

WATER PERMIT NO. 1784-1

Name of Applicant: Mark Jensen

Address: HC 66 Box 67A, Newell SD 57760

Phone: ⁴⁶⁰⁹605 866-4069

Amount of Water Claimed: 190 AF

Total Acres: NA

Source of Water Supply: runoff & Hans Creek

Water to be used for: fish & wildlife propagation and livestock water

County: Butte

Type of Waste Disposal System:

Location: 27 miles north of Newell

PRIORITY Date Received: 12-24-2002

Application/License Fee: \$275

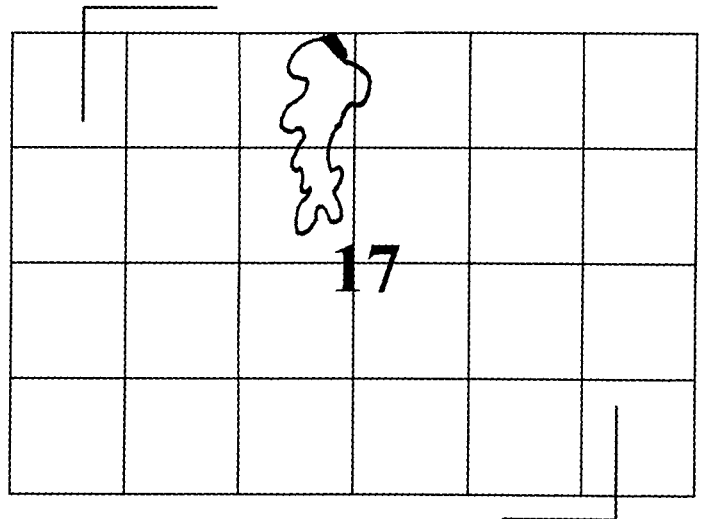
Corrected Application Received: 1-13-2003

Period of Annual Use: January 1 – December 31

Remarks: Reconstruction of Hoover Dam

Diversion Point: NE ¼ NW ¼ Section 17-T13N-
R7E

Land to be Irrigated: E ½ NW ¼, NW ¼ NE ¼
Section 17-T13N-R7E



Depth of Well: NA

Well Driller: : NA

Remarks:

Type of Map: topo

Prepared by: Roger C Smith, Ducks Unlimited

Reviewed and the Number Assigned on: 1-13-2003

By: Karen Schlaak

Notice of Hearing - date to intervene: _____

SOUTH DAKOTA
WATER PERMIT NO. 1784-1

Date of first receipt of application December 24, 2002.

Date of return to applicant for corrections, amendments or changes December 30, 2002.

Date of receipt of corrected application January 13, 2003.

The Chief Engineer, on behalf of the Water Management Board, issues Water Permit No. 1784-1 to Mark Jensen, HC 66 Box 67A, Newell SD 57760 authorizing the construction of the dam and the placing of water to beneficial use subject to the following limitations, conditions and qualifications:

1. Water Permit No. 1784-1 authorizes impoundment of 190 acre-feet of water from runoff and Hans Creek by reconstructing Hoover Dam located in the NE ¼ NW ¼ Section 17 with water impounded in the E ½ NW ¼, NW ¼ NE ¼ Section 17; all in T13N-R7E.
2. The water appropriated shall be used for the purpose of fish and wildlife propagation and livestock water purposes and may not exceed the amount of water needed for beneficial 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. 1784-1 is March 24, 2003.
5. The date from which applicant may claim right is December 24, 2002.
6. One-fifth of the construction is to be completed on or before September 24, 2005.
7. All construction is to be completed on or before March 24, 2008.
8. Water is to be put to beneficial use on or before March 24, 2012.
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. Water Permit No. 1784-1 authorizes a dam with a storage capacity of 190 acre feet of water and sufficient water annually to maintain the water level to the outlet elevation of 2,753 feet mean sea level.
2. Low flows as needed for downstream domestic use, including livestock water and prior water rights must be by-passed.

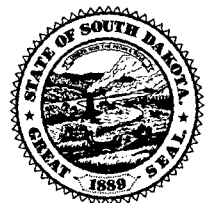
WATER MANAGEMENT BOARD

By: Garland Erbele

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

APR 21 2003

date



FORM 2: Application for uses other than irrigation
(type or print)

RECEIVED
DEC 24 2002
WATER RIGHTS
PROGRAM

Mail to: Water Rights Program Joe Foss Building 523 E. Capitol Pierre, SD 57501-3181 (605) 773-3352	No. <u>1784-1</u> (office use only) Hydrologic Unit <u>10130304</u>
	Basin <u>Moreau River</u>
	Newspaper <u>Butte Co. Valley Irrigator</u>

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

Check use(s) of water:

- | | | | |
|---|---|--|--|
| ☐ Municipal | ☐ Suburban Housing | ☐ Recreational | ☐ Institutional |
| ☐ Rural Water System | ☐ Commercial | ☒ Fish & Wildlife | ☐ Geothermal Heat |
| ☐ Domestic (over 18 gpm) | ☐ Industrial | ☒ Other <u>cattle watering</u> | |

Type of Application: (check one)

- ☒ New ☐ Vested Right (Use predates Mar 2, 1955) ☐ Future Use Reservation
☐ Place to Beneficial Use Water Reserved by Future Use Permit No. _____
☐ Amendment/Correction to Permit No. _____

Description of amendment/correction: (i.e. change diversion point(s), add diversion point(s), change use, etc.)

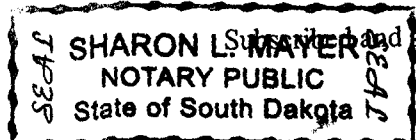
- Name of Applicant Mark Jensen Phone 605-866-4069
(check one) ☒ Owner ☐ Tenant/lessee
Mailing Address HC 66 Box 67A; Newell, SD State SD 57760
(Street, RR, or Box and City) (Zip Code)
- Amount of water claimed _____ *CFS or _____ **GPM 190 ***AF
(*Cubic Feet per Second) (**Gallons per Minute) (**Acre Feet - storage capacity of dam/dugout or annual use if applicable)
- Source of water supply surface runoff - Hans Creek Tributary to South Fork Moreau River
- Location of point of diversion (example - 3 wells in SW1/4 NE1/4 section 12-T104N-R53W) County Butte
NE 1/4 NW 1/4 17 TWP. 13 N RGE 7 E Water Impounded:
LAT - 45.09696° LONG - 103.29428° E 1/2 NW 1/4, NW 1/4 NE 1/4 Sec 17-T13N-
R7E
- County or counties where water will be used BUTTE
- Annual period during which water is to be used JAN 1 - DEC. 31
- Give a description of the 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)
Reconstruction of an existing dam. Due to the link of a primary spillway, numerous spillways have been abandoned because of head erosion. Design Report attached.

STATE OF SOUTH DAKOTA)
County of PEWNINGTON SS

Attachments: Attach Form 2A if diversion is from a well or dugout, or if storage of water is proposed. Attach map and any other technical information. (see instructions)

I, MARK O. JENSEN, 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.

Applicant's signature Mark O Jensen



4/29/04 Commission Expires November 21, 2004

Sharon L Mayer
Notary Public signature

(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 _____ 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. Wastewater Disposal System Information

- a) Type of System (i.e. septic tank, drain field) _____
- b) System Capacity (gallons) _____ Year Constructed _____
- c) Connected to the City of _____ Sanitary System

3. Dugout Information

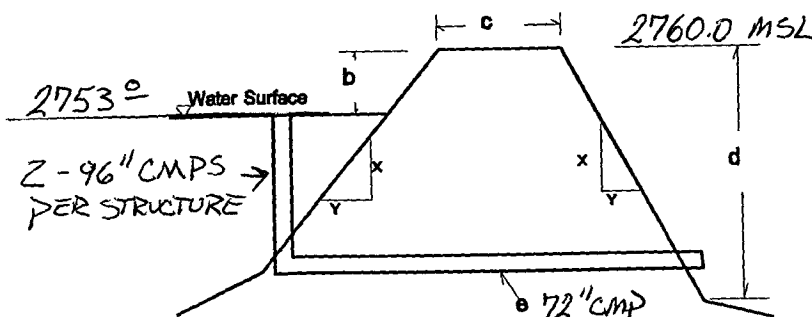
- a) Surface Dimensions _____ Depth _____
- b) Depth to water (ground surface to water level) _____

4. Water Storage Dams

If the proposed water use system contains one or more storage dams, please furnish the information requested below for each dam. The locations of the dams need to 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:

Roger C. Smith, P.E. 701-355-
Ducks Unlimited, Inc. 3553
2525 River Road
Bismarck, ND 58503



TOTAL STRUCTURES - 2

Total Structures - 2

- b) Freeboard 7.0'
- c) Crest Width 12'
Crest Length 2148'
- d) Height Max-16 (Top-pipe invert)
- e) Primary Outlet Capacity 630 cfs
If pipe, diameter 2-Dual 96" Risers/72"
- f) Secondary Spillway Capacity 1097 pipes
Spillway Width 100'
- g) X & Y Slope 3:1
Upstream 3:1
Downstream 3:1
- h) Surface Area of Impoundment 60.6
- i) Storage 188 Acre Feet
- j) Drainage Area Above Dam 14500 Acres
22.6 sq. miles

RECEIPT

WATER RIGHTS PROGRAM

South Dakota Department of Environment and Natural Resources

Date December 30, 20 02

RECEIVED OF Ducks Unlimited Inc., One Waterfowl Way, Memphis TN 38120

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

Fee for Application for Permit No. <u>2499-2 1784-1</u> to Appropriate Water, to construct and to put water to beneficial use	225	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. _____		
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	225.00

No.

000487

By

Darland Elbeke
Chief Engineer *gm*

RECEIPT

WATER RIGHTS PROGRAM

South Dakota Department of Environment and Natural Resources

Date January 13, 200302

RECEIVED OF Ducks Unlimited Inc., One Waterfowl Way, Memphis TN 38120

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		
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>2499-2 1784-1</u>	50	00
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. **000529**

By

Darlene E. Eide
Chief Engineer *gm*

DESIGN REPORT

For

HOOVER DAM

BUTTE COUNTY, SD (SD-0352-01)

November 26, 2002



Ducks Unlimited, Inc.
2525 River Road
Bismarck, ND 58501

DESIGN REPORT

PROJECT: Hoover Dam
SD -0350-01

LOCATIONS: NE ½ SECTION 17, TWP. 13 N RGE. 7E
Butte County, South Dakota

MARSH DATA: Full Service Level (FSL) @ 2753.0
60.6 Surface Acres @ FSL
189 Acre-Feet Capacity @ FSL
Maximum Depth -7'

PROJECT DATA: Top of Dam - elevation 2760.0 (Top of compacted fill add 4" for topsoil)
Primary Spillway - elevation 2753.0
Emergency Spillway - elevation 2756.0 (Top of finished grade)
Upstream Berm - 10' wide @ elevation 2753.0
Side Slopes - 3 (horizontal): 1 (vertical)



CLASSIFICATION: Based on the classification criteria outlined in Chapter 74:02:08 "Safety of Dams," it is recommended that the proposed reconstructed dam be classified as a small, Category 3 dam. No loss of life and minimal economic loss is expected should failure occur. The product of the "maximum storage capacity" times the "effective height" is 8880. (888 acre-feet x 10.0')

PRELIMINARY RISK ASSESSMENT: The proposed dam reconstruction planned on Hans Creek, located 3.72 miles above it's confluence with the South Fork Moreau River. Hans Creek enters the South Fork Moreau River 1500 feet above the bridge crossing on Highway #79. Determining impacts to the highway due to a clear weather breach of the reconstruction impoundment was not deemed necessary due to the bridge capacity at the roadway and effects of routing the flood through the creek channels.

PROPOSED PROJECT: The project consists of reconstructing an existing dam, installing primary spillways, and excavating a new emergency spillway. I do not know the full history of the dam. The dam may have been constructed as part of a WPA or CCC program. It has been extended numerous times as spillway erosion advanced to the reservoir. Erosion in the most recent emergency spillway had advanced to a point that the landowner installed a pipe. Either buoyancy or ice created uplift to the pipe and piping resulted, draining the reservoir. Channels were constructed and it appears that small primary spillways



Advancing Headcut



were attempted. All attempts apparently resulted in spillways being used too frequently causing head-cutting. In an attempt to reduce the frequency and duration of use in the emergency spillway, two primary spillways are planned. Variable level drawdown capabilities will be included in one of the primary spillways. The new emergency spillway will have a longer bulking length but will still empty into an eroded channel. A realignment of the existing embankment will result in what will be a virtual reconstruction with portions of the existing fill being used as a berm. The

new embankment material will be compacted to 95% of the Standard Proctor at -1% to +3% of optimum moisture. The dam will be constructed having a top width of 12' and having a 10' berm at the upstream full service level. All slopes will be constructed to a 3:1 slope.

PRIMARY SPILLWAY: In an effort to limit the use of what is a potentially erodible spillway, two primary spillways are planned. The structures will have fixed level water control capabilities at elevation 2753.0. Variable level water control will be provided by a separate structure having the capability of retaining water at 4" increments between elevations 2749.0 and 2753.0. The two structures will act independently of each other and be at two different locations. Each structure will have a riser that will act as a circular weir and be 96" in diameter and made of 12 gage corrugated metal pipe. The outlet barrels will be a 72", 14 gage corrugated metal pipe at a 0% slope at elevation 2744.0. All corrugated metal pipe will be coated with a 10-mill polymeric film laminate both inside and outside. A protected plunge pool will be located at the discharge end of both outlet pipes.

EMERGENCY SPILLWAY: The emergency spillway will be excavated having a 100' bottom width and 3:1 slopes. The top of the finished spillway grade, after replacing 4" of topsoil, will be 2756.0 or 3 feet above the crests of the primary spillways. The length of the level crest at the spillway centerline is 554 feet. Flows will outlet into an eroded natural drainage. No work is presently planned within the natural drainage.

Location Of New Excavated
Emergency Spillway



HYDROLOGY / HYDRAULICS: A hydrologic analysis of surface water runoff was performed using two methods. A peak discharge was determined from regression equations developed in WATER-RESOURCE INVESTIGATIONS REPORT 80-80 USGS. The NRCS TR-20 METHOD was used to determine the inflow hydrograph. The hydraulic curve number used in the TR-20 METHOD was manipulated to create peak discharges similar to those developed from the regression equation. Other assumptions made in developing inflow hydrographs by the TR-20 METHOD were:

Rain Duration = 1.00

Rain Table # = 1

Antecedent moisture condition = 2

Inflow hydrographs developed from the TR-20 METHOD were routed through the primary and emergency spillways. This yielded outflow hydrographs revealing peak discharges at maximum reservoir elevations corresponding to various runoff events. The following table is a summary of that printout:

PARAMETERS:

WATERSHED – 22.6 SQ MI

TIME OF CONCENTRATION – 7.5.0 HOURS

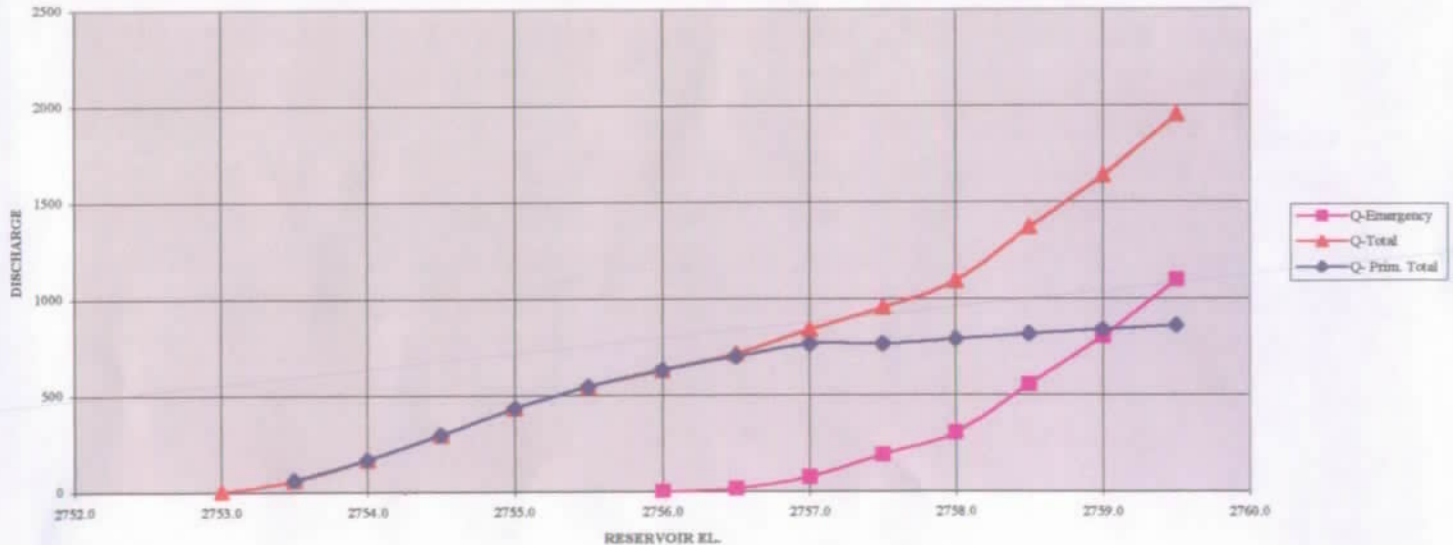
CURVE #'s – 70 (5 yr) 74 (10 yr) 75 (25yr) 76 (50yr) 79 (100 yr)

Event Frequency	Rainfall (in.)	Runoff* (ac-ft)	Inflow (cfs)	Outflow (cfs)	Max WSP (el.)	Freeboard** (ft.)	Flow in ES (cfs)
5 yr	2.2	386	313	273.4	2754.42	5.58	0
10 yr	2.4	662	577	466.2	2755.16	4.84	0
25yr	3.0	1158	1070	767.6	2756.71	3.29	22.5
50 yr	3.4	1558	1490	1042.4	2757.82	2.18	287
100 yr	3.8	2172	2163	1623.8	2758.97	1.03	787

*values indicate the TR-20 model prediction. USGS Regression Equations predicted 20%-30% less runoff.

**Calculated from top of compacted fill, excluding topsoil. 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 estimated from FLOWCOMP, a computer-aided hydraulic program analyzing gradually varied flow profiles in prismatic open channels using the standard step method.

SPILLWAY RATING CURVES



DROUGHT ANALYSIS: The frequency in which there will be adequate runoff was not an important criteria to project sponsors. Using NRCS methods, the 80% and 50% annual runoff will generate 66 and 265 acre-feet respectively. The annual requirement assuming an evaporative loss of approximately 3.0 feet is 133 acre-feet. Although the watershed is large and the surface soils are predominately resistant to infiltration, upstream storage and periodic dry spells will result in years that the shallow reservoir goes dry.



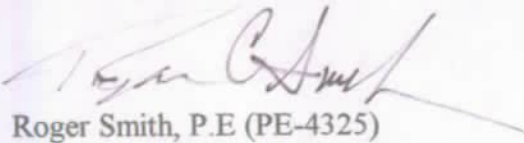
Boring Being Advanced At One Of The Primary Spillway Structure Locations

SOIL INVESTIGATION: Zeltinger Geotechnical Engineering has completed a geotechnical investigation. A report on the exploration program is available upon request. Other than some soft lean clays below 6.5 feet and soft fat clays below 17', soils were predominately firm to very hard fat clays. Due to the nature of fat clays, proper moisture and compaction will be applied to fill materials.

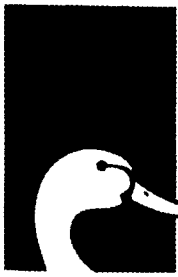
IMPACTS TO SURROUNDING PROPERTY: The planned construction and subsequent reservoir at the full service level will be contained within land owned by Mark Jensen. The planned construction restores water-holding capabilities to a dam that, up until 1997, held water.

Dated: November 26, 2002

Submitted By:


Roger Smith, P.E (PE-4325)
Regional Engineer
Ducks Unlimited
Great Plains Regional Office





DUCKS
UNLIMITED
INC.

GREAT PLAINS REGIONAL OFFICE

2525 River Road
Bismarck, North Dakota 58503-9011
(701) 355-3500
(701) 355-3575 Fax

RECEIVED

DEC 24 2002

WATER RIGHTS
PROGRAM

December 20, 2002

Tim Schall
Water Rights Division
SD Dept Water & Natural Resources
523 E. Capitol
Pierre, SD 57501

Re: Hoover Dam Restoration (near the town of Hoover, SD)

Dear Mr. Schall:

Enclosed is a water right application for a dam reconstruction project near the town of Hoover, SD. Mark Jensen owns the land the dam and reservoir is on.

I have included the application (forms 2 and 2A), plans, Design Report, and a payment of \$225.

If you have any questions please feel free to contact me.

Sincerely,

Roger Smith, P.E.
Regional Engineer
Great Plains Regional Office

Cc: Steve Fairbairn



DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES

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

December 30, 2002

Roger C Smith
Ducks Unlimited, Inc.
2525 River Road
Bismarck ND 58503

RE: Reconstruction of Hoover Dam

Dear Mr. Smith:

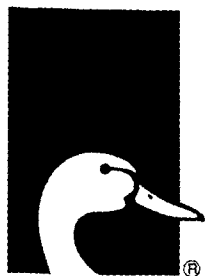
Thank you for submitting the *Application for a Permit to Appropriate Water* for reconstruction of Hoover Dam (Mark Jensen).

We have received the \$225 application filing fee. In addition to the application filing fee, the Water Rights Program collects the \$50 licensing fee at the time of filing. Please submit \$50 for the licensing of the water permit.

If you have any questions, please contact me.

Sincerely,

Karen Schlaak
Water Rights Program
605 773-3352



DUCKS
UNLIMITED
INC.

GREAT PLAINS REGIONAL OFFICE

2525 River Road
Bismarck, North Dakota 58503-9011
(701) 355-3500
(701) 355-3575 Fax

January 2, 2003

RECEIVED
JAN 13 2003
WATER RIGHTS
PROGRAM

Karen Schlaak
Water Rights Division
SD Dept Water & Natural Resources
523 E. Capitol
Pierre, SD 57501

Re: Hoover Dam Restoration (near the town of Hoover, SD)

Dear Ms. Schlaak:

Enclosed is a licensing fee to accompany the application for Hoover Dam near the town of Hoover, SD. The application and application filing fee have been submitted.

If you have any questions please feel free to contact me.

Sincerely,

Roger Smith, P.E.
Regional Engineer
Great Plains Regional Office

Water Permit Application #1784-1
#2499-2
Mark Jensen

Cat. 3 - Low Hazard

Top of Dam Elev. - 2760
2nd Spillway Elev. - 2756
P. Spillway Elev. - 2753
D/S Toe Elev. - 2744

Ht. = 16 ft

Normal Storage Capacity - 190 Ac.-Ft
Int. Storage Capacity - 421
Max. Storage Capacity - 888

Int. Capacity x Eff Ht. = $421 \times 12 = 5052 > 3000 \therefore$ 50 yr
Minimum Spillway Design

From USGS WRI 80-80 "Tech. For Est. Flood Peaks ... in SD"

DA = 14,500 Ac = 22.6 mi²

Slope = 20 ft/mi (Ave. Upper 1/3 = 33 ft lower 2/3 = 16)

SI = 2.5

$$Q_{50} = 106 A^{.63} S^{.45} S_i^{-.69}$$

$$= 106 (22.6)^{.63} (20)^{.45} (2.5)^{-.69}$$

$$= 106 (7.13) (3.85) (.5314)$$

$$= \underline{1546 \text{ cfs}}$$

$$Q_{100} = 132 A^{.65} S^{.46} S_i^{-.67}$$

$$= 132 (22.6)^{.65} (20)^{.46} (2.5)^{-.67}$$

$$= 132 (7.5888) (3.9671) (.5412)$$

$$= \underline{2150 \text{ cfs}}$$

Secondary Spillway Flow

$$Q = CLH^{3/2} \quad C = 2.6$$

$$= (2.6)(100)(4)^{3/2} \quad L = 100$$

$$= \underline{2080 \text{ cfs}} \quad H = 4$$

Ducks Unlimited uses the NRCS TR-20 model to route a Q_{50} peak of 1490 cfs thru the dam with 2.18 ft of freeboard remaining, and a Q_{100} peak of 2163 cfs thru the dam with 1.03 ft of freeboard remaining.

Section 74:02:08:09

NRCS Annual Yield

CN = 76 ISO = 1 DA = 14,500 Ac

1. Topo Map - OK
2. Dam Axis Profile - OK
3. Dam Max X-Sec. - OK
4. Area - Capacity - OK
5. Outlet Details - OK
6. Spillway Rating - OK
7. Spillway Details - OK
8. Specs - 5th DU - OK
9. EPP - Cat. 3 N/A - OK

80% chance = 0.06

$$0.06 \times 14,500 \text{ ac} = \underline{72.5 \text{ Ac.-Ft}}$$

50% chance = 0.19

$$0.19 \times 14,500 \text{ ac} = \underline{230 \text{ Ac.-Ft}}$$

10% chance = 1.1

$$1.1 \times 14,500 \text{ ac} = \underline{1329 \text{ Ac.-Ft}}$$





**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 24, 2003

Mark Jensen
HC 66 Box 67A
Newell, SD 57760

Dear Mr. Jensen:

We have reviewed the plans and specifications for your dam project located in the NW 1/4 of Section 17-T13N-R7E, in Butte County. The plans and specifications as submitted are approved. Approval of the plans and specifications does not authorize construction of the dam. The construction of the dam may not begin until Water Permit No. 1784-1 is approved.

Our review was to determine compliance with the requirements of the Water Management Board Safety of Dams Rules, Chapter 74:02:08. Approval of these plans and specifications does not release you, as owner of the dam, from the responsibility for operating and maintaining the dam in good repair to ensure the safety of the dam.

The Hoover Dam will be classified as a small size Category 3, Low Hazard dam with a dam height of 16 feet and a normal storage capacity of 190 acre-feet and a maximum storage capacity of 888 acre-feet.

If you have any questions, please feel free to contact us.

Sincerely,

Gale N. Selken, P.E.
Natural Resources Engineer Director
for Garland Erbele, Chief Engineer
Water Rights Program
(605) 773-3352

c: Roger Smith, Ducks Unlimited Inc.

REPORT ON
WATER PERMIT APPLICATION No. 1784-1
Mark Jensen
January 28, 2003

Water Permit Application No. 1784-1 has been filed by Mark Jensen to impound 190 acre-feet of water by reconstructing Hoover Dam, located in the NE 1/4 NW 1/4 of Section 17-T13N-R7E in Butte County. The application also requests impoundment of sufficient water to maintain water at the outlet elevation of 2753.0 feet mean sea level. The water will be used for fish and wildlife production and livestock use.

Discussion:

The dam will be classified as a small size, Category 3, Low Hazard dam. Ducks Unlimited Inc. has designed the dam. The plans and specifications have been reviewed and will be approved.

The reconstructed Hoover Dam will be 16 feet high with a normal storage capacity of 190 acre-feet with a reservoir level at the primary spillway elevation, and a maximum storage capacity of 888 acre-feet with a reservoir level at the top of dam elevation. A dam of this size and hazard classification is required to have a minimum spillway design capable of passing a 50-year frequency event.

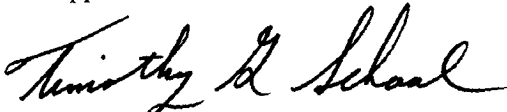
Hoover dam has a drainage area of 14,500 acres or 22.6 square miles. The reconstruction project is designed to have two-double 96 inch diameter CMP risers with a 72 inch diameter CMP barrel and seven feet of freeboard serving as primary spillway structures at different locations, and a 100 foot wide earthcut secondary spillway with 4.0 feet of available freeboard. Ducks Unlimited, Inc. uses the NRCS TR-20 model to route a 50-year frequency event peak of 1490 cfs through the spillways with 2.18 feet of freeboard remaining, and a 100-year frequency event peak of 2163 cfs through the spillways with 1.03 feet of freeboard remaining.

The annual yield for this drainage area with an 80 percent chance of occurrence, or 8 out of 10 years, is expected to be 72.5 acre-feet. The annual yield with a 50 percent chance of occurrence, or 1 out of 2 years, is expected to be 230 acre-feet and the annual yield with a 10 percent chance, or 1 out of 10 years, is expected to be 1329 acre-feet.

Hoover Dam is located in the NE1/4 NW 1/4 of Section 17-T13N-R7E on Hans Creek about two miles upstream of its confluence with the South Fork Moreau River. The Ducks Unlimited Design Report indicates that Hoover Dam has existed for quite some time, and possibly as long ago as the 1930's as a WPA project. There are no existing Water Permit/Rights located between Hoover Dam and the South Fork Moreau River.

Conclusions:

1. Water Permit Application No. 1784-1 should be approved since unappropriated water is available and approval should not have an adverse effect on existing Water Permits/Rights.
2. If approved, the low flow bypass requirement for downstream domestic use should be a qualification on Water Permit Application No. 1784-1.



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

Approved by:



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



**DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES**

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

**RECOMMENDATION OF CHIEF ENGINEER FOR WATER PERMIT
APPLICATION NO. 1784-1, Mark Jensen**

Pursuant to SDCL 46-2A-2, the following is the recommendation of the Chief Engineer, Water Rights Program, Department of Environment and Natural Resources concerning Water Permit Application No. 1784-1, Mark Jensen, HC 66, Box 67A, Newell SD 57760.

The Chief Engineer is recommending APPROVAL of Application No. 1784-1 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) it is in the public interest with the following qualifications:

1. Water Permit No. 1784-1 authorizes a dam with a storage capacity of 190 acre feet of water and sufficient water annually to maintain the water level to the outlet elevation of 2,753 feet mean sea level.
2. Low flows as needed for downstream domestic use, including livestock water and prior water rights must be by-passed.

See report on application for additional information.

Garland Erbele, Chief Engineer
February 21, 2003



**DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES**

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

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

February 24, 2003

Mark Jensen
HC 66 Box 67A
Newell SD 57760

Dear Mr. Jensen:

Water Permit Application No. 1784-1 for fish & wildlife propagation and livestock water 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 Butte Co Valley Irrigator printed at Newell, SD (Ph # 605-456-2585). You will need to contact the newspaper and authorize publication of this notice. 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. Upon receiving authorization, 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 also 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
Natural Resources Engineer
(605) 773-3352

enclosures

cc: Roger Smith, Ducks Unlimited, 2525 River Road, Bismarck ND 58501

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 ENVIRONMENT
and NATURAL RESOURCES

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

February 24, 2003

Butte Co. Valley Irrigator
PO Box 167
Newell SD 57760-0167

ATTENTION: Legal Public Notice

Enclosed is a Notice of Hearing on Application No. 1784-1 to Appropriate Water to be published twice. Please publish the first notice on March 5, 2003 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 Mark Jensen, HC66 Box 67A, Newell SD 57760 (Ph # 605-866-4069).

Please send the Water Rights Program the first publication immediately. The publication is checked for accuracy so any corrections can be made in the second publication. You may use the form below or fax a copy of the first publication. Any fax should be sent to the attention of Karen Schlaak at (605) 773-4068. Publication errors can invalidate the public notice.

After the second publication, **please send us an affidavit or use the enclosed Proof of Publication form.** The applicant pays the cost of publication, but the Water Rights Program records require an affidavit or Proof of Publication. Delays in receiving the affidavit can be costly to the applicant.

Sincerely,

Eric Gronlund
Natural Resources Engineer
605 773-3352

enclosures

-----CUT HERE-----

TO: Eric Gronlund
Water Rights Program
Joe Foss Building
Pierre SD 57501-3181

No. 1784-1

Date _____

We are in receipt of your letter of February 24, 2003 enclosing Notice of Hearing to Appropriate Water by Application No. 1784-1 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 March 5, 2003 with the second publication 7 days later. The applicant is responsible for payment.

NOTICE OF APPLICATION NO. 1784-1 to Appropriate Water

Notice is given that Mark Jensen, HC 66 Box 67A, Newell SD 57760 has filed an application for a water permit to impound 190 acre-feet of water from runoff and Hans Creek by reconstructing Hoover Dam located in the NE $\frac{1}{4}$ NW $\frac{1}{4}$ Section 17 with water impounded in the E $\frac{1}{2}$ NW $\frac{1}{4}$, NW $\frac{1}{4}$ NE $\frac{1}{4}$ Section 17; all in T13N-R7E. This application requests impoundment of sufficient water to maintain water to the outlet elevation of 2753.0 feet mean sea level. The water is for fish and wildlife propagation and livestock water purposes.

Pursuant to SDCL 46-2A-2, the Chief Engineer recommends APPROVAL of Application No. 1784-1 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. In accordance with SDCL 46-2A-23, the Chief Engineer will act on the application, as recommended, unless a petition is filed opposing the application or the applicant files a petition contesting the Chief Engineer's recommendation. If a petition opposing the application or contesting the recommendation is filed, then a hearing will be scheduled and the Water Management Board will consider the application. Notice of the hearing will be given to the applicant and any person filing a petition.

Any person interested in opposing or supporting this application or recommendation must file a written petition with BOTH the applicant and Chief Engineer. The applicant must file a petition if contesting the Chief Engineer's recommendation. The Chief Engineer's address is "Water Rights Program, 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 March 24, 2003.

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. Contact Eric Gronlund at the above Water Rights Program address to request copies of information pertaining to this application. Steven M. Pirner, Secretary, Department of Environment and Natural Resources.

PROOF OF PUBLICATION

STATE OF SOUTH DAKOTA)
) SSCounty of Butte)I, Lori Deighton

certify that the attached printed Notice was taken

from the Butte County Valley Irrigatorprinted and published in SturgisCounty of Meade and

state of South Dakota. The notice was published

in the newspaper on the following two dates:

March 6, 2003March 13, 2003Cost of Printing \$ 36.39Lori Deighton
(Signature)Office Manager
(Title)March 13, 2003
(Date Signed)NOTICE OF APPLICATION
NO. 1784-1 to Appropriate
Water

Notice is given that Mark Jensen, HC 66 Box 67A, Newell SD 57760 has filed an application for a water permit to impound 190 acre-feet of water from runoff and Hans Creek by reconstructing Hoover Dam located in the NE1/4 NW1/4 Section 17 with water impounded in the E1/2 NW1/4, NW1/4 NE1/4 Section 17; all in T13N-R7E. This application requests impoundment of sufficient water to maintain water to the outlet elevation of 2753.0 feet mean sea level. The water is for fish and wildlife propagation and livestock purposes.

Pursuant to SDCL 46-2A-2, the Chief Engineer recommends APPROVAL of Application No. 1784-1 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. In accordance with SDCL 46-2A-23, the Chief Engineer will act on the application, as recommended, unless a petition is filed opposing the application or the applicant files a petition contesting the Chief Engineer's recommendation. If a petition opposing the application or contesting the recommendation is filed, then a hearing will be scheduled and the Water Management Board will consider the application. Notice of the hearing will be given to the applicant and any person filing a petition.

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The petition may be informal, but must include a statement describing the petitioner's interest in the application, the petitioner's reason 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. Contact Eric Gronlund at the above Water Rights Program a "ress to request copies of information pertaining to this application. Steven M. Pirner, Secretary, Department of Environment and Natural Resources.

Published Thursday, March 6, and
March 13, 2003
Butte County Valley Irrigator

NOTICE OF APPLICATION
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Water

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The petition may be informal, but must include a statement describing the petitioner's interest in the application, the petitioner's reason 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. Contact Eric Gronlund at the above Water Rights Program address to request copies of information pertaining to this application. Steven M. Pirner, Secretary, Department of Environment and Natural Resources.

Published Thursday, March 6,
and March 13, 2003
Butte County Valley Irrigator

RECEIVED
MAR 14 2003
WATER RIGHTS
PROGRAM



DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES

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

APR 21 2003

Mark Jensen
HC 66 Box 67A
Newell SD 57760

Dear Mr. Jensen:

Enclosed is Water Permit No. 1784-1 authorizing construction of your water diversion system and beneficial use of the water, not exceeding the limits as specified in the Water Permit.

Form 10, *Notice of Completion of Works and Application of Water to Beneficial Use*, is enclosed. Please return this completed form after you have finished the system and have put the water to beneficial use. An investigation can then be scheduled so the water license may be issued, thus completing the acquisition of a water right.

An informational sheet *Common Water Right Questions?* is also enclosed. This sheet is intended to answer some of the questions associated with obtaining and keeping a water right.

Sincerely,

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

enclosures

Permit No. 1784-1
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 18, 2003**, made a thorough examination of the water use system constructed by **Mark Jensen** of **HC 66 Box 67A** holder of Permit No. **1784-1**, bearing the priority of **December 24, 2002** authorizing the storage of **190** acre-feet of the waters of **runoff & Hans Creek** for **fish & wildlife propagation and livestock use** purposes, in **Butte** County.

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

A. Works used to divert the water:

A 16 foot high earthen dam with a normal storage capacity of 190 acre feet

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

N/A

C. Works used to apply water to beneficial use:

A 16 foot high earthen dam with a normal storage capacity of 190 acre feet

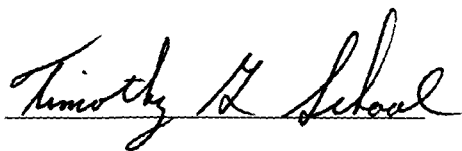
The system is in the following condition **good**. The point of diversion is located **150 feet south & 2500 feet east of the NW corner of Sec. 17-T13N-R7E (NE ¼ NW ¼)**. The works are capable of storing **190** acre-feet of water which is to be used for **fish & wildlife propagation and livestock use**. Water has been put to beneficial use to the maximum extent as follows:

A 16 foot high earthen dam with a normal storage capacity of 190 acre feet

and the license should be issued for **190** acre-feet of storage.

Applicable permit qualifications have been complied with: Yes **X**

Exceptions to compliance are: **none** Date Report Completed: **February 3, 2004**



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

REPORT ON INSPECTION OF PERMIT NO. 1784-1

NAME & ADDRESS OF PERMIT HOLDER: Mark Jensen, HC 66 Box 67A, Newell SD 57760

DIVERSION POINT LEGAL LOCATION: 150 feet south & 2500 feet east of the NW corner of Sec. 17-T13N-R7E (NE ¼ NW ¼).

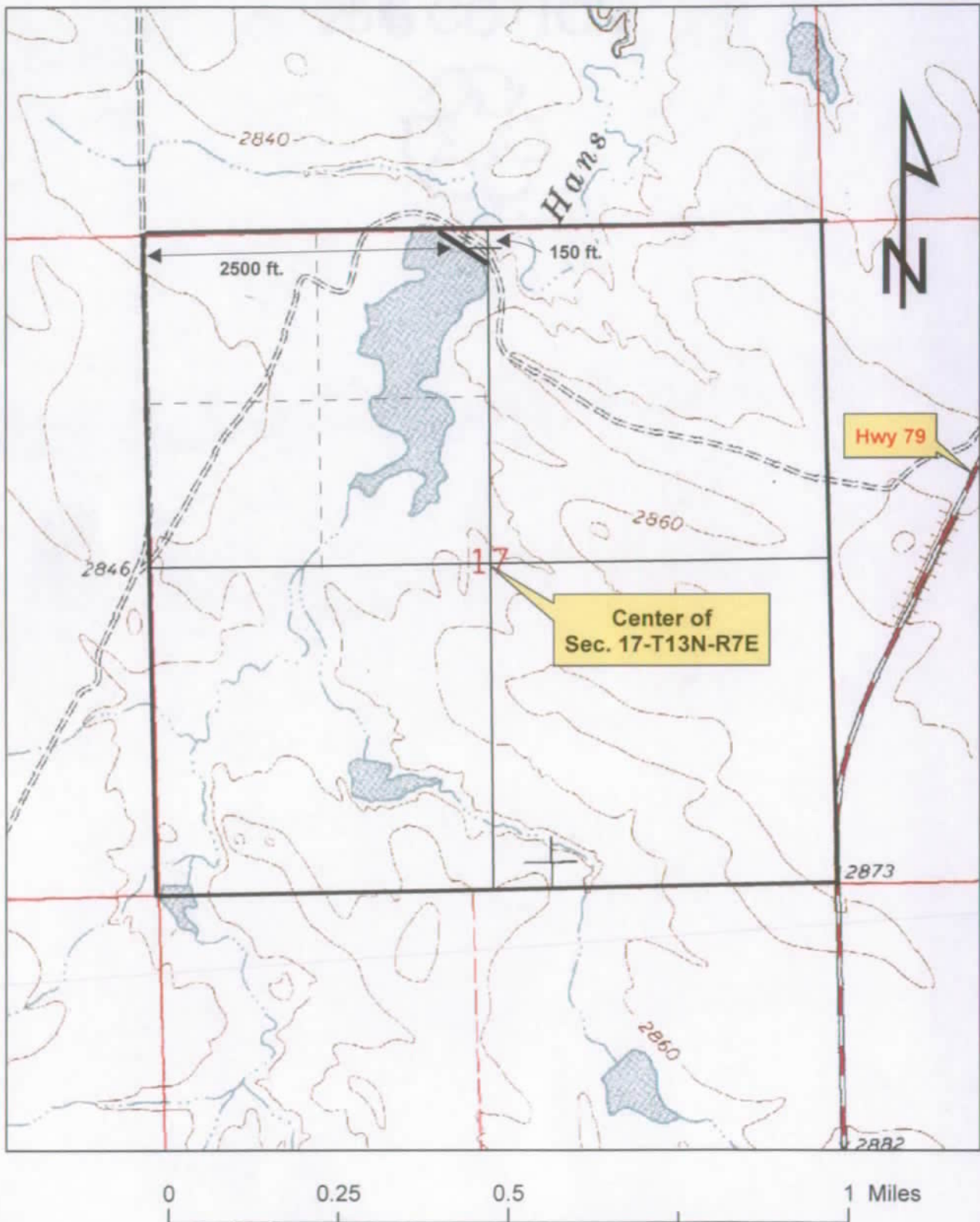
DAM INFORMATION:

- 1) Height to crest 16 feet
- 2) Height to primary spillway 9 feet
- 3) Height to secondary spillway 12 feet
- 4) Crest width 12 feet
- 5) Crest length 2148 feet
- 6) Spillway length XXX feet
- 7) Spillway width 100 feet
- 8) Approx. storage (Normal) 190 acre-feet
- 9) Approx. storage (Maximum) 888 acre-feet
- 10) Date constructed: Fall 2003

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

Water Permit Application No. 1784-1



South Dakota Department of
Environment and Natural Resources



Timothy G. Schaal
Timothy G. Schaal, P.E. 2/3/04
Natural Resources Engineer Specialist
DENR, Water Rights Program

STATE OF SOUTH DAKOTA

WATER LICENSE NO. 1784-1

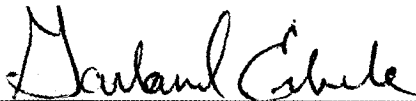
(1) Mark Jensen, HC 66 Box 67A, Newell SD 57760 made Application No. 1784-1, December 24, 2002 for a water permit to impound 190 acre feet of water from runoff and Hans Creek, Butte County, South Dakota for fish and wildlife propagation and livestock watering purposes. Permit No. 1784-1, with a priority date of December 24, 2002 was approved March 24, 2003 and issued to the applicant for diversion of water with construction of the described water supply system to be completed on or before March 24, 2008 and for the application to beneficial use of water on or before March 24, 2012.

(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. 1784-1 is issued a license, bearing a priority date of December 24, 2002, to impound 190 acre feet of water in Hoover Dam.

The location of the storage dam (spillway) is 150 feet south and 2,500 feet east of the northwest corner of Section 17-T13N-R7E (NE ¼ NW ¼).

(3) This license is subject to South Dakota Water Law, any limitations or conditions listed in Water Permit No. 1784-1, including the following now applicable qualifications:

- Water Permit No. 1784-1 authorizes a dam with a storage capacity of 190 acre feet of water and sufficient water annually to maintain the water level to the outlet elevation of 2,753 feet mean sea level.
- Low flows as needed for downstream domestic use, including livestock water and prior water rights must be by-passed.



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

FEB 20 2004

date





**DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES**

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

FEB 20 2004

1784-1

Mark Jensen
HC 66 Box 67A
Newell SD 57760

Dear Mr. Jensen:

Enclosed is Water License No. 1784-1. This is the final water right document completing your process of obtaining a Water Right.

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

1784-1

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

Date 1-5-2004

TO: Water Rights Program, DENR
523 E. Capitol
Pierre, SD 57501-3181

FROM:

Mark & Fleda Jensen
(name)15850 Hoover Rd
(address)Newell, SD 57760
(city, state, zip)605-866-4609
(phone)

I have completed the construction of the water use system and I have put the water to beneficial use to the maximum extent it is going to be used.

Water Permit No. 1784-1 states that the water use system is to be constructed by

3/24/2008, and water is to be put to beneficial use by 3/24/2012
(date) (date)

The water use system was completed on 9/20/2003
(date)

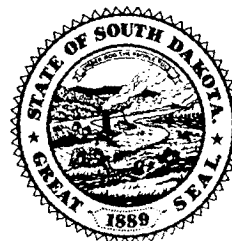
Applying the water to beneficial use was completed on 9/20/2003
(date)

You may schedule an investigation so that the water license may be issued.

Fleda Jensen
(signature)

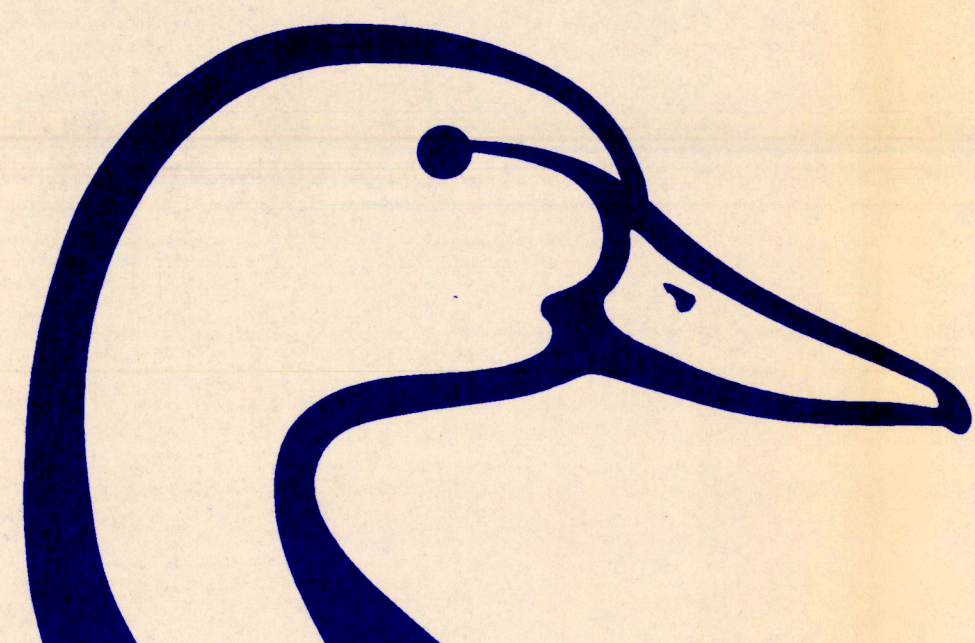
7-98

RECEIVED
JAN 06 2004
WATER RIGHTS
PROGRAM



2499-2

2499-2 1784-1



DUCKS UNLIMITED

DUCKS UNLIMITED

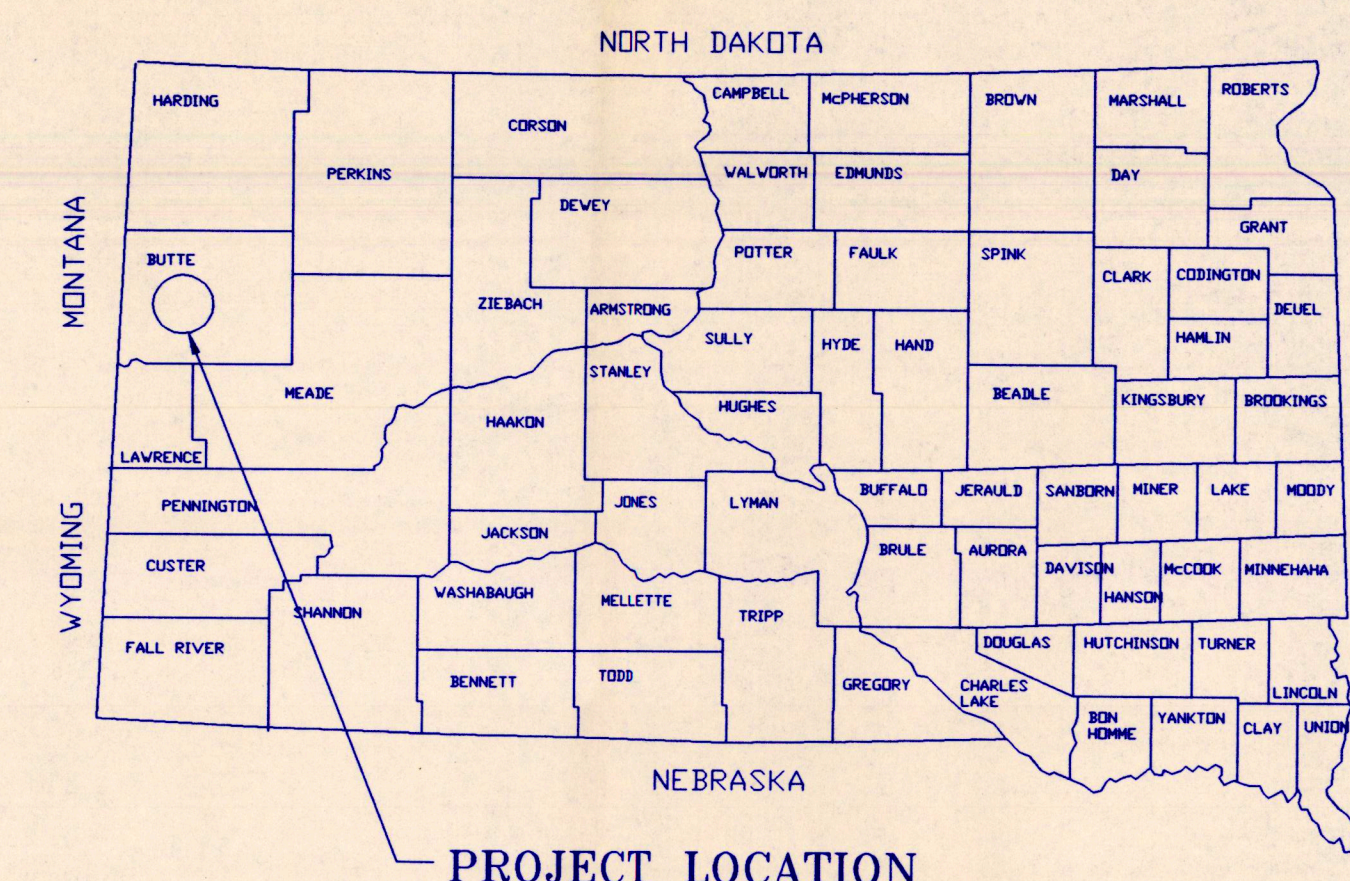
PROJECT

HOOVER DAM

SECTION 17, T13N, R7E
BUTTE COUNTY, SOUTH DAKOTA

IN COOPERATION WITH

US FISH & WILDLIFE SERVICE



PROJECT LOCATION

RECEIVED
DEC 24 2002
WATER RIGHTS
PROGRAM

SPECIFICATIONS

- 101 GENERAL CONDITIONS
- 102 SUPPLEMENTAL CONDITIONS
- 201 MOBILIZATION
- 202 SITE PREPARATION
- 203 EXCAVATION
- 204 EMBANKMENT CONSTRUCTION
- 205 WATER
- 206 WATER CONTROL STRUCTURE INSTALLATION
- 206A WATER CONTROL STRUCTURE & CULVERT APPURTENANCES
- 207 CAST-IN-PLACE CONCRETE
- 208 CULVERT INSTALLATION
- 209 RIPRAP PLACEMENT
- 307 REMOVAL AND SALVAGE OF EXISTING CULVERTS/STRUCTURES

PLAN INDEX

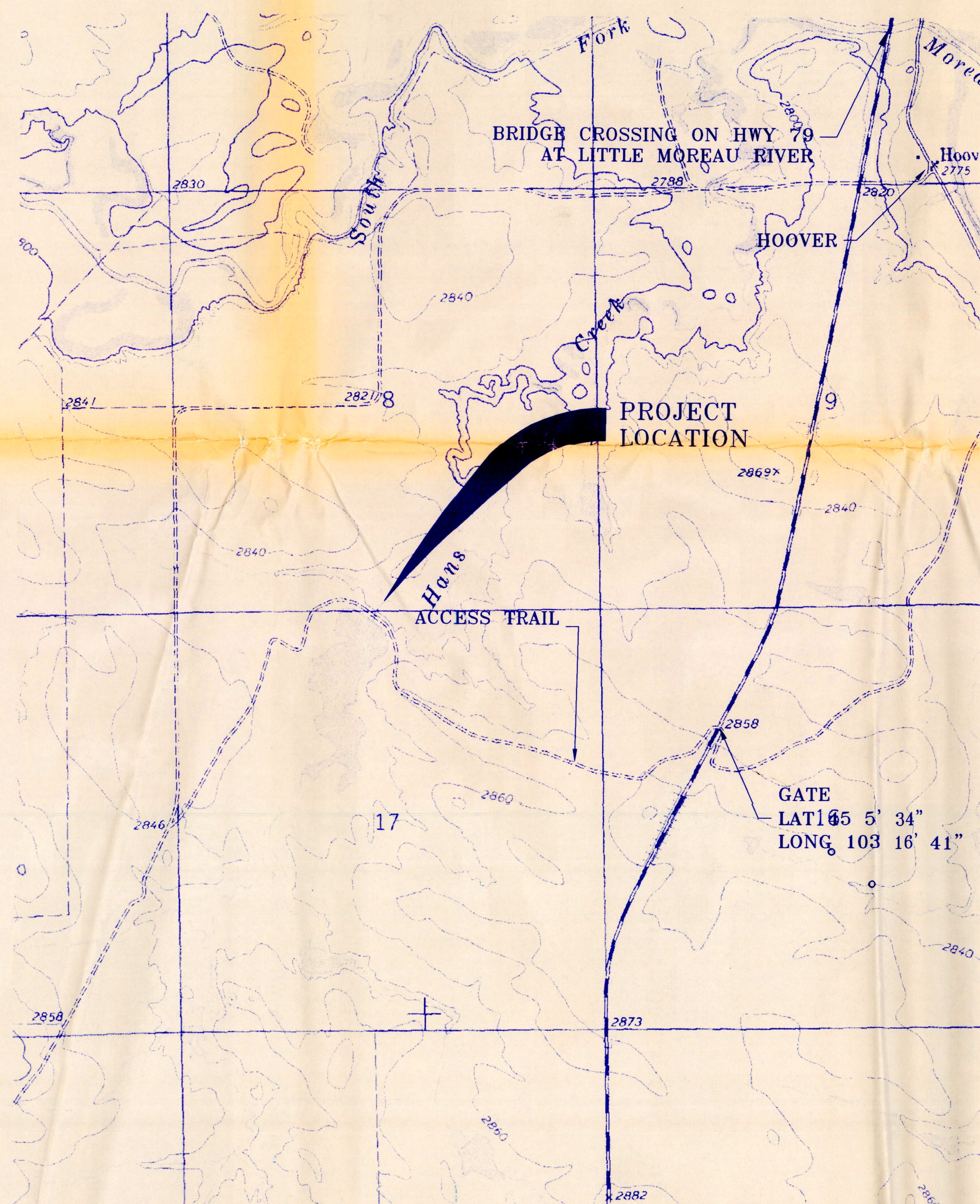
- 1 PROJECT LOCATION MAPS
- 2 PROJECT TOPOGRAPHY
- 3 EMBANKMENT PLAN & PROFILE
- 4 EMBANKMENT CROSS SECTIONS
- 5 EMBANKMENT CROSS SECTIONS
- 6 EMERGENCY SPILLWAY PLAN & PROFILE
- 7 STRUCTURE A PLAN & PROFILE
- 8 STRUCTURE B PLAN & PROFILE
- 9 WATER CONTROL STRUCTURE PLAN & PROFILE
- 10 SOILS INFORMATION

ESTIMATED QUANTITIES

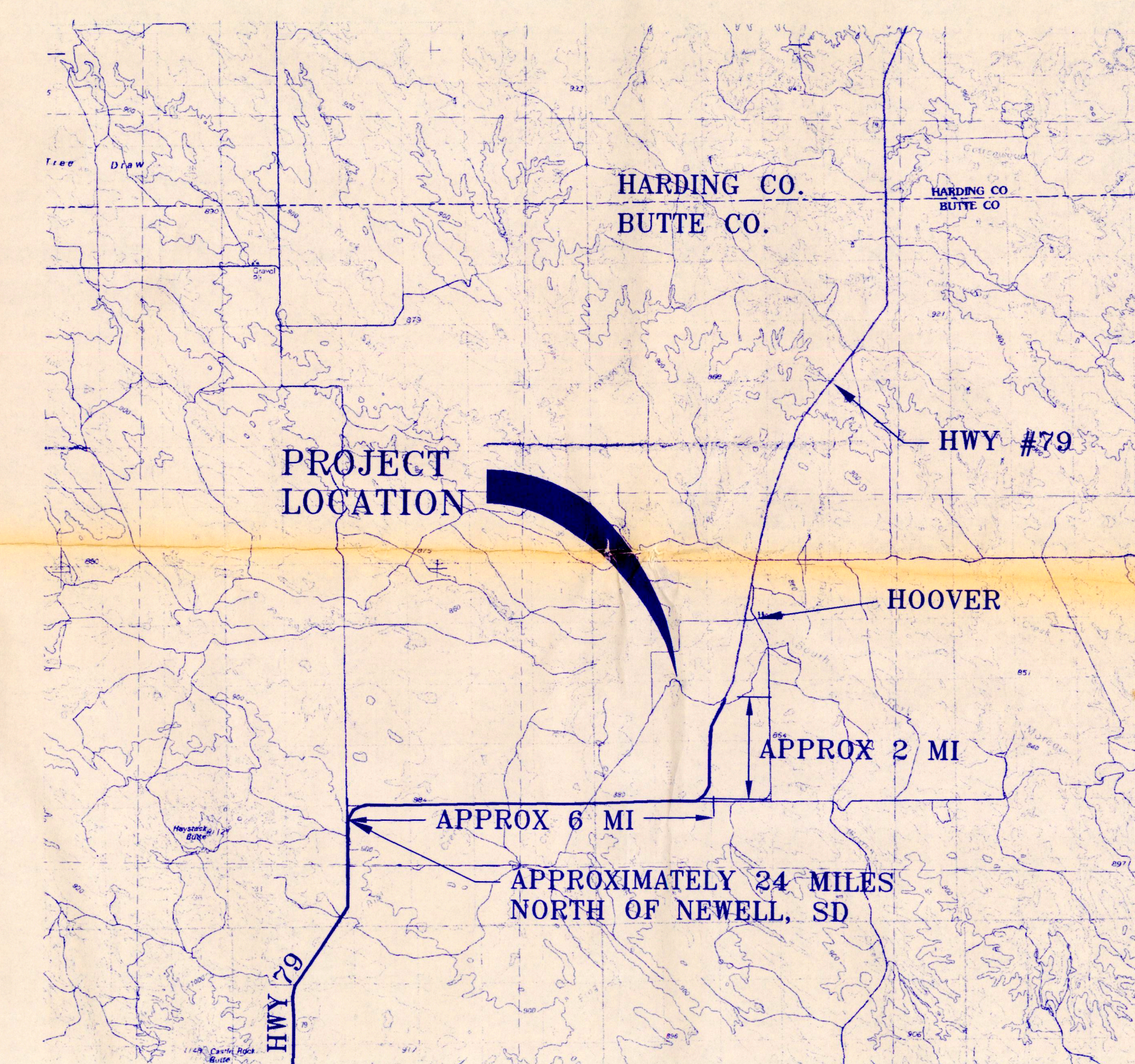
MOBILIZATION	1 L.S.
SITE PREPARATION	1110 C.Y.-P*
EMBANKMENT CONSTRUCTION	28252 C.Y.-P*
WATER	500 M-GAL.**
WATER CONTROL STRUCTURE INSTALLATION	2 EA.
CULVERT INSTALLATION	180 L.F.-P
RIPRAP (CLASS I)	24 C.Y.-P
RIPRAP (CLASS II)	70 C.Y.-P
REMOVAL - EXISTING CULVERTS / TIRES	1 L.S.

*CY-P - PAYMENT WILL BE BASED ON THIS PLAN QUANTITY. A SHRINK FACTOR IS NOT INCLUDED (MINIMAL SHRINKAGE AND/OR EXPANSION IN VOLUME FROM BORROW TO FILL IS ANTICIPATED)

**PAYMENT WILL BE BASED ON ACUTAL AMOUNT USED. SEE SPECIFICATION 205.



VICINITY MAP
SCALE: 1" = 1000'

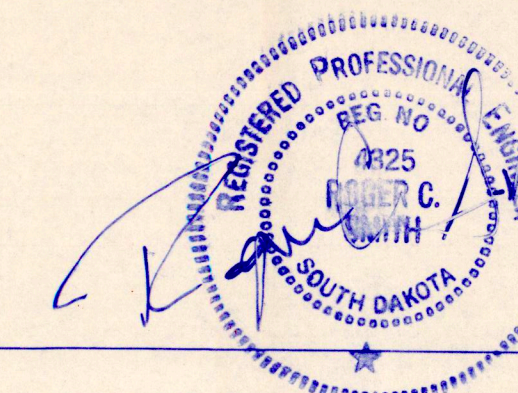


LOCATION MAP
SCALE: 1" = 2 MILES

DRIVING DIRECTIONS

FROM REVA, SD, WEST ON HWY 20 TO JUNCTION HWY 79, SOUTH APPROXIMATELY 32 MILES TO LITTLE MOREAU RIVER BRIDGE, CONTINUE SOUTH 1.7 MILES TO ACCESS TRAIL GATE.

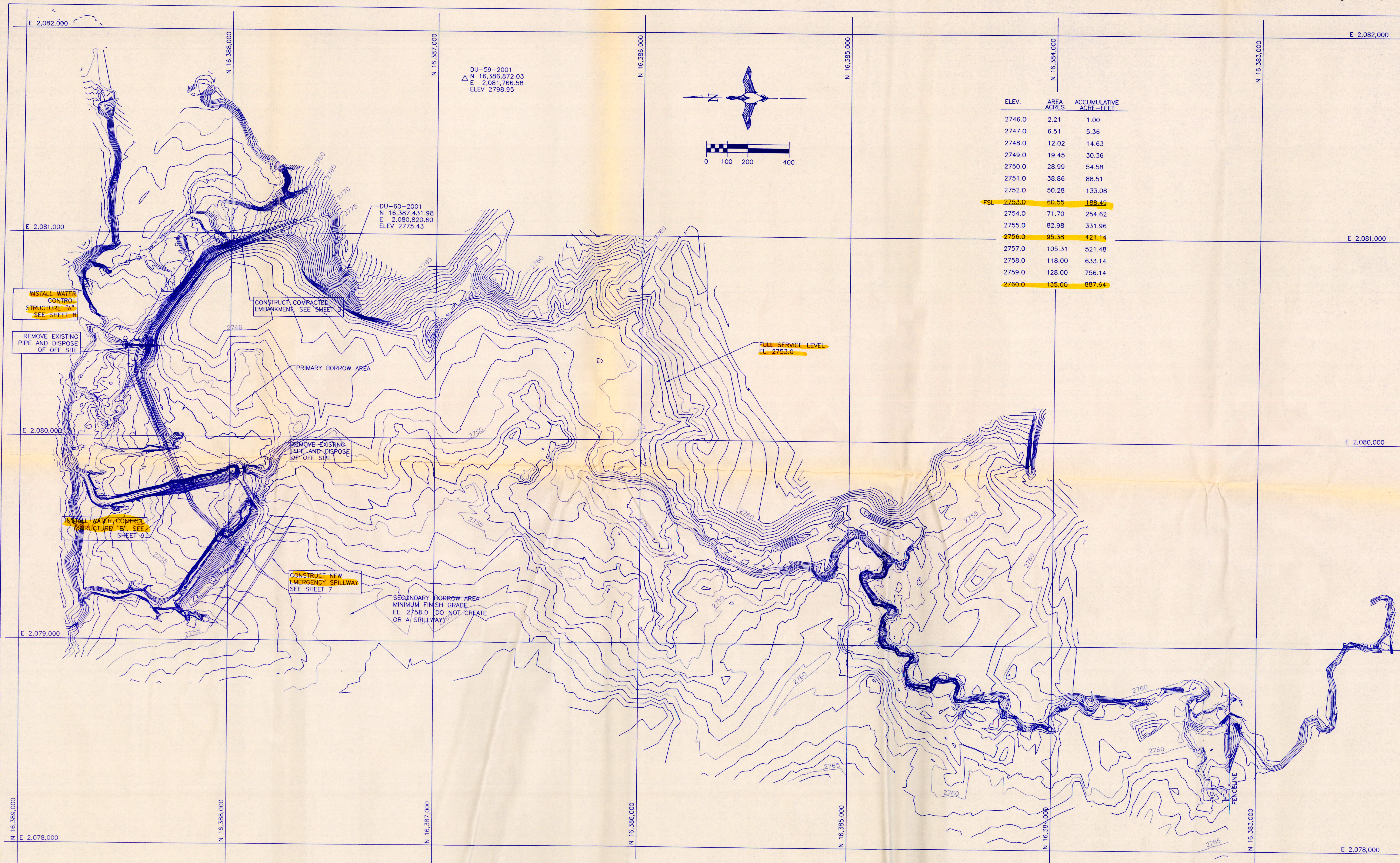
FROM NEWELL, SD - NORTH ON HWY 79 APPROXIMATELY 24 MILES, EAST ON HWY 79 APPROXIMATELY 6 MILES, NORTH APPROXIMATELY 2 MILES TO ACCESS TRAIL GATE.



DUCKS UNLIMITED INC. GREAT PLAINS REGIONAL OFFICE DATE: 11-27-2002	PROJECT NO. SD350-1 HOOVER DAM LOCATION & VICINITY MAPS SHEET NO. 1 OF 10	DESIGNED BY: RS DRAWN BY: SURVEYED BY: CHECKED BY:
	APPROVED BY: [Signature]	1784-1 2499-2

K:\SD\SD-350\SHEET1.DWG

2499-2 E1784-



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HORIZONTAL CONTROL:
COORDINATES ARE UTM ZONE 13 COORDINATES IN US FEET (NAD 83(1996)).
THEY WERE ESTABLISHED FROM THE WGS84 ELLIPSOID WITH INFORMATION FROM
TRIMBLE 4400 & 4700 GPS RECEIVERS ON DECEMBER 18TH, 2001 AND
CALIBRATED TO USGS STATION STAMPED "FROG 1951" WHICH IS A THIRD
ORDER HORIZONTAL CONTROL STATION.

VERTICAL CONTROL:
WAS ESTABLISHED FROM THE 99 GEOID CONUS AND CALIBRATED TO THE
SAME STATION MENTION ABOVE WITH A SCALED AND PUBLISHED ELEVATION
OF 2861 FEET ON THE NAVD 88.

PREPARED BY:



TOMAN ENGINEERING COMPANY
CONSULTING CIVIL ENGINEERS
BOX 2102 ST. N.W. • WABASH, NORTH DAKOTA 58554 • 701-663-6463



GREAT PLAINS REGIONAL OFFICE

DATE: 06/26/02

SHEET NO. 2 OF 10

PROJECT NO. SD-0350-001

HOOVER DAM
SITE TOPOGRAPHY
PROJECT FEATURES

APPROVED BY:

APPROVED BY:

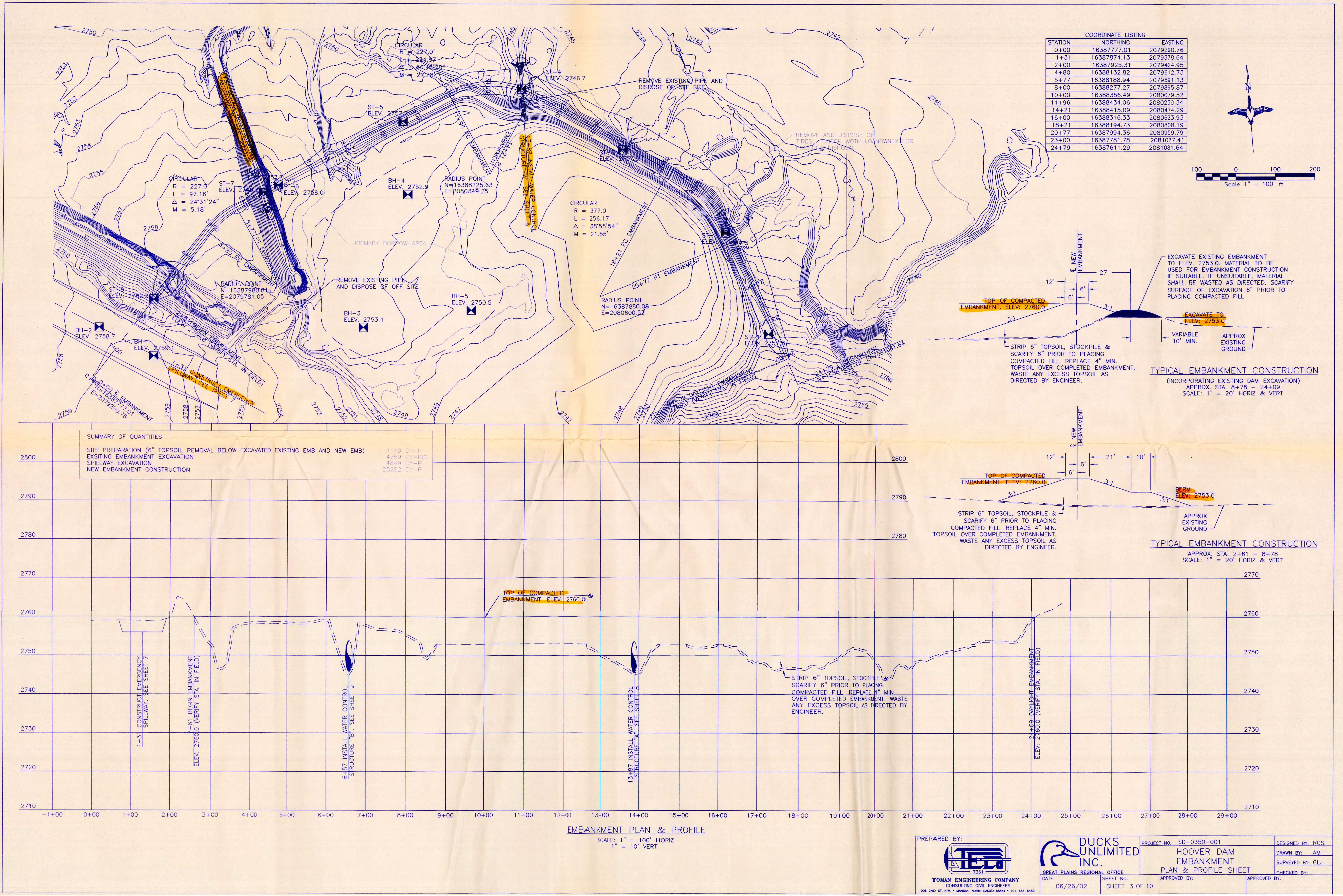
DESIGNED BY: RCS

DRAWN BY: DAK

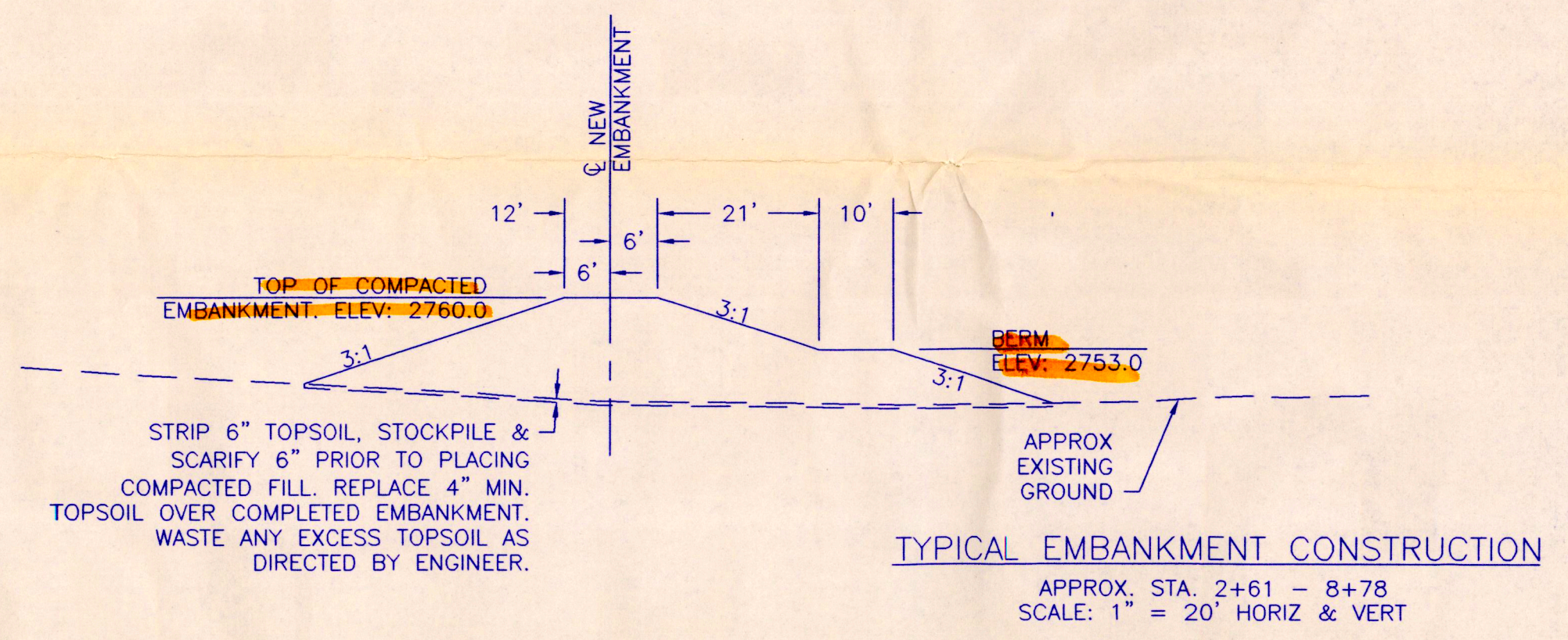
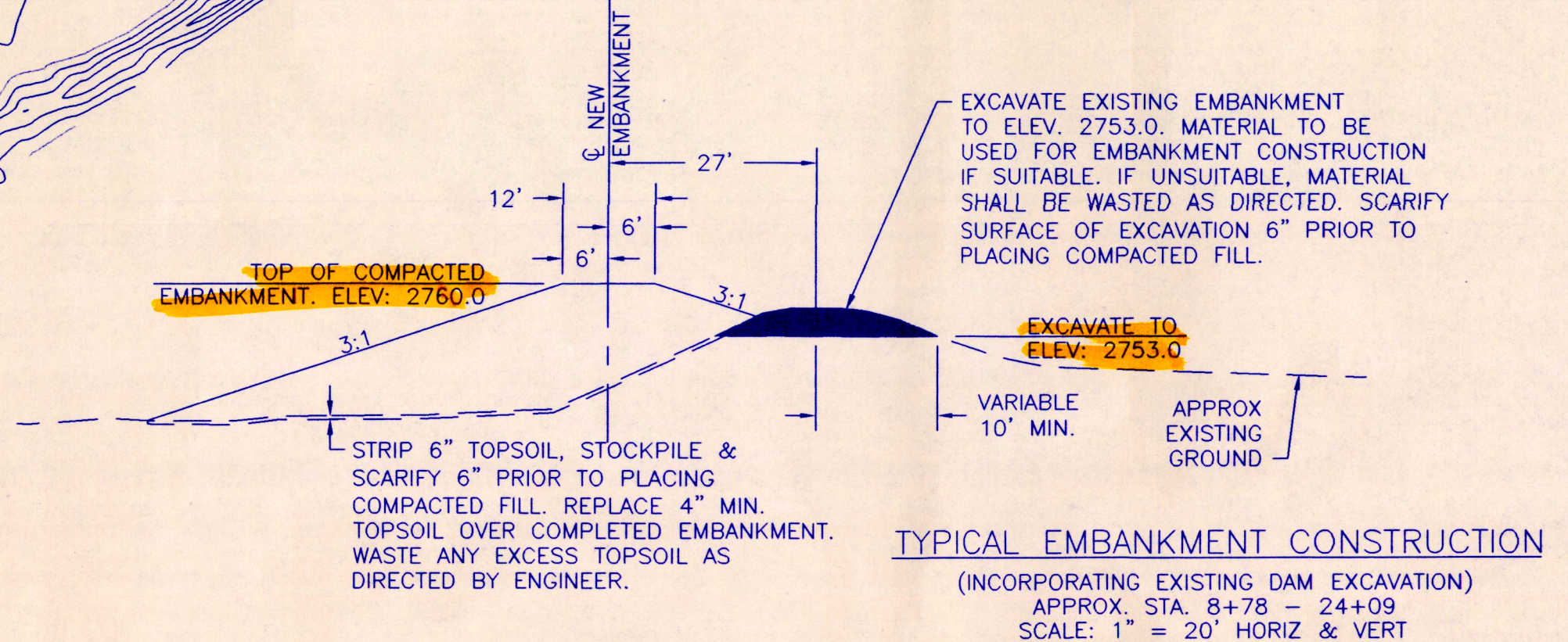
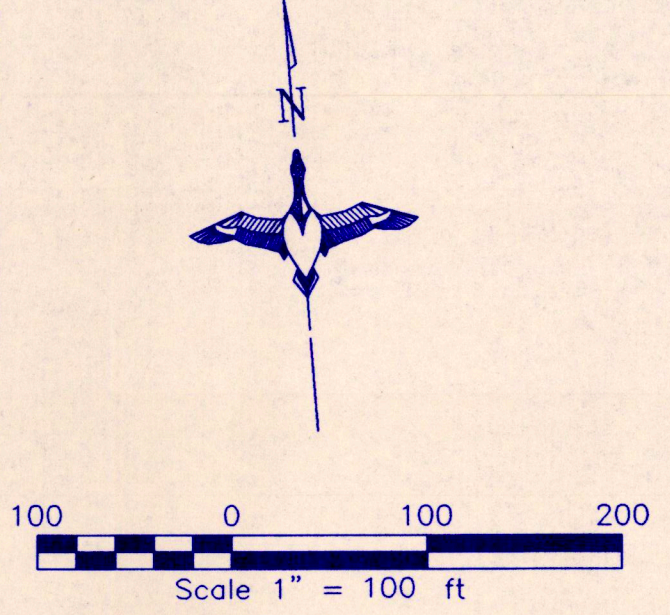
SURVEYED BY: GLJ

CHECKED BY:

2499-251784-1



COORDINATE LISTING		
STATION	NORTHING	EASTING
0+00	16387777.01	2079290.76
1+31	16387874.13	2079378.64
2+00	16387925.31	2079424.95
4+80	16388132.82	2079612.73
5+77	16388188.94	2079691.13
8+00	16388277.27	2079895.87
10+00	16388356.49	2080079.52
11+96	16388434.06	2080239.34
14+21	16388415.09	2080474.29
16+00	16388316.33	2080623.93
18+21	16388194.73	2080808.19
20+77	16387994.36	2080959.79
23+00	16387781.78	2081027.41
24+79	16387611.29	2081081.64



EMBANKMENT PLAN & PROFILE
SCALE: 1" = 100' HORIZ
1" = 10' VERT

PREPARED BY:

TOMAN ENGINEERING COMPANY
CONSULTING CIVIL ENGINEERS
906 2ND ST. N.W. • ANCHORAGE, ALASKA 99504 • 731-563-5443

DUCKS UNLIMITED INC.

GREAT PLAINS REGIONAL OFFICE

DATE: 06/26/02

SHEET NO. 3 OF 10

PROJECT NO. SD-0350-001

HOOVER DAM EMBANKMENT

PLAN & PROFILE SHEET

APPROVED BY:

DESIGNED BY: RCS

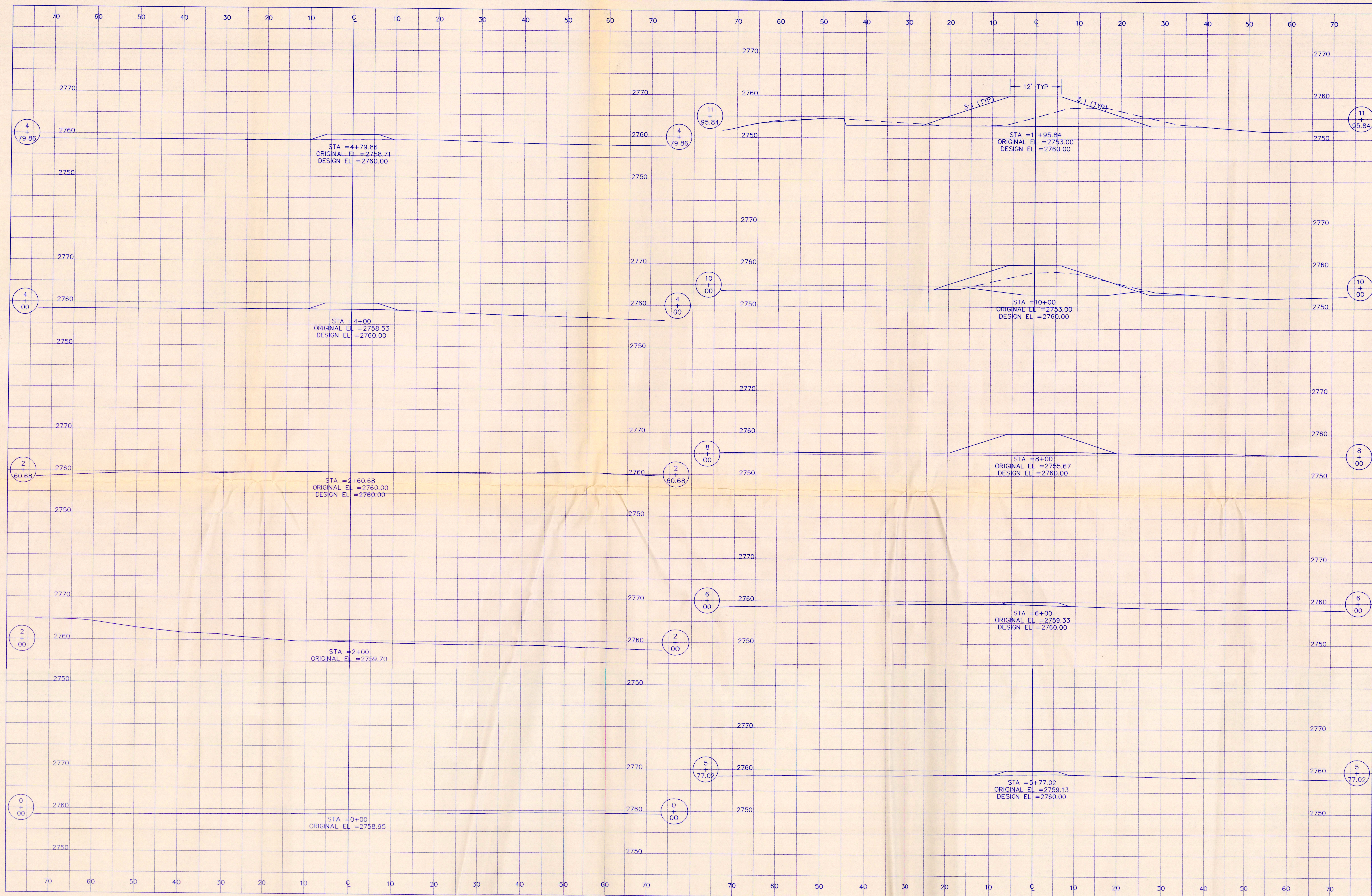
DRAWN BY: AM

SURVEYED BY: GLJ

CHECKED BY:

APPROVED BY:

2499-29
1784-1



EMBANKMENT CROSS SECTIONS

STA: 0+00 - 11+95.84
SCALE: 1" = 10' HORIZ & VERT

PREPARED BY:



TOMAN ENGINEERING COMPANY
CONSULTING CIVIL ENGINEERS
908 2ND ST. N.W. • MINNEAPOLIS, NORTH DAKOTA 58504 • 701-663-6463



GREAT PLAINS REGIONAL OFFICE
DATE: 06/26/02

PROJECT NO. SD-0350-001

HOOVER DAM
EMBANKMENT
CROSS SECTIONS

APPROVED BY:

APPROVED BY:

DESIGNED BY: RCS

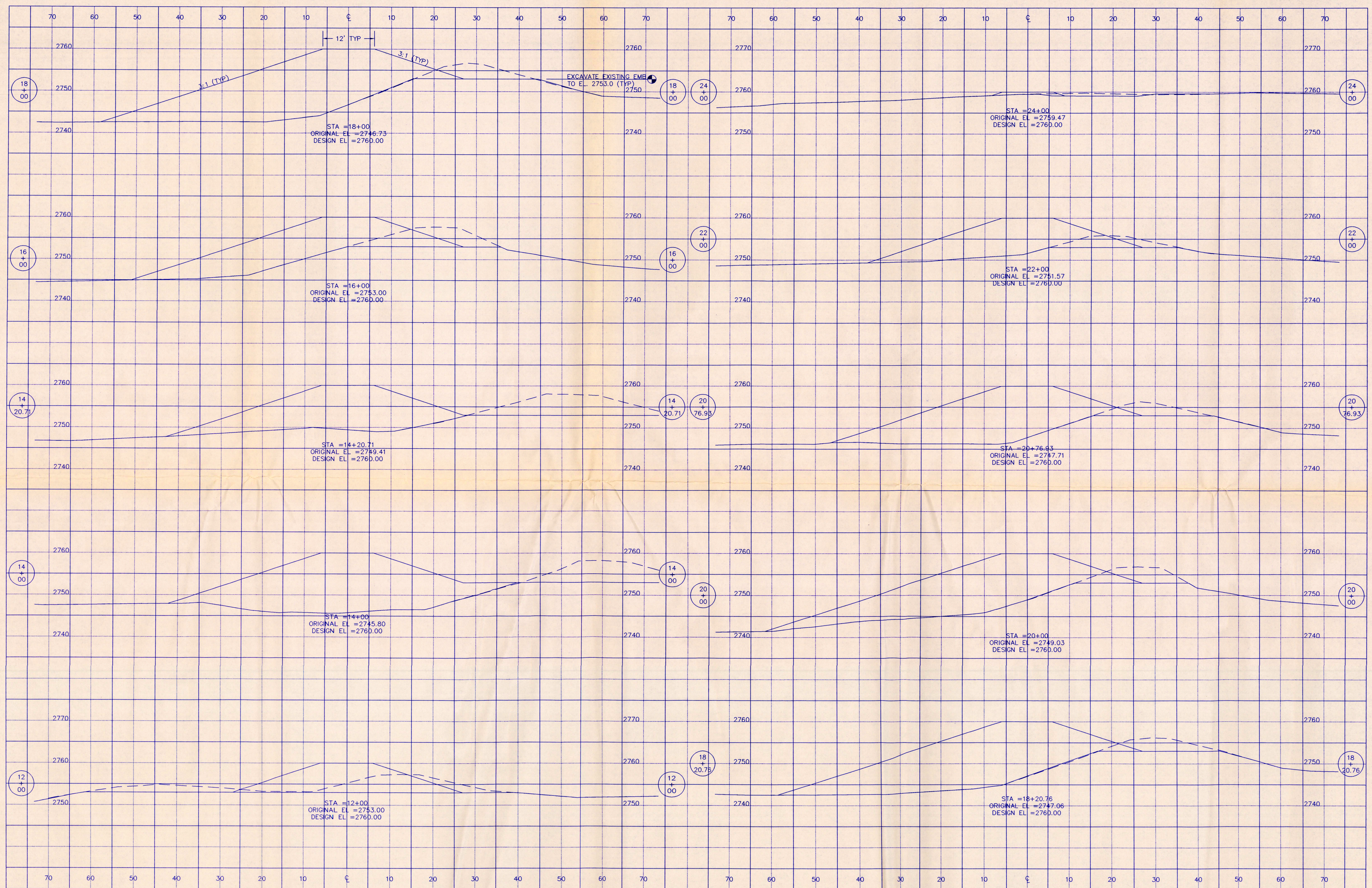
DRAWN BY: AM

SURVEYED BY: GLJ

CHECKED BY:

SHEET NO. 4 OF 10

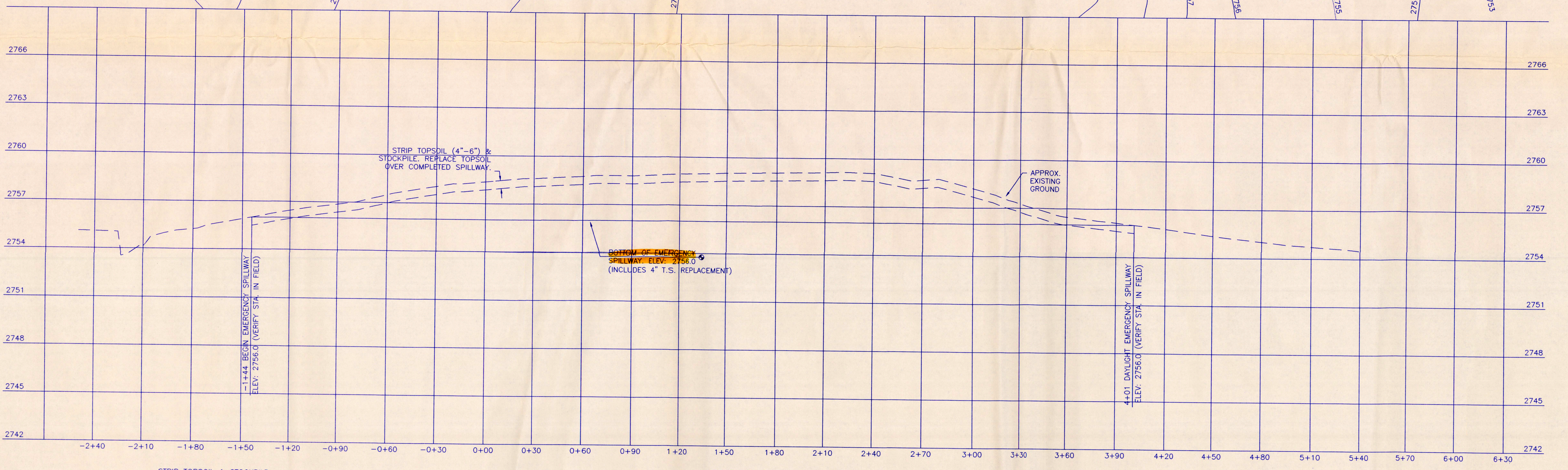
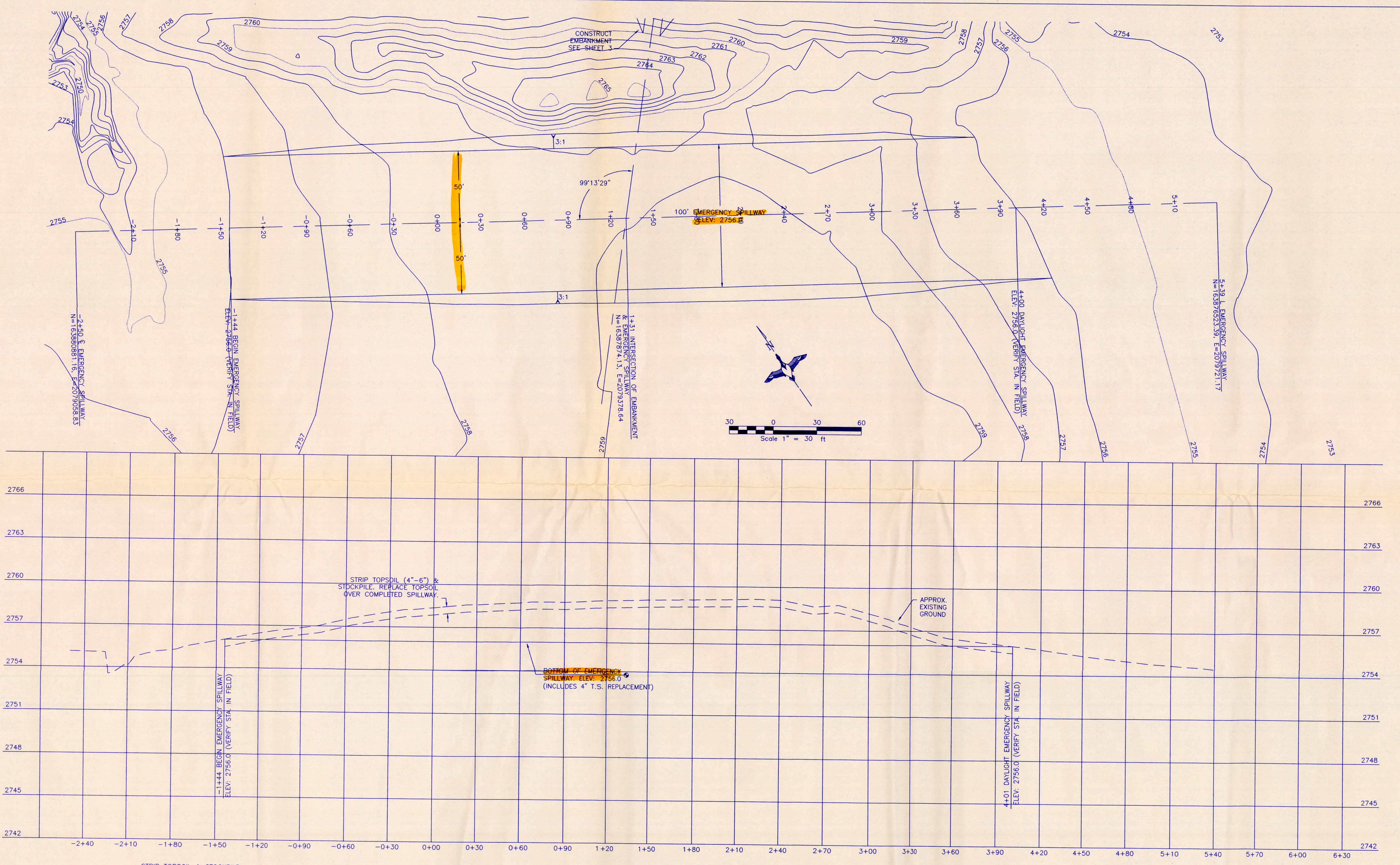
0499-23,1784-1



EMBANKMENT CROSS SECTIONS
STA: 12+00 - 24+00
SCALE: 1" = 10' HORIZ & VERT

PREPARED BY: TOMAN ENGINEERING COMPANY CONSULTING CIVIL ENGINEERS 506 2ND ST. N.W. • WASHINGTON, NORTH DAKOTA 58504 • 701-653-6483	DATE: 06/26/02 SHEET NO. 5 OF 10	PROJECT NO. SD-0350-001 HOOPER DAM EMBANKMENT CROSS SECTIONS	DESIGNED BY: RCS DRAWN BY: AM SURVEYED BY: GLJ CHECKED BY:
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2499.24
1784.1

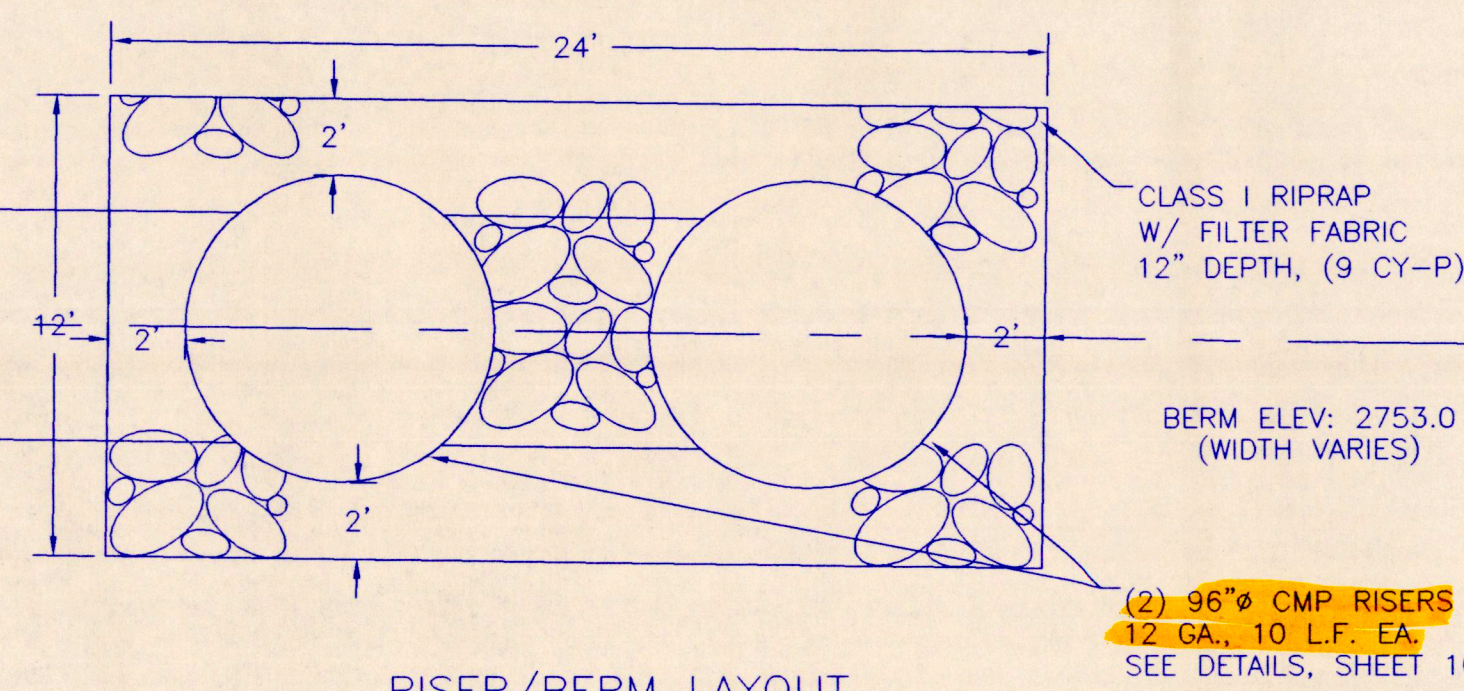
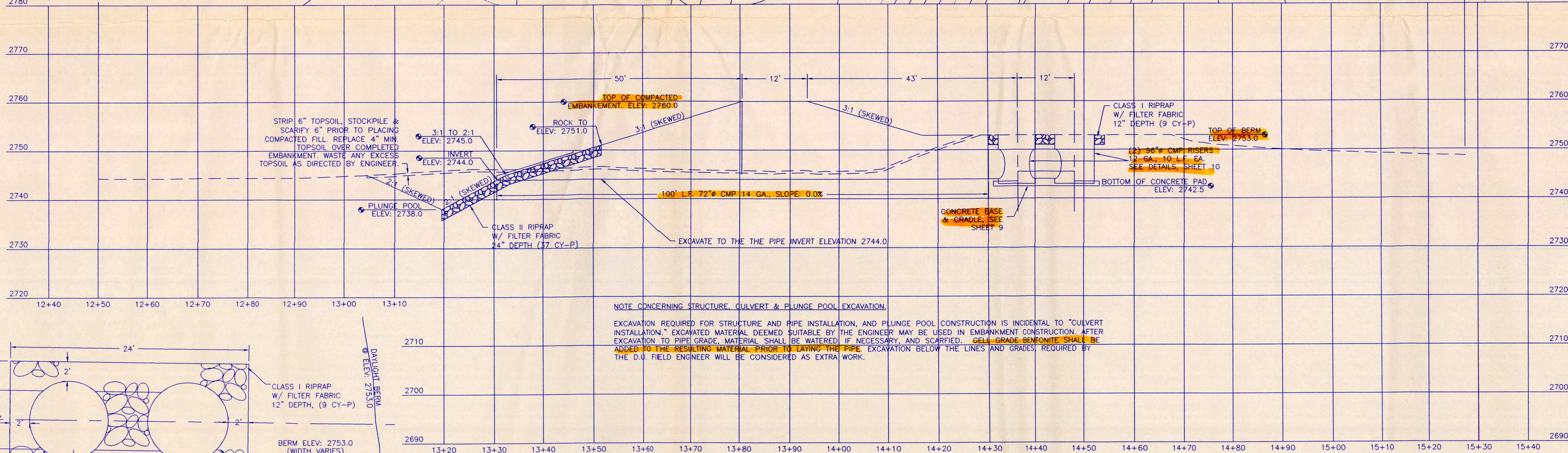
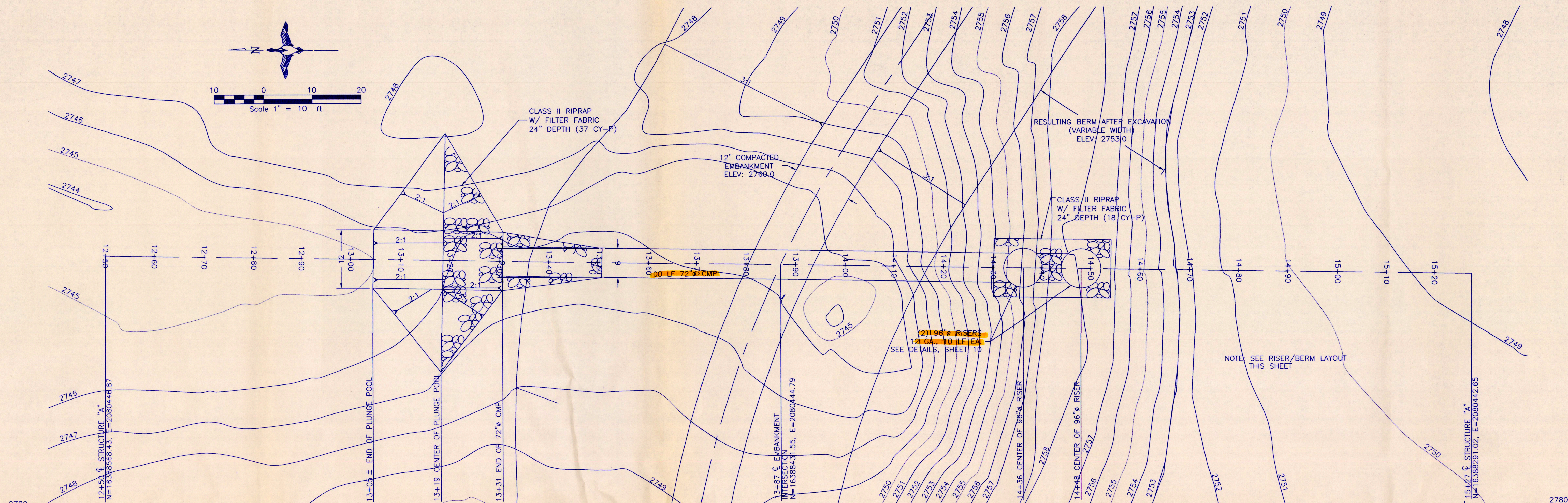


EMERGENCY SPILLWAY PLAN & PROFILE
SCALE: 1" = 30' HORIZ
1" = 3' VERT

TYPICAL EMERGENCY SPILLWAY X-SECTION
SCALE: 1" = 10' HORIZ & VERT

PREPARED BY: TOMAN ENGINEERING COMPANY CONSULTING CIVIL ENGINEERS 908 2ND ST. N.W. • WAKEFELD, NORTH DAKOTA 58554 • 701-643-6483	PROJECT NO. SD-0350-001 HOOPER DAM EMERGENCY SPILLWAY PLAN & PROFILE		DESIGNED BY: RCS DRAWN BY: AM SURVEYED BY: GLJ CHECKED BY:
	DATE: 06/26/02 SHEET NO. 6 OF 10		APPROVED BY:
	GREAT PLAINS REGIONAL OFFICE		APPROVED BY:
	SHEET NO. 6 OF 10		APPROVED BY:

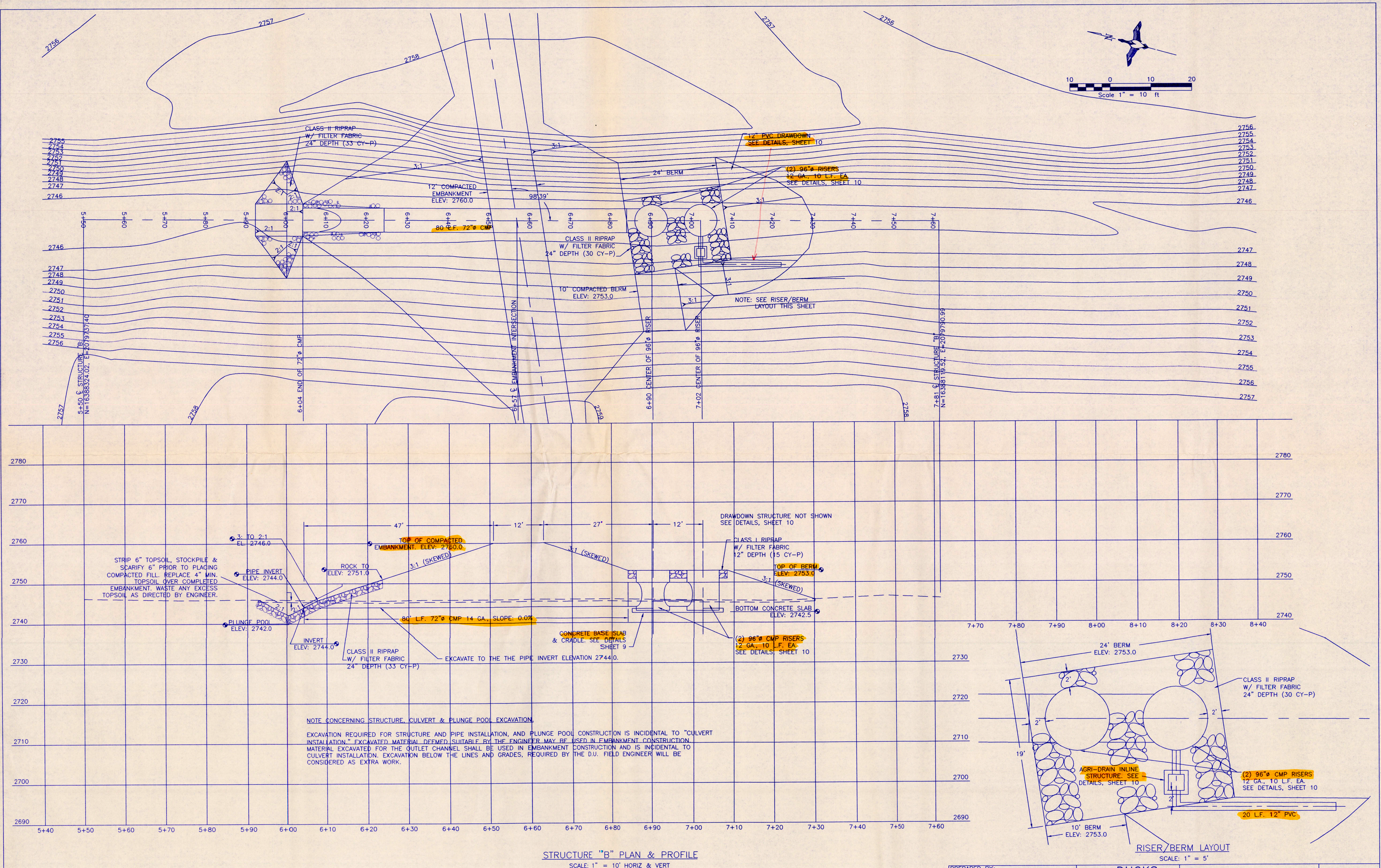
0499-28
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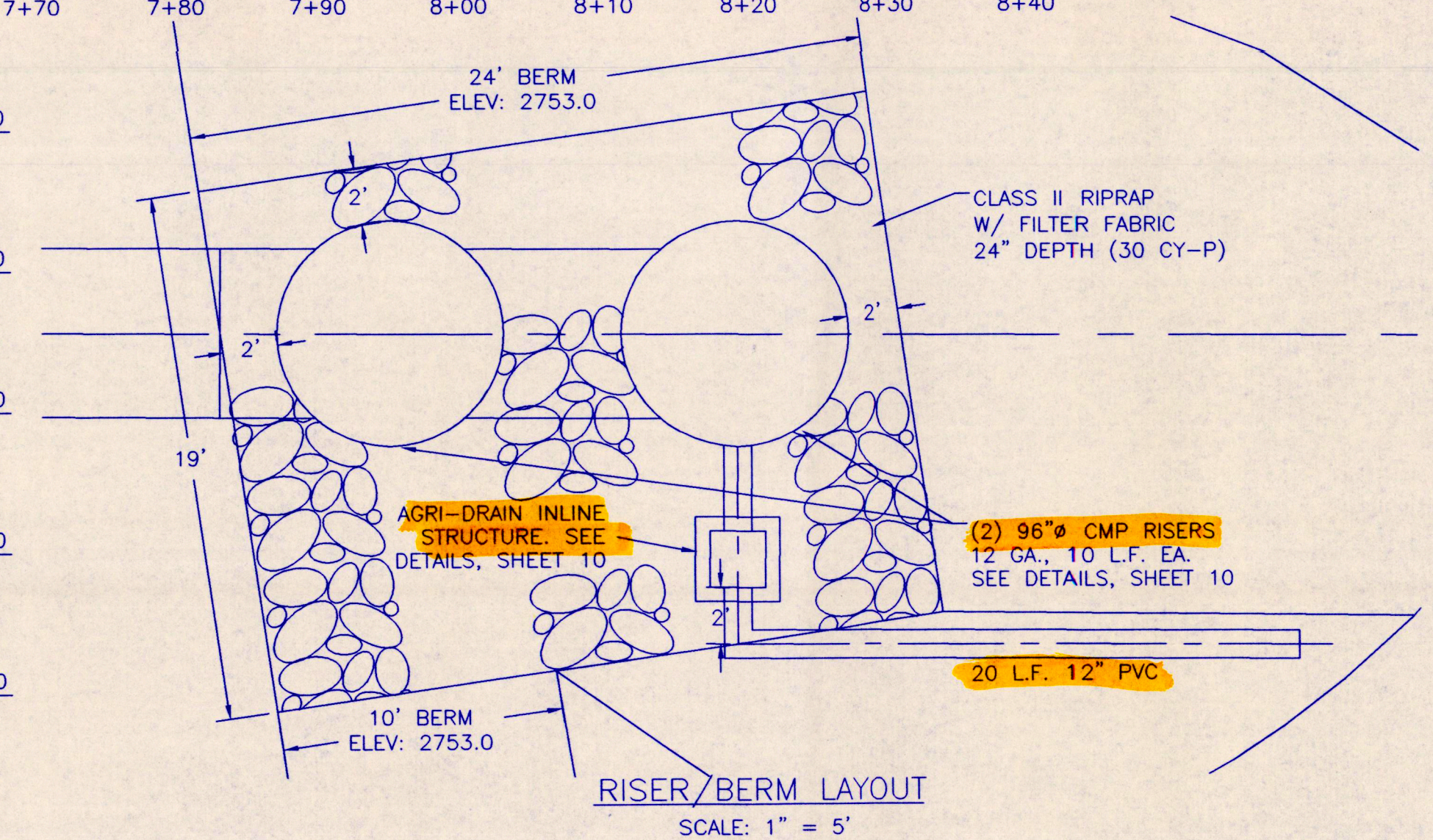
STRUCTURE "A" PLAN & PROFILE
SCALE: 1" = 10' HORIZ & VERT

PREPARED BY: TOMAN ENGINEERING COMPANY CONSULTING CIVIL ENGINEERS 806 2ND ST. N.W. • WASHINGTON, NORTH DAKOTA 58554 • 701-653-6463	PROJECT NO. SD-0350-001 HOOVER DAM STRUCTURE "A" PLAN & PROFILE SHEET NO. 7 OF 10 DATE: 06/26/02	DESIGNED BY: RCS DRAWN BY: AM SURVEYED BY: GLW CHECKED BY: APPROVED BY:
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2499-2 & ~~1741-1~~
1784-1

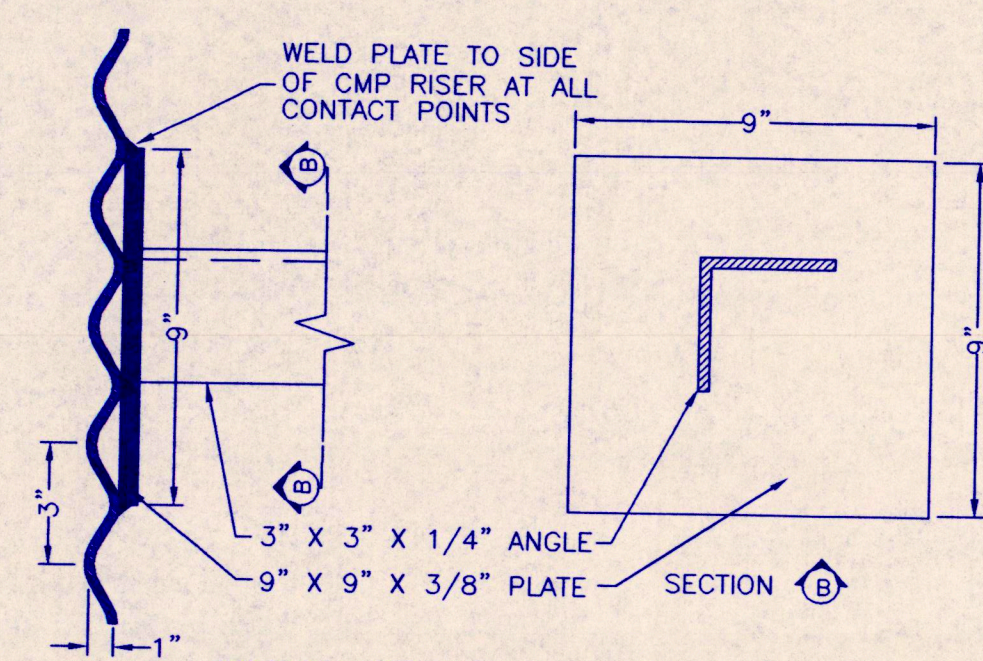


STRUCTURE "B" PLAN & PROFILE
SCALE: 1" = 10' HORIZ & VERT

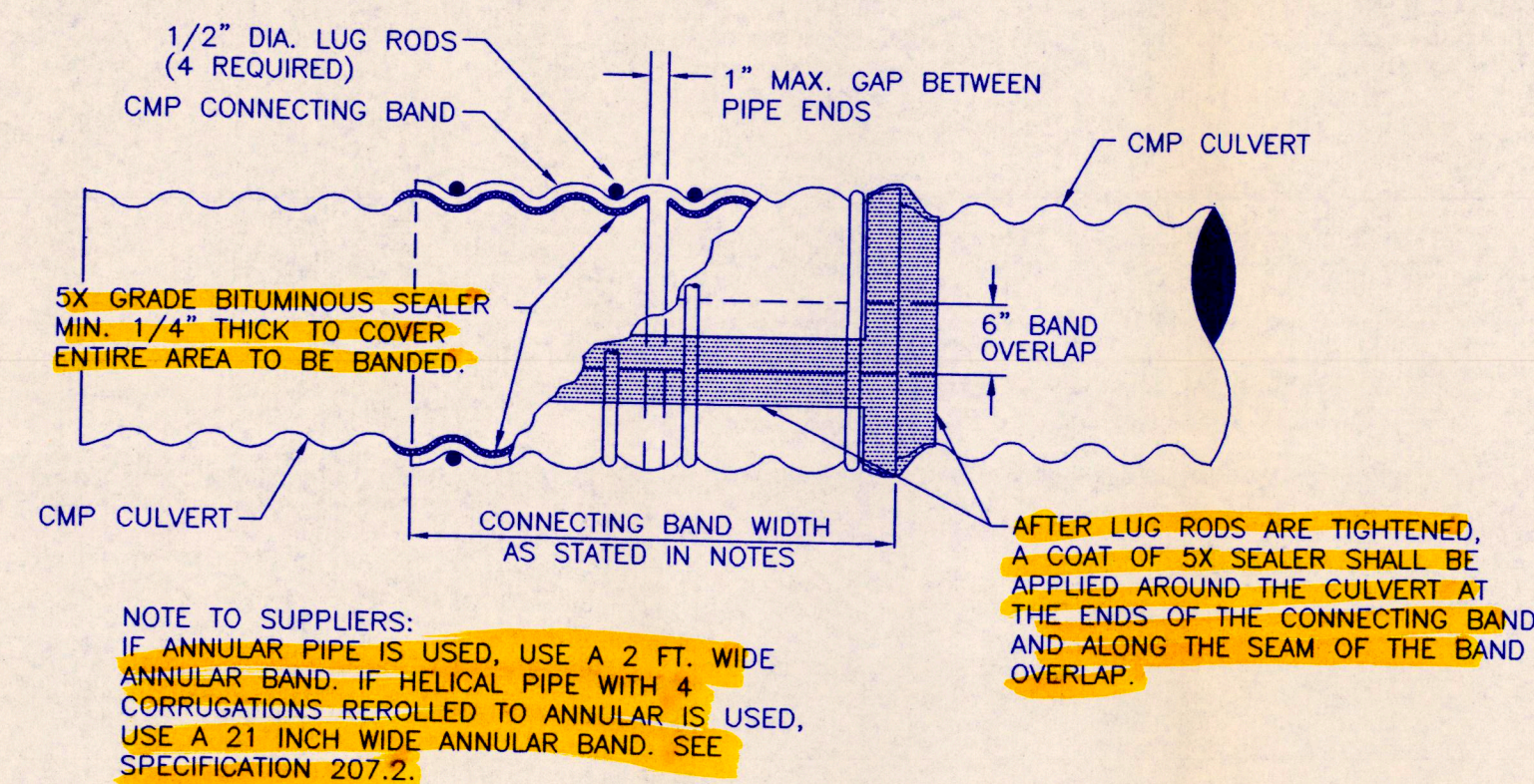


RISER/BERM LAYOUT
SCALE: 1" = 5'

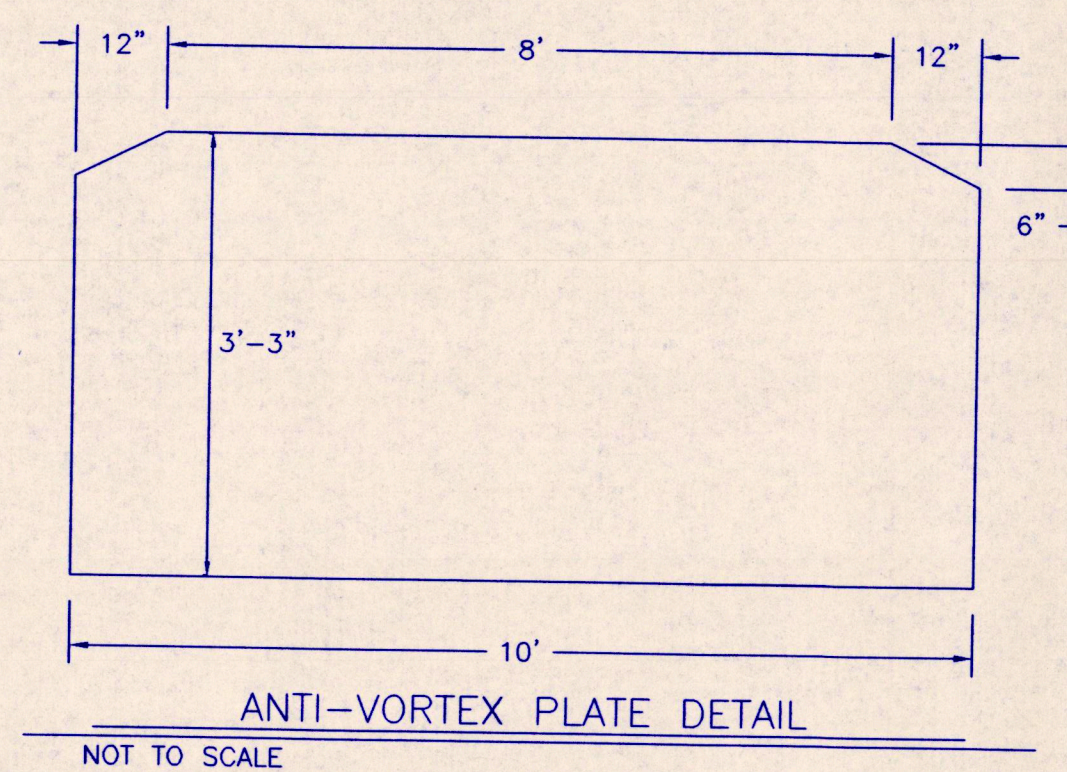
2499-2 & 1784-1



CROSS BRACE REINFORCING PLATE

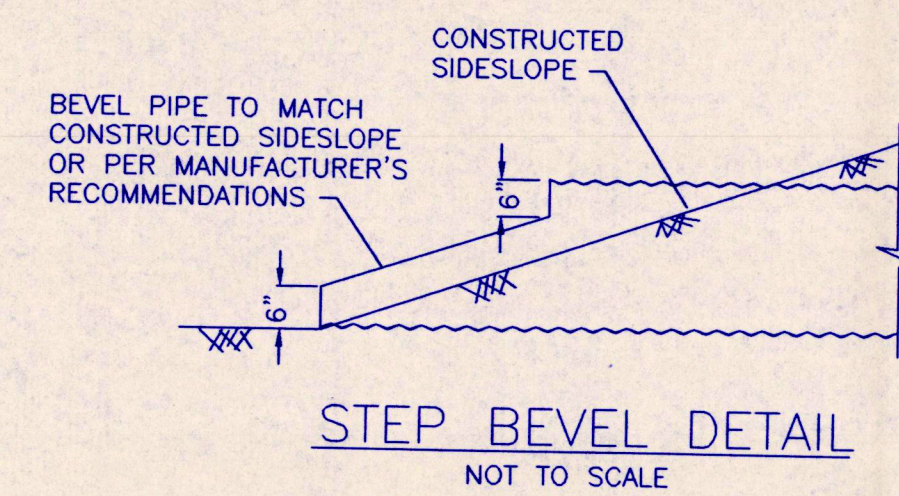


CONNECTING BAND DETAIL
NOT TO SCALE

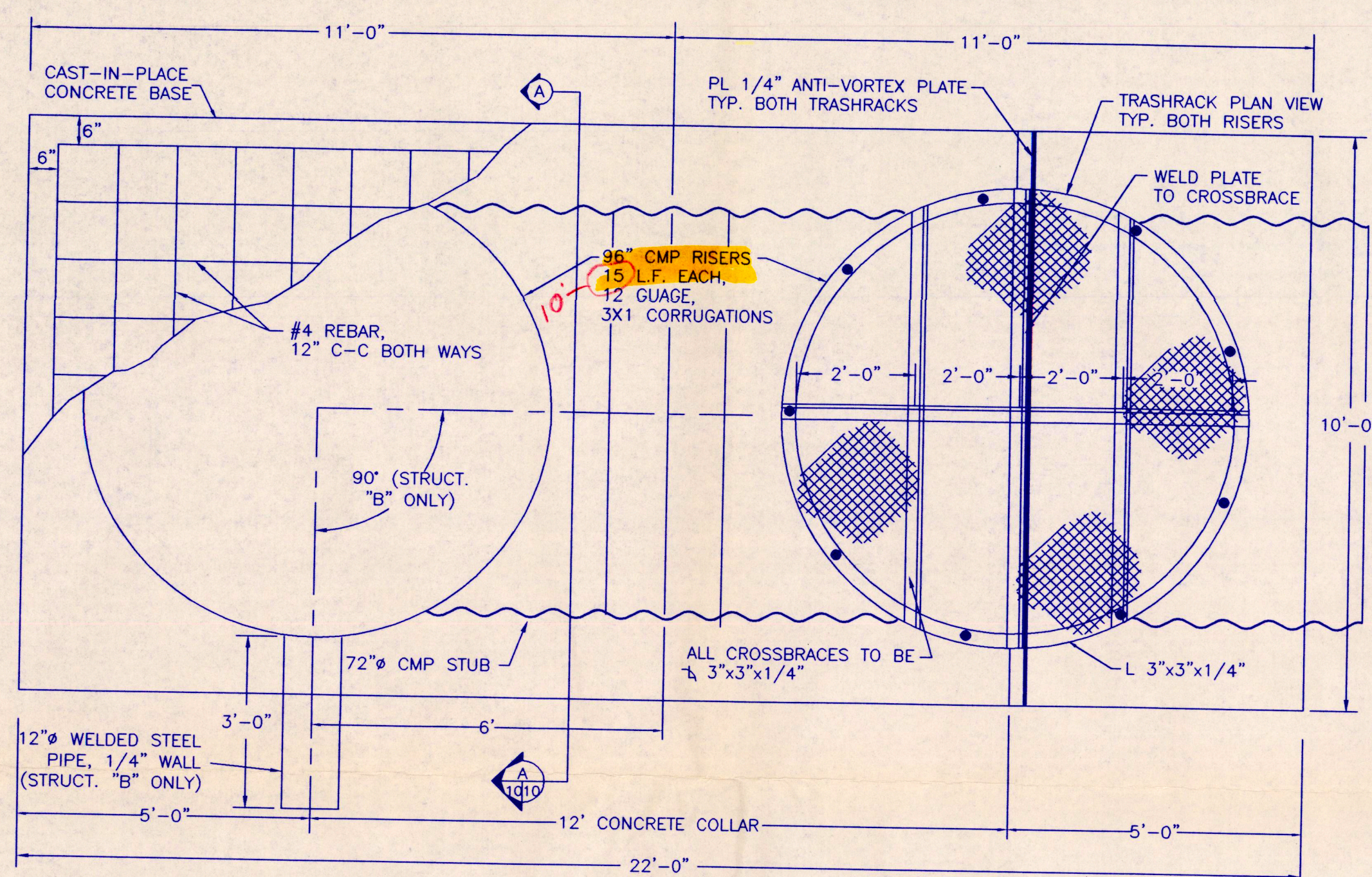


ANTI-VORTEX PLATE DETAIL

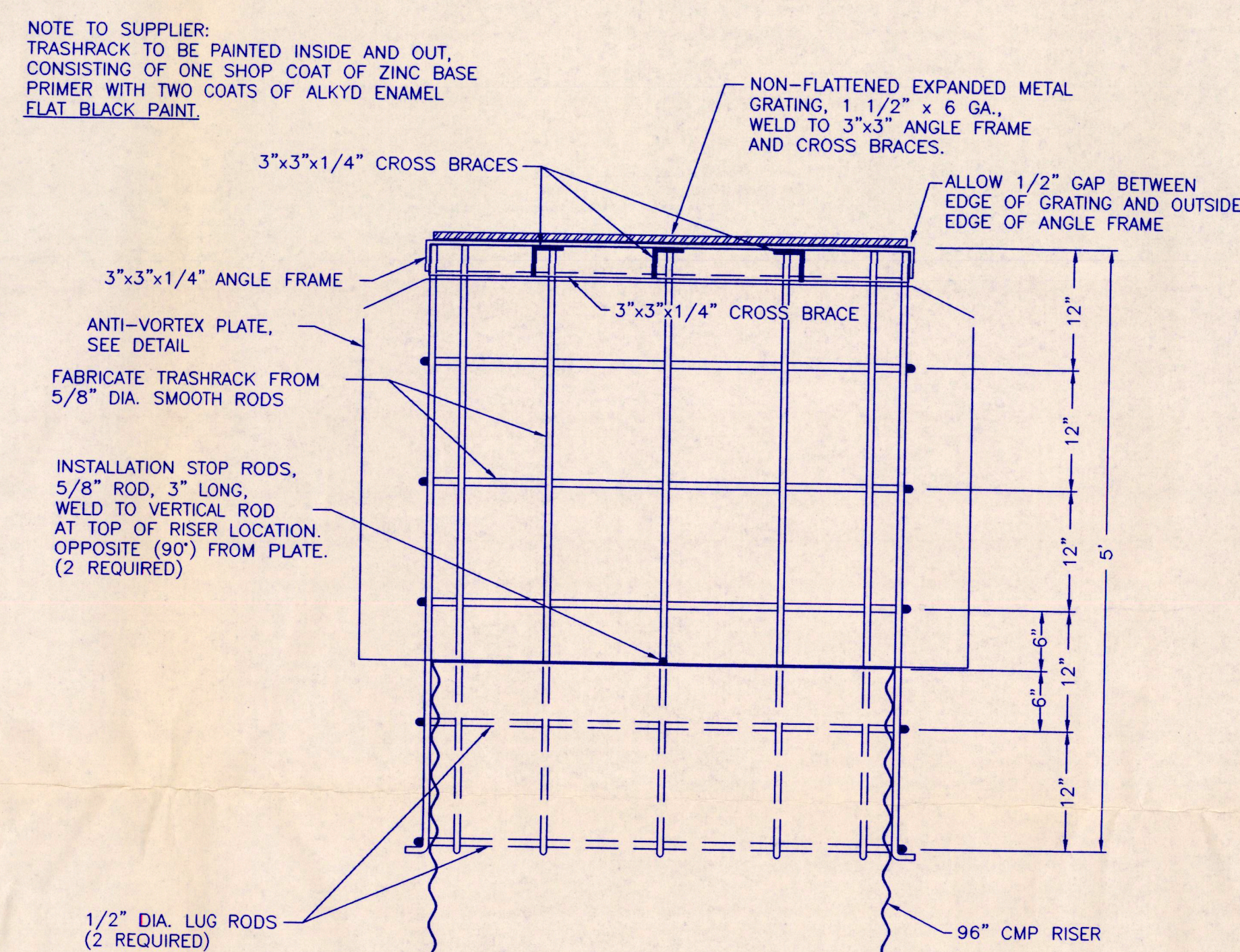
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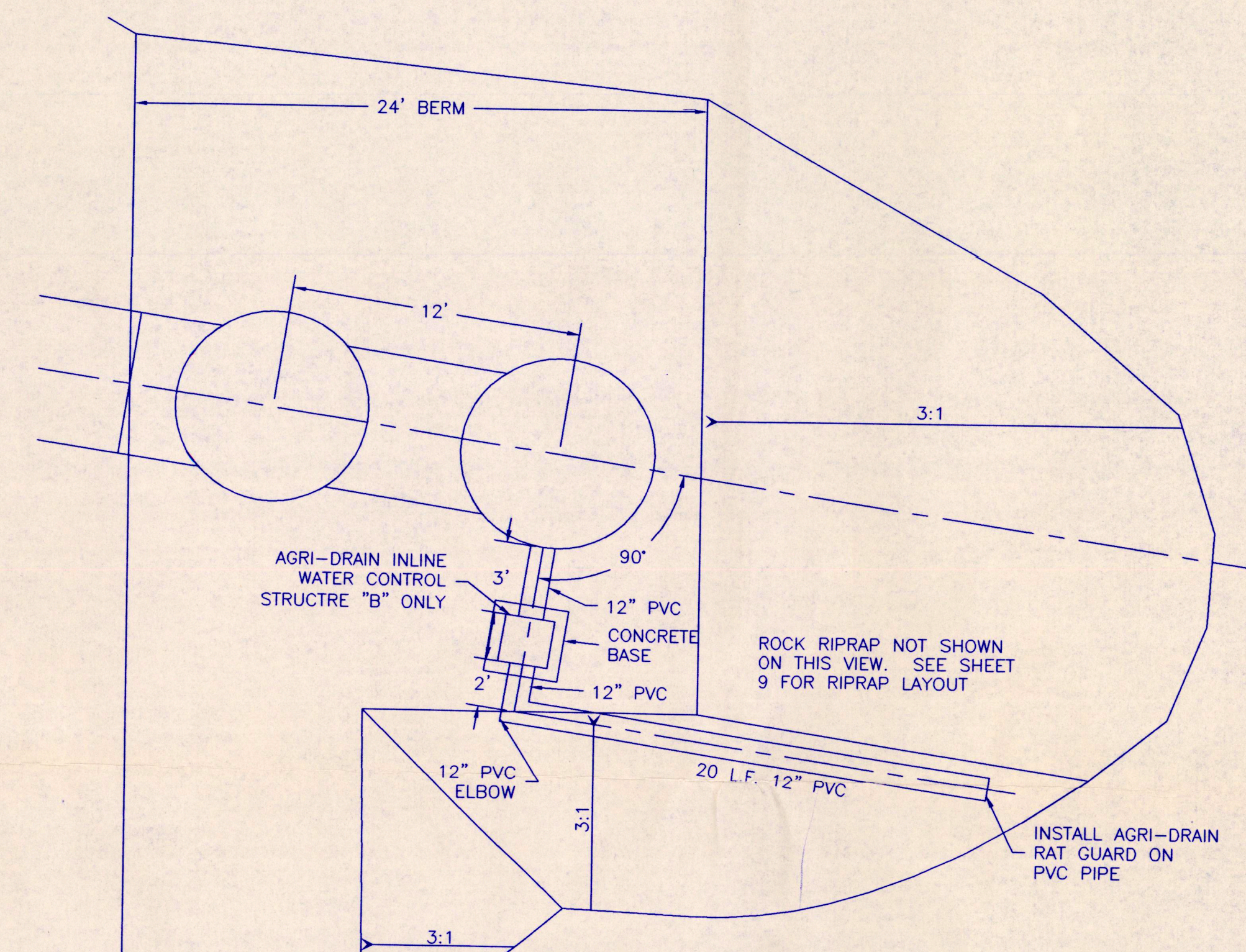
STEP BEVEL DETAIL
NOT TO SCALE



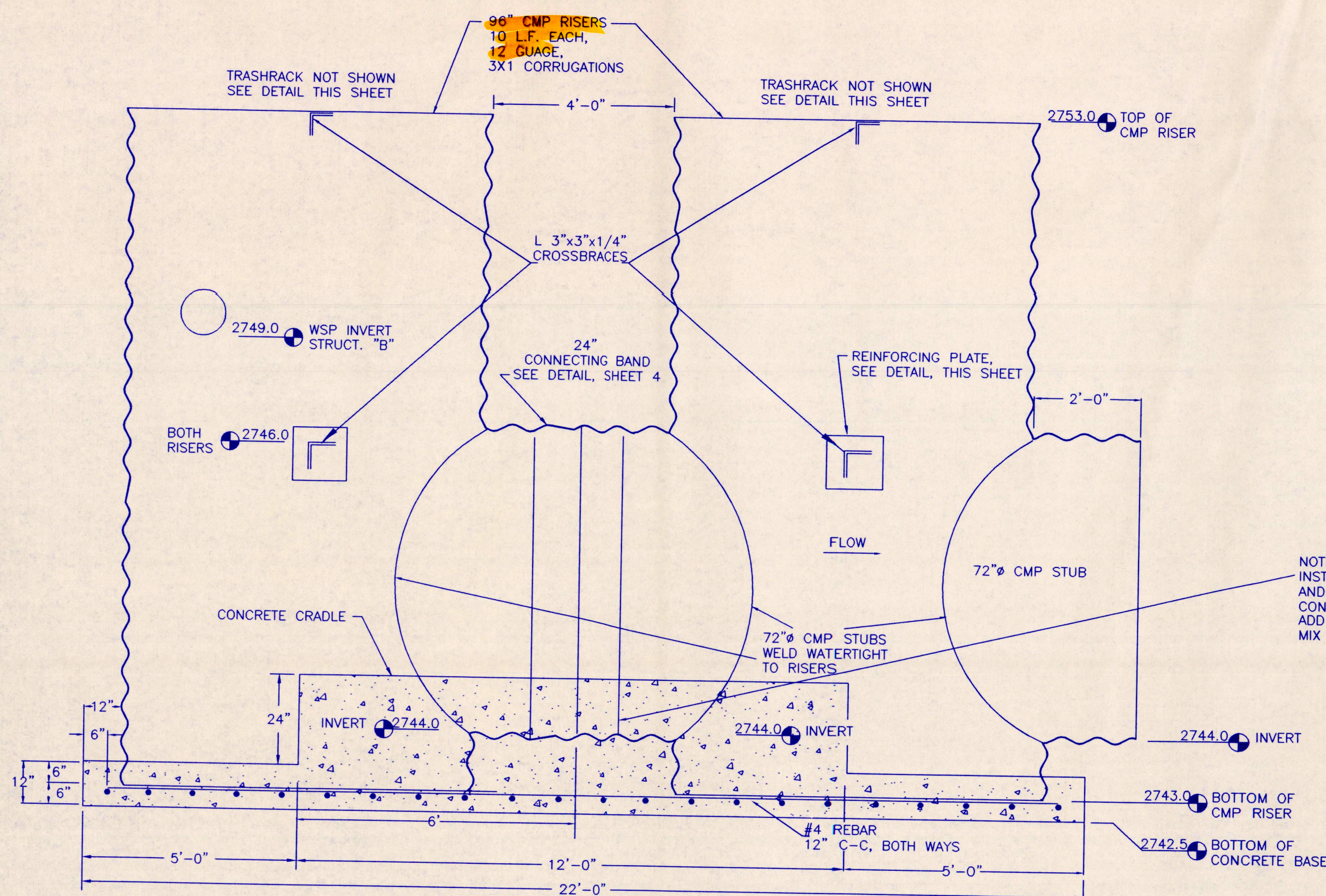
WATER CONTROL STRUCTURE PLAN ("A" & "B")
NOT TO SCALE



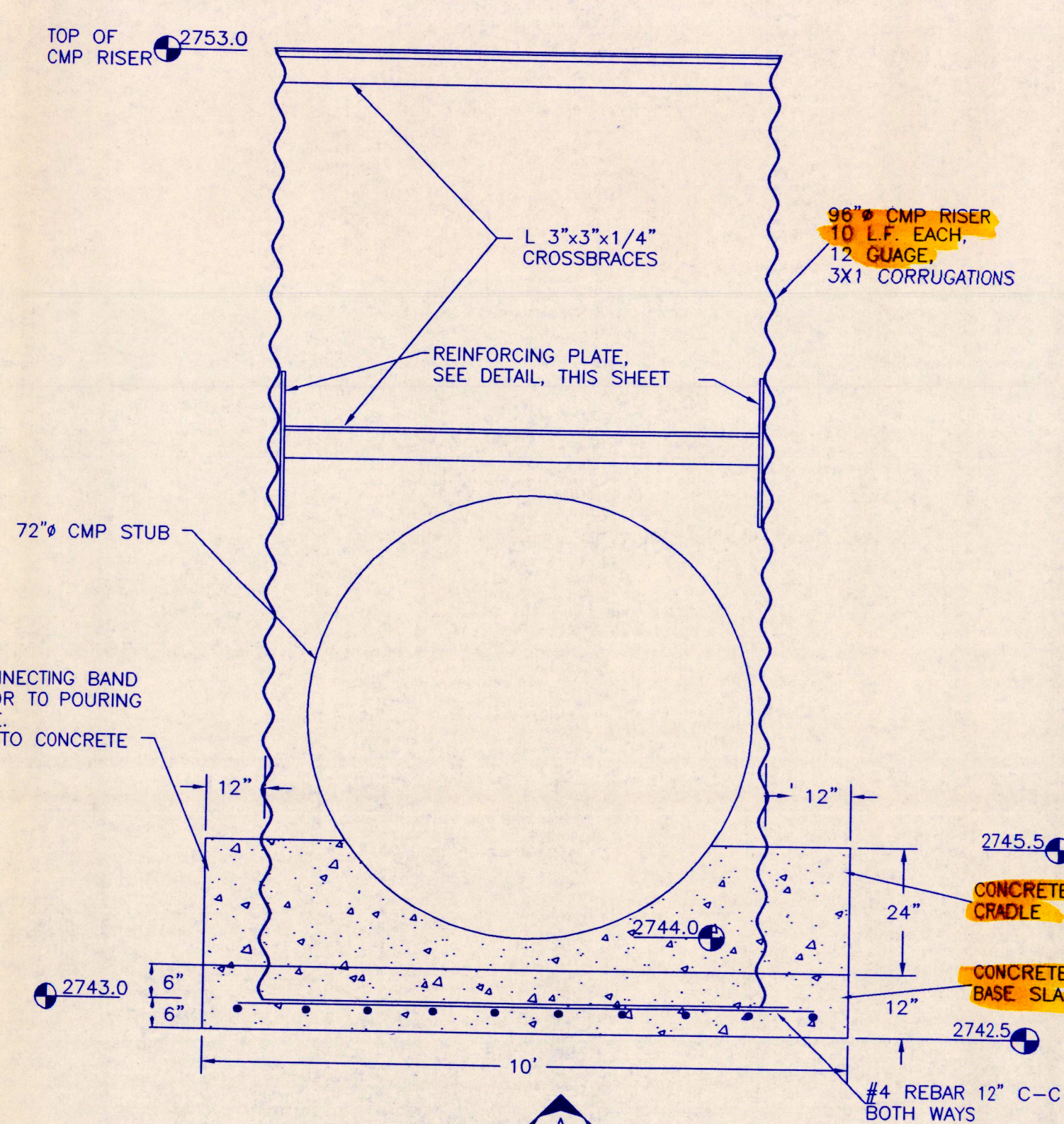
TRASHRACK PROFILE
NOT TO SCALE



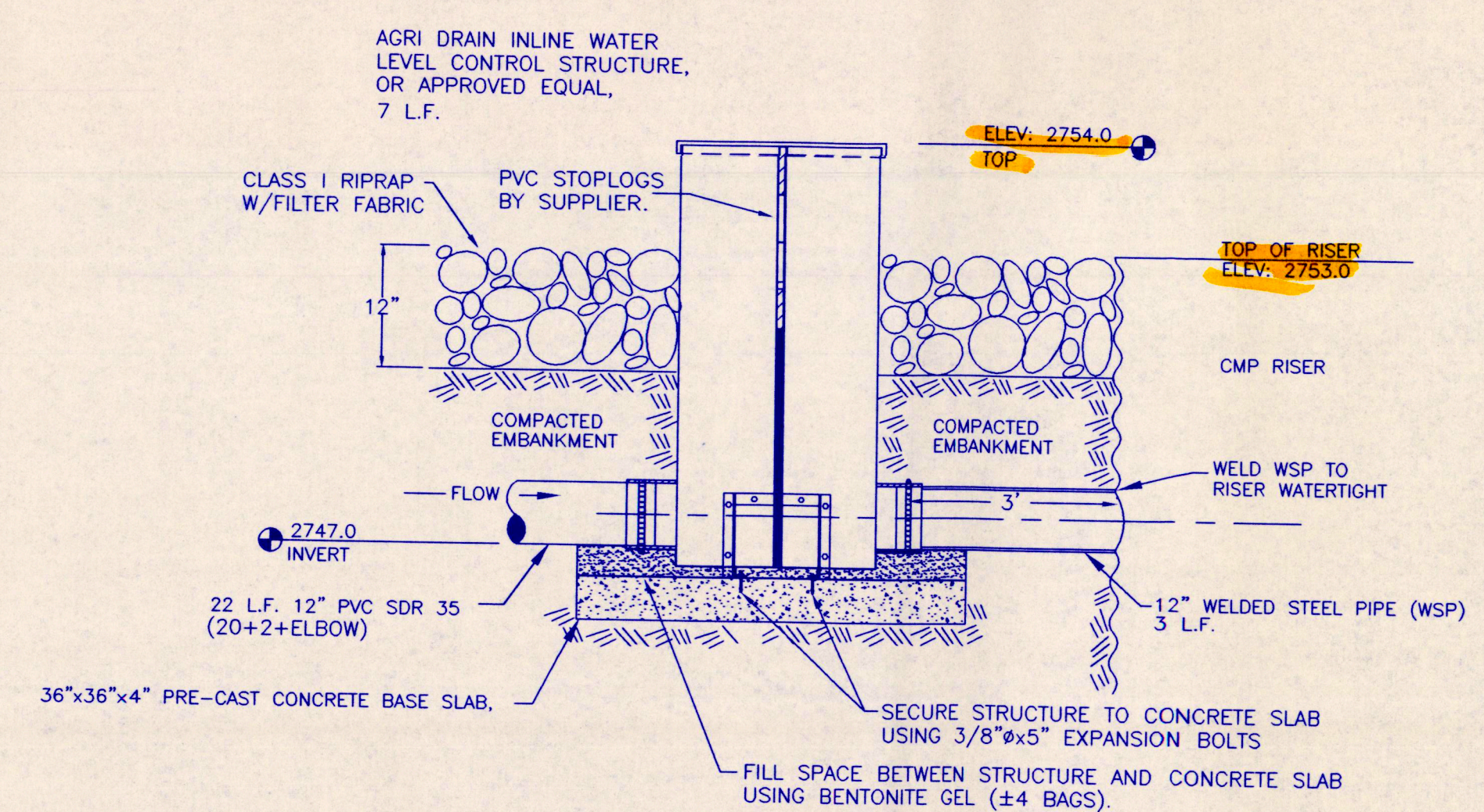
DRAWDOWN STRUCTURE "B" PLAN VIEW
SCALE: 1" = 5'



WATER CONTROL STRUCTURE ("A" & "B")
 C PROFILE



SECTION
CONCRETE GRADE SECTION



INLINE DRAWDOWN STRUCTURE PROFILE
NOT TO SCALE

