____ Depth _____
- b) Casing Type _____ Diameter _____ Thickness _____
- c) Screen Type _____ Diameter _____ Thickness _____
- d) Gravel Pack Thickness _____ Length of Gravel Pack _____
- e) Depth to Top of Water Bearing Material _____
- f) Depth to Water (ground surface to water level) _____
- g) Distance to nearest existing domestic well:
- On applicants property _____ On property owned by others _____

2. Dugout Information Estimates

- a) Surface Dimensions _____ Depth _____
- b) Depth to water (ground surface to water level) _____

3. Water Storage Dams

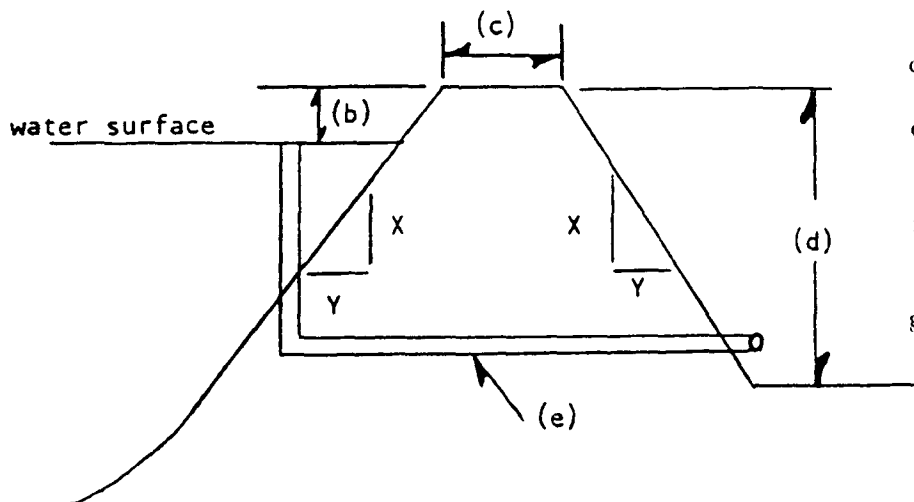
If the proposed water use system contains one or more storage dams, please furnish the information requested below. The locations of each dam should be shown on the map submitted with the application.

- a) If a private engineering firm or government agency was involved in the design of this dam please give their name and address

Ducks Unlimited, Inc.

6115 East Main Avenue

Bismarck, ND 58501



- b) Freeboard 7 feet
- c) Crest Width 12 feet
Crest Length App. 700 feet
- d) Height App. 20 feet
- e) Primary Outlet Capacity See "Design Report"
If Pipe, diameter 48 inch
- f) Secondary Spillway Capacity 3.7 fps
Spillway width 180 feet
- g) X & Y Slope
Upstream 1:3
Downstream 1:3
- Surface Area of Impoundment 16.1
- Storage 87.1 acre feet
- Drainage area above dam 3940 Acres

Signature of Applicant

USDA - Forest Service

South Dakota Department of Water and Natural Resources

RECEIVED OF US Dept of Ag-NFC, Box 60075 St, New Orleans LA 70160

By John H. H. H. H.
Chief Engineer

RUN
 Hello, this program estimates peak discharges and runoff volumes for 2, 5, 10, 25, 50, and 100 year floods based upon equations specified in USGS publication: Techniques for Estimating Flood Peaks Volumes, and Hydrographs on Small Streams, September 1980, Water Resources Investigations 80-50. Input data needed to run this program are: drainage basin size (sq. mi.), soil infiltration index (see Figure 13 in publication), and main channel slope in feet per mile.

WHAT IS THE DRAINAGE BASIN NAME?
 ? 1509-1 FOREST SERVICE
 ENTER THE DRAINAGE BASIN AREA (SQ. MI.)
 ? 6.15
 ENTER THE SOIL INFILTRATION INDEX FROM FIGURE 13
 ? 2.66
 DO YOU WISH TO DETERMINE THE PEAK DISCHARGE? (Y/N)
 ? Y
 ENTER SLOPE ALONG MAIN CHANNEL (FT/MILE)
 ? 61

THE ESTIMATED PEAK DISCHARGE FOR 2, 5, 10, 25, 50, AND 100 YEAR FLOODS FOR 1509-1 FOREST SERVICE DRAINAGE ARE:

Q2 = 99.46685 CFS
 Q5 = 248.9988 CFS
 Q10 = 427.2996 CFS
 Q25 = 748.379 CFS
 Q50 = 1077.773 CFS
 Q100 = 1476.849 CFS

THE ESTIMATED RUNOFF VOLUME FOR 2, 5, 10, 25, 50, AND 100 YEARS FLOODS FOR 1509-1 FOREST SERVICE DRAINAGE ARE:

V2 = 86.95322 ACRE-FEET
 V5 = 157.1423 ACRE-FEET
 V10 = 221.6786 ACRE-FEET
 V25 = 332.1539 ACRE-FEET
 V50 = 432.8215 ACRE-FEET
 V100 = 555.2331 ACRE-FEET

THE ACCURACY OF THE ESTIMATED PEAK DISCHARGES AND RUNOFF VOLUMES ARE SUBJECT TO THE LIMITATIONS AS SPECIFIED IN THE ABOVE USGS PUBLICATION

Peak-discharge relation	Standard error of estimate (%)	Runoff volume relation	Standard error of estimate (%)
	Average Range		Average Range
Q2	106 (+152,-60)	V2	86 (+136,-58)
Q10	90 (+124,-53)	V10	92 (+128,-56)
Q25	90 (+125,-56)	V25	90 (+125,-55)
Q50	93 (+130,-56)	V50	89 (+123,-55)
Q100	98 (+139,-58)	V100	89 (+123,-55)

DO YOU WISH TO GENERATE A SYNTHETIC HYDROGRAPH FOR 1509-1 FOREST SERVICE DRAINAGE BASIN? (Y/N).
 ? Y

ENTER THE NUMERICAL FLOODING FREQUENCY, i.e. for a 25 year flood enter the value 25.0
 ? 25

THE 25 YEAR SYNTHETIC HYDROGRAPH FOR THE 1509-1 FOREST SERVICE DRAINAGE IS AS FOLLOWS:

TIME (MINUTES)	DISCHARGE (CFS)
0	0
39.80565	53.8487
99.67609	162.1468
139.5463	311.8245
199.3522	611.1761
219.2874	710.96
239.2226	748.379
259.1578	733.9039
279.0931	686.614
358.8339	473.5733

438.51	205.8766
598.0565	149.6758
797.4067	64.8595
995.7609	34.54596
1196.113	6.236491
1395.465	0

DO YOU WISH TO GENERATE ANOTHER SYNTHETIC HYDROGRAPH? (Y/N)
 ? Y
 ENTER THE NUMERICAL FLOODING FREQUENCY, i.e. for a 25 year
 flood enter the value 25.0
 ? 50

THE 50 YEAR SYNTHETIC HYDROGRAPH FOR THE 1509-1 FOREST SERVICE
 DRAINAGE IS AS FOLLOWS:

TIME (MINUTES)	DISCHARGE (CFS)
0	0
54.10605	100.5921
90.17676	233.5175
126.2475	445.0721
180.3535	680.1812
198.3889	1023.684
216.4242	1077.773
234.4596	1059.81
252.4949	587.9586
324.6363	582.5896
414.8131	413.1463
541.0606	215.5546
721.4141	93.40699
901.7675	35.92577
1082.121	8.981441
1262.475	0

DO YOU WISH TO GENERATE ANOTHER SYNTHETIC HYDROGRAPH? (Y/N)
 ? N

IF YOU WISH TO RUN THIS PROGRAM AGAIN, TYPE RUN.
 HAVE A NICE DAY!
 OK

TYPE 1509-1.DAT
T1 SUBCRITICAL FLOW, USDA DAM, PERKINGS COUNTY, WTR PRMT APPL. 1506-1
T2 EARTHEN EMERGENCY SPILLWAY, TRAPEZOIDAL, 2/21/91 dsb USDA, FOREST SER
T3 180 FOOT WIDE, MANNINGS N= 0.035, X-SECTIONS FROM PLANS AND SPECS
J1 0 2 0 0 -1 0 0 2514.3
J2 0 -1
NC 0.035 0.035 0.035 -1 .3
QT 5 400 800 950 1400 1700 1780
X1 0.00 4 0 198
GR 2517. 0 2514. 9 2514. 189 2517. 198
X1 0.90 4 0 198 90 90
GR 2517. 0 2514. 9 2514. 189 2517. 198
X1 1.90 4 0 198 100 100 100
GR 2517. 0 2514. 9 2514. 189 2517. 198
X1 2.23 4 0 198 33 33 33
GR 2517. 0 2514. 9 2514. 189 2517. 198
X1 2.32 4 0 216 9 9 9
GR 2517. 0 2511. 18 2511. 198 2517. 216
X1 2.90 4 0 216 58 58 58
GR 2517. 0 2511. 18 2511. 198 2517. 216
X1 3.90 4 0 216 100 100 100
GR 2517. 0 2511. 18 2511. 198 2517. 216
X1 4.90 4 0 216 100 100 100
GR 2517. 0 2511. 18 2511. 198 2517. 216
X1 5.90 4 0 216 100 100 100
GR 2517. 0 2511. 18 2511. 198 2517. 216

EJ
T1 USDA FOREST SERVICE 800 CFS
T2
T3
J1 3 -1 2514.4
J2 2 -1
T1 USDA FOREST SERVICE 950 CFS
T2
T3
J1 4 -1 2514.5
J2 3 -1
T1 USDA FOREST SERVICE 1400 CFS
T2
T3
J1 5 -1 2514.6
J2 4 -1
T1 USDA FOREST SERVICE 1700 CFS
T2
T3
J1 6 -1 2514.7
J2 5 -1
T1 USDA FOREST SERVICE 1750 CFS
T2
T3
J1 7 -1 2514.8
J2 15 -1

ER

C:\HEC2\TYPE 1509-1.DAT

* WATER SURFACE PROFILES *
* VERSION OF SEPTEMBER 1988 *
* ERROR: 01,02,03 *
* UPDATED: SEPTEMBER 1989 *
* RUN DATE 2/21/91 TIME 14:55:43 *

* U.S. ARMY CORPS OF ENGINEERS *
* THE HYDROLOGIC ENGINEERING CENTER *
* 609 SECOND STREET, SUITE D *
* DAVIS, CALIFORNIA 95616-4687 *
* (916) 756-1104 *

X X XXXXXXX XXXXX XXXXX
X X X X X
X X X X X
XXXXXXX XXXX X XXXXX XXXXX
X X X X X
X X X X X
X X XXXXXXX XXXXX XXXXXXX

END OF BANNER

1 2/21/91 14:55:43

PAGE 1

ERROR CORR - 01,02,03
 MODIFICATION -

T1 SUBCRITICAL FLOW, USDA DAM, PERKINGS COUNTY, WTR PRMT APPL. 1506-1
 T2 EARTHEN EMERGENCY SPILLWAY, TRAPEZOIDAL, 2/21/91 @55 USDA, FOREST SER
 T3 180 FOOT WIDE, MANNINGS N= 0.035, X-SECTIONS FROM PLANS AND SPECS

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FG
	0	2	0	0	-1	0	0		2514.3	
J2	NPROF	IPLOT	PREVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
		0	-1							
NC	0.035	0.035	0.035	.1	.3					
QT	6	400	800	950	1400	1700	1780			
X1	0.00	4	0	198						
GR	2517.	0	2514.	9	2514.	189	2517.	198		
X1	0.90	4	0	198	90	90	90			
GR	2517.	0	2514.	9	2514.	189	2517.	198		
X1	1.90	4	0	198	100	100	100			
GR	2517.	0	2514.	9	2514.	189	2517.	198		
X1	2.23	4	0	198	33	33	33			
GR	2517.	0	2514.	9	2514.	189	2517.	198		
X1	2.32	4	0	216	9	9	9			
GR	2517.	0	2511.	18	2511.	198	2517.	216		
X1	2.90	4	0	216	58	58	58			
GR	2517.	0	2511.	18	2511.	198	2517.	216		
X1	3.90	4	0	216	100	100	100			
GR	2517.	0	2511.	18	2511.	198	2517.	216		
X1	4.90	4	0	216	100	100	100			
GR	2517.	0	2511.	18	2511.	198	2517.	216		
X1	5.90	4	0	216	100	100	100			
GR	2517.	0	2511.	18	2511.	198	2517.	216		

1 2/21/91 14:55:43 PAGE 2

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	GLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XLN	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	IDONT	CDRAR	TOPWID	ENDST

*PROF 1
 0
 CCHV= .100 CEHV= .300
 *SECNO .000
 3720 CRITICAL DEPTH ASSUMED

.000	.53	2514.53	2514.53	2514.30	2514.80	.27	.00	.00	2517.00
400.	0.	400.	0.	0.	96.	0.	0.	0.	2517.00
.00	.00	4.15	.00	.000	.035	.000	.000	2514.00	7.41
.022628	0.	0.	0.	0	13	0	.00	183.18	190.59

 0
 *SECNO .900
 3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, K-RATIO = 3.65

.900	1.14	2515.14	.00	.00	2515.20	.06	.38	.02	2517.00
400.	0.	400.	0.	0.	211.	0.	0.	0.	2517.00
.01	.00	1.90	.00	.000	.035	.000	.000	2514.00	5.55
.001702	90.	90.	90.	4	0	0	.00	185.50	192.45

 0
 *SECNO 1.900

1.900	1.29	2515.29	.00	.00	2515.34	.04	.14	.00	2517.00
400.	0.	400.	0.	0.	238.	0.	1.	1.	2517.00
.03	.00	1.68	.00	.000	.035	.000	.000	2514.00	5.12
.001148	100.	100.	100.	3	0	0	.00	187.76	192.88

 0 2.230

400.	0.	400.	0.	0.	247.	0.	1.	1.	2517.00
.04	.00	1.52	.00	.000	.035	.000	.000	2514.00	4.93
.001031	33.	33.	33.	0	0	0	.00	185.04	193.02

0
*SECND 2.320

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, K-RATIO = 7.30

2.320	4.37	2515.37	.00	.00	2515.38	.00	.00	.00	2517.00
400.	0.	400.	0.	0.	845.	0.	1.	1.	2517.00
.04	.00	.47	.00	.000	.035	.000	.000	2511.00	4.88
.000019	9.	9.	9.	2	0	0	.00	206.24	211.12

0
1

2/21/91 14:55:43

PAGE 3

SECND	DEPTH	CWSEL	CRWS	WSELK	EG	HV	HL	GLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*SECND 2.900

2.900	4.37	2515.37	.00	.00	2515.38	.00	.00	.00	2517.00
400.	0.	400.	0.	0.	845.	0.	2.	1.	2517.00
.07	.00	.47	.00	.000	.035	.000	.000	2511.00	4.88
.000019	58.	58.	58.	2	0	0	.00	206.25	211.12

0

*SECND 3.900

3.900	4.38	2515.38	.00	.00	2515.38	.00	.00	.00	2517.00
400.	0.	400.	0.	0.	845.	0.	4.	2.	2517.00
.13	.00	.47	.00	.000	.035	.000	.000	2511.00	4.87
.000019	100.	100.	100.	0	0	0	.00	206.26	211.13

0

*SECND 4.900

4.900	4.38	2515.38	.00	.00	2515.38	.00	.00	.00	2517.00
400.	0.	400.	0.	0.	845.	0.	6.	2.	2517.00
.19	.00	.47	.00	.000	.035	.000	.000	2511.00	4.86
.000019	100.	100.	100.	0	0	0	.00	206.27	211.14

0

*SECND 5.900

5.900	4.33	2515.38	.00	.00	2515.38	.00	.00	.00	2517.00
400.	0.	400.	0.	0.	846.	0.	8.	3.	2517.00
.25	.00	.47	.00	.000	.035	.000	.000	2511.00	4.86
.000019	100.	100.	100.	0	0	0	.00	206.28	211.14

0

1

2/21/91 14:55:43

PAGE 4

T1 USDA FOREST SERVICE 800 CFS
T2
T3

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
		3			-1				2514.4	
J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIX	ITRACE
	2		-1							

1

2/21/91 14:55:43

PAGE 5

SECND	DEPTH	CWSEL	CRWS	WSELK	EG	HV	HL	GLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*PROF 2

0

CCHV= .100 CEHV= .300

*SECND .000

3720 CRITICAL DEPTH ASSUMED

.000	.85	2514.85	2514.85	2514.40	2515.26	.42	.00	.00	2517.00
800.	0.	800.	0.	0.	154.	0.	0.	0.	2517.00
.00	.00	5.13	.00	.000	.035	.000	.000	2514.00	5.46
.015049	0.	0.	0.	0	13	0	.00	185.07	191.54

0

*SECND .900

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, K-RATIO = 2.97

.900	1.62	2515.62	.00	.00	2515.73	.11	.44	.03	2517.00
800.	0.	800.	0.	0.	299.	0.	0.	0.	2517.00
.01	.00	2.67	.00	.000	.035	.000	.000	2514.00	4.14
.002157	90.	90.	90.	4	0	0	.00	199.71	193.85

0

*SECND 1.900

1.900	1.82	2515.82	.00	.00	2515.91	.09	.18	.00	2517.00
800.	0.	800.	0.	0.	336.	0.	1.	1.	2517.00
.02	.00	2.38	.00	.000	.035	.000	.000	2514.00	3.56
.001481	100.	100.	100.	2	0	0	.00	190.88	194.44

0

*SECND 2.230

2.230	1.87	2515.87	.00	.00	2515.96	.08	.05	.00	2517.00
800.	0.	800.	0.	0.	349.	0.	1.	1.	2517.00
.03	.00	2.29	.00	.000	.035	.000	.000	2514.00	3.35
.001309	33.	33.	33.	0	0	0	.00	191.29	194.64

0

*SECND 2.320

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRAATIO = 5.10

2.320	4.95	2515.95	.00	.00	2515.96	.01	.00	.01	2517.00
800.	0.	800.	0.	0.	965.	0.	2.	1.	2517.00
.03	.00	.83	.00	.000	.035	.000	.000	2511.00	3.14
.000050	9.	9.	9.	2	0	0	.00	209.72	212.85

0

2/21/91 14:55:43

PAGE 6

SECND	DEPTH	CWSEL	CRWS	WSELK	EG	HV	HL	GLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CDRAR	TOPWID	ENDST

*SECND 2.900

2.900	4.95	2515.95	.00	.00	2515.97	.01	.00	.00	2517.00
800.	0.	800.	0.	0.	965.	0.	3.	1.	2517.00
.05	.00	.83	.00	.000	.035	.000	.000	2511.00	3.13
.000050	58.	58.	58.	2	0	0	.00	209.74	212.87

0

*SECND 3.900

3.900	4.95	2515.95	.00	.00	2515.97	.01	.01	.00	2517.00
800.	0.	800.	0.	0.	967.	0.	5.	2.	2517.00
.08	.00	.83	.00	.000	.035	.000	.000	2511.00	3.11
.000050	100.	100.	100.	0	0	0	.00	209.77	212.89

0

*SECND 4.900

4.900	4.97	2515.97	.00	.00	2515.98	.01	.00	.00	2517.00
800.	0.	800.	0.	0.	968.	0.	7.	2.	2517.00
.11	.00	.83	.00	.000	.035	.000	.000	2511.00	3.10
.000050	100.	100.	100.	0	0	0	.00	209.80	212.90

0

*SECND 5.900

5.900	4.97	2515.97	.00	.00	2515.98	.01	.00	.00	2517.00
800.	0.	800.	0.	0.	969.	0.	10.	3.	2517.00
.15	.00	.83	.00	.000	.035	.000	.000	2511.00	3.08
.000050	100.	100.	100.	0	0	0	.00	209.83	212.92

0

2/21/91 14:55:43

PAGE 7

T1 USDA FOREST SERVICE 550 CFS
T2
T3

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FG
		4			-1				2514.5	
J2	NPROF	IPLOT	PREVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
		3		-1						

2/21/91 14:55:43

PAGE 8

SECND	DEPTH	CWSEL	CRWS	WSELK	EG	HV	HL	GLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CDRAR	TOPWID	ENDST

*PROF 3

DCHV= .100 CEHV= .300

*SECNO .000

3720 CRITICAL DEPTH ASSUMED

.000	.95	2514.95	2514.95	2514.50	2515.41	.47	.00	.00	2517.00
950.	0.	950.	0.	0.	173.	0.	0.	0.	2517.00
.00	.00	5.49	.00	.000	.035	.000	.000	2514.00	5.15
.018369	0.	0.	0.	0	13	0	.00	185.68	191.64

*SECNO .300

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATID = 2.85

.900	1.75	2515.75	.00	.00	2515.90	.13	.45	.03	2517.00
950.	0.	950.	0.	0.	328.	0.	1.	0.	2517.00
.01	.00	2.90	.00	.000	.035	.000	.000	2514.00	3.69
.002267	90.	50.	90.	3	0	0	.00	190.62	194.31

*SECNO 1.900

1.900	1.98	2515.98	.00	.00	2516.08	.10	.19	.00	2517.00
950.	0.	950.	0.	0.	367.	0.	1.	1.	2517.00
.02	.00	2.59	.00	.000	.035	.000	.000	2514.00	3.07
.001567	100.	100.	100.	2	0	0	.00	191.56	194.93

*SECNO 2.230

2.230	2.04	2516.04	.00	.00	2516.13	.10	.05	.00	2517.00
950.	0.	950.	0.	0.	380.	0.	2.	1.	2517.00
.02	.00	2.50	.00	.000	.035	.000	.000	2514.00	2.87
.001399	33.	33.	33.	0	0	0	.00	192.26	195.13

*SECNO 2.320

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATID = 4.71

2.320	5.13	2516.13	.00	.00	2516.14	.01	.00	.01	2517.00
950.	0.	950.	0.	0.	1002.	0.	2.	1.	2517.00
.03	.00	.95	.00	.000	.035	.000	.000	2511.00	2.61
.000063	9.	9.	9.	2	0	0	.00	210.78	213.39

2/21/91 14:55:43

PAGE 9

SECNO	DEPTH	QWSEL	CRITWS	WSELK	EG	HV	HL	QLOSS	BANK	ELEV
Q	QLOS	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT	
TIME	VLDE	VCH	VRDB	XNL	XNCH	XNR	WTN	ELMIN	SSTA	
SLOPE	XLOBL	XLCH	XLDBR	ITRIAL	IDC	ICONT	CDRAR	TDWID	ENDST	

*SECNO 2.900

2.900	5.13	2516.13	.00	.00	2516.15	.01	.00	.00	2517.00
950.	0.	950.	0.	0.	1003.	0.	3.	1.	2517.00
.04	.00	.95	.00	.000	.035	.000	.000	2511.00	2.50
.000063	58.	58.	58.	2	0	0	.00	210.80	213.40

*SECNO 3.900

3.900	5.14	2516.14	.00	.00	2516.15	.01	.01	.00	2517.00
950.	0.	950.	0.	0.	1004.	0.	5.	2.	2517.00
.07	.00	.95	.00	.000	.035	.000	.000	2511.00	2.58
.000063	100.	100.	100.	0	0	0	.00	210.84	213.42

*SECNO 4.900

4.900	5.15	2516.15	.00	.00	2516.16	.01	.01	.00	2517.00
950.	0.	950.	0.	0.	1005.	0.	8.	2.	2517.00
.10	.00	.94	.00	.000	.035	.000	.000	2511.00	2.56
.000062	100.	100.	100.	0	0	0	.00	210.88	213.44

*SECNO 5.900

5.900	5.15	2516.15	.00	.00	2516.17	.01	.01	.00	2517.00
950.	0.	950.	0.	0.	1007.	0.	10.	3.	2517.00
.13	.00	.94	.00	.000	.035	.000	.000	2511.00	2.54
.000062	100.	100.	100.	0	0	0	.00	210.92	213.46

2/21/91 14:55:43

PAGE 10

T1 USDA FOREST SERVICE 1400 CFS

T2
T3

J1	ICHECK	INO	NINV	IDIR	STAT	METRIC	HVINS	B	WSEL	FR
		5			-1				2514.6	
J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIN	ITRACE

SECNO	DEPTH	CWSEL	CRWS	WSELK	EG	HV	HL	QLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XLN	XLNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	IDCNT	CORAR	TOPWID	ENDST

*PROF 4

0

CCHV= .100 CEHV= .300

*SECNO .000

3720 CRITICAL DEPTH ASSUMED

.000	1.23	2515.23	2515.23	2514.60	2515.83	.60	.00	.00	2517.00
1400.	0.	1400.	0.	0.	225.	0.	0.	0.	2517.00
.00	.00	6.21	.00	.000	.035	.000	.000	2514.00	5.32
.015800	0.	0.	0.	0	13	0	.00	187.36	152.68

0

*SECNO .900

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIC = 3.57

.900	2.15	2516.15	.00	.00	2516.34	.19	.47	.04	2517.00
1400.	0.	1400.	0.	0.	402.	0.	1.	0.	2517.00
.01	.00	3.45	.00	.000	.035	.000	.000	2514.00	2.54
.002547	90.	90.	90.	3	0	0	.00	192.93	195.46

0

*SECNO 1.900

1.900	2.41	2516.41	.00	.00	2516.56	.15	.21	.00	2517.00
1400.	0.	1400.	0.	0.	451.	0.	2.	1.	2517.00
.02	.00	3.11	.00	.000	.035	.000	.000	2514.00	1.78
.001754	100.	100.	100.	2	0	0	.00	194.44	195.22

0

*SECNO 2.230

2.230	2.47	2516.47	.00	.00	2516.61	.14	.06	.00	2517.00
1400.	0.	1400.	0.	0.	464.	0.	2.	1.	2517.00
.02	.00	3.02	.00	.000	.035	.000	.000	2514.00	1.57
.001594	33.	33.	33.	0	0	0	.00	194.86	196.43

0

*SECNO 2.320

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIC = 3.96

2.320	5.60	2516.60	.00	.00	2516.63	.03	.00	.01	2517.00
1400.	0.	1400.	0.	0.	1102.	0.	2.	1.	2517.00
.02	.00	1.27	.00	.000	.035	.000	.000	2511.00	1.20
.000102	9.	9.	9.	2	0	0	.00	213.60	214.80

0

1

SECNO	DEPTH	CWSEL	CRWS	WSELK	EG	HV	HL	QLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XLN	XLNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	IDCNT	CORAR	TOPWID	ENDST

*SECNO 2.900

2.900	5.61	2516.61	.00	.00	2516.63	.02	.01	.00	2517.00
1400.	0.	1400.	0.	0.	1103.	0.	4.	1.	2517.00
.03	.00	1.27	.00	.000	.035	.000	.000	2511.00	1.18
.000101	58.	58.	58.	2	0	0	.00	213.64	214.82

0

*SECNO 3.900

3.900	5.62	2516.62	.00	.00	2516.64	.02	.01	.00	2517.00
1400.	0.	1400.	0.	0.	1106.	0.	6.	2.	2517.00
.06	.00	1.27	.00	.000	.035	.000	.000	2511.00	1.15
.000101	100.	100.	100.	0	0	0	.00	213.70	214.85

0

*SECNO 4.900

4.900	5.63	2516.63	.00	.00	2516.65	.02	.01	.00	2517.00
1400.	0.	1400.	0.	0.	1108.	0.	9.	3.	2517.00
.08	.00	1.25	.00	.000	.035	.000	.000	2511.00	1.12
.000100	100.	100.	100.	0	0	0	.00	213.76	214.86

0

*SECNO 5.900

5.900	5.64	2516.64	.00	.00	2516.66	.02	.01	.00	2517.00
1400.	0.	1400.	0.	0.	1110.	0.	11.	3.	2517.00
.10	.00	1.25	.00	.000	.035	.000	.000	2511.00	1.09
.000099	100.	100.	100.	0	0	0	.00	213.82	214.91

0

1

T1 USDA FOREST SERVICE 1700 CFS
T2
T3

J1	ICHECK	IND	NINV	IDIR	STRT	METRIC	HVINS	D	WSEL	FR
		6			-1				2514.7	
J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	ISW	CHNIM	ITRACE
	5		-1							

1 2/21/91 14:55:43 PAGE 14

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	QLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*PROF 5
0
CCHV= .100 CEHV= .300
*SECNO .000
3720 CRITICAL DEPTH ASSUMED
.000 1.39 2515.39 2515.39 2514.70 2515.07 .68 .00 .00 2517.00
1700. 0. 1700. 0. 0. 256. 0. 0. 0. 2517.00
.00 .00 5.63 .00 .000 .035 .000 .000 2514.00 4.82
.016199 0. 0. 0. 0 13 0 .00 188.36 193.18

0
*SECNO .900
3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 2.46
.900 2.38 2516.38 .00 .00 2516.61 .23 .49 .05 2517.00
1700. 0. 1700. 0. 0. 446. 0. 1. 0. 2517.00
.01 .00 3.81 .00 .000 .035 .000 .000 2514.00 1.85
.002679 90. 90. 90. 3 0 0 .00 194.29 196.15

0
*SECNO 1.900
1.900 2.65 2516.65 .00 .00 2516.83 .18 .22 .00 2517.00
1700. 0. 1700. 0. 0. 499. 0. 2. 1. 2517.00
.01 .00 3.40 .00 .000 .035 .000 .000 2514.00 1.03
.001857 100. 100. 100. 2 0 0 .00 195.94 196.97

0
*SECNO 2.230
2.230 2.72 2516.72 .00 .00 2516.89 .17 .36 .00 2517.00
1700. 0. 1700. 0. 0. 513. 0. 2. 1. 2517.00
.02 .00 3.31 .00 .000 .035 .000 .000 2514.00 .81
.001698 33. 33. 33. 0 0 0 .00 196.37 197.15

0
*SECNO 2.320
3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 3.66
2.320 5.88 2516.88 .00 .00 2516.91 .03 .00 .01 2517.00
1700. 0. 1700. 0. 0. 1161. 0. 2. 1. 2517.00
.02 .00 1.45 .00 .000 .035 .000 .000 2511.00 .37
.000127 9. 9. 9. 2 0 0 .00 215.26 215.63

1 2/21/91 14:55:43 PAGE 15

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	QLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*SECNO 2.900
2.900 5.88 2516.88 .00 .00 2516.92 .03 .01 .00 2517.00
1700. 0. 1700. 0. 0. 1163. 0. 4. 1. 2517.00
.03 .00 1.45 .00 .000 .035 .000 .000 2511.00 .35
.000127 58. 58. 58. 2 0 0 .00 215.30 215.65

0
*SECNO 3.900
3.900 5.90 2516.90 .00 .00 2516.93 .03 .01 .00 2517.00
1700. 0. 1700. 0. 0. 1166. 0. 7. 2. 2517.00
.05 .00 1.45 .00 .000 .035 .000 .000 2511.00 .31
.000126 100. 100. 100. 0 0 0 .00 215.38 215.69

0
*SECNO 4.900

4.900	5.91	2515.91	.00	.00	2515.94	.03	.01	.00	2517.00
1700.	0.	1700.	0.	0.	1165.	0.	5.	2.	2517.00
.07	.03	1.45	.00	.000	.035	.000	.000	2511.00	.27
.000125	100.	100.	100.	0	0	0	.00	215.46	215.73

0

*SECND 5.900

5.900	5.92	2515.92	.00	.00	2515.95	.03	.01	.00	2517.00
1700.	0.	1700.	0.	0.	1171.	0.	12.	3.	2517.00
.09	.00	1.45	.00	.000	.035	.000	.000	2511.00	.24
.000124	100.	100.	100.	0	0	0	.00	215.53	215.75

0

2/21/91 14:55:43

PAGE 16

T1 1780
T2 USDA FOREST SERVICE 1780 CFS
T3

J1	ICHECK	INQ	NINW	IDIR	STRT	METRIC	HVINS	Q	WSEL	FG
		7			-1				2514.8	

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	15		-1							

2/21/91 14:55:43

PAGE 17

SECNO	DEPTH	CWSEL	CRWS	WSELK	EG	HV	HL	GLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLDBL	XLCH	XLOBR	ITRIAL	IDC	IDCNT	CORAR	TOPWID	ENDST

*PROF 6

0

DCHV= .100 DEHV= .300

*SECNO .000

3720 CRITICAL DEPTH ASSUMED

.000	1.43	2515.43	2515.43	2514.80	2515.14	.71	.00	.00	2517.00
1780.	0.	1780.	0.	0.	264.	0.	0.	0.	2517.00
.00	.00	6.74	.00	.000	.035	.000	.000	2514.00	4.70
.016171	0.	0.	0.	0	13	0	.00	188.55	193.30

*SECNO .900

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 2.44

.900	2.44	2516.44	.00	.00	2516.68	.24	.45	.05	2517.00
1780.	0.	1780.	0.	0.	457.	0.	1.	0.	2517.00
.01	.00	3.89	.00	.000	.035	.000	.000	2514.00	1.68
.002707	90.	90.	90.	3	0	0	.00	194.65	196.32

*SECNO 1.900

1.900	2.72	2516.72	.00	.00	2516.90	.19	.22	.00	2517.00
1780.	0.	1780.	0.	0.	512.	0.	2.	1.	2517.00
.01	.00	3.48	.00	.000	.035	.000	.000	2514.00	.84
.001880	100.	100.	100.	2	0	0	.00	196.32	197.16

*SECNO 2.230

2.230	2.79	2516.79	.00	.00	2516.97	.13	.05	.00	2517.00
1780.	0.	1780.	0.	0.	526.	0.	2.	1.	2517.00
.02	.00	3.38	.00	.000	.035	.000	.000	2514.00	.62
.001722	33.	33.	33.	0	0	0	.00	196.76	197.38

*SECNO 2.320

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 3.59

2.320	5.65	2516.95	.00	.00	2516.98	.04	.00	.01	2517.00
1780.	0.	1780.	0.	0.	1176.	0.	2.	1.	2517.00
.02	.00	1.51	.00	.000	.035	.000	.000	2511.00	.15
.000134	9.	9.	9.	2	0	0	.00	215.68	215.84

2/21/91 14:55:43

PAGE 18

SECNO	DEPTH	CWSEL	CRWS	WSELK	EG	HV	HL	GLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLDBL	XLCH	XLOBR	ITRIAL	IDC	IDCNT	CORAR	TOPWID	ENDST

SLOPE	XLDEL	XLCH	XLDBR	ITRIAL	IDC	IDONT	DOBAR	TOPWID	ENDBT
*SECND 2.500									
2.900	5.95	2516.95	.00	.00	2516.95	.04	.01	.00	2517.00
1780.	0.	1780.	0.	0.	1178.	0.	4.	1.	2517.00
.03	.00	1.51	.00	.000	.035	.000	.000	2511.00	.14
.000133	58.	58.	58.	2	0	0	.00	215.73	215.65
*SECND 3.900									
3.900	5.97	2516.97	.00	.00	2517.00	.04	.01	.00	2517.00
1780.	0.	1780.	0.	0.	1181.	0.	7.	2.	2517.00
.03	.00	1.51	.00	.000	.035	.000	.000	2511.00	.10
.000132	100.	100.	100.	0	0	0	.00	215.61	215.90
*SECND 4.900									
4.900	5.98	2516.98	.00	.00	2517.02	.04	.01	.00	2517.00
1780.	0.	1780.	0.	0.	1184.	0.	9.	2.	2517.00
.07	.00	1.50	.00	.000	.035	.000	.000	2511.00	.05
.000131	100.	100.	100.	0	0	0	.00	215.89	215.94
*SECND 5.900									
5.900	5.99	2516.99	.00	.00	2517.03	.03	.01	.00	2517.00
1780.	0.	1780.	0.	0.	1187.	0.	12.	3.	2517.00
.08	.00	1.50	.00	.000	.035	.000	.000	2511.00	.02
.000130	100.	100.	100.	0	0	0	.00	215.97	215.98

2/21/91 14:55:43 PAGE 19

THIS RUN EXECUTED 2/21/91 14:55:52

HEC2 RELEASE DATED SEP 88 UPDATED SEPT 1989

ERROR CORR - 01,02,03
MODIFICATION -

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

180 FOOT WIDE, MANNINGS

SUMMARY PRINTOUT TABLE 150

SECND	XLCH	ELTRD	ELLCD	ELMIN	Q	DWSL	CRWS	EG	10*KS	VCH	AREA	.01K	
*	.000	.00	.00	.00	2514.00	400.00	2514.53	2514.53	2514.80	226.28	4.16	96.25	26.59
*	.000	.00	.00	.00	2514.00	800.00	2514.85	2514.85	2515.26	190.49	5.19	154.28	57.96
*	.000	.00	.00	.00	2514.00	950.00	2514.95	2514.95	2515.41	183.69	5.49	173.15	70.09
*	.000	.00	.00	.00	2514.00	1400.00	2515.23	2515.23	2515.83	168.00	6.21	225.25	108.01
*	.000	.00	.00	.00	2514.00	1700.00	2515.39	2515.39	2516.07	161.99	6.63	256.48	133.57
*	.000	.00	.00	.00	2514.00	1780.00	2515.43	2515.43	2516.14	161.71	6.74	253.94	139.98
*	.900	90.00	.00	.00	2514.00	400.00	2515.14	.00	2515.20	17.02	1.90	210.95	96.96
*	.900	90.00	.00	.00	2514.00	800.00	2515.52	.00	2515.73	21.67	2.67	299.26	171.86
*	.900	90.00	.00	.00	2514.00	950.00	2515.76	.00	2515.90	22.67	2.90	327.96	199.53
*	.900	90.00	.00	.00	2514.00	1400.00	2516.15	.00	2516.34	25.47	3.49	401.70	277.43
*	.900	90.00	.00	.00	2514.00	1700.00	2516.38	.00	2516.61	26.75	3.81	443.84	328.46
*	.900	90.00	.00	.00	2514.00	1780.00	2516.44	.00	2516.68	27.07	3.89	457.24	342.13
	1.900	100.00	.00	.00	2514.00	400.00	2515.29	.00	2515.34	11.48	1.68	237.84	118.05
	1.900	100.00	.00	.00	2514.00	800.00	2515.82	.00	2515.91	14.81	2.38	336.34	207.90
	1.900	100.00	.00	.00	2514.00	950.00	2515.98	.00	2516.08	15.67	2.59	367.41	240.03
	1.900	100.00	.00	.00	2514.00	1400.00	2516.41	.00	2516.56	17.54	3.11	450.58	334.24
	1.900	100.00	.00	.00	2514.00	1700.00	2516.65	.00	2516.83	18.57	3.40	499.35	394.46
	1.900	100.00	.00	.00	2514.00	1780.00	2516.72	.00	2516.90	18.80	3.48	511.89	410.49
	2.230	33.00	.00	.00	2514.00	400.00	2515.33	.00	2515.37	10.21	1.62	246.56	125.21
	2.230	33.00	.00	.00	2514.00	800.00	2515.87	.00	2515.96	13.09	2.29	349.31	221.10
	2.230	33.00	.00	.00	2514.00	950.00	2516.04	.00	2516.13	13.99	2.50	380.44	254.01
	2.230	33.00	.00	.00	2514.00	1400.00	2516.47	.00	2516.51	15.94	3.02	464.23	350.62
	2.230	33.00	.00	.00	2514.00	1700.00	2516.72	.00	2516.85	16.58	3.31	513.47	412.54
	2.230	33.00	.00	.00	2514.00	1780.00	2516.79	.00	2516.97	17.22	3.38	526.09	428.99
*	2.320	5.00	.00	.00	2511.00	400.00	2515.37	.00	2515.36	.19	.47	644.62	513.77
*	2.320	5.00	.00	.00	2511.00	800.00	2515.95	.00	2515.95	.50	.83	965.32	1128.36
*	2.320	5.00	.00	.00	2511.00	950.00	2516.13	.00	2516.14	.63	.95	1002.37	1197.16
*	2.320	5.00	.00	.00	2511.00	1400.00	2516.60	.00	2516.53	1.02	1.27	1102.15	1389.49
*	2.320	5.00	.00	.00	2511.00	1700.00	2516.88	.00	2516.91	1.27	1.46	1161.31	1507.87
*	2.320	5.00	.00	.00	2511.00	1780.00	2516.95	.00	2516.98	1.34	1.51	1176.45	1538.69

SECNO	XLCH	ELTRD	ELLC	ELMIN		CWSL	DRWS	EG	10*KB	VCH	AREA	.01K
2.900	58.00	.00	.00	2511.00	400.00	2515.37	.00	2515.38	.19	.47	844.82	914.12
2.900	58.00	.00	.00	2511.00	800.00	2515.96	.00	2515.97	.50	.83	966.96	1131.38
2.900	58.00	.00	.00	2511.00	950.00	2516.13	.00	2516.15	.63	.95	1003.05	1198.53
2.900	58.00	.00	.00	2511.00	1400.00	2516.61	.00	2516.63	1.01	1.27	1103.40	1391.96
2.900	58.00	.00	.00	2511.00	1700.00	2516.88	.00	2516.92	1.27	1.46	1162.94	1511.17
2.900	58.00	.00	.00	2511.00	1780.00	2516.95	.00	2516.99	1.32	1.51	1178.20	1548.24
3.900	100.00	.00	.00	2511.00	400.00	2515.38	.00	2515.38	.19	.47	845.22	914.81
3.900	100.00	.00	.00	2511.00	800.00	2515.96	.00	2515.97	.50	.83	966.96	1131.38
3.900	100.00	.00	.00	2511.00	950.00	2516.14	.00	2516.15	.63	.95	1004.44	1201.14
3.900	100.00	.00	.00	2511.00	1400.00	2516.62	.00	2516.64	1.01	1.27	1105.65	1396.39
3.900	100.00	.00	.00	2511.00	1700.00	2516.90	.00	2516.93	1.26	1.46	1165.67	1516.72
3.900	100.00	.00	.00	2511.00	1780.00	2516.97	.00	2517.00	1.32	1.51	1181.09	1548.17
4.900	100.00	.00	.00	2511.00	400.00	2515.38	.00	2515.38	.19	.47	845.63	915.50
4.900	100.00	.00	.00	2511.00	800.00	2515.97	.00	2515.98	.50	.83	968.03	1133.36
4.900	100.00	.00	.00	2511.00	950.00	2516.15	.00	2516.16	.62	.94	1005.77	1203.66
4.900	100.00	.00	.00	2511.00	1400.00	2516.63	.00	2516.65	1.00	1.26	1107.74	1400.52
4.900	100.00	.00	.00	2511.00	1700.00	2516.91	.00	2516.94	1.25	1.45	1168.46	1522.39
4.900	100.00	.00	.00	2511.00	1780.00	2516.98	.00	2517.02	1.31	1.50	1183.94	1553.99
5.900	100.00	.00	.00	2511.00	400.00	2515.38	.00	2515.38	.19	.47	845.03	916.19
5.900	100.00	.00	.00	2511.00	800.00	2515.97	.00	2515.98	.50	.83	969.06	1135.25
5.900	100.00	.00	.00	2511.00	950.00	2516.15	.00	2516.17	.62	.94	1007.11	1206.18
5.900	100.00	.00	.00	2511.00	1400.00	2516.64	.00	2516.66	.99	1.26	1109.88	1404.76
5.900	100.00	.00	.00	2511.00	1700.00	2516.92	.00	2516.95	1.24	1.45	1171.09	1527.74
5.900	100.00	.00	.00	2511.00	<u>1780.00</u>	<u>2516.99</u>	.00	2517.03	1.30	1.50	1186.79	1559.83

180 FOOT WIDE, MANNINGS

SUMMARY PRINTOUT TABLE 150

SECNO	J	CWSL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
*	.000	400.00	2514.53	.00	.00	183.18	.00
*	.000	800.00	2514.85	.32	.00	185.07	.00
*	.000	950.00	2514.95	.10	.00	185.68	.00
*	.000	1400.00	2515.23	.28	.00	187.36	.00
*	.000	1700.00	2515.39	.17	.00	188.36	.00
*	.000	1780.00	2515.43	.04	.00	188.59	.00
*	.900	400.00	2515.14	.00	.61	186.90	90.00
*	.900	800.00	2515.62	.48	.77	189.71	90.00
*	.900	950.00	2515.76	.15	.82	190.62	90.00
*	.900	1400.00	2516.13	.39	.93	192.93	90.00
*	.900	1700.00	2516.38	.23	.99	194.29	90.00
*	.900	1780.00	2516.44	.06	1.01	194.63	90.00
1.900	400.00	2515.29	.00	.15	.00	187.75	100.00
1.900	800.00	2515.82	.53	.20	.00	190.88	100.00
1.900	950.00	2515.98	.16	.22	.00	191.86	100.00
1.900	1400.00	2516.41	.43	.25	.00	194.44	100.00
1.900	1700.00	2516.65	.25	.27	.00	195.94	100.00
1.900	1780.00	2516.72	.05	.28	.00	196.32	100.00
2.230	400.00	2515.33	.00	.04	.00	188.04	33.00
2.230	800.00	2515.87	.54	.03	.00	191.29	33.00
2.230	950.00	2516.04	.16	.06	.00	192.26	33.00
2.230	1400.00	2516.47	.43	.06	.00	194.86	33.00
2.230	1700.00	2516.72	.25	.07	.00	196.37	33.00
2.230	1780.00	2516.79	.06	.07	.00	196.75	33.00
*	2.320	400.00	2515.37	.00	.04	206.24	9.00
*	2.320	800.00	2515.95	.58	.08	209.72	9.00
*	2.320	950.00	2516.13	.18	.09	210.78	9.00
*	2.320	1400.00	2516.60	.47	.13	213.60	9.00
*	2.320	1700.00	2516.88	.28	.15	215.26	9.00
*	2.320	1780.00	2516.95	.07	.16	215.68	9.00
2.900	400.00	2515.37	.00	.00	.00	206.25	58.00
2.900	800.00	2515.96	.58	.00	.00	209.74	58.00
2.900	950.00	2516.13	.18	.00	.00	210.80	58.00
2.900	1400.00	2516.61	.47	.01	.00	213.54	58.00
2.900	1700.00	2516.88	.28	.01	.00	215.30	58.00
2.900	1780.00	2516.95	.07	.01	.00	215.73	58.00

SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
3.900	400.00	2515.38	.00	.00	.00	206.25	100.00
3.900	800.00	2515.96	.55	.01	.00	209.77	100.00
3.900	950.00	2516.14	.19	.01	.00	210.84	100.00
3.900	1400.00	2516.62	.48	.01	.00	213.70	100.00
3.900	1700.00	2515.90	.28	.01	.00	215.38	100.00
3.900	1780.00	2515.57	.07	.01	.00	215.81	100.00
4.900	400.00	2515.38	.00	.00	.00	206.27	100.00
4.900	800.00	2515.97	.59	.01	.00	209.80	100.00
4.900	950.00	2515.15	.18	.01	.00	210.88	100.00
4.900	1400.00	2516.63	.48	.01	.00	213.76	100.00
4.900	1700.00	2515.91	.28	.01	.00	215.45	100.00
4.900	1780.00	2516.58	.07	.01	.00	215.89	100.00
5.900	400.00	2515.38	.00	.00	.00	206.28	100.00
5.900	800.00	2515.57	.59	.00	.00	209.53	100.00
5.900	950.00	2516.15	.18	.01	.00	210.92	100.00
5.900	1400.00	2516.64	.48	.01	.00	213.62	100.00
5.900	1700.00	2515.92	.29	.01	.00	215.53	100.00
5.900	1780.00	2516.59	.07	.01	.00	215.97	100.00

1

SUMMARY OF ERRORS AND SPECIAL NOTES

CAUTION SECNO= .000 PROFILE= 1 CRITICAL DEPTH ASSUMED
 CAUTION SECNO= .000 PROFILE= 2 CRITICAL DEPTH ASSUMED
 CAUTION SECNO= .000 PROFILE= 3 CRITICAL DEPTH ASSUMED
 CAUTION SECNO= .000 PROFILE= 4 CRITICAL DEPTH ASSUMED
 CAUTION SECNO= .000 PROFILE= 5 CRITICAL DEPTH ASSUMED
 CAUTION SECNO= .000 PROFILE= 6 CRITICAL DEPTH ASSUMED

WARNING SECNO= .900 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
 WARNING SECNO= .900 PROFILE= 2 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
 WARNING SECNO= .900 PROFILE= 3 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
 WARNING SECNO= .900 PROFILE= 4 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
 WARNING SECNO= .900 PROFILE= 5 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
 WARNING SECNO= .900 PROFILE= 6 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 2.320 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
 WARNING SECNO= 2.320 PROFILE= 2 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
 WARNING SECNO= 2.320 PROFILE= 3 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
 WARNING SECNO= 2.320 PROFILE= 4 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
 WARNING SECNO= 2.320 PROFILE= 5 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
 WARNING SECNO= 2.320 PROFILE= 6 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

P O L E

Water permit Appl. No. 7509-1 USDA

B A R R E T T

T21N

T20N

Map prepared

David Brown
Natural Resources Engineer III
Bureau of Water Rights Division
Pierre, SD 57501
2/25/94

R12E R13E

85% channel length

GRAND RIVER

PLEASANT VALLEY

NATIONAL GRASSLAND

10% channel length

Proposed
dam
site

Safety of Dams Review

2/20/91 1/3

Water Permit Applic. No. 1509-1

USDA, Forest Service

South Fork Impoundment, Parkins Co., NW 1/4 SE 1/4 Sec. 39, T20N R13E

Dam Data

Normal Storage = 87.1 ac-FT @ 2,510.00 Fmsl, Surface Area = 16.1 acres

Maximum Storage = 236 ac-FT @ 2,517.00 Fmsl, Surface Area = 27.6 acres

Toe elevations = 2494.00 Fmsl

Top of Dam elevation = 2,517.00 Fmsl

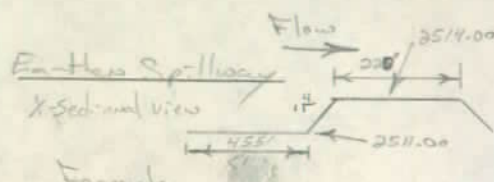
Drainage Area = 6.15 mi², 3940 ac.

Height = 2,517.00 - 2494.00 = 23 Feet

Hydraulic Data

Two discharge structures

- 1) Earthen emergency spillway
- 2) 72" riser with 48" barrel CMP



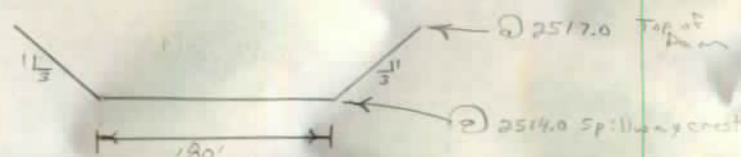
Formula

Broad Crested Weir

$$Q = CLH^{3/2}$$

$$Q = (2.5)(189')^{3/2}$$

$$Q_{max} = 2,455 \text{ cfs}$$



Where: Q = discharge (cfs)

C = coefficient of Discharge (2.5 assumed)

L = length (ft) = $\frac{1}{2}(180 + 198) = 189 \text{ ft}$

H = head (ft) = 2517 - 2514 = 3.0 ft

Check Q_{max} with HEC2

See Computer printout

HEC2 X-Sectional Data

ID#	Station	Elevation
6.90 Modified	0.0	2517.0
	20.0	2510.0
	30.0	2510.0
	67.0	2511.0
	247.0	2511.0
	350.0	2517.0

ID#	Station	Elevation
4.90 Modified	0.0	2517.0
	14.0	2512.3
	66.0	2511.0
	246.0	2511.0
	264.0	2517.0

5.90 Modified	0.0	2517.0
	67.0	2511.0
	247.0	2511.0
	265.0	2517.0

3.90 Modified	0.0	2517.0
	10.0	2513.7
	62.0	2512.0
	74.0	2511.0
	254.0	2511.0
	272.0	2517.0

Water Permit Appl. No. 1507-1

D. O.
BrownHEC2 Input Data

TD#	Station	Elevation
2.90	0.0	2517.0
modified	14.0	2512.3
	67.0	2512.0
	70.0	2511.0
	250.0	2511.0
	268.0	2517.0

2.32	0.0	2517.0
modified	14.0	2512.3
	67.0	2512.0
	70.0	2511.0
	250.0	2511.0
	268.0	2517.0

TD#	Station	Elevation
2.23	0.0	2517.0
	9.0	2514.0
	189.0	2514.0
	198.0	2517.0

1.90	0.0	2517.0
	9.0	2514.0
	189.0	2514.0
	198.0	2517.0

0.90	0.0	2517.0
	9.0	2514.0
	189.0	2514.0
	198.0	2517.0

0.00	0.0	2517.0
	9.0	2514.0
	189.0	2514.0
	198.0	2517.0

Summary of HEC2 Analysis

① Elevation 2516.99, $Q_{max} = 1780 \text{ cfs}$ with exit velocity of 6.74 cfs
 ↳ critical depth

Hydrologic Analysis

- use USGS VDOT method, Techniques for estimating Flood Peaks, Volumes, and Hydrographs on Small Streams in SD, Water Resources Investigations 80-80, September, 1980.

Given: Drainage Area = 6.15 mi²

Soil Infiltration Index = 2.66 (Fig. 13)

Main Channel Slope = $(2748 \text{ ft} - 2503 \text{ ft}) / (5.4 \text{ mi} \times 5280) = 61 \text{ ft/mi}$
 ↳ taken from USGS Topo map

total length of channel

Results

- From computer printout

$Q_{25} = 748 \text{ cfs}$, $Q_{50} = 1078 \text{ cfs}$, $Q_{100} = 1477 \text{ cfs}$

Water Permit Application No. 1509-1David
BrownSummary of Safety of Dams Review

- 1) Q_{max} of emergency spillway = 1780 cfs (HEC2)
- 2) Q_{max} of 72" rise & 40' tunnel not determined
- 3) Spillway design flood 74:02:08:07 = 25 year frequency
- Small Category 3 dam which qualifies for 74:02:08:07.01 exception

Intermediate storage = 87.1 ac-ft

Effective length = 23 Feet

Product = $(87.1 \text{ ac-ft}) \times (23 \text{ Feet}) = 2003$ which is less than 3000

- 4) $Q_{25} = 748 \text{ cfs}$
- 5) Emergency spillway will easily pass the 25 year frequency storm & will also pass the 100 year storm
- 6) All contents of plans & specifications have been submitted to the Chief Engineer pursuant to 74:02:08:07 Safety Dams Rules
- 7) All Safety of Dams requirements have been met by the applicant

Form C

CERTIFICATE OF WITHDRAWAL OF
WATER FOR APPROPRIATION

TO

UNITED STATES DEPARTMENT OF Interior
BUREAU OF Reclamation

Priority Date
March 27, 1949

Withdrawal No. US 594-1

Grand River
Stream

The United States of America acting through K. F. Vernon, Regional Director, Region 6, Bureau of Reclamation, United States Department of the Interior, having made application for the withdrawal of certain heretofore unappropriated public waters of the State of South Dakota, and having complied with the requirements of the statute of the State of South Dakota providing for such withdrawal, such statute and authority being contained in and described as Section 61.0137 of the South Dakota Code of 1939, now therefore:

All unappropriated water of the Grand River and its tributaries and their sources of supply, including definite streams and water courses, and including natural springs now or hereafter subject to appropriation, including all waste seepage and return flow waters from any operations or uses, in connection with a reclamation development to be constructed by the Bureau of Reclamation, are hereby withdrawn from future appropriation during the continuance of the right herein granted and contained.

Part of the reserved waters under this application will be conserved and controlled by a dam on the Grand River situated in the E $\frac{1}{2}$ Sec. 24; SE $\frac{1}{4}$, NE $\frac{1}{2}$ Sec. 25; NE $\frac{1}{2}$ Sec. 36, all in Twp. 21 N. of Range 15 East of the Black Hills Meridian; and SW $\frac{1}{2}$ Sec. 18; NW $\frac{1}{2}$ Sec. 19, all in Twp. 21 N. of Range 16 East of the Black Hills Meridian, to form a reservoir with a capacity of about 467,000 acre-feet and utilized, in part, by means of a distributary system to serve the lands ultimately included within said reclamation development.

The waters, both those allowed to flow naturally and those conserved and controlled by said dam, will be used for domestic, municipal, stock water, irrigation, mining, or industrial purposes, and such other uses as the Congress of the United States has or shall hereafter authorize.

A map included with the notice (2-35-Muron, S. Dak. 3-29-48) is a general map of the proposed dam and reservoir and reclamation development.

This certificate and withdrawal shall in no manner prejudice, alter, amend or effect the rights of any prior appropriator or prior appropriation of water, nor of any application for appropriation pending upon the date of this certificate, but the rights and privileges of any and all such prior appropriators or applicants for appropriation of water shall remain inviolate and intact, the same as if the within withdrawal had not been made.

This certificate shall be and is subject to cancellation in accordance with the provisions of the statute hereinbefore referred to and under the authority of which this certificate is issued.

AND ON RECORD IN THE OFFICE OF THE REGIONAL DIRECTOR OF THE NATIONAL BUREAU OF STANDARDS FOR PERMANENT RECORDS
RECORDS SECTION, SECTION 4571
REL. 90-1
1-22-49
DATE RECORDED
FILED
Grand River

DESIGN REPORT

PROJECT: SOUTH FORK IMPOUNDMENT
SD-060-01

LOCATION: S.W.1/4 SECTION 29 TWP.20N. RGE.13.
Perkins County, South Dakota

MARSH DATA: Full Service Level (FSL) @ 2510.0
16.1 Surface Acres @ FSL
87.1 Acre-Feet Capacity @ FSL



CLASSIFICATION OF PROPOSED DAM:

Based on the classification criteria outlined in Chapter 74:02:08 "Safety of Dams," it is recommended that the proposed dam be classified as a small, Category 3 dam. No loss of life and minimal economic loss potential is expected should failure occur. The product of the maximum storage capacity times the effective height is 5520.

PRELIMINARY RISK ASSESSMENT

Ducks Unlimited constructed a dam known as Pasture 6EN in 1985 approximately 3 stream miles downstream of the proposed Impoundment. There are no structures between the proposed impoundment and the existing impoundment. The primary and emergency spillways in the proposed South Fork Impoundment are designed to pass similar runoff events as the spillways in the existing 6EN Impoundment. Minimal economic loss potential is expected should failure occur to either South Fork or 6EN.

DESIGN:

The watershed consists of approximately 6.15 square miles. The primary spillway consist of a 72" riser and a 48" barrel constructed of corrugated metal pipe. The plunge pool is lined with rock riprap. The emergency spillway is 180 ft. wide having a level crest of approximately 200 ft long. The maximum velocity on the level crest during the 100 year event is 3.7 fps. The top of the finished grade of the embankment is such that a minimum of 1 ft. of freeboard is available during the 100 year event. The level crest will be constructed at elevation 2514.0

The Soil Conservation Service (SCS) TR-20 Hydrology program was used to determine the discharge at various reservoir stages with respect to time. The program uses accepted procedures to develop inflow and outflow hydrographs. An antecedent moisture condition (AMC II) was used in the computations resulting in a conservative estimate of runoff and peak flows. The primary spillway capacity was calculated by comparing discharges developed by the weir flow formula and formulas for calculating head loss through

corrugated metal pipe. The emergency spillway capacity was calculated using Technical Release No. 39 Hydraulics of Broad-Crested Spillways developed by the SCS.

The following is a relationship between peak inflows, corresponding outflows, and reservoir elevations:

<u>EVENT</u> <u>YR</u>	<u>PEAK</u> <u>IN</u> <u>CFS</u>	<u>RUNOFF</u> <u>VOLUME</u> <u>AC-FT</u>	<u>MAX WATER</u> <u>ELEVATION</u> <u>MSL</u>	<u>PEAK</u> <u>OUT</u> <u>FT</u>	<u>AVAILABLE</u> <u>FREEBOARD</u> <u>CFS</u>	<u>FLOW</u> <u>IN E.S.</u> <u>FT</u>
5	432	285	2513.99	222	3.25	0
10	641	398	2514.97	433	2.28	197
100	1315	753	2516.20	1251	1.05	950

Dated: January 8, 1991

Submitted By:



Roger Smith, P.E
PE-4325

United States
Department of
Agriculture

Forest
Service

Grand River
Ranger
District

P.O. Box 390
Lemmon, SD 57638

Reply To: 6300

Date: January 17, 1991

State of South Dakota Water Rights Division
523 E. Capitol
Pierre, SD 57501

Dear Sir:

Enclosed is an Application for Permit to Appropriate Water for your review. The filing fee will be coming within the next month from our Finance Center in New Orleans.

If you have any questions regarding this application, please contact me at (605) 374-3592. Thank you.

Sincerely,



TERRY JONES
Acting District Ranger

Enclosure





DUCKS
UNLIMITED
INC.

DUCKS UNLIMITED, INC.
GREAT PLAINS REGIONAL OFFICE

6115 East Main Avenue
Bismarck, North Dakota, 58501
(701) 258-5599

January 31, 1991

Terry Jones
Grand River District
PO Box 390
Lemmon, SD 57638

RE: South Fork Impoundment

Mr. Jones:

With this letter I am sending the revised preliminary plans for the South Fork Project to Don McGuire and the SD Water Rights Division. I have incorporated the information from the soil investigation into these revised preliminary plans.

Sincerely,

Roger Smith, P.E.
Regional Engineer

cc: Ms. Louise Odegaard
Don McGuire
Ron Duvall



DEPARTMENT OF WATER & NATURAL RESOURCES

Joe Foss Building
523 East Capitol
Pierre, South Dakota 57501-3181

February 6, 1991

USDA, Forest Service
Terry Jones
PO Box 390
Lemmon SD 57638

Dear Mr. Jones:

In regard to your water permit application submitted January 22, 1991 for the South Fork Impoundment Project, the following needs to be clarified. The application indicates the location of the point of diversion to be located in the SW 1/4 Section 29, T20N, R13E. It appears from looking at the map submitted with the application, that the diversion point would be located in the NW 1/4 SE 1/4 Section 29, T20N, R13E. Enclosed is a map we have prepared showing where we believe the point of diversion will be located. Please confirm which location is correct? Also, will this project impound water into any other quarter-quarter section?

If you have any questions, please contact this office.

Sincerely,

Karen Schlaak
Natural Resources Analyst
605 773-3352

enclosure

United States
Department of
Agriculture

Forest
Service

Grand River
Ranger
District

P.O. Box 390
Lemmon, SD 57638

Date: February 13, 1991

Karen Schlaak
Natural Resource Analyst
South Dakota Department of Water and Natural Resources
Joe Foss Building
523 East Capitol
Pierre, SD 57501



Dear Ms. Schlaak:

In reference to your letter dated February 6, 1991, it appears that you are correct in your estimation of the legal description for the location of the diversion point of the South Fork Impoundment Project. The diversion point will be located in the NW1/4 SE 1/4 Section 29, T20N, R13E, and not as it appears on the Water Application we submitted. When the reservoir is full, water will back up into the SW1/4 NE1/4 Section 29.

Sincerely,

A handwritten signature in cursive script, appearing to read "Terry Jones".

Terry Jones
Acting District Ranger



DEPARTMENT OF WATER & NATURAL RESOURCES

Joe Foss Building
523 East Capitol
Pierre, South Dakota 57501-3181

March 28, 1991

Roger Smith, P.E.
Regional Engineer
Ducks Unlimited, Inc.
6115 East Main Avenue
Bismarck, North Dakota 58501

Dear Mr. Smith:

We have reviewed the plans and specifications submitted for the South Forks Impoundment Project in Perkins, County, South Dakota. The plans and specifications as submitted are approved.

Our review was to determine compliance with the requirements specified by the Water Management Board Safety of Dams Rules, Chapter 74:02:08. Approval of these plans and specifications does not release the U.S. Forest Service as owner of the South Fork Impoundment Project from the responsibility for operating and maintaining the dam in good repair to assure the safety of the project.

If you have any questions, please let us know.

Sincerely,

Gale N. Selken, P.E.
Natural Resources Engineer IV
for John Hatch, Chief Engineer
Water Rights Division
605 773-3352

cc: Terry Jones, USDA Forest Service, Grand River District

REPORT ON
WATER RIGHT APPLICATION NO. 1509-1
USDA FOREST SERVICE
MARCH 26, 1991

Water Permit Application No. 1509-1 was filed by the USDA Forest Service to impound 87 acre-feet of water by constructing a dam in the South Fork Improvement Area. The dam is to be located in the NW 1/4 SE 1/4 of Section 29-T20N-R13E in Perkins County. Water is to be stored annually to the primary spillway elevation of 2510 feet mean sea level and the water is to be used to provide habitat for fish and wildlife production and recreational use.

Discussion:

Water Permit Application No. 1509-1 is located on a tributary to the South Fork of the Grand River. There are no other Water Rights/Permits on this tributary; however, there are three other Water Rights/Permits on the South Fork of the Grand River between Water Permit Application No. 1509-1 and the U.S. Bureau of Reclamation's Shadehill Reservoir. The following table is a summary of these Water Rights/Permits in an upstream to downstream order.

Water Right/Permit No.	Name	Priority Date	Diversion Rate	Acres Irrigated
678-1	Morris O. Jensen	03/13/63	1.5 cfs	106.7
1196-1	Margaret Starkey	04/17/80	1.14 cfs	80.0
1042-1	Marlo D. Johnson	12/11/74	0.92 cfs	64.3

The U.S. Bureau of Reclamation holds U.S. Withdrawal No. 594-1 for the Shadehill Dam and Reservoir. This project is located at the confluence of the North Fork and South Fork of the Grand River and would be approximately 20 miles downstream from Water Permit Application No. 1509-1. Water Rights/Permits issued out of the Grand River have a standard Grand River qualification addressing the Bureau's U.S. Withdrawal No. 594-1.

The South Fork Improvement Project will have a drainage area above the dam of approximately 6.15 square miles. This drainage will produce an estimated runoff volume of 285 acre-feet for a 5 year event, and 641 acre-feet for a 10-year event, and 753 acre-feet for a 100-year event. Approval of Water Permit Application No. 1509-1 should have no adverse effect of the existing Water Rights/Permits on the South Fork of the Grand River.

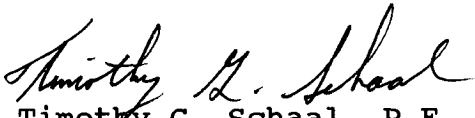
The South Fork Improvement Dam will be 23 feet high and have a normal storage capacity (spillway elevation) of 87 acre-feet and a maximum storage capacity (top of dam elevation) of 236 acre-feet. The dam will be classified as a small size Category 3, low hazard dam. A dam of this size and category is required to have the minimum spillway

capacity to pass a 25-year frequency event without overtopping the embankment. The South Fork Improvement Dam will have the spillway capacity to pass a 100-year frequency event without overtopping the embankment. The plans and specifications for this project have been submitted and approved.

Conclusion:

1. Water Permit Application No. 1509-1 should be approved. Approval of Water Permit Application No. 1509-1 should have no adverse effect on existing downstream Water Rights/Permits.
2. Water Permit Application No. 1509-1 should have the standard low flow by-pass qualification for downstream domestic use and prior water rights and the following Grand River qualification.

Flows of the Grand River proposed for use under this permit are included under U.S. Withdrawal No. 594-1 for storage in Shadehill Reservoir. Restrictions on the use of water granted under this permit may be necessary if the Bureau of Reclamation Develops the Shadehill Unit Irrigation Project as proposed under such withdrawal.



Timothy G. Schaal, P.E.
Natural Resources Engineer III

Reviewed by:



Gale N. Selken, P.E.
Natural Resources Engineer IV

References:

Water Rights Division, 1991, Water Rights/Permit Files, DWNr, Joe Foss Building, Pierre, SD

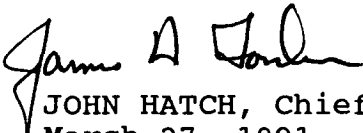
RECOMMENDATION OF CHIEF ENGINEER FOR WATER PERMIT
APPLICATION NO. 1509-1, USDA, Forest Service

Pursuant to SDCL 46-2A-2, the following is the recommendation of the Chief Engineer, Water Rights Division, Department of Water and Natural Resources concerning Water Permit Application No. 1509-1, USDA, Forest Service, PO Box 390, Lemmon, SD.

The Chief Engineer is recommending APPROVAL of Application No. 1509-1 because 1) there is reasonable probability that there is unappropriated water available for the applicant's proposed use, 2) the proposed diversion can be developed without unlawful impairment of existing rights, 3) the proposed use is a beneficial use, and 4) in the public interest with the following qualifications:

1. Low flows as needed for downstream domestic use, including livestock water and prior water rights must be by-passed.
2. Flows of the Grand River proposed for use under this permit are included under U.S. Withdrawal No. 594-1 for storage in Shadehill Reservoir. Restrictions on the use of water granted under this permit may be necessary, if the Bureau of Reclamation develops the Shadehill Unit Irrigation Project as proposed under such withdrawal.
3. Approval of Permit No. 1509-1 authorizes storage of up to 87 acre-feet annually.

See report on application for additional information.


For JOHN HATCH, Chief Engineer
March 27, 1991



DEPARTMENT OF WATER & NATURAL RESOURCES

Joe Foss Building
523 East Capitol
Pierre, South Dakota 57501-3181

NOTE: TO BE SURE OF PUBLICATION ON
THE CORRECT DATES, CONTACT
THE NEWSPAPER RIGHT AWAY.

March 28, 1991

Terry Jones
USDA, Forest Service
PO Box 390
Lemmon, SD 57638

Dear Mr. Jones:

Water Permit Application No. 1509-1 for wildlife production and recreational use has been examined and found to comply with the South Dakota Water Laws and applicable rules. A notice of hearing has been sent to the Publisher of The Bison Courier printed at Bison, SD. For your information, a copy of the notice, the recommendation of the Chief Engineer and a report on the application are enclosed. Please review the notice prior to publication and notify this office, if you have any corrections or questions.

Be sure to contact the above newspaper to authorize publication of your Notice of Hearing and to arrange for payment. Early contact with the paper can eliminate delays. The publisher has been instructed to publish your notice once each week for two consecutive weeks with the last publication to occur twenty days before the board meeting. The newspaper has been instructed to send us the Proof of Publication. We must receive Proof of Publication before action can be taken on the application.

Sincerely,

Eric Gronlund
Eric Gronlund
Natural Resources Engineer
605 773-3352

enclosures

NOTE: If you plan to contest any part of the Chief Engineer's recommendation, you must file a petition pursuant to the procedures outlined in the attached notice of hearing. The Water Management Board will then consider your concerns during a hearing on the application.



DEPARTMENT OF WATER & NATURAL RESOURCES

Joe Foss Building
523 East Capitol
Pierre, South Dakota 57501-3181

March 28, 1991

The Bison Courier
Box 429
Bison, SD 57620

ATTENTION: Legal Department

Enclosed is a Notice of Hearing on Application No. 1509-1 to be published twice. Please publish the first notice on April 3, 1991, with the second publication 7 days later.

The APPLICANT MUST VERIFY TO YOU THAT THE NOTICE IS TO BE PUBLISHED, before you make the first publication. Please BILL the APPLICANT for the cost of publication. The APPLICANT is the USDA, Forest Service, PO Box 390, Lemmon, SD 57638.

A copy of BOTH publications must be SENT to the WATER RIGHTS DIVISION. IMMEDIATELY return the FIRST publication with the FIRST Transmittal form on the bottom of this page. The first copy is needed to check the publication for errors so any corrections can be made in the second publication. Publication errors can invalidate the public notice and cause the applicant costly delays.

Please be sure the SECOND publication is returned IMMEDIATELY with the enclosed Proof of Publication form. DO NOT WAIT until the end of the month or the billing cycle. No action may be taken on the permit application until proof of publication has been received.

Sincerely,

Eric Gronlund
Eric Gronlund
Natural Resources Engineer
605 773-3352

enclosures

-----CUT HERE-----
FIRST TRANSMITTAL NOTICE TO: Eric Gronlund
Water Rights Division
Joe Foss Building
Pierre SD 57501-3181

No. _____

Date _____

We are in receipt of your letter of _____ enclosing Notice of Hearing to
Appropriate Water by Application No. _____ which was first published in our issue
of _____. ENCLOSED IS A COPY OF THIS FIRST PUBLICATION.

Name _____

Newspaper _____

Instruction to Newspaper - Publish first Notice on April 3, 1991, with the second publication 7 days later. The applicant is responsible for payment.

NOTICE OF HEARING on Application No. 1509-1 to Appropriate Water

Notice is given that the USDA, Forest Service, PO Box 390, Lemmon, SD 57638 has filed an application for a water permit to impound 87 acre-feet of water by constructing a dam in the South Fork Improvement Project Area. The dam site is to be located in the NW 1/4 SE 1/4 and water may also be impounded in the SW 1/4 NE 1/4; all in Section 29-T20N-R13E. Water is to be stored annually to an approximate elevation of 2510 feet mean sea level and is to be used to provide habitat for fish and wildlife production and recreational use.

Pursuant to SDCL 46-2A-2, the Chief Engineer recommends APPROVAL of Application No. 1509-1 because 1) unappropriated water is available, 2) existing rights will not be unlawfully impaired, 3) it is a beneficial use of water, and 4) it is in the public interest. Unless a petition is filed opposing the application or the applicant files a petition contesting the chief engineer's recommendation, the Water Management Board will NOT CONDUCT a HEARING to consider this application and the chief engineer will issue the permit as recommended. Petitions filed in support of the application will NOT require the Board to hear the application.

Any person interested in opposing or supporting this application must file a written petition with BOTH the applicant and Chief Engineer. The applicant must also file a petition if opposed to the Chief Engineer's recommendation. The Chief Engineer's address is "Water Rights Division, Foss Building, 523 E Capitol, Pierre SD 57501 (605 773-3352)" and the applicant's mailing address is given above. A petition filed by either an interested person or the applicant must be filed by April 22, 1991. The petition may be informal, but must include a statement describing the petitioner's interest in the application, the petitioner's reasons for opposing or supporting the application, and the signature and mailing address of the petitioner or the petitioner's legal counsel, if legal counsel is obtained.

For purposes of publishing 1) the notice of hearing on Application No. 1509-1 and 2) the chief engineer's recommendation, a Board meeting is scheduled for May 1, 1991, at 10:00 am in the meeting room at Chef Louie's, 601 E. Havens, Mitchell, SD. If this application is opposed or the recommendation is contested, the May 1, 1991, hearing date may be rescheduled for another Board meeting. If the hearing is rescheduled, notice of the time and place will be given by First Class Mail to the applicant and persons filing petitions. Anyone not filing a petition, but interested in attending the hearing, may contact the Division of Water Rights to confirm a hearing date and location. The May 1, 1991, hearing date will be automatically delayed for at least 20 days upon written request to the Chief Engineer from the applicant or any interested person opposing the application. The request for an automatic delay must be filed by April 22, 1991.

If a hearing is held, the Chief Engineer's recommendation is not final or binding upon the Board. The Board is authorized to 1) approve, 2) approve with qualifications, 3) defer, or 4) deny this application based on the facts presented at the public hearing. Any hearing will be an adversary proceeding. Any person filing a petition and/or the applicant have the right to be represented by a lawyer and may present evidence or cross-examine witnesses according to SDCL 1-26. These and other due process rights will be forfeited if not exercised. Decisions of the Board may be appealed to the Circuit Court and State Supreme Court as provided by law. Contact the Water Rights Division to request copies of information pertaining to this application or to assure access to the hearing by the handicapped.

This application is made pursuant to SDCL 46-1-1 thru 46-1-9, 46-1-12 thru 46-1-16; 46-2-3.1, 46-2-9, 46-2-11, 46-2-13, 46-2-17; 46-2A-1 thru 46-2A-10, 46-2A-12, 46-2A-14, 46-2A-15; 46-5-1 thru 46-5-11, 46-5-13 thru 46-5-15, 46-5-24, 46-5-25, 46-5-30.2, 46-5-30.4, 46-5-31; and Board Rules ARSD 74:02:01:01 thru 74:02:01:15.

THE BISON COURIER

Affidavit of Publication



STATE OF SOUTH DAKOTA)

County of Perkins

ss.

Paulette D. Ellison of said State and
County being duly sworn on her oath says: That she is the SECRETARY
of THE BISON COURIER, a weekly newspaper of general circulation
printed and published in the City of Bison, County of Perkins, State of
South Dakota.

Notice of Hearing - Appropriate Water

.....
printed copy of which is hereunto annexed, was published in the regular
and entire issue of said newspaper during the period and time of
publication, and that notice was published in the newspaper proper, and
not in a supplement.

once a week for 2 successive weeks, to-wit:

Wednesday, 4-3 91

Wednesday, 4-10 91

Wednesday, 19

Wednesday, 19

Wednesday, 19

Wednesday, 19

FEE \$ 57.84

..... Paulette D. Ellison SECRETARY

Sworn and subscribed to before me this 22. day of April ...
A.D., 1991.

Linda Tech
Comm. Exp. 7-18-91

**NOTICE OF HEARING
on Application No. 1509-1 to
Appropriate Water**

Notice is given that the USDA, Forest Service, P.O. Box 390, Lemmon, SD 57638 has filed an application for a water permit to impound 87 acre-feet of water by constructing a dam in the South Fork Improvement Project Area. The dam site is to be located in the NW1/4SE1/4 and water may also be impounded in the SW1/4NE1/4; all in Section 29-T20N-R13E. Water is to be stored annually to an approximate elevation of 2510 feet mean sea level and is to be used to provide habitat for fish and wildlife production and recreational use.

Pursuant to SDCL 46-2A-2, the Chief Engineer recommends APPROVAL of Application No. 1509-1 because 1) unappropriated water is available, 2) existing rights will not be unlawfully impaired, 3) it is a beneficial use of water, and 4) it is in the public interest. Unless a petition is filed opposing the application or the applicant files a petition contesting the chief engineer's recommendation, the Water Management Board will NOT CONDUCT a HEARING to consider this application and the chief engineer will issue the permit as recommended. Petitions filed in support of the application will NOT require the Board to hear the application.

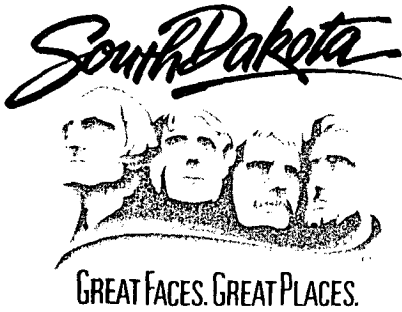
Any person interested in opposing or supporting this application must file a written petition with BOTH the applicant and Chief Engineer. The applicant must also file a petition if opposed to the Chief Engineer's recommendation. The Chief Engineer's address is "Water Rights Division, Foss Building, 523 E Capitol, Pierre, SD 57501 (605 773-3352)" and the applicant's mailing address is given above. A petition filed by either an interested person or the applicant must be filed by April 22, 1991. The petition may be informal, but must include a statement describing the petitioner's interest in the application, the petitioner's reasons for opposing or supporting the application, and the signature and mailing address of the petitioner or the petitioner's legal counsel, if legal counsel is obtained.

For purposes of publishing 1) the notice of hearing on Application No. 1509-1 and 2) the chief engineer's recommendation, a Board meeting is scheduled for May 1, 1991, at 10:00 a.m. in the meeting at Chef Louie's, 601 E Havens, Mitchell, SD. If this

application is opposed or the recommendation is contested, the May 1, 1991, hearing date may be rescheduled for another Board meeting. If the hearing is rescheduled, notice of the time and place will be given by First Class Mail to the applicant and persons filing petitions. Anyone not filing a petition, but interested in attending the hearing, may contact the Division of Water Rights to confirm a hearing date and location. The May 1, 1991, hearing date will be automatically delayed for at least 20 days upon written request to the Chief Engineer from the applicant or any interested person opposing the application. The request for an automatic delay must be filed by April 22, 1991.

If a hearing is held, the Chief Engineer's recommendation is not final or binding upon the Board. The Board is authorized to 1) approve, 2) approve with qualifications, 3) defer, or 4) deny this application based on the facts presented at the public hearing. Any hearing will be an adversary proceeding. Any person filing a petition and/ or the applicant have the right to be represented by a lawyer and may present evidence or cross-examine witnesses according to SDCL 1-26. These and other due process rights will be forfeited if not exercised. Decisions of the Board may be appealed to the Circuit Court and State Supreme Court as provided by law. Contact the Water Rights Division to request copies of information pertaining to this application or to assure access to the hearing by the handicapped.

This application is made pursuant to SDCL 46-1-1 thru 46-1-9, 46-1-12 thru 46-1-16; 46-2-3.1, 46-2-9, 46-2-11, 46-2-13, 46-2-17; 46-2A-1 thru 46-2A-10, 46-2A-12, 46-2A-14, 46-2A-15; 46-5-1 thru 46-5-11, 46-5-13 thru 46-5-15, 46-5-24, 46-5-25, 46-5-30.2, 46-5-30.4, 46-5-31; and Board Rules ARSD 74:02:01:01 thru 74:02:01:15.



**DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES**

JOE FOSS BUILDING
523 EAST CAPITOL
PIERRE SOUTH DAKOTA 57501-3181

SEP 26 1991

Terry Jones
USDA, Forest Service
PO Box 390
Lemmon, SD 57638

Dear Mr. Jones:

Enclosed is Water Permit No. 1509-1 authorizing construction of your water diversion system and put the water to beneficial use, not exceeding the limits as specified in the Water Permit.

Also enclosed is Form 10, Notice of Completion of Works and Application of Water to Beneficial Use, which you are to complete and submit to the Chief Engineer when you have completed the system and/or have put the water to beneficial use. An inspection can then be scheduled so that the Water License may be issued, thus completing your acquisition of a Water Right.

Very truly yours,

JOHN HATCH, Chief Engineer
Water Rights Division
605 773-3352

enclosures

PLEASE NOTE: Certain changes can be made in your permit within the five year construction period, usually without affecting the priority date provided an application to amend your permit is made within the five year period - i.e. changes in location or number of diversion points (wells) or location of land to be irrigated. Well locations for wells into the same aquifer can be moved up to 660 feet without application.

Applications to amend a permit after the five year construction period will be assigned a new priority date. Applications to change water sources, to add lands or increase original diversion rates, if approved will usually receive the date of the new application as a priority date regardless of the five year construction period.



United States
Department of
Agriculture

Forest
Service

Grand River
Ranger
District

P.O. Box 390
Lemmon, SD 57758



Reply to: 2610

Date: November 7, 1991

Department of Environment and Natural Resources
ATTN: John Hatch
Joe Foss Building
523 East Capitol
Pierre, SD 57501-3181

Dear Mr. Hatch:

Enclosed is our completed "Notice of Completion of Works and Application of Water to Beneficial Use" form for water permit 1509-1.

Sincerely,

FOREST G. MORIN
District Ranger

Enclosure





NOTICE OF COMPLETION OF WORKS AND
APPLICATION OF WATER TO BENEFICIAL USE

Date November 5, 1991

TO: Water Rights Division, DWNR
Joe Foss Building
Pierre SD 57501-3181

FROM: Forest Service P.O. Box 390 Lemmon, SD 57638
name address city

I have completed the construction of the water diversion system and I have put the water to beneficial use to the maximum extent it is going to be used. I have not exceeded the amounts specified in Water Permit No. 1509-1.

Water Permit No. 1509-1 states that the diversion system is to be constructed by 9/30/91, and that the water it put to beneficial use by 9/30/91.

The diversion system was completed on 9/30/91.
Applying the water to beneficial use was completed on 9/30/91.

You may schedule an inspection so that the Water License may be issued.

Forest L. Mow
signature



**DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES**

PMB 2020
JOE FOSS BUILDING
523 EAST CAPITOL
PIERRE, SOUTH DAKOTA 57501-3182
www.state.sd.us/denr

February 10, 2004

1509-1

Curt Hansen
USDA Forest Service
PO Box 390
Lemmon SD 57638

Dear Mr. Hansen:

On November 19, 2003 the investigation of your water use system, including the extent of application of water to beneficial use, as developed under Water Permit No. 1509-1, was completed by Tim Schaal, a staff engineer with our program. Your final water right document, the water license, can now be issued.

State law requires that we charge a \$50.00 fee for the investigation and issuance of the water license. Upon receipt of the \$50.00 fee from you, we will complete processing your water license. The check or money order for the fee should be made payable to the "Water Rights Program".

Your licensed water right will be similar to a property right that can not be lost as long as the water use continues and you abide by the permit requirements.

If you have any questions regarding the water permit, investigation of your water use system or payment of the fee, please contact Genny McMath with our program at (605) 773-3352.

Sincerely,

Karen Schlaak
Water Rights Program
(605) 773-3352

RECEIPT

WATER RIGHTS PROGRAM

South Dakota Department of Environment and Natural Resources

Date February 12, 20 04

RECEIVED OF Mary Haase, USDA, PO Box 390. Lemmon SD 57638

The following amount in fees for services rendered as provided for by law:

Fee for Application for Permit No. _____ to Appropriate Water, to construct and to put water to beneficial use	50	00
Fee for Application for Permit No. _____ to Appropriate Water for Future use		
Fee to retain Future Use Permit No. _____ after period of seven years.		
Fee for Inspecting Constructed Works, confirming beneficial use and issuing Water License No. <u>1509-1</u>		
Fee for Filing Transfer Form _____		
Fee for _____		
Fee for Issuing New Well Driller's License No. _____ for C.Y. _____		
Fee for Renewal of Well Driller's License No. _____ for C.Y. _____		
Fee for Issuing Well Pump Installer's License No. _____ for C.Y. _____		
Fee for Renewal of Well Pump Installer's License No. _____ for C.Y. _____		
(Any Other Work Provided by Law)	TOTAL	50.00

No. 001188

By Stanley Ebele
Chief Engineer *gm*

REPORT ON INSPECTION OF PERMIT NO. 1509-1

DATE OF INSPECTION: November 19, 2003

NAME & ADDRESS OF INSPECTION CONTACT/ Curt Hansen

RELATIONSHIP TO PERMIT HOLDER, IF APPLICABLE: Assistant Ranger

NAME & ADDRESS OF PERMIT HOLDER: USDA Forest Service, PO Box 390,
Lemmon, SD 57638

DIVERSION POINT LEGAL LOCATION: 1850 feet north & 1320 feet west of the SE corner of
Sec. 29-T20N-R13E (N ½ NE ¼).

DAM INFORMATION:

- 1) Height to crest 23 feet
- 2) Height to primary spillway 16 feet
- 3) Height to secondary spillway 20 feet
- 4) Crest width 12 feet
- 5) Crest length 700 feet
- 6) Spillway length XXX feet
- 7) Spillway width 180 feet
- 8) Approx. storage (Normal) 87 acre-feet
- 9) Approx. storage (Maximum) 236 acre-feet
- 10) Date constructed: Fall 1991

PERMIT QUALIFICATIONS AND REGULATIONS:

- 1) Soil and water permit lands agree with lands being irrigated and lands listed on permit N/A
- 2) Special qualifications to permit being abided by yes
- 3) All structures, wells and lands on map yes
- 4) Irrigation Questionnaires checked to determine if permit owner started irrigation by the end of construction period N/A

Permit No. 1509-1
Moreau River - Water District

Report Of Examination Of Works And/Or Application of Water To Beneficial Use

TO: Chief Engineer, Water Rights Program, DENR, Foss Bldg., Pierre, SD 57501

I have this day, November 19, 2003, made a thorough examination of the water use system constructed by USDA Forest Service of PO Box 390, Lemmon, SD 57638 holder of Permit No. 1509-1, bearing the priority of January 22, 1991 authorizing the storage of 87 acre-feet of the waters of runoff (tributary South Fork Grand River) for fish & wildlife propagation purposes, in Perkins County.

I have to report on the conditions of the same as follows:

A. Works used to divert the water:

A 23 foot high earthen dam with a Normal storage capacity of 87 acre-feet

B. Works used to transport water to place of use:

N/A

C. Works used to apply water to beneficial use:

A 23 foot high earthen dam with a Normal storage capacity of 87 acre-feet

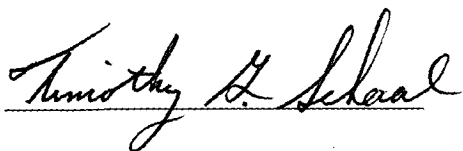
The system is in the following condition good. The point of diversion is located 1850 feet north & 1320 feet west of the SE corner of Sec. 29-T20N-R13E (N ½ SE ¼). The works are capable of storing 87 acre-feet of water which is to be used for fish & wildlife propagation. Water has been put to beneficial use to the maximum extent as follows:

A 23 foot high earthen dam with a Normal storage capacity of 87 acre-feet

and the license should be issued for 87 acre-feet of storage.

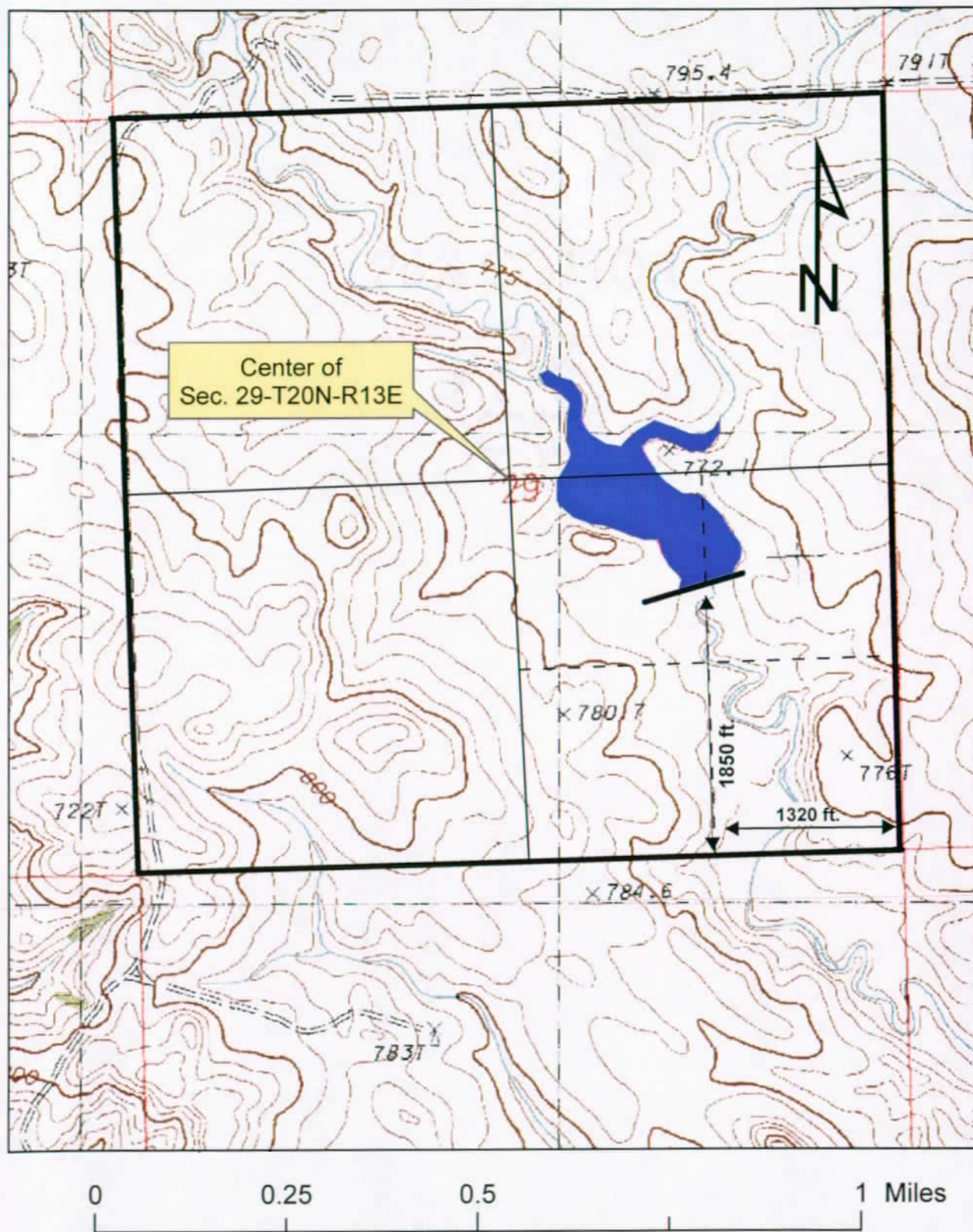
Applicable permit qualifications have been complied with: Yes X

Exceptions to compliance are: none Date Report Completed: February 6, 2003



Timothy G. Schaal, P.E.
Natural Resources Engineer Specialist
DENR, Water Rights Program

Water Permit Application No. 1509-1



South Dakota Department of
Environment and Natural Resources



Timothy G. Schaal
Timothy G. Schaal, P.E. 11/6/04
Natural Resources Engineer Specialist
DENR, Water Rights Program

STATE OF SOUTH DAKOTA

WATER LICENSE NO. 1509-1

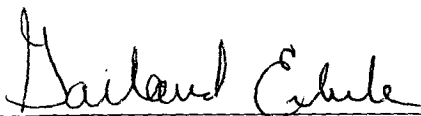
(1) USDA Forest Service, PO Box 390, Lemmon SD 57638 made Application No. 1509-1, January 22, 1991 for a water permit to impound 87 acre feet of water from runoff (tributary of South Fork Grand River), Perkins County, South Dakota for fish and wildlife propagation and recreational purposes. Permit No. 1509-1, with a priority date of January 22, 1991 was approved May 1, 1991 and issued to the applicant for diversion of water with construction of the described water supply system to be completed on or before May 1, 1996 and for the application to beneficial use of water on or before May 1, 2000.

(2) The water supply system has been completed and water applied to beneficial use in accordance with South Dakota State Law. Pursuant to South Dakota Codified Law 46-5-30.1, the holder and/or owner of Water Right No. 1509-1 is issued a license, bearing a priority date of January 22, 1991, to impound 87 acre feet of water.

The location of the storage dam (spillway) is 1,850 feet north and 1,320 feet west the southeast corner of Section 29-T20N-R13E (N ½ SE ¼).

(3) This license is subject to South Dakota Water Law, any limitations or conditions listed in Water Permit No. 1509-1, including the following now applicable qualifications:

- Low flows as needed for downstream domestic use, including livestock water and prior water rights must be by-passed.
- Flows of the Grand River proposed for use under this permit are included under U.S. Withdrawal No. 594-1 for storage in Shadehill Reservoir. Restrictions on the use of water granted under this permit may be necessary, if the Bureau of Reclamation develops the Shadehill Unit Irrigation Project as proposed under such withdrawal.
- Approval of Permit No. 1509-1 authorizes storage of up to 87 acre-feet annually.



Garland Erbele, Chief Engineer
Water Rights Program
Department of Environment and Natural Resources

MAY 14 2004

date





MAY 14 2004

**DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES**

PMB 2020
JOE FOSS BUILDING
523 EAST CAPITOL
PIERRE, SOUTH DAKOTA 57501-3182
www.state.sd.us/denr

1509-1

USDA Forest Service
Curt Hansen
PO Box 390
Lemmon SD 57638

Dear Mr. Hansen:

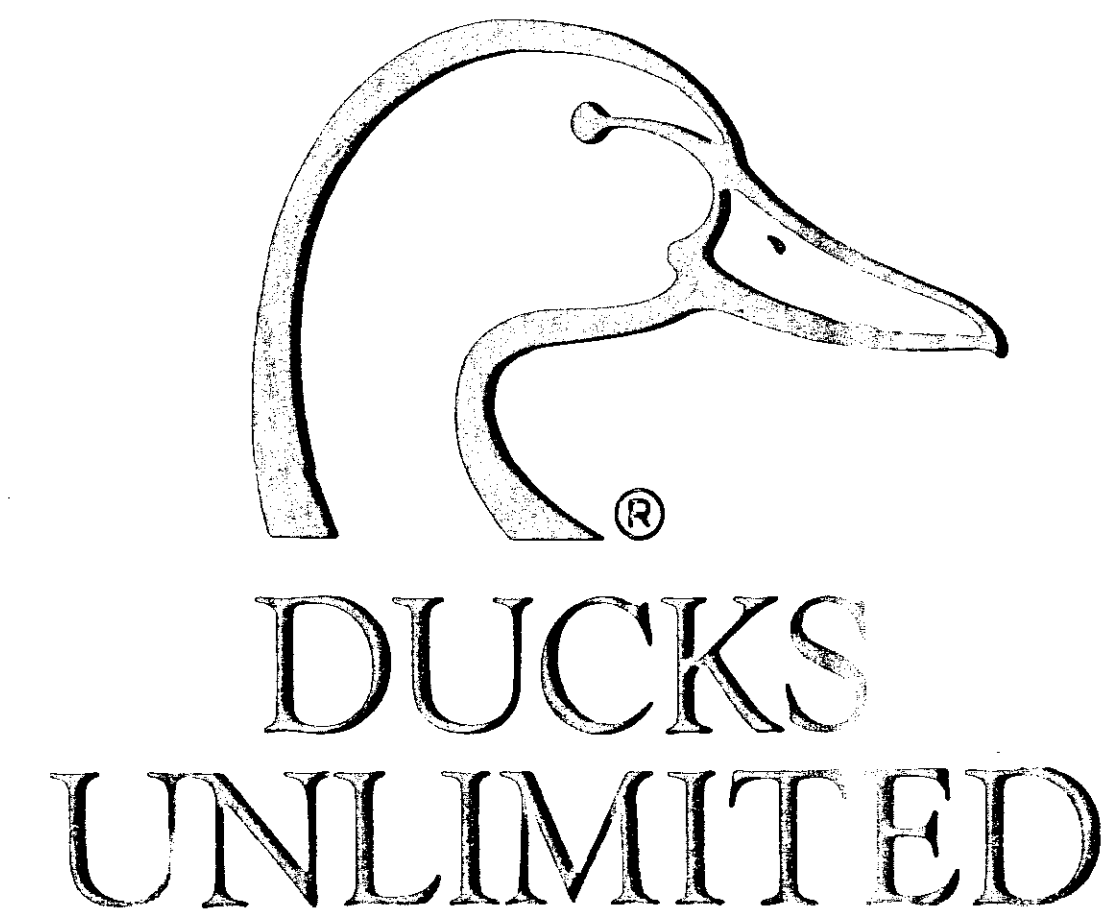
Enclosed is Water License No. 1509-1. This is the final water right document completing your process of obtaining a Water Right. Enclosed is Receipt No. 1509-1 in the amount of \$50.00 which you paid for the investigation and issuance of the Water License.

As long as you use the water beneficially, as stated in the Water License, State Water Laws provide that you have a continuing right to use the water.

Sincerely,

Garland Erbele, Chief Engineer
Water Rights Program
(605) 773-3352

enclosures



DUCKS UNLIMITED

PROJECT

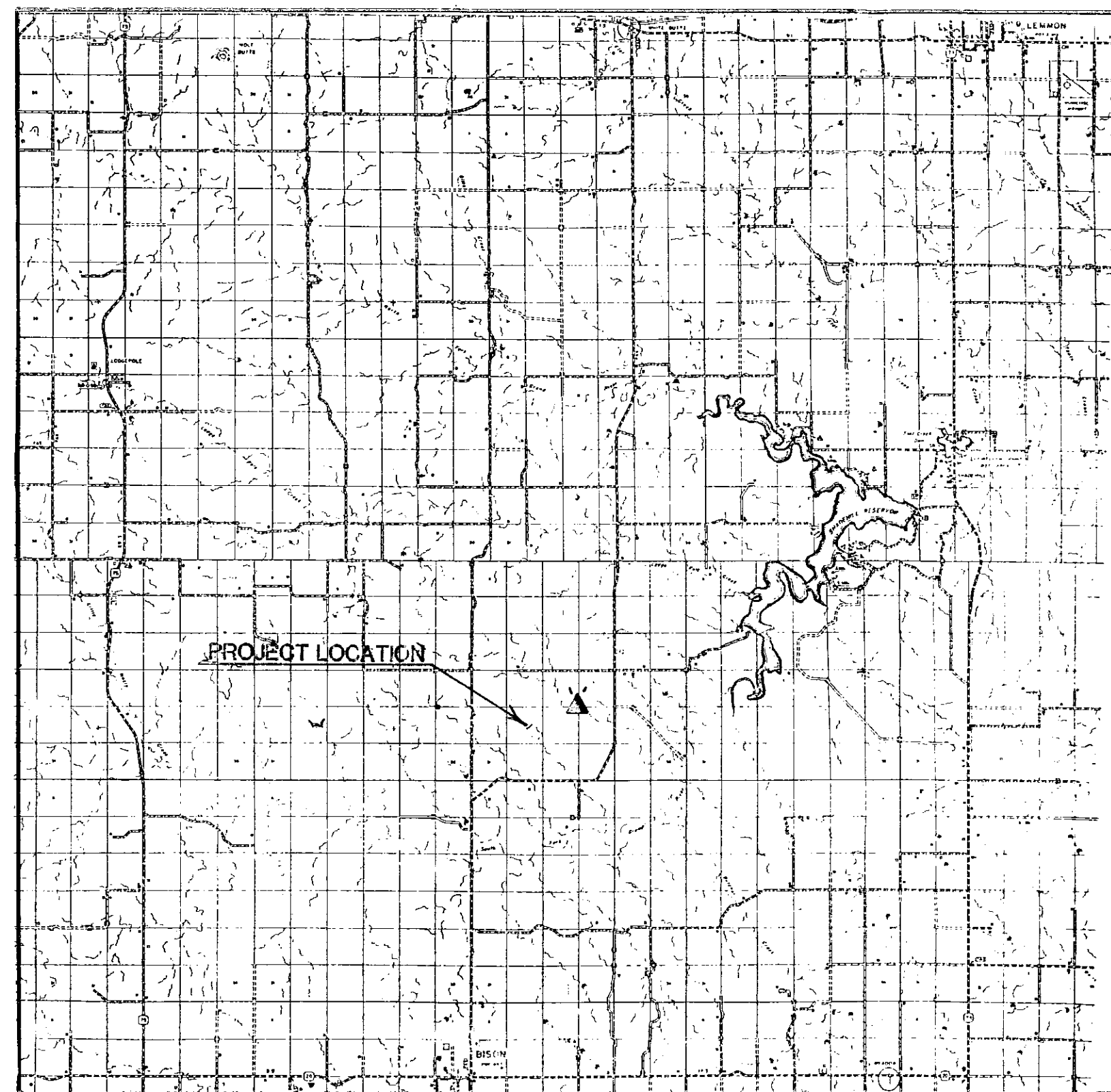
SOUTH FORK IMPOUNDMENT

SEC.29, TWP.20N. RGE.13E.

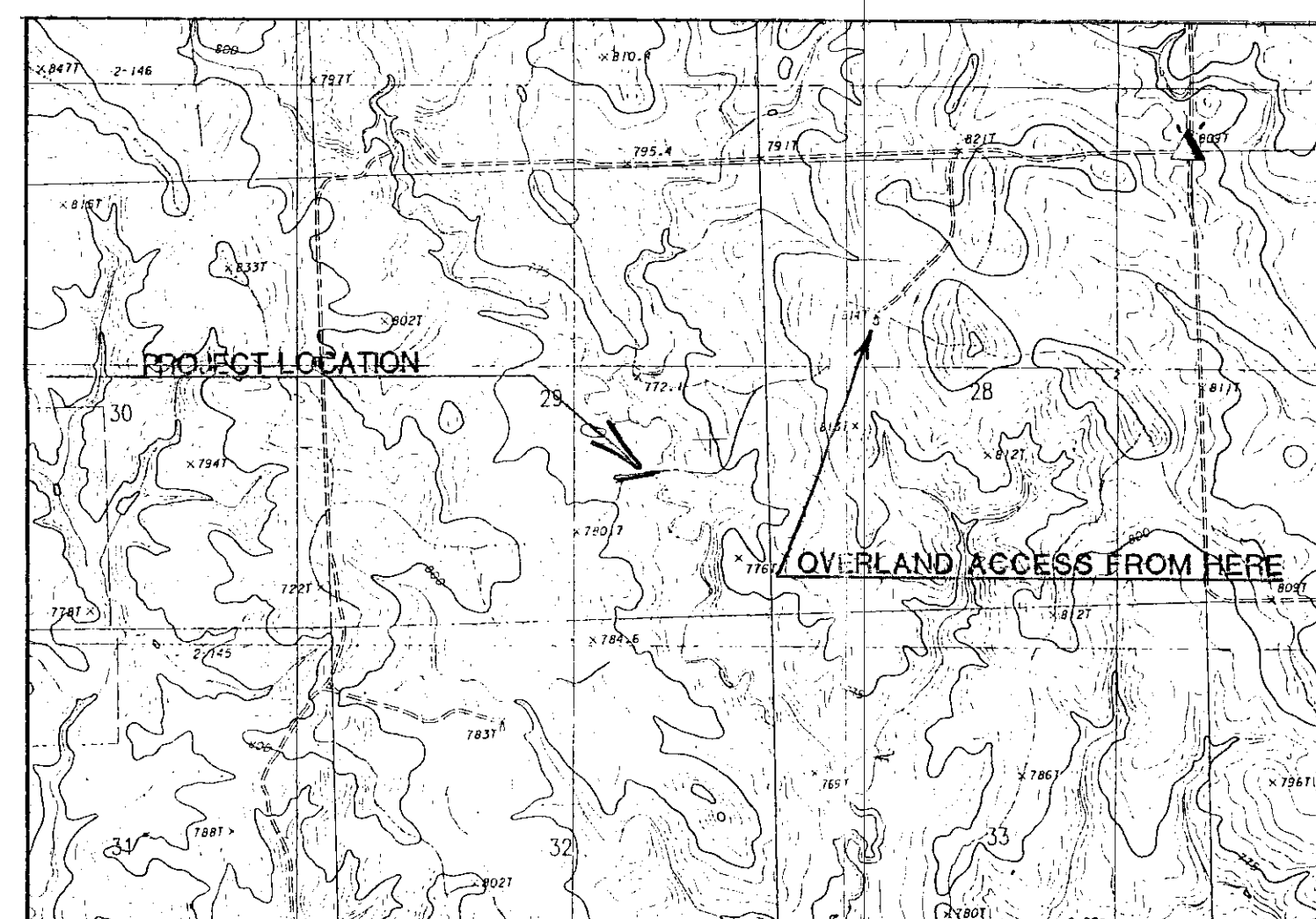
PERKINS COUNTY SOUTH DAKOTA

IN COOPERATION WITH

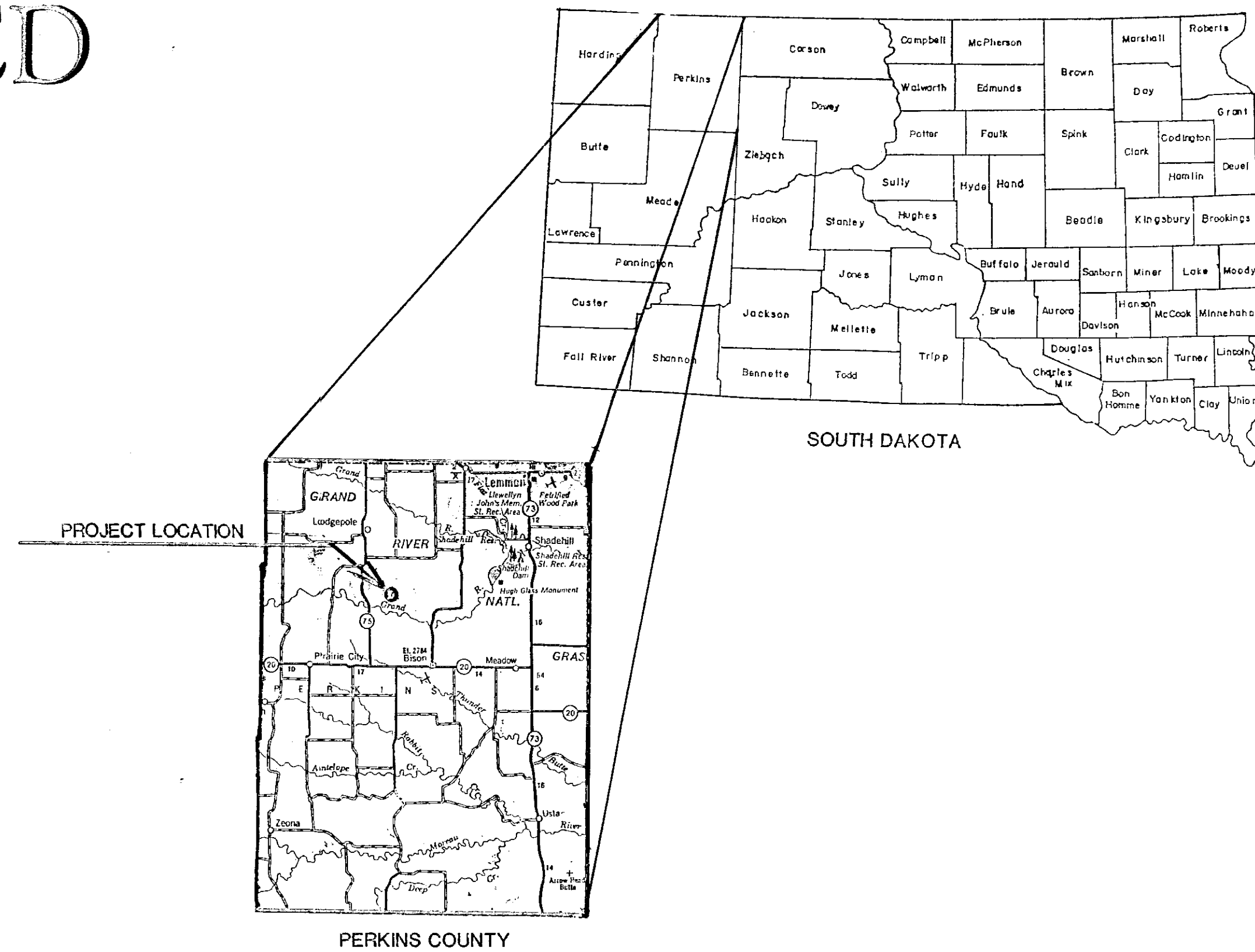
US FOREST SERVICE



LOCATION MAP



VICINITY MAP
SCALE: 1" = 2,000'

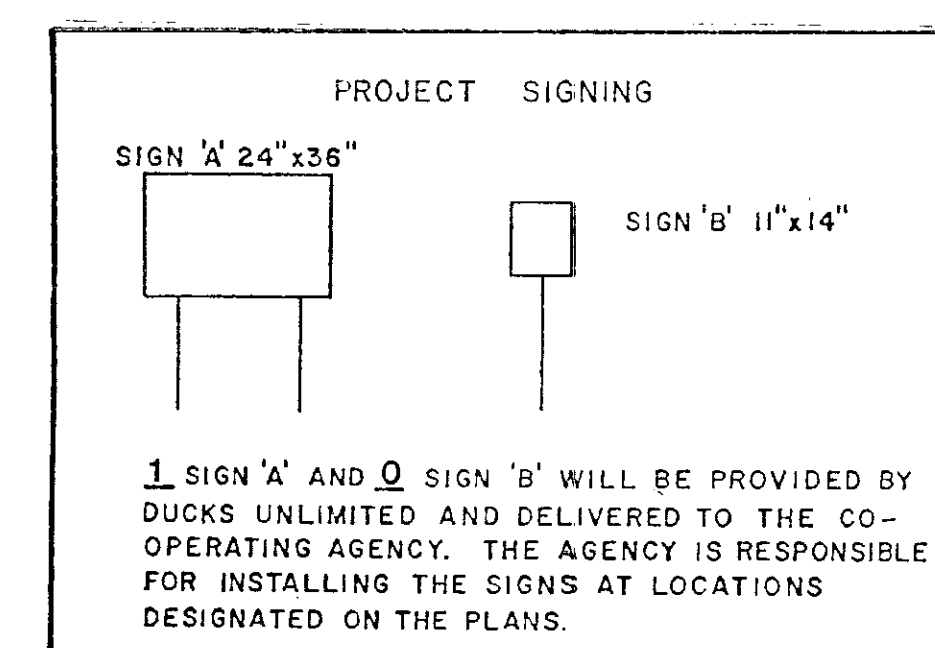


INDEX

1. VICINITY MAP
2. SITE TOPOGRAPHY & SOILS
3. SITE PLAN & C PROFILES
4. STRUCTURE PLAN & PROFILE & DETAILS

SPECIFICATIONS

GENERAL CONDITIONS	101
MOBILIZATION	201
SITE PREPARATION	202
EXCAVATION	203
EMBANKMENT CONSTRUCTION	204
WATER	205
WATER CONTROL STRUCTURE INSTALLATION	206
WATER CONTROL STRUCTURE & CULVERT APPURTENANCES	206A
CULVERT INSTALLATION	207
CAST-IN-PLACE REINFORCED CONCRETE	208
RIPRAP PLACEMENT	209

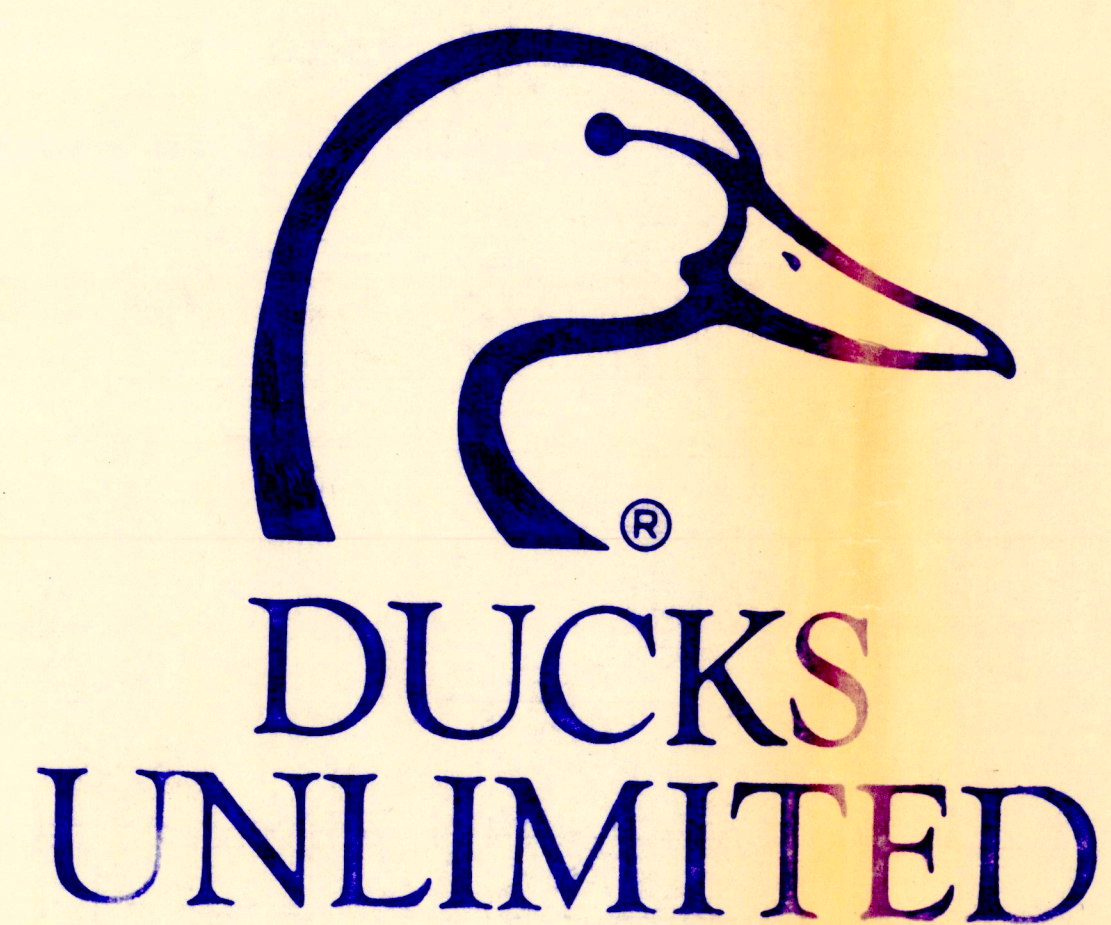


PRELIMINARY

DUCKS UNLIMITED INC. GREAT PLAINS REGIONAL OFFICE	PROJECT NO. DU-1-SD-060-01	DESIGNED BY: RCS
	SOUTH FORK IMP. VICINITY MAP	
DATE: 1-7-91	SHEET NO: 1 OF 4	APPROVED BY: [Signature] PE
		CHECKED BY: [Signature]



Appl. No. 1509-1



DUCKS UNLIMITED

PROJECT

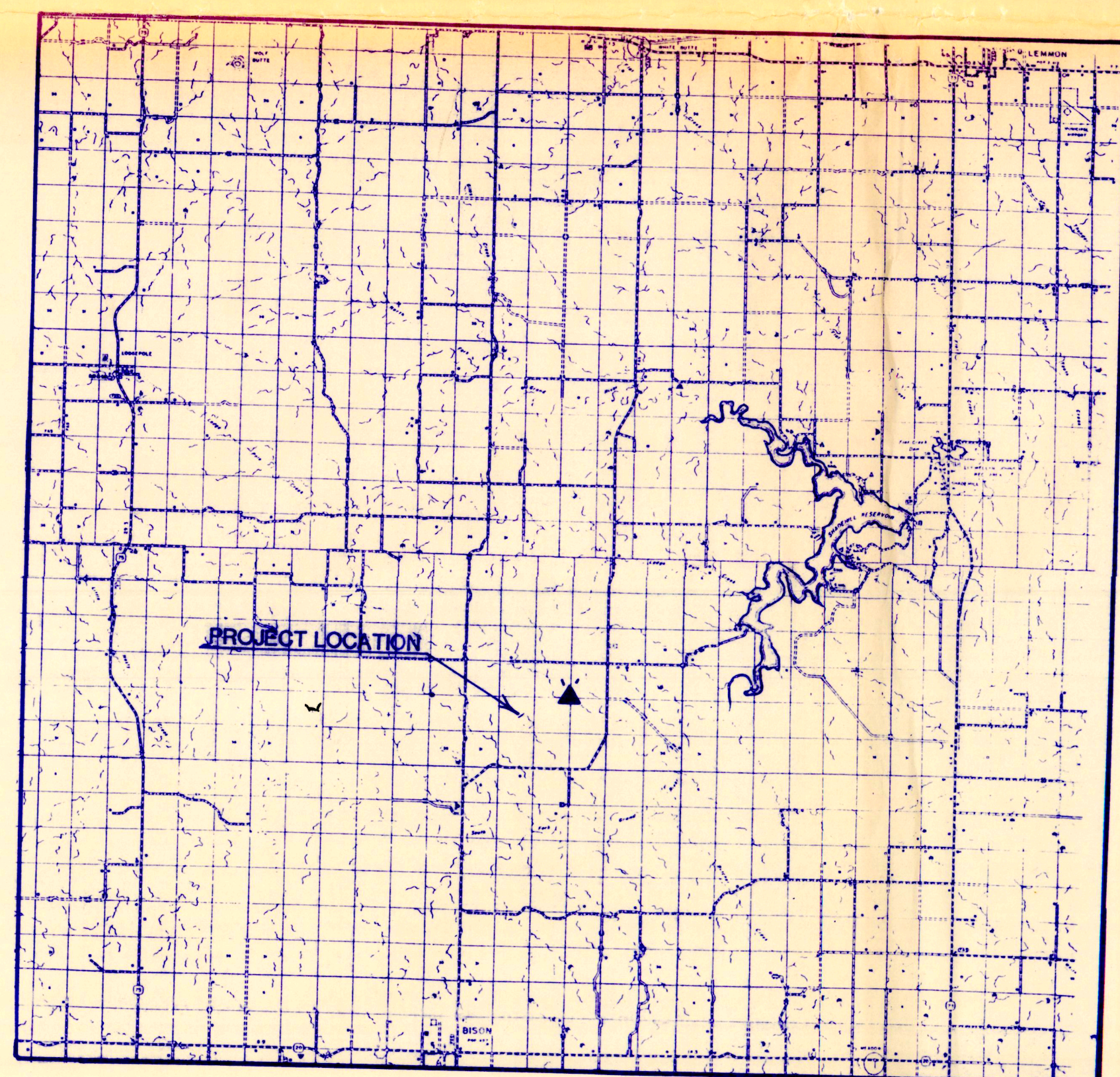
SOUTH FORK IMPOUNDMENT

SEC.29, TWP.20N. RGE.13E.

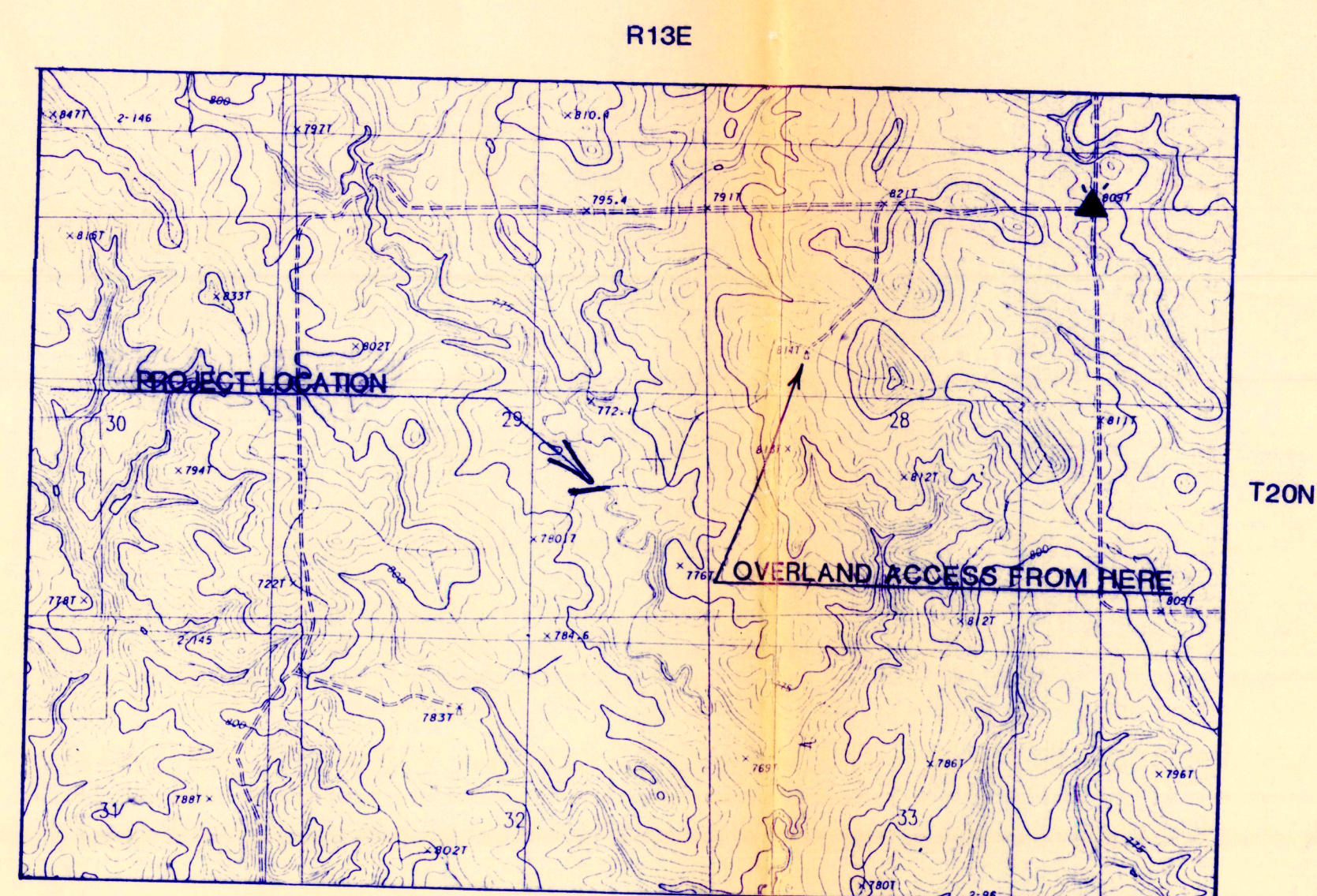
PERKINS COUNTY SOUTH DAKOTA

IN COOPERATION WITH

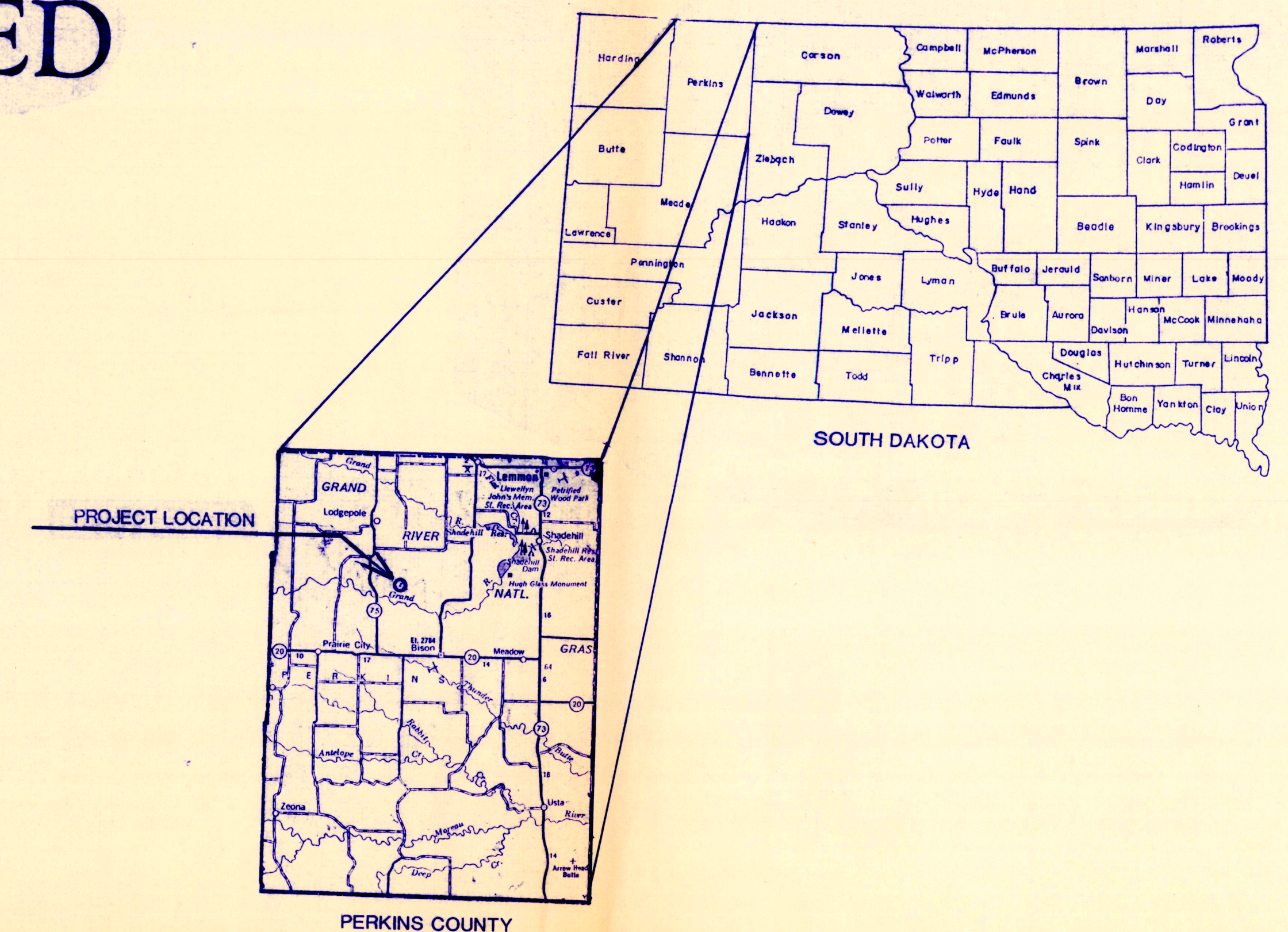
US FOREST SERVICE



LOCATION MAP



VICINITY MAP
SCALE : 1" = 2,000'

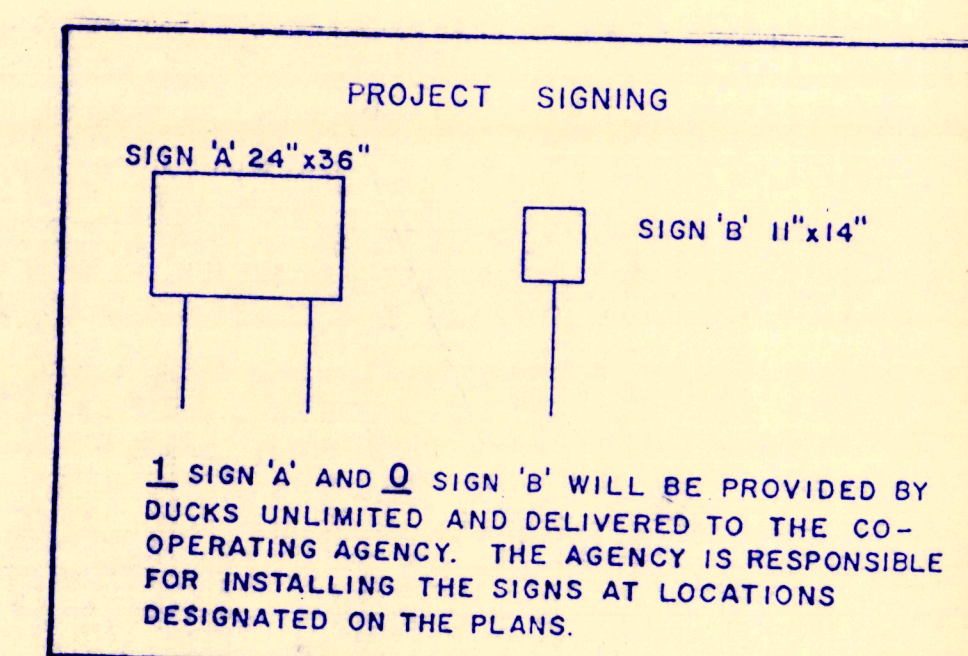


SPECIFICATIONS

GENERAL CONDITIONS	101
MOBILIZATION	201
SITE PREPARATION	202
EXCAVATION	203
EMBANKMENT CONSTRUCTION	204
WATER	205
WATER CONTROL STRUCTURE INSTALLATION	206
WATER CONTROL STRUCTURE & CULVERT APPURTENANCES	206A
CULVERT INSTALLATION	207
CAST-IN-PLACE REINFORCED CONCRETE	208
RIPRAP PLACEMENT	209

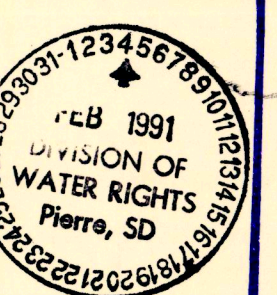
INDEX

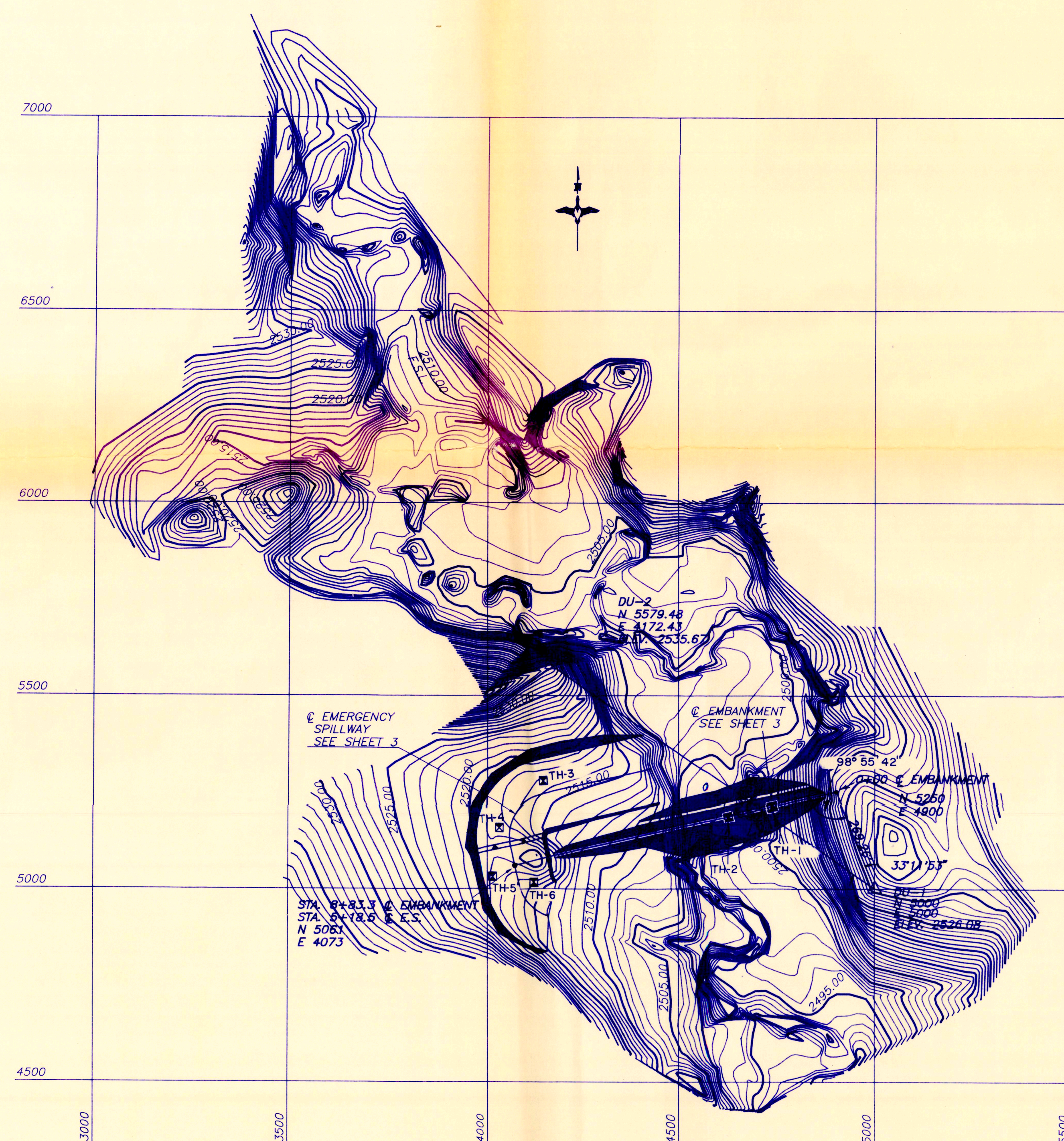
1. VICINITY MAP
2. SITE TOPOGRAPHY & SOILS
3. SITE PLAN & E PROFILES
4. STRUCTURE PLAN & PROFILE & DETAILS



PRELIMINARY

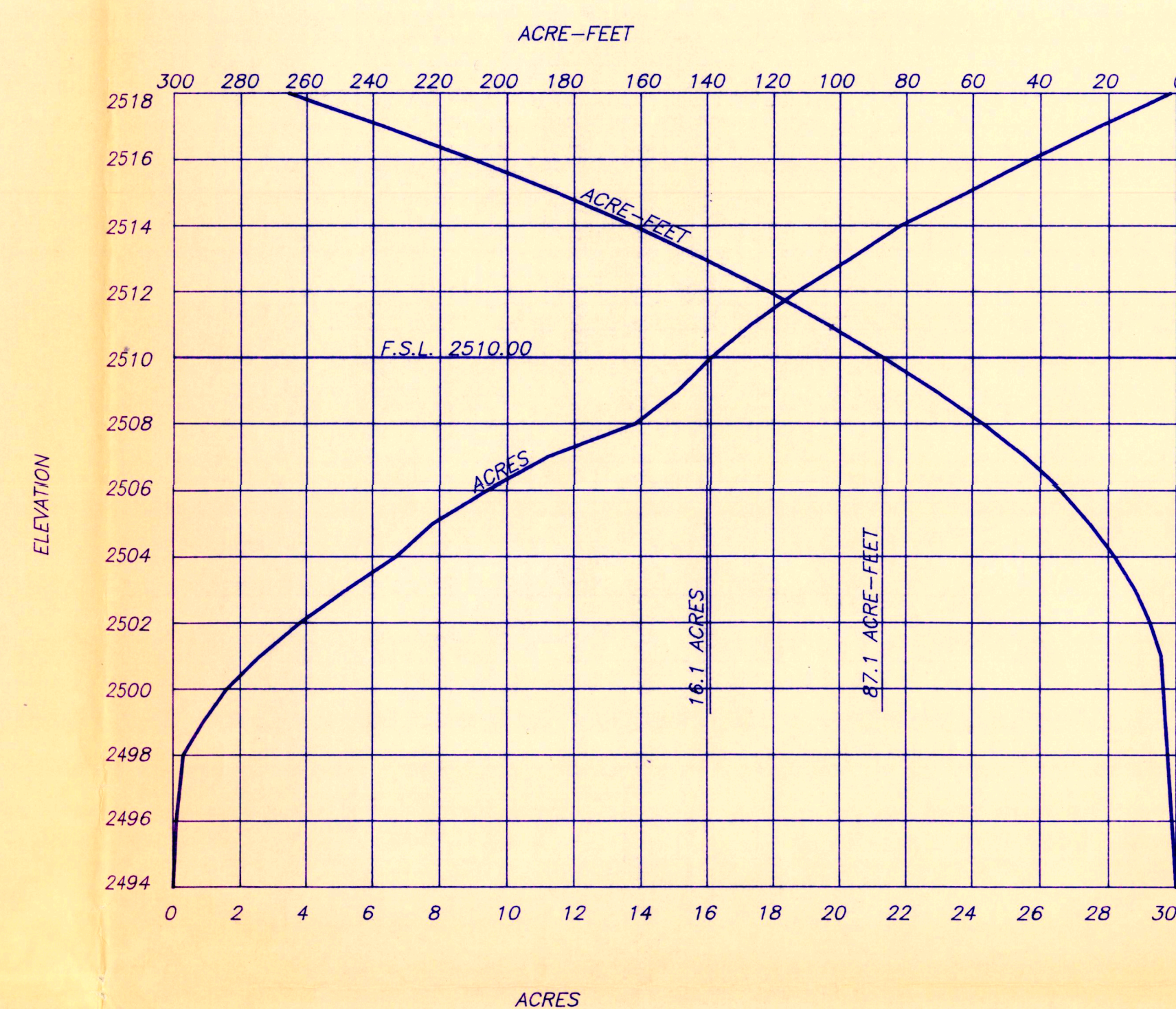
	DUCKS UNLIMITED INC.	PROJECT NO. DU-1-SD-060-01	DESIGNED BY: RCS
	GREAT PLAINS REGIONAL OFFICE	SOUTH FORK IMP. VICINITY MAP	DRAWN BY: TD
DATE: 1-7-91	SHEET NO: 1 OF 4	APPROVED BY: [Signature]	CHECKED BY: [Signature]





SITE TOPOGRAPHY

SCALE
1"=200'



AREA CAPACITY CURVE

MARSH DATA	
FULL SERVICE LEVEL (F.S.L.)	2510.00
SURFACE AREA AT F.S.L.	16.1 ac
SHORELINE AT F.S.L.	0.9 mi
CAPACITY AT F.S.L.	87.1 ac-ft
DRAINAGE AREA (GROSS)	6.15 mi ² 3940 ac

ESTIMATED QUANTITIES	
MOBILIZATION	1 LS
SITE PREPARATION	1233 CY-P
* EXCAVATION (EMERGENCY SPILLWAY)	19826 CY
EMBANKMENT (INCLUDES 15% SHRINKAGE)	24,050 CY-P
WATER CONTROL STRUCTURE (72" RISER FIXED LEVEL CONTROL 20 LF, ALSO INCLUDES WCS APPURTENANCES SUCH AS TRASHRACK, ETC.)	1 LS
CULVERT INSTALLATION (48" CMP)	111 LF
* CAST-IN-PLACE CONCRETE	1.32 CY
RIPRAP	19 CY-P
* = NOT A PAY ITEM	

* = NOT A PAY ITEM

[illegible]

 MIDWEST TESTING LABORATORY			
1015 N. Lincoln Ave. • P.O. Box 1000 • Chicago, Illinois 60601 Phone: (312) 321-1100 • Telex: 250000 • Cable: MIDWESTLAB			
Job No. _____ Project Description _____		Sample No. _____ Location _____	Date _____ Test _____
1. TEST DESCRIPTION 1.1. TEST METHOD _____		Sample No. _____ Location _____	Date _____ Test _____
2. TEST RESULTS 2.1. TEST METHOD _____		Sample No. _____ Location _____	Date _____ Test _____
3. TEST RESULTS 3.1. TEST METHOD _____		Sample No. _____ Location _____	Date _____ Test _____
4. TEST RESULTS 4.1. TEST METHOD _____		Sample No. _____ Location _____	Date _____ Test _____
5. TEST RESULTS 5.1. TEST METHOD _____		Sample No. _____ Location _____	Date _____ Test _____
6. TEST RESULTS 6.1. TEST METHOD _____		Sample No. _____ Location _____	Date _____ Test _____
7. TEST RESULTS 7.1. TEST METHOD _____		Sample No. _____ Location _____	Date _____ Test _____
8. TEST RESULTS 8.1. TEST METHOD _____		Sample No. _____ Location _____	Date _____ Test _____
9. TEST RESULTS 9.1. TEST METHOD _____		Sample No. _____ Location _____	Date _____ Test _____
10. TEST RESULTS 10.1. TEST METHOD _____		Sample No. _____ Location _____	Date _____ Test _____
11. TEST RESULTS 11.1. TEST METHOD _____		Sample No. _____ Location _____	Date _____ Test _____
12. TEST RESULTS 12.1. TEST METHOD _____		Sample No. _____ Location _____	Date _____ Test _____
13. TEST RESULTS 13.1. TEST METHOD _____		Sample No. _____ Location _____	Date _____ Test _____
14. TEST RESULTS 14.1. TEST METHOD _____		Sample No. _____ Location _____	Date _____ Test _____
15. TEST RESULTS 15.1. TEST METHOD _____		Sample No. _____ Location _____	Date _____ Test _____
16. TEST RESULTS 16.1. TEST METHOD _____		Sample No. _____ Location _____	Date _____ Test _____
17. TEST RESULTS 17.1. TEST METHOD _____		Sample No. _____ Location _____	Date _____ Test _____
18. TEST RESULTS 18.1. TEST METHOD _____		Sample No. _____ Location _____	Date _____ Test _____
19. TEST RESULTS 19.1. TEST METHOD _____		Sample No. _____ Location _____	Date _____ Test _____
20. TEST RESULTS 20.1. TEST METHOD _____		Sample No. _____ Location _____	Date _____ Test _____
21. TEST RESULTS 21.1. TEST METHOD _____		Sample No. _____ Location _____	Date _____ Test _____
22. TEST RESULTS 22.1. TEST METHOD _____		Sample No. _____ Location _____	Date _____ Test _____
23. TEST RESULTS 23.1. TEST METHOD _____		Sample No. _____ Location _____	Date _____ Test _____
24. TEST RESULTS 24.1. TEST METHOD _____		Sample No. _____ Location _____	Date _____ Test _____
25. TEST RESULTS 25.1. TEST METHOD _____		Sample No. _____ Location _____	Date _____ Test _____
26. TEST RESULTS 26.1. TEST METHOD _____		Sample No. _____ Location _____	Date _____ Test _____
27. TEST RESULTS 27.1. TEST METHOD _____		Sample No. _____ Location _____	Date _____ Test _____
28. TEST RESULTS 28.1. TEST METHOD _____		Sample No. _____ Location _____	Date _____ Test _____
29. TEST RESULTS 29.1. TEST METHOD _____		Sample No. _____ Location _____	Date _____ Test _____
30. TEST RESULTS 30.1. TEST METHOD _____		Sample No. _____ Location _____	Date _____ Test _____
31. TEST RESULTS 31.1. TEST METHOD _____		Sample No. _____ Location _____	Date _____ Test _____
32. TEST RESULTS 32.1. TEST METHOD _____		Sample No. _____ Location _____	Date _____ Test _____
33. TEST RESULTS 33.1. TEST METHOD _____		Sample No. _____ Location _____	Date _____ Test _____
34. TEST RESULTS 34.1. TEST METHOD _____		Sample No. _____ Location _____	Date _____ Test _____
35. TEST RESULTS 35.1. TEST METHOD _____		Sample No. _____ Location _____	Date _____ Test _____
36. TEST RESULTS 36.1. TEST METHOD _____		Sample No. _____ Location _____	Date _____ Test _____
37. TEST RESULTS 37.1. TEST METHOD _____		Sample No. _____ Location _____	Date _____ Test _____

[illegible][illegible]

MIDWEST TESTING LABORATORY

TEST NO. <u>3123</u>		LOG ON TEST FORM NO. <u>3</u>		VERTICAL SCALE		"TAY"	
TEST: <u>Prepared</u> Tests: <u>Time</u> Interference: <u>Notes</u> Remarks: <u>Spec. Name</u>							
NO.	DESCRIPTION	TEMP.	LABORATORY DATA				
			NO. TEST	REMARKS	TEMP.	W. L. V.	
1	SEAN PLAT WITH SAND-brown, heavy, sticky, surface vegetation is upper 1". Ideal to	2	28	21.7			
2	SEAN PLAT - light brown, fine, very dense, white mineral inclusions (ISC)	3	13	41.7			
4	SEAN PLAT SAND WITH GRAVEL - light brown, fine to coarse, dark	5	28	28			
6	SEAN PLAT brownish gray, dark, no inclusions (C)	8	33	17			
9	SEAN PLAT SAND brown, fine, no inclusions	9	30	28			
10	SEAN PLAT SAND brown, fine, no inclusions						

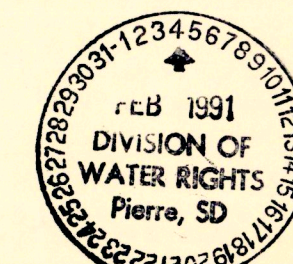
* Values influenced by frost

WATER LEVEL DATA		SPILL & BENCH INFORMATION		SPRING DATA	
DATE	TIME	SPILL	BENCH	SPRING	WATER
11-10-78	10:00	YES	NO	YES	NO
				WATER USED	

TESTED BY: W. Roberts

 MIDWEST TESTING LABORATORY		REPORT DATE _____ REPORT NO. _____	
PROJECT <u>12345</u> <u>100 W. 10th St.</u>		LOCATION <u>CHICAGO, ILL.</u>	
OWNER <u>THOMAS BUCH</u> <u>100 W. 10th St.</u>		DESIGN ENGINEER <u>DR. J. SMITH</u>	
DATE	NO. TESTS	TESTS PASSED	PERCENTAGE PASSED
12-1-78	10	8	80%
12-15-78	10	10	100%
1-15-79	10	10	100%
2-15-79	10	10	100%
3-15-79	10	10	100%
4-15-79	10	10	100%
5-15-79	10	10	100%
6-15-79	10	10	100%
7-15-79	10	10	100%
8-15-79	10	10	100%
9-15-79	10	10	100%
10-15-79	10	10	100%
11-15-79	10	10	100%
12-15-79	10	10	100%
1-15-80	10	10	100%
2-15-80	10	10	100%
3-15-80	10	10	100%
4-15-80	10	10	100%
5-15-80	10	10	100%
6-15-80	10	10	100%
7-15-80	10	10	100%
8-15-80	10	10	100%
9-15-80	10	10	100%
10-15-80	10	10	100%
11-15-80	10	10	100%
12-15-80	10	10	100%
1-15-81	10	10	100%
2-15-81	10	10	100%
3-15-81	10	10	100%
4-15-81	10	10	100%
5-15-81	10	10	100%
6-15-81	10	10	100%
7-15-81	10	10	100%
8-15-81	10	10	100%
9-15-81	10	10	100%
10-15-81	10	10	100%
11-15-81	10	10	100%
12-15-81	10	10	100%
1-15-82	10	10	100%
2-15-82	10	10	100%
3-15-82	10	10	100%
4-15-82	10	10	100%
5-15-82	10	10	100%
6-15-82	10	10	100%
7-15-82	10	10	100%
8-15-82	10	10	100%
9-15-82	10	10	100%
10-15-82	10	10	100%
11-15-82	10	10	100%
12-15-82	10	10	100%
1-15-83	10	10	100%
2-15-83	10	10	100%
3-15-83	10	10	100%
4-15-83	10	10	100%
5-15-83	10	10	100%
6-15-83	10	10	100%
7-15-83	10	10	100%
8-15-83	10	10	100%
9-15-83	10	10	100%
10-15-83	10	10	100%
11-15-83	10	10	100%
12-15-83	10	10	100%
1-15-84	10	10	100%
2-15-84	10	10	100%
3-15-84	10	10	100%
4-15-84	10	10	100%
5-15-84	10	10	100%
6-15-84	10	10	100%
7-15-84	10	10	100%
8-15-84	10	10	100%
9-15-84	10	10	100%
10-15-84	10	10	100%
11-15-84	10	10	100%
12-15-84	10	10	100%
1-15-85	10	10	100%
2-15-85	10	10	100%
3-15-85	10	10	100%
4-15-85	10	10	100%
5-15-85	10	10	100%
6-15-85	10	10	100%
7-15-85	10	10	100%
8-15-85	10	10	100%
9-15-85	10	10	100%

PRELIMINARY



DUCKS
UNLIMITED
INC.

PROJECT NO.: DU-1-SD-060-01

SOUTH FORK IMP.
SITE TOPOGRAPHY & SOILS

DESIGNED BY:	RCS
DRAWN BY:	TE
SURVEYED BY:	
CHECKED BY:	

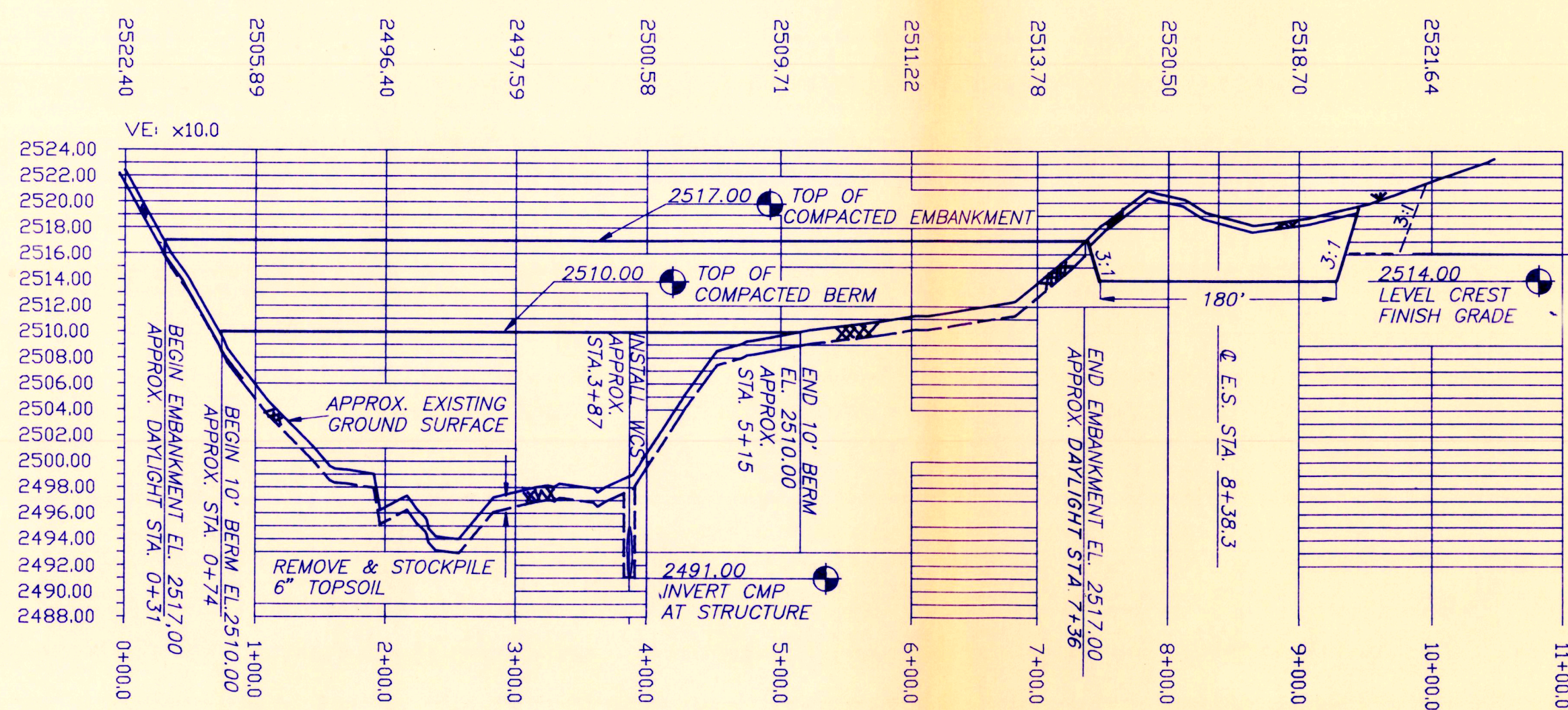
DATE: 1-3-91

SHEET NO:
2 OF 4

APPROVED BY:

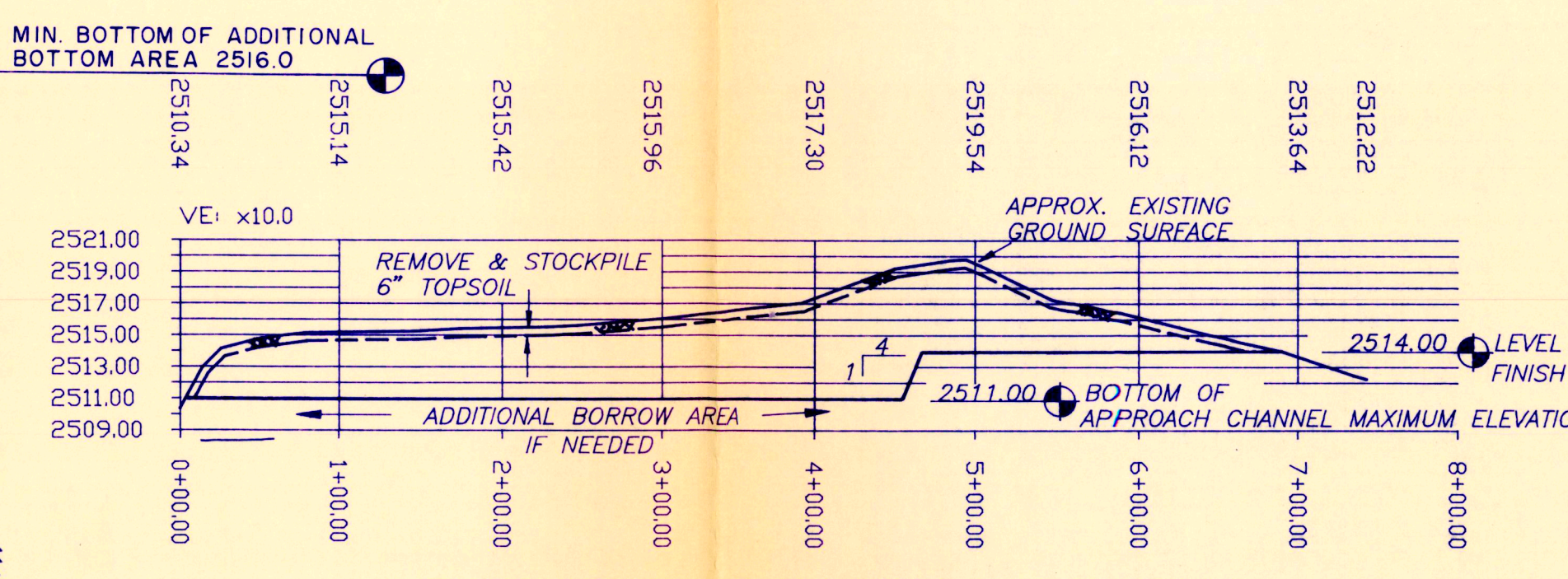
CHECKED BY:
APPROVED BY:

1509-1



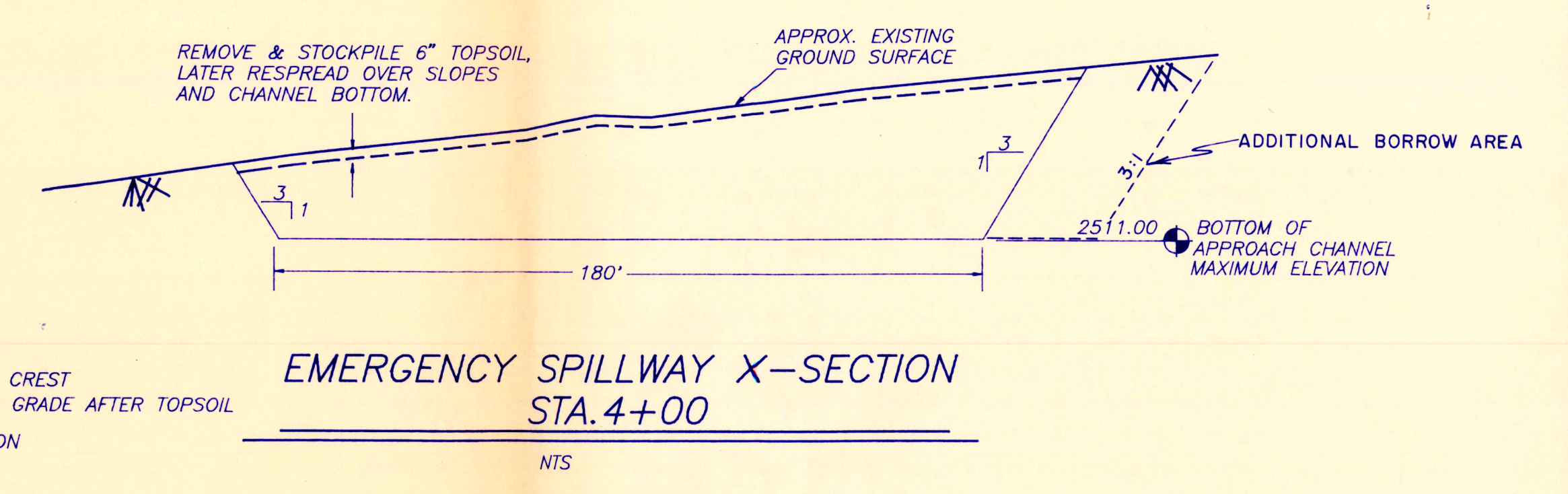
EMBANKMENT & PROFILE

SCALE: 1"=10' VERT., 1"=100' HORIZ.



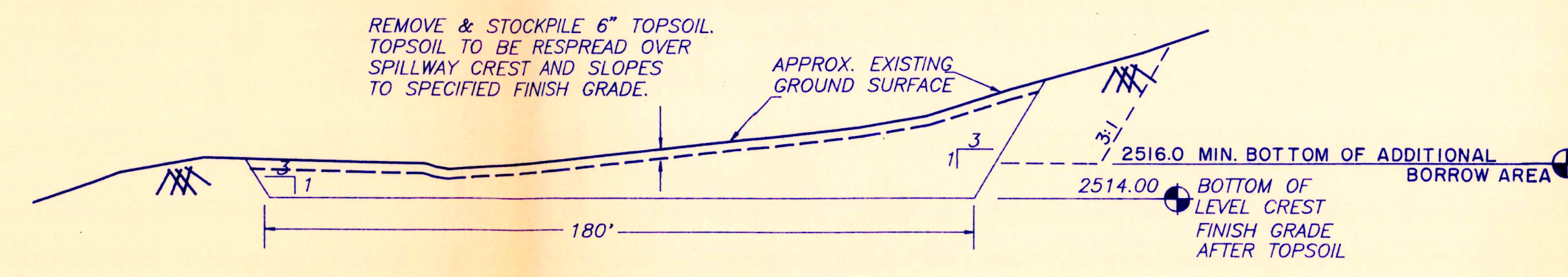
EMERGENCY SPILLWAY & PROFILE

SCALE: 1"=10' VERT., 1"=100' HORIZ.



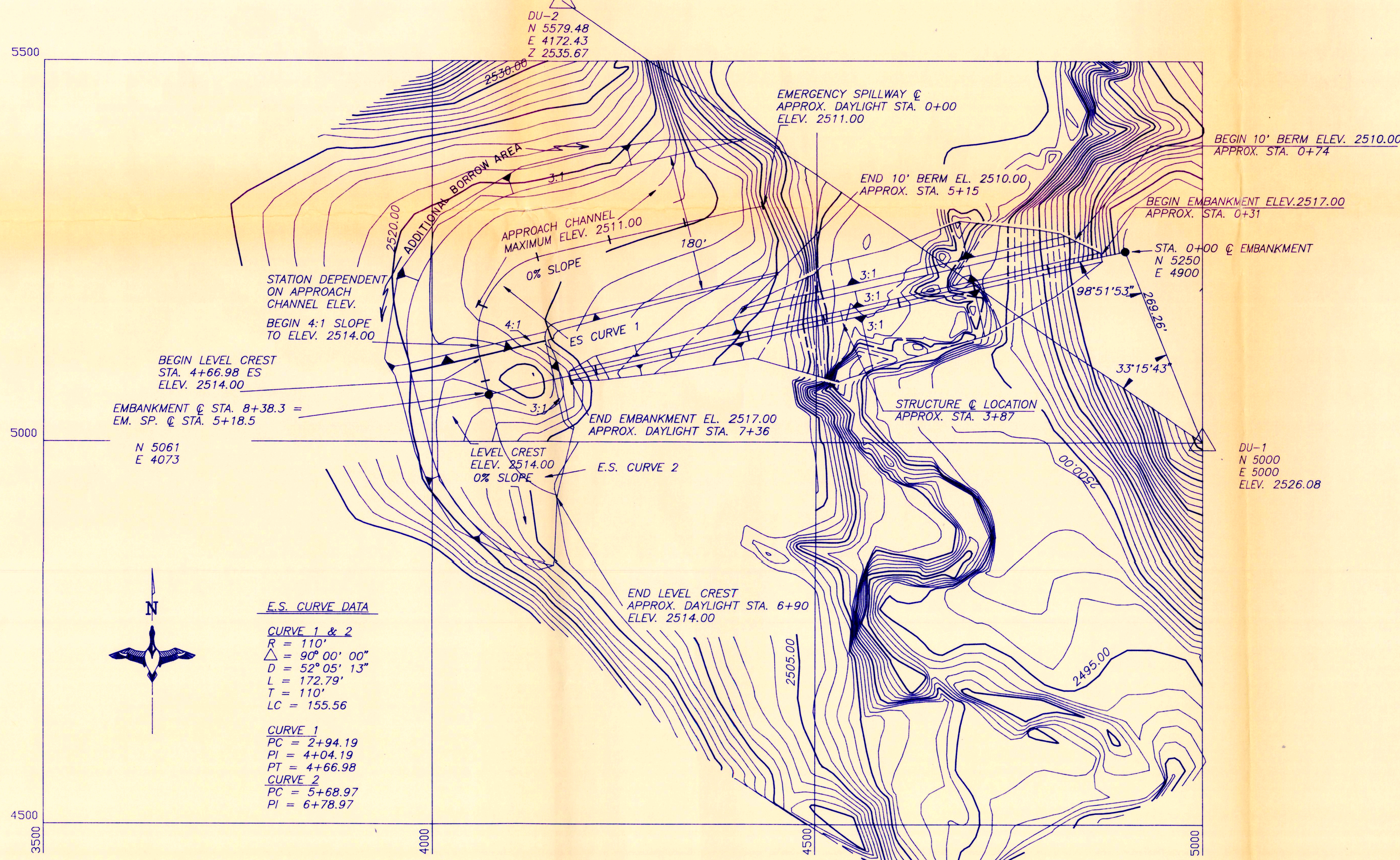
EMERGENCY SPILLWAY X-SECTION STA. 4+00

NTS



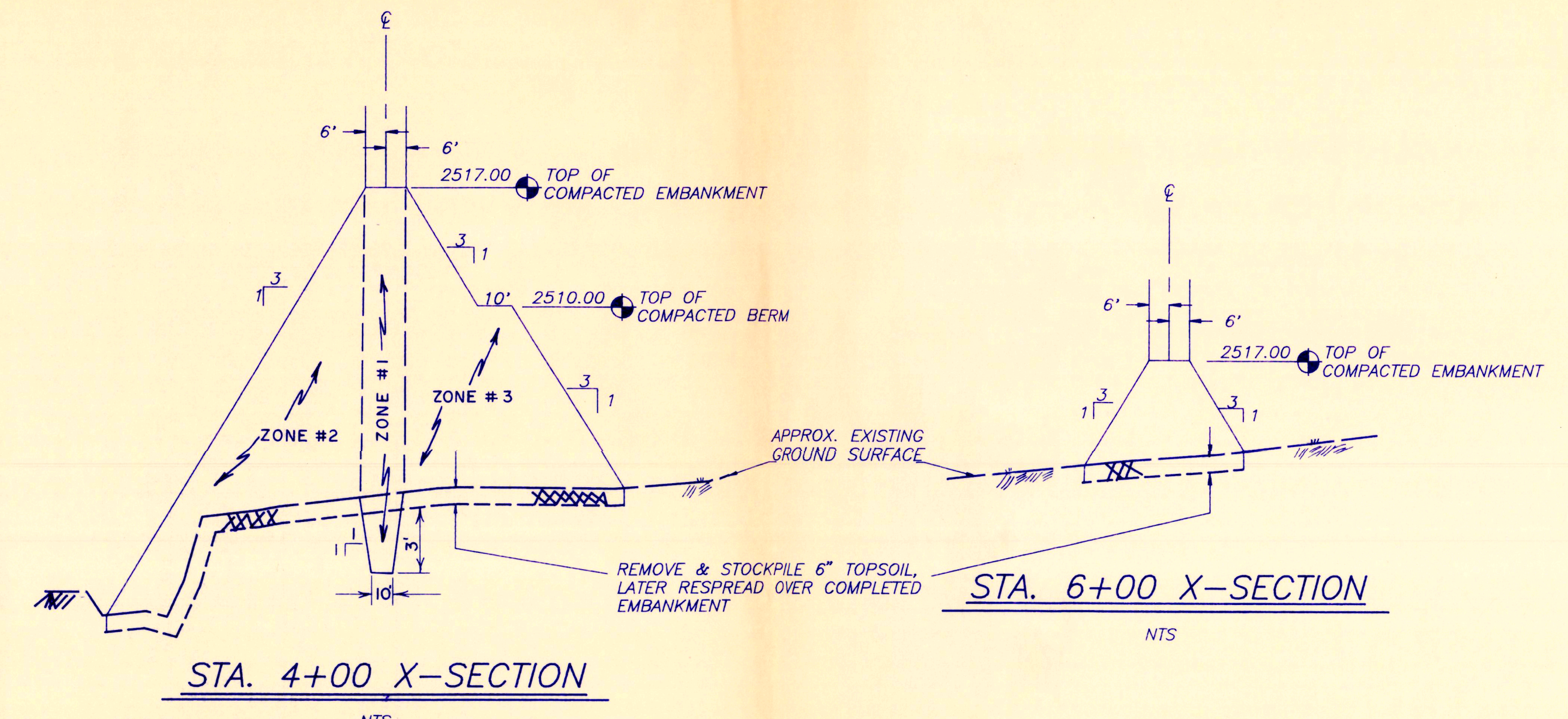
EMERGENCY SPILLWAY X-SECTION STA. 6+00

NTS



SITE PLAN

SCALE: 1"=100'



STA. 4+00 X-SECTION

NTS

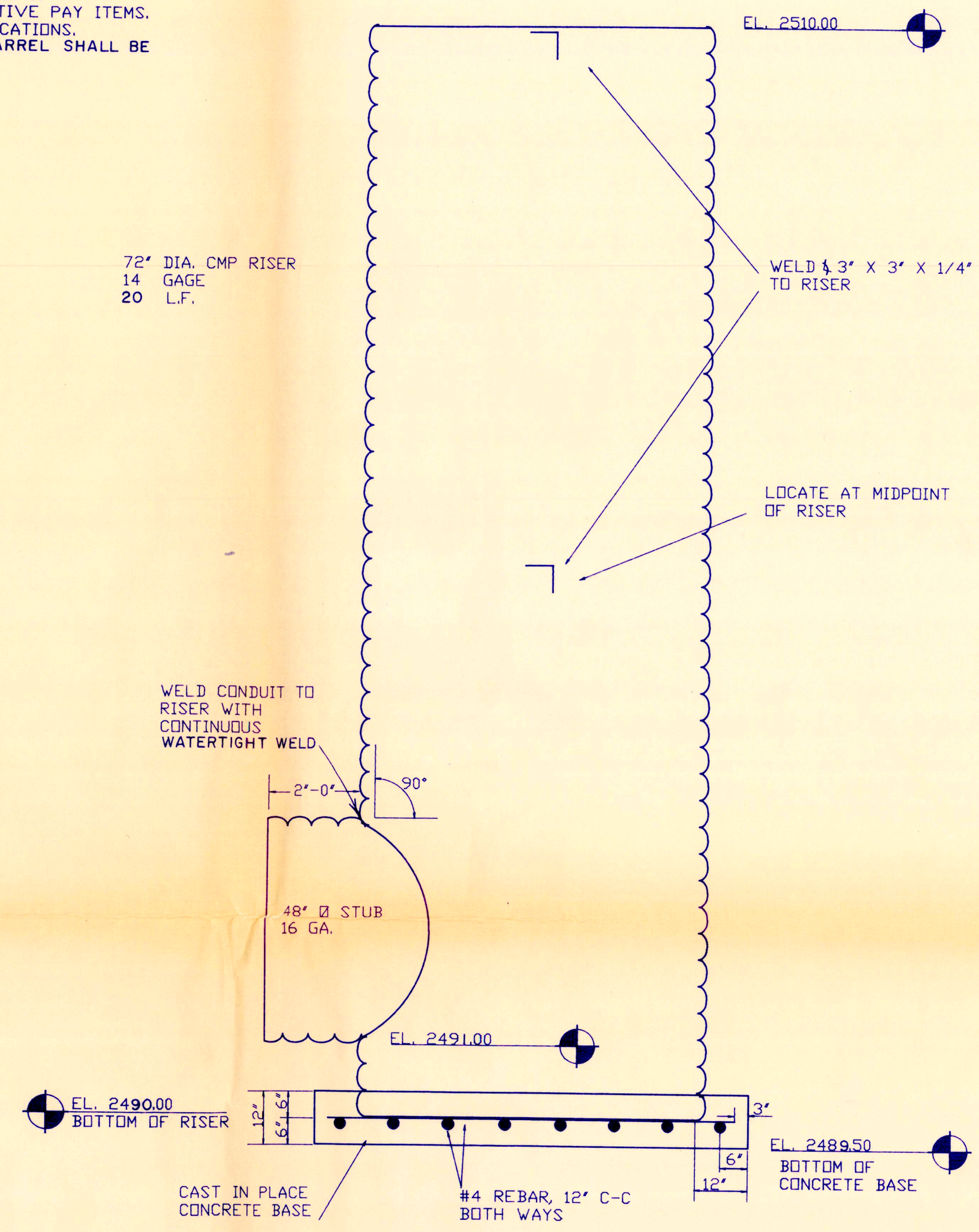
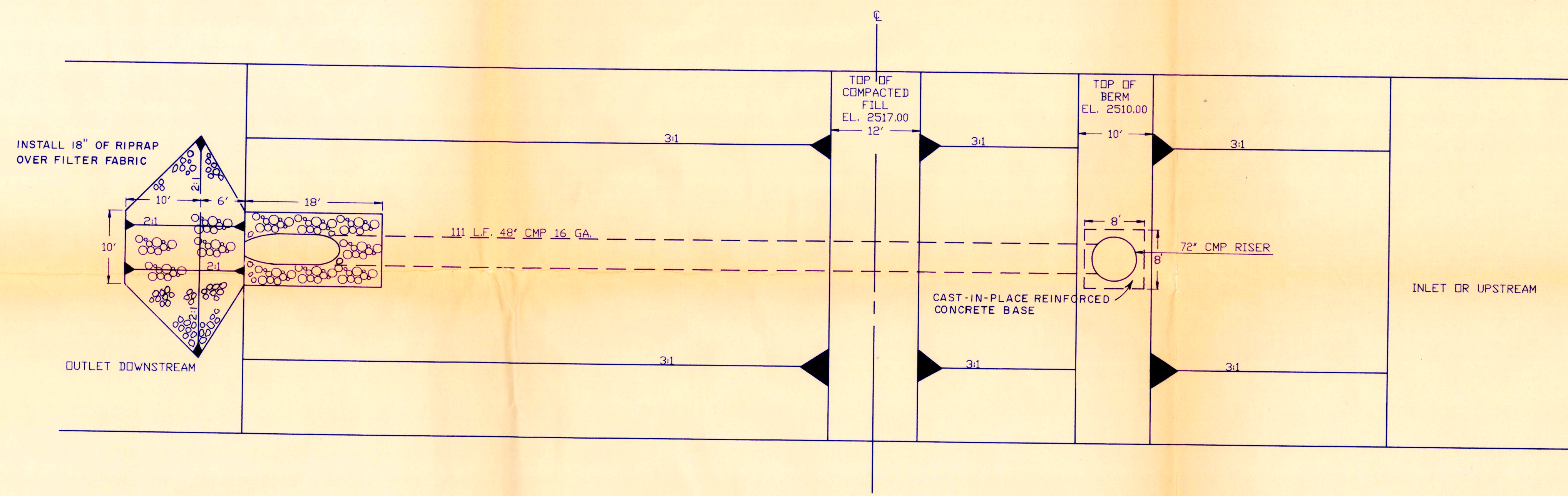
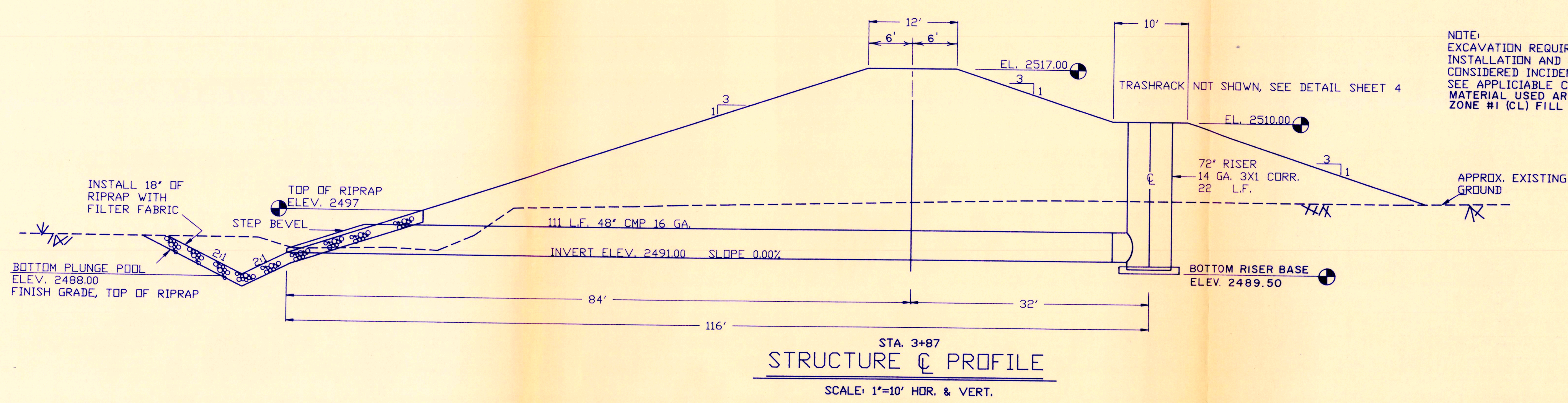
TYPICAL FROM STA. 0+74 - STA. 5+15
ZONE #1 = MATERIAL CLASSIFIED AS LEAN CLAY (CL)
ZONE #2 = MATERIAL MADE UP OF A COMPOSITE MATERIAL FROM LEAN CLAY & CLAYEY SAND, MIXING WILL BE REQUIRED. (CL/CS)
ZONE #3 = MATERIAL MAY BE MADE UP OF PREDOMINANTLY CLAYEY SAND SOILS (CS)

PRELIMINARY

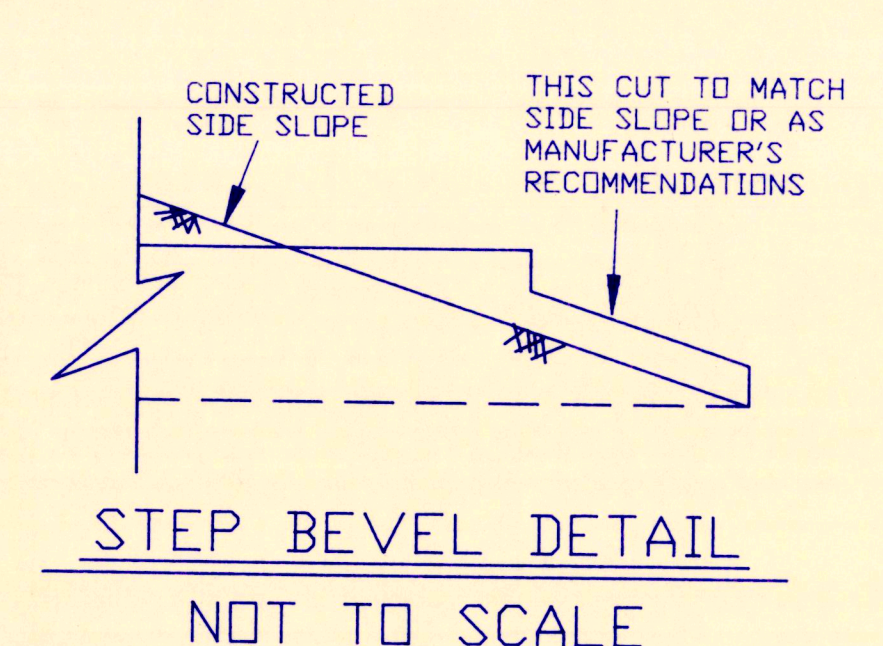
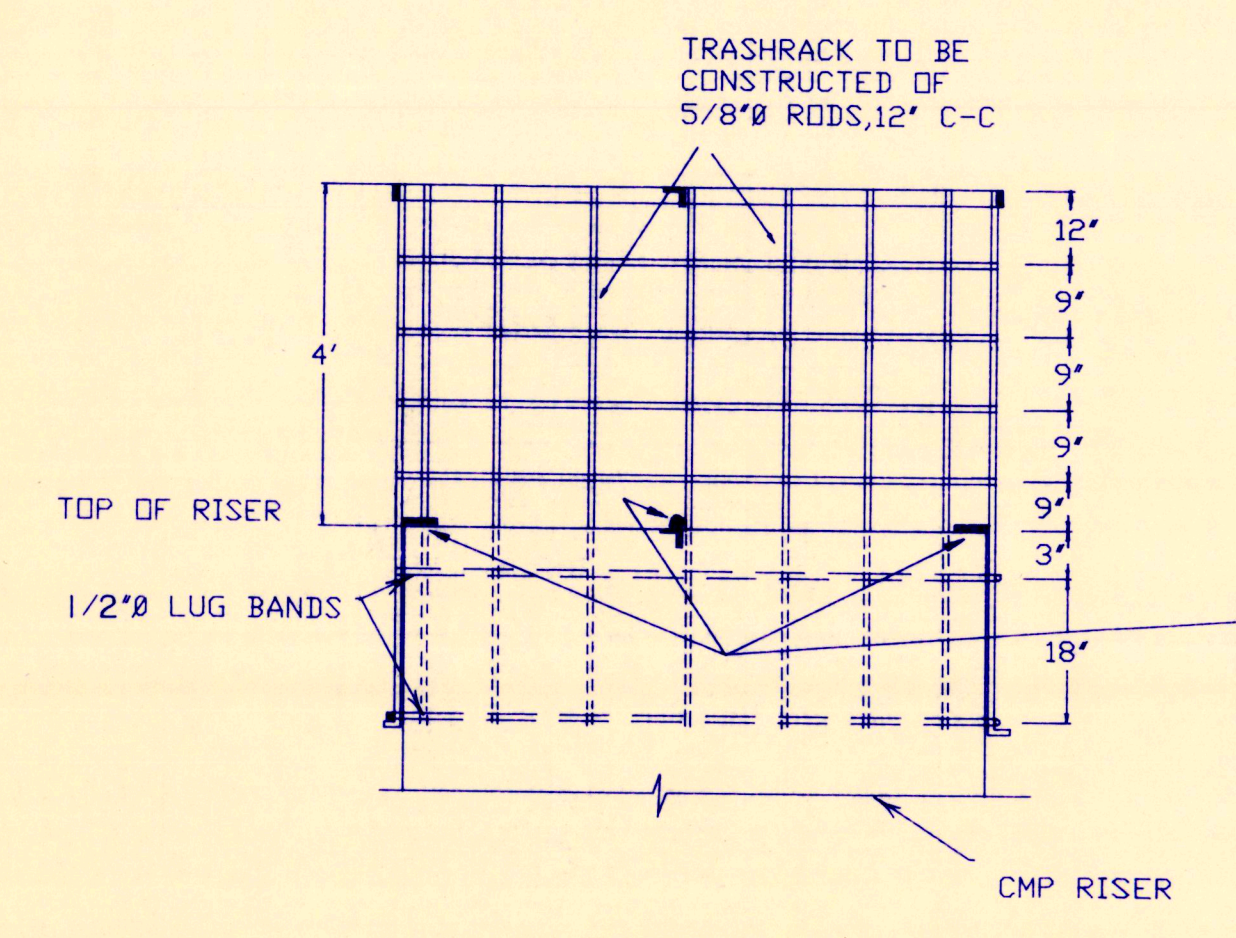
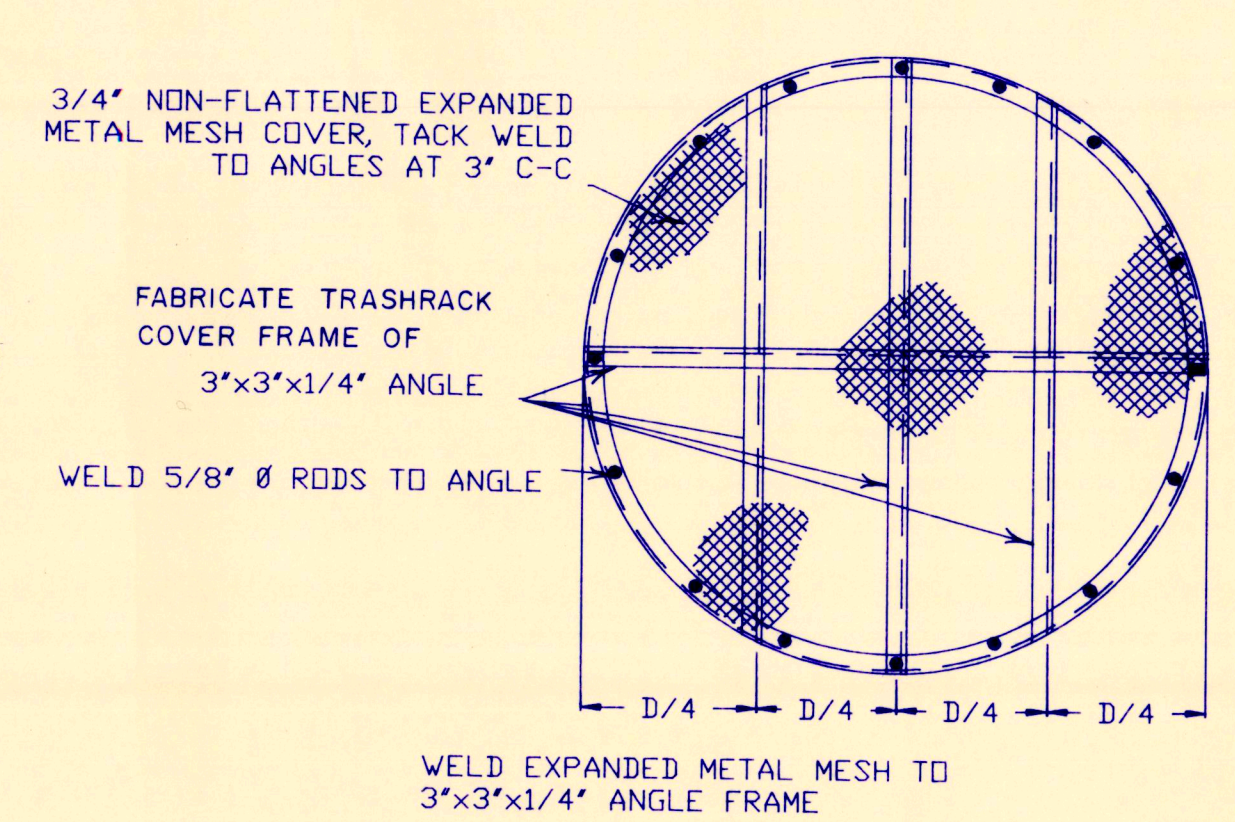
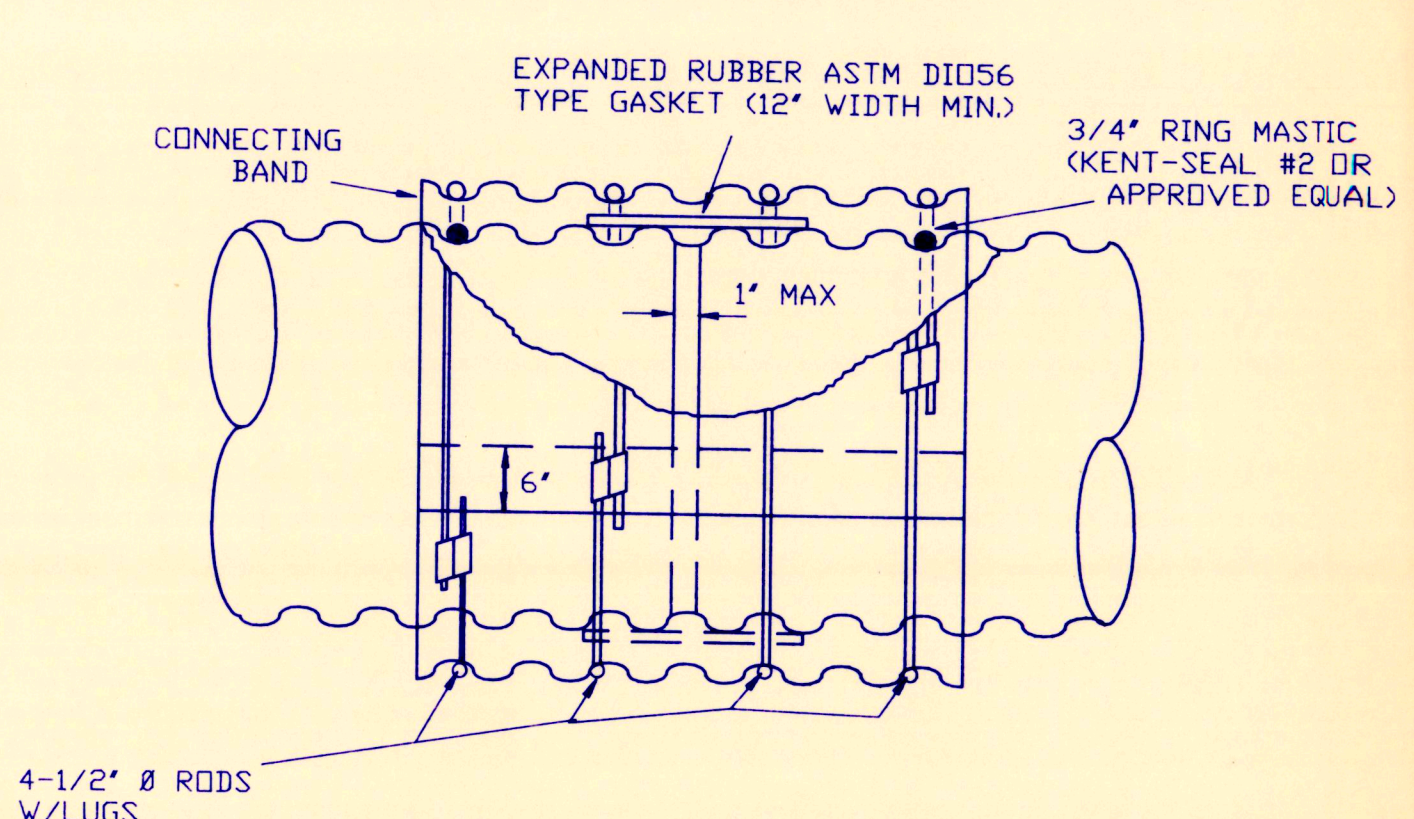


DUKS UNLIMITED INC. GREAT PLAINS REGIONAL OFFICE	PROJECT NO. DU-1-SD-060-01	DESIGNED BY: RCS
	SOUTH FORK IMP. SITE PLAN & & PROFILES	DRAWN BY: TE
DATE: 1-3-91	SHEET NO: 3 OF 4	CHECKED BY:
	APPROVED BY:	

1509-1



- NOTES
1. 6' BAND OVERLAP SHALL BE COATED WITH TAR, PRIOR TO SECURING RODS
 2. AFTER BANDS HAVE BEEN TIGHTENED, A COAT OF TAR SHALL BE PLACED AROUND THE PIPE AT THE ENDS OF THE CONNECTING BANDS
 3. FOR ACCEPTABLE BANDING ALTERNATIVES SEE D.U. SPECIFICATION 207



CONTROL STRUCTURE DETAIL
NOT TO SCALE

STEP BEVEL DETAIL
NOT TO SCALE

TRASHRACK DETAIL
NOT TO SCALE

PRELIMINARY

	PROJECT NO. DU-1-SD-060-01	DESIGNED BY: RCS
	SOUTH FORK IMP.	DRAWN BY: IE
GREAT PLAINS REGIONAL OFFICE	STRUCTURE PLAN & PROFILE	CHECKED BY:
DATE: 1-3-91	SHEET NO: 4 OF 4	APPROVED BY: