

WATER PERMIT NO. 7093-3

Name of Applicant: Thomas Wolf

Address: 416 N Chicago Ave, Madison SD 57042

Phone: 605 427-3447

Amount of Water Claimed: 68 AF

Total Acres: NA

Source of Water Supply: runoff & springs

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

County: Lake

Type of Waste Disposal System:

Location: 2 miles south of Madison

PRIORITY

Date Received: 1-26-09

Application/License Fee: \$200

Corrected Application Received:

Period of Annual Use: January 1 – December 31

Remarks:

Diversion Point: SE ¼ SW ¼ Sec 20-T106N-
R52W.

Land to be Irrigated:

Depth of Well: NA

Well Driller:

Remarks:

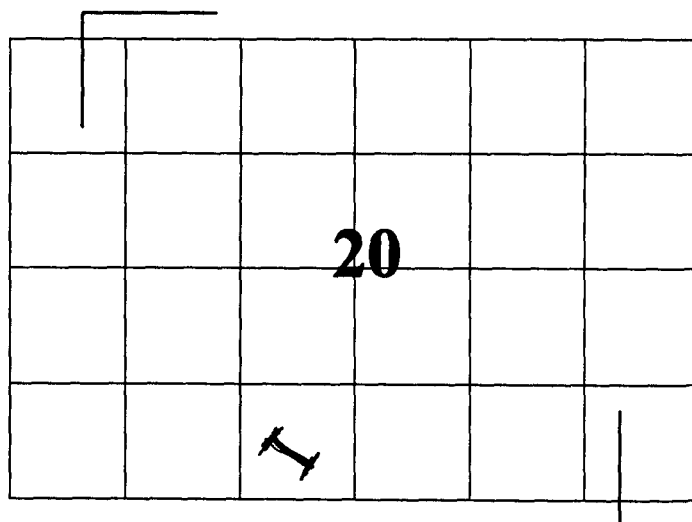
Type of Map: topo

Prepared by: Laura Stern, NRCS

Reviewed and the Number Assigned on: 1-26-09

By: Karen Schlaak

Notice of Hearing - date to intervene: _____



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JAN 26 2009
WATER RIGHTS
PROGRAM

Mail to: Water Rights Program Joe Foss Building 523 E. Capitol Pierre, SD 57501-3181 (605) 773-3352	No. <u>7093-3</u> (office use only)	Hydrologic Unit <u>10170203</u>
	Basin <u>Sioux River</u>	
	Newspaper <u>Daily Leader PO Box 348</u>	
	<u>605-256-4555</u>	<u>Madison</u>

57042

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 Livestock | |

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.)

1. Name of Applicant Thomas Wolf Phone 605-427-3447
(check one) ☒ Owner ☐ Tenant/lessee
Mailing Address 416 N. Chicago Ave, Madison, S.D. State 57042
(Street, R.R. or Box and City) (Zip Code)

2. Amount of water claimed _____ *CFS or _____ 4 **GPM 68 ~~67.0~~ ***AF
(*Cubic Feet per Second) (**Gallons per Minute) (***)Acre Feet - storage capacity of dam/dugout or annual use if applicable)

3. Source of water supply One dam filled by surface runoff and springs

4. Location of point of diversion (example - 3 wells in SW1/4 NE1/4 section 12-T104N-R53W) County Lake
Dam in SE1/4 SW1/4, Section 20-T106N-R52W water impounded: SE 1/4 SW 1/4 Sec 20
106 and NE 1/4 NW 1/4 Sec 29 all in T106N
R52W

5. County or counties where water will be used Lake

6. Annual period during which water is to be used January 1 to December 31

7. 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)

See Attachment

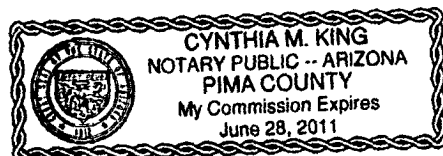
STATE OF Arizona SS
County of Pima

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, Thomas Wolf, 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 Thomas Wolf

Subscribed and sworn to before me this 20 day of January 20 09



Cynthia M. King
Notary Public signature

**SOUTH DAKOTA
WATER PERMIT NO. 7093-3**

Date of first receipt of application January 26, 2009.

Date of receipt of plans and specifications completing the application April 17, 2009.

The Water Management Board approved Water Permit No. 7093-3 on July 8, 2009 for Thomas Wolf, 416 N Chicago Ave, Madison SD 57042 authorizing the construction of a dam and the placing of water to beneficial use subject to the following limitations, conditions and qualifications:

1. Water Permit No. 7093-3 authorizes impoundment of 68 acre-feet of water from runoff and springs by constructing a dam located in the SE ¼ SW ¼ Section 20 with water impounded in the SE ¼ SW ¼ Section 20 and the NE ¼ NW ¼ Section 29; all in T106N-R52W. A diversion of 4 gallons per minute will take place to serve livestock water tanks.
2. The water appropriated shall be used for fish and wildlife propagation, recreation 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 from which applicant may claim right is April 17, 2009.
5. One-fifth of the construction is to be completed on or before January 8, 2012.
6. All construction is to be completed on or before July 8, 2014.
7. Water is to be put to beneficial use on or before July 8, 2018.
8. 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. 7093-3 authorizes a dam with a storage capacity of 68.0 acre feet of water and sufficient water annually to maintain the water level to the outlet elevation.
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

JUL 22 2009

date



(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

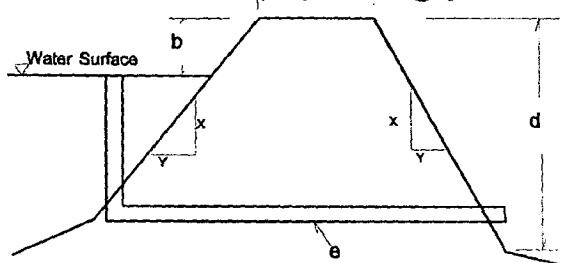
- a) Surface Dimensions _____ Depth _____
- b) Depth to water (ground surface to water level) _____

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:

Laura Stern
Natural Resource Cons. Serv.
NRCS-SD
100 SW 2nd St.
Madison, SD 57042
520 3rd Ave.
P.O. Box 626
Brookings, SD 57006



- b) Freeboard _____ 5.4'
- c) Crest Width _____ 14'
- d) Crest Length _____ 340'
- e) Height _____ 26.4'
- f) Primary Outlet Capacity _____ 44.6 cfs
If pipe, diameter _____ 24"
- g) Secondary Spillway Capacity _____ 568 cfs
Spillway Width _____ 150'
- h) X & Y Slope _____
Upstream _____ 3:1
Downstream _____ 3:1
- i) Surface Area of Impoundment _____ 8.9 acres
- j) Storage _____ 67.9 Acre Feet
- k) Drainage Area Above Dam _____ 760.0 Acres

Tom Wolf Dam Description
Lake County, South Dakota
SE4, SW4, 20-T106N-R22W

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The proposed dam is planned to be built this summer. The height of the dam is 26.4' with 20' depth of water. The dam has a 14' top and 3:1 sideslopes. The principal spillway is a riser hood combination. A 48" diameter corrugated metal pipe (CMP) riser 3.5' long feeds water into a 24" diameter CMP hooded barrel that is approximately 130' long. The auxiliary spillway is 150' wide with 3:1 sideslopes. At the principal spillway, the pond stores 67.9 acre-feet of water. A livestock pipeline will draw 4 gpm of water out of the pool area to supply water to two tanks throughout the grazing season. The amount of water used for livestock watering is 0.3 acre-feet per year.

In addition, this dam falls under the South Dakota Safety of Dams Rules. A detailed set of plans is being prepared for this dam and a risk assessment will be performed including a breach routing.

RECEIPT

WATER RIGHTS PROGRAM

South Dakota Department of Environment and Natural Resources

Date 1/26, 20 09

RECEIVED OF Thomas H Wolf 416 N Chicago Ave Madison SD 57042

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

Fee for Application for Permit No. <u>7073-3</u> to Appropriate Water, to construct and to put water to beneficial use	150	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>7073-3</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	200 00

No.

03072

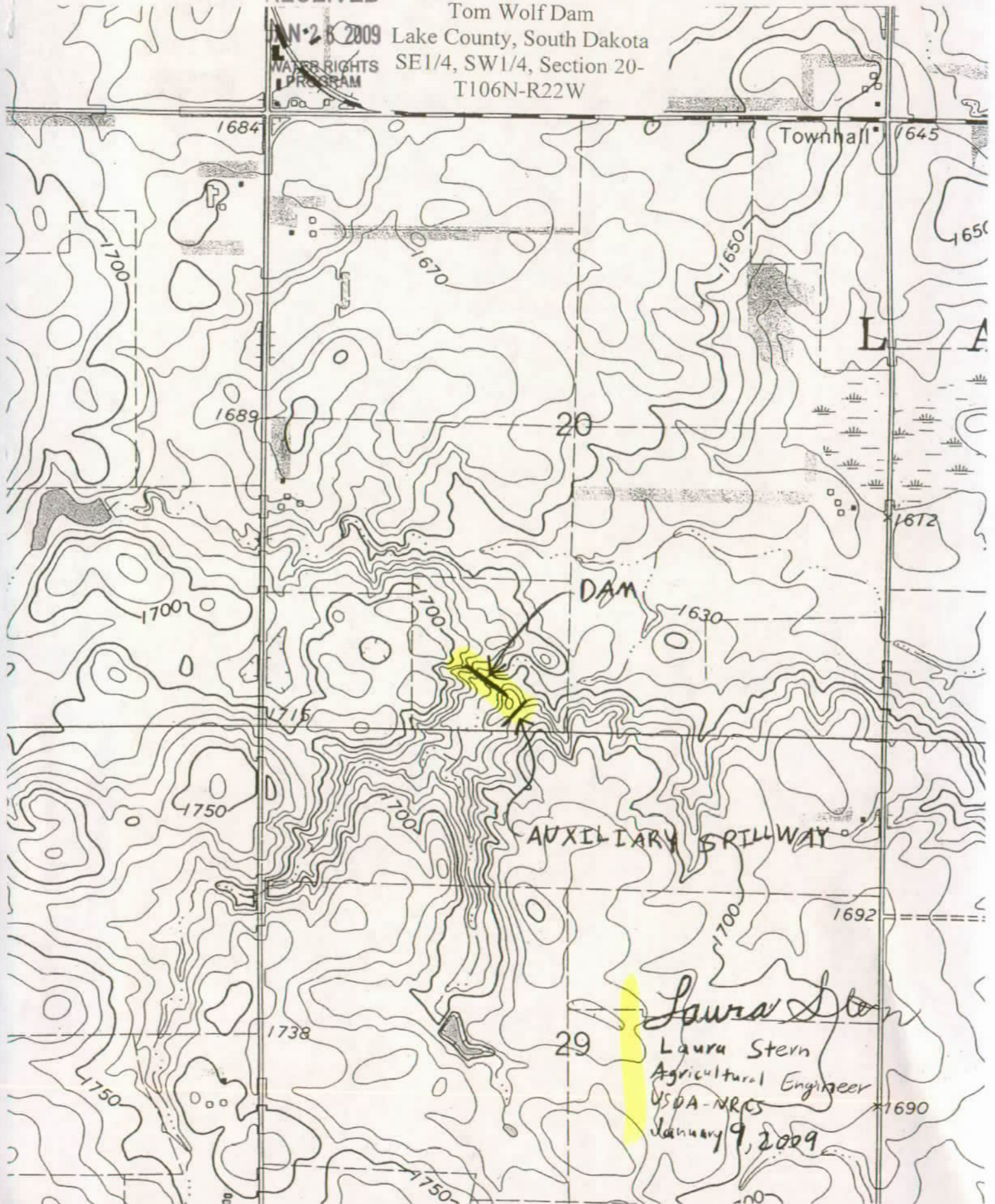
By

Lauren E. Erbe
Chief Engineer

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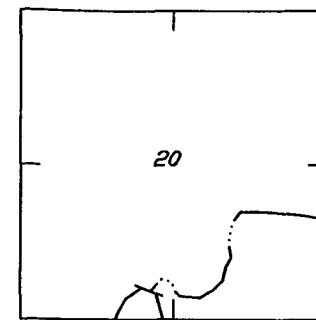
JAN 28 2009
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Tom Wolf Dam
Lake County, South Dakota
SE1/4, SW1/4, Section 20-
T106N-R22W



DRAINAGE AREA ACRES	ANNUAL YIELD @ 80% AC.FT.	PEAK RUNOFF <u>50</u> YR. CFS. (25or50yr)	EMERG. SPWY. <u>50</u> YR. CFS.	WATER DEPTH @ P.S. FT.	SURFACE AREA @ P.S. ACRES	SEDIMENT STORAGE AC.FT.	STORAGE		
							@ P.S. AC.FT.	@ E.S. AC.FT.	@ TOP OF DAM AC.FT.
760	10.8	698	597	20	8.9	15.7	68.3	89.7	128.1

1. S.D. LAW STATES: "NO EXCAVATOR MAY BEGIN ANY EXCAVATION WITHOUT FIRST NOTIFYING THE ONE-CALL NOTIFICATION CENTER' AT THE NUMBER 1-800-781-7474."
2. LANDOWNER IS RESPONSIBLE FOR COMPLYING WITH ALL FEDERAL, STATE, AND LOCAL LAWS AND MAINTAINING THIS DAM IN ACCORDANCE WITH S.D. OPERATION & MAINTENANCE GUIDELINES.
3. THIS PROJECT IS X IS NOT CLASSIFIED AS A "DAM" BY S.D. LAW. ACCORDING TO S.D. LAW, A STRUCTURE IS CLASSIFIED AS A DAM IF IT IS > THAN 25 FT HIGH (TOP TO D.S. TOE) AND IMPOUNDS > THAN 15 AC FT OR IF IT IS > THAN 6 FT HIGH AND IMPOUNDS > THAN 50 AC FT.
4. IF CULTURAL RESOURCES ARE DISCOVERED, DISCONTINUE CONSTRUCTION AND NOTIFY THE LOCAL NRGS OFFICE.
5. SEED ABOVE HWL. THE TOP AND BACKSLOPE OF DAM, THE E.S., ALL DIKES, AND ALL DISTURBED AREAS DESIGNATED BY THE ENGINEER.
6. SCARIFYING & STRIPPING OF THE DAM SITE AND DEPTH OF CORE TRENCH SHALL BE INSPECTED AND APPROVED BY AUTHORIZED PERSONNEL PRIOR TO BACKFILL. EXCAVATE CORE TRENCH 1 FT INTO IMPERMEABLE MATERIAL. CONSTRUCT THE FULL DEPTH OF THE CORE TRENCH TO HWL. ELEV. (see Profile of Embankment).



7. BORROW FOR THE DAM SHALL
COME FROM A LOCATION
AGREED TO BY THE
LANDOWNER AND ENGINEER.
BORROW SHALL BE WITHIN
1000' OF THE DAM SITE.

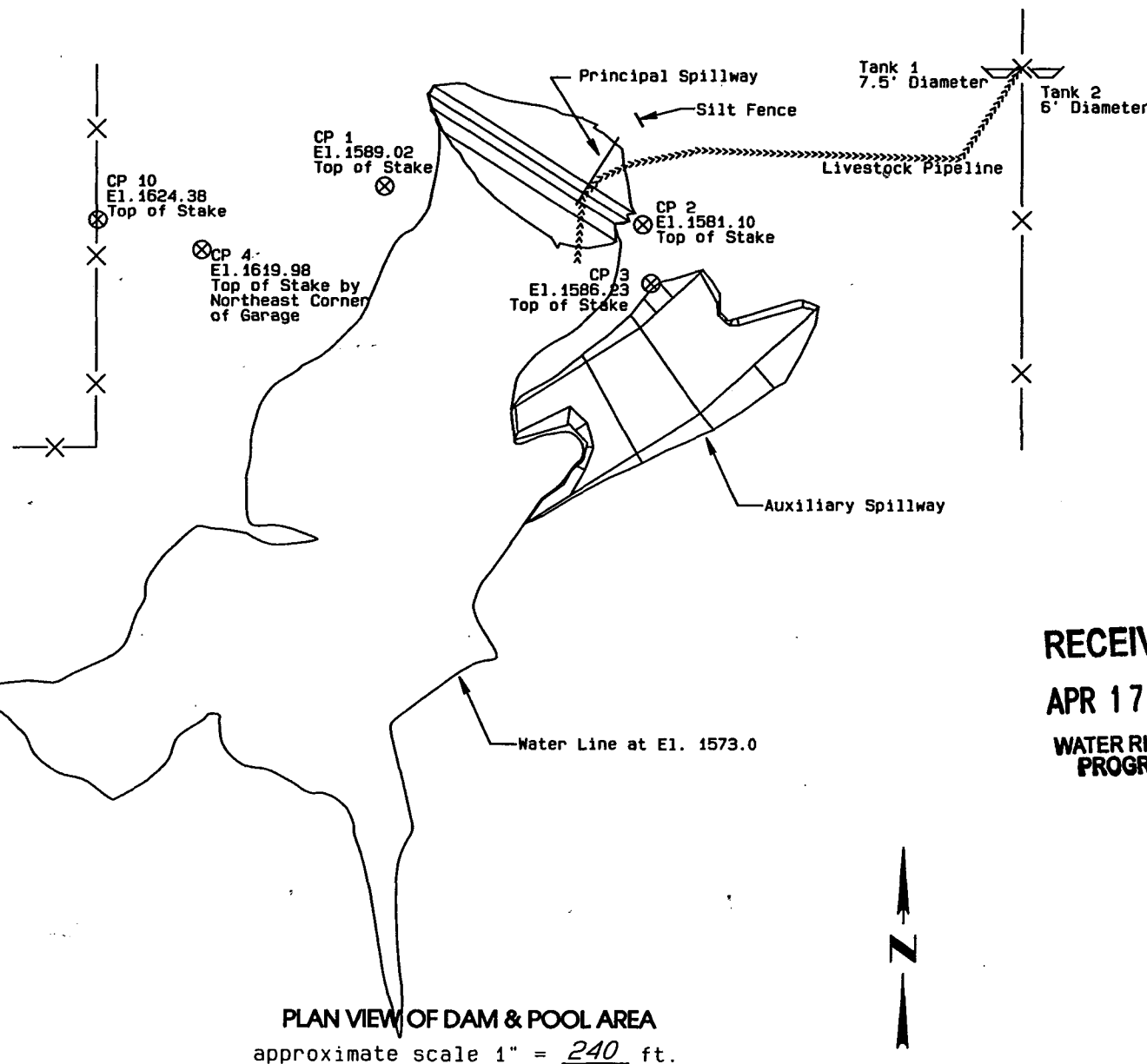
8. LIVESTOCK PIPELINE PATH
AND TANK LOCATIONS SHALL
BE MARKED BY NRCS STAFF
PRIOR TO INSTALLATION.

TABLE OF QUANTITIES			
ITEM	UNIT	QUANT.	AS BUILT
EXCAVATION			
STRIPPING DAM & OUTLET CHANNEL	CY	786	
CORE TRENCH	CY	2,194	
AUXILIARY SPILLWAY (AS)	CY	9,254	
STRIPPING BORROW SITE	CY	1,575	
EARTH FILL--DAM, CORE, & STRIPPING	CY	19,245	
SALVAGING AND SPREADING TOPSOIL--AS	CY	1,287	
BORROW SITE	CY	1,575	
SEEDING	AC	4.6	
PRINCIPAL SPILLWAY			
VERTICAL INLET ASSEMBLY, 12 GAGE	EACH	1	
24" DIA 14 GAGE HELICAL CMP PIPE	LF	119	
INLET BAFFLE	EACH	1	
DRAIN FILTER MATERIAL--COMPACTED	CY	29	
ROCK RIPRAP	CY	14	
FILTER FABRIC	SY	32	
OUTLET PIPE SUPPORT	EACH	1	
1.5 INCH PVC SDR 26 (160 PSI)	LF	820	
TANKS	EACH	2	
LIVESTOCK PIPELINE INLET 12" DIA CMP	LF	6	
SILT FENCE	LF	20	

Diagram illustrating the typical cross section of a dam, showing dimensions and elevations:

- SETTLEMENT 5%
- PRINCIPAL SPWY. EL. 1573.0
- TOP OF DAM EL. 1578.4
- AUXILIARY SPWY. EL. 1575.2
- DO NOT STRIP 3' ADJACENT TO STAKES
- CL (Center Line)
- STRIP & SALVAGE THE SOD FOUNDATION TO CONSOLIDATED SUBSOIL (approx. 6")
- SCARIFY FOUNDATION A MIN. OF 4" PRIOR TO PLACING FILL.
- CORE TRENCH: (see PROFILE OF DAM)

Dimensions shown include 14', 10', 3', and 1'.



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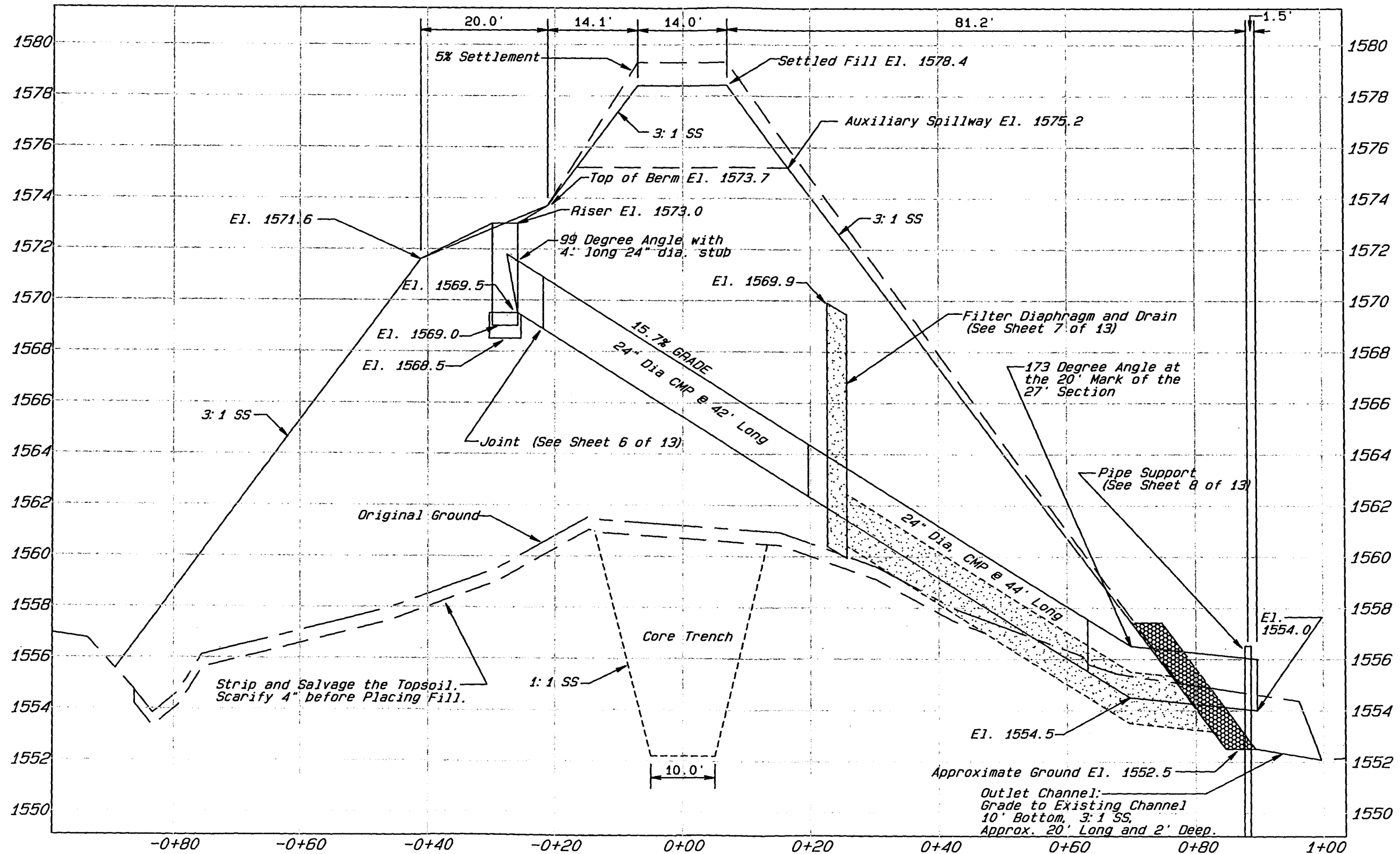
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SD - 4 STRIPPING
SD - 5 EXCAVATION
SD - 7S EARTH FILL CLASS "S"
SD - 8 ROCK RIPRAP AND BEDDING
SD - 10 SALVAGING & SPREADING TOPSOIL
SD - 12B CONCRETE FOR MINOR STRUCTURES
SD - 15 CORRUGATED METAL PIPE
SD - 16 TIMBER FAB. & INSTALLATION
SD - 17 METAL FAB. & INSTALLATION
SD - 20A PLASTIC PIPELINE
SD - 28 SEEDING
SD - 50 CORRUGATED STEEL PIPE
SD - 55 PLASTIC PIPE
SD - 95 GEOTEXTILE
SD - 592 GEOTEXTILE
```

TOM WOLF
LAKE COUNTY
SE4, SW4, S 20, T 106, R 52

U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

Designed <i>Stern 1-09</i>	Date	Approved by: <i>Micell Burke</i>	
Drawn <i>Stern 1-09</i>		Title: <i>Agricultural Engineer</i>	
Checked <i>M. Burke 4/09</i>		Sheet <i>1</i>	of <i>13</i>
		File Name: <i>Earth Dam 1 to 17</i>	

PROFILE OF PRINCIPAL SPILLWAY AT STA. 3+06



Date 01-09
 Designed Laura Stern
 Drawn Laura Stern
 Checked
 Approved

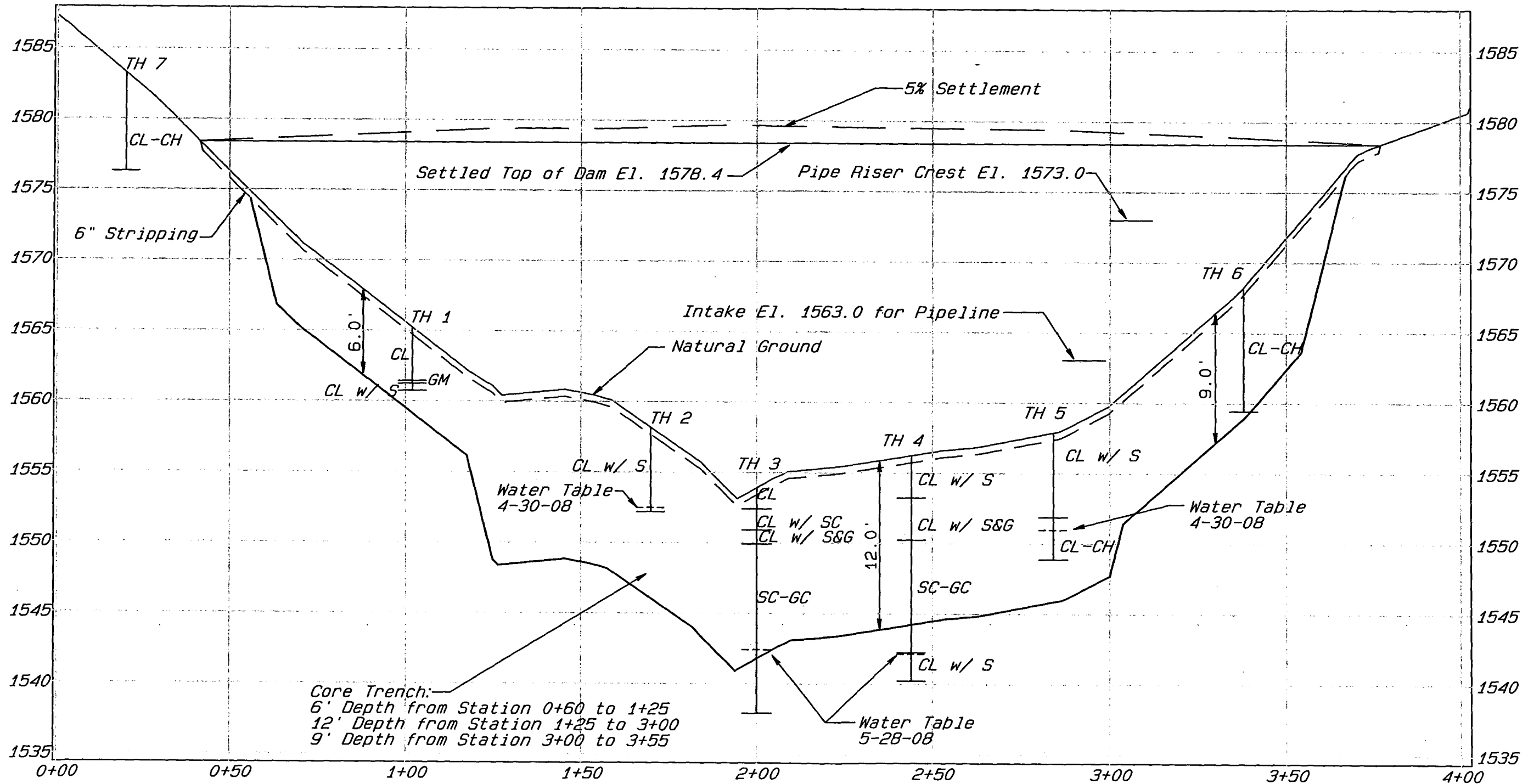
PRODUCER Tom Wolf
 SW4 SECTION 20 T.106 R. 52
 Lake COUNTY
 Lake CONSERVATION DISTRICT

USDA - NRCS
 Brookings Field Support Office
 520 Third Street
 Brookings, South Dakota 57006

NRCS
 Natural Resources Conservation Service
 United States Department of Agriculture

File Name: WellDampro
 Drawing No.
 4/6/2009 11:24AM
 Sheet 2 of 13

PROFILE ALONG CENTERLINE OF DAM



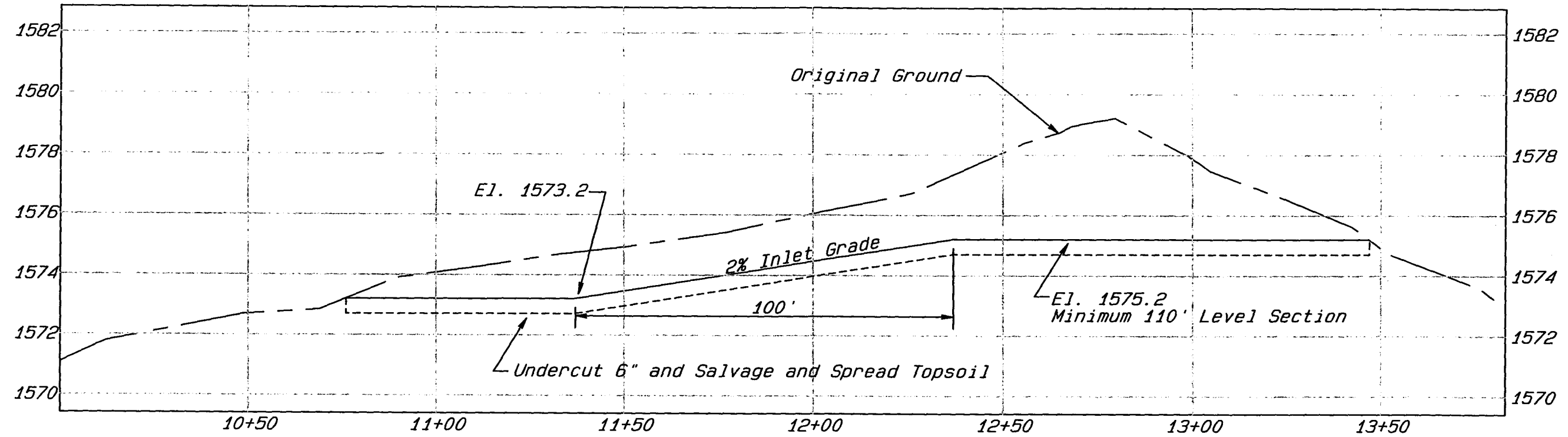
Date	01-09
Designed	Laura Stern
Drawn	Laura Stern
Checked	
Approved	

PRODUCER Tom Wolf
 SW4 SECTION 20 T106 R. 52
 Lake COUNTY
 Lake CONSERVATION DISTRICT

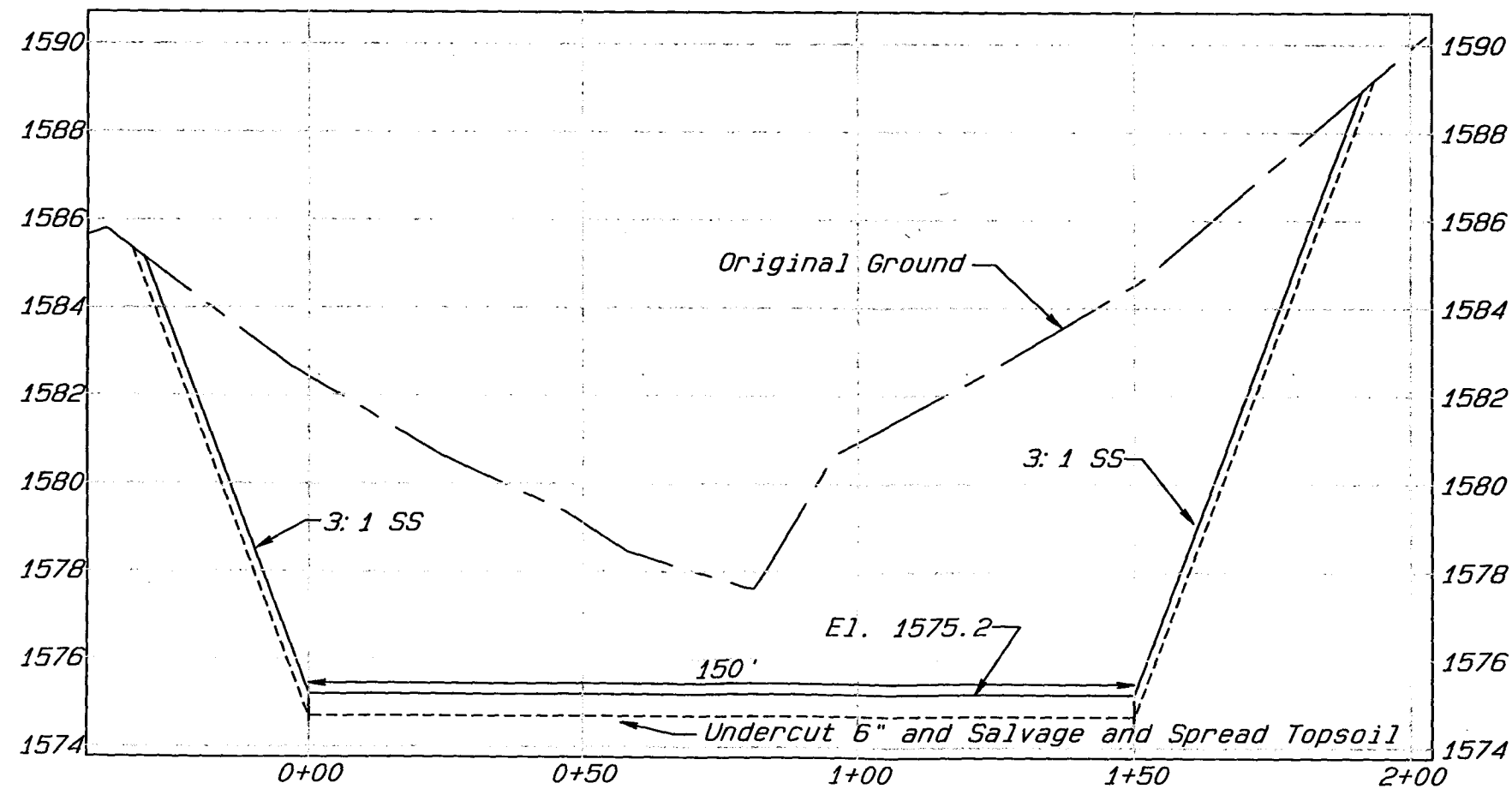
USDA - NRCS
 Brookings Field Support Office
 520 Third Street
 Brookings, South Dakota 57006



PROFILE ALONG CENTERLINE OF AUXILIARY SPILLWAY



TYPICAL AUXILIARY SPILLWAY CROSS SECTION



Date	01-09
Designed	Laura Stern
Drawn	Laura Stern
Checked	
Approved	

PRODUCER	Tom Wolf
SW4 SECTION	20 T.106 R. 52
Lake	COUNTY
Lake	CONSERVATION DISTRICT

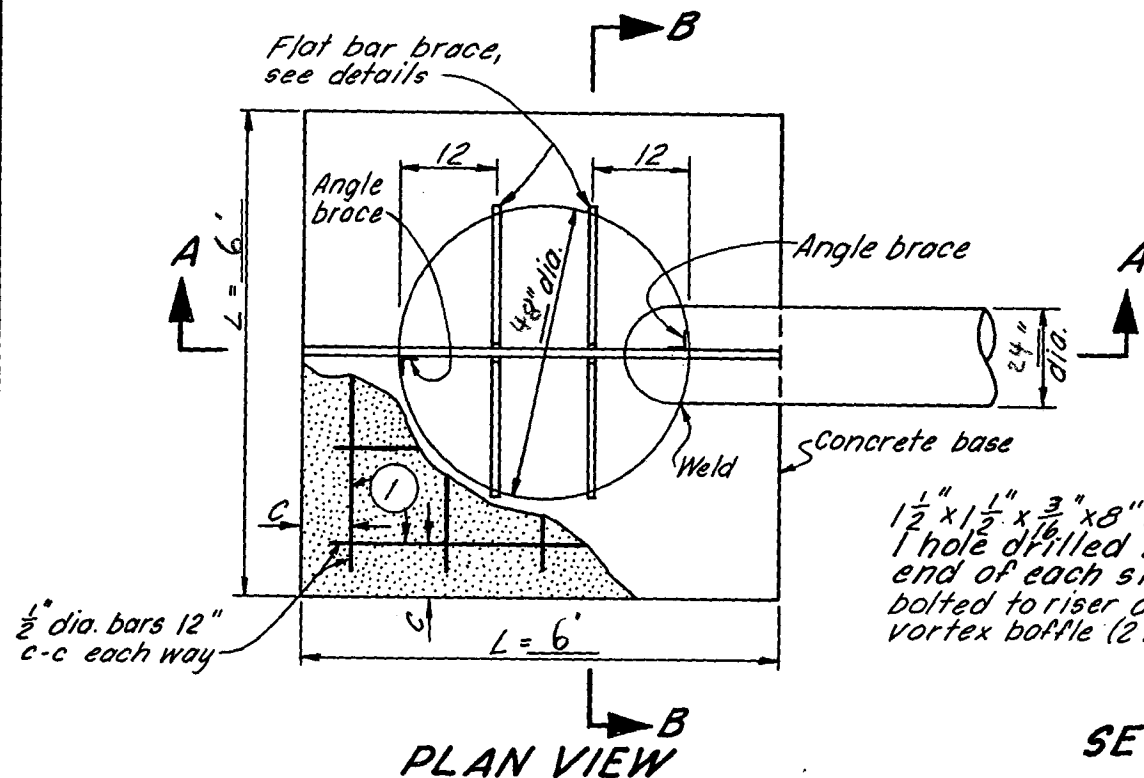
USDA - NRCS	57006
Brookings Field Support Office	
520 Third Street	
Brookings, South Dakota	



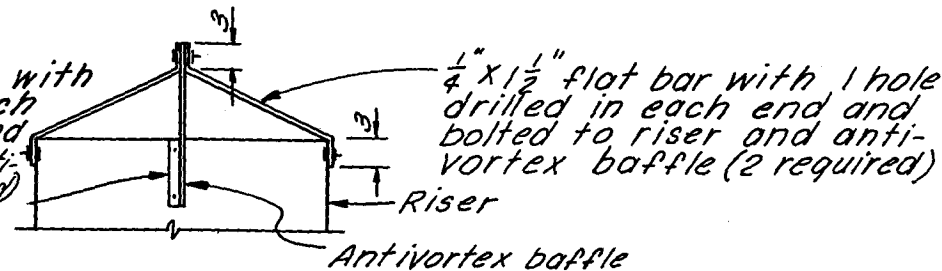
File Name:	WdDam.pro
Drawing No.	
4/3/2009 11:03AM	
Sheet	4 of 13

STEEL SCHEDULE AND CONCRETE QUANTITIES

RISER DIA. IN.	BARREL DIA. IN.	BAR SIZE	MARK	TYPE	NO. REQ'D.	LENGTH FT.-IN.	TOTAL LENGTH FT.-IN.	TOTAL WT. LB.	CONC. CU.YD.	C IN.	L FT.-IN.
48	24	4	1	STR	12	5-6	66-0	44	1.3	6	6-0



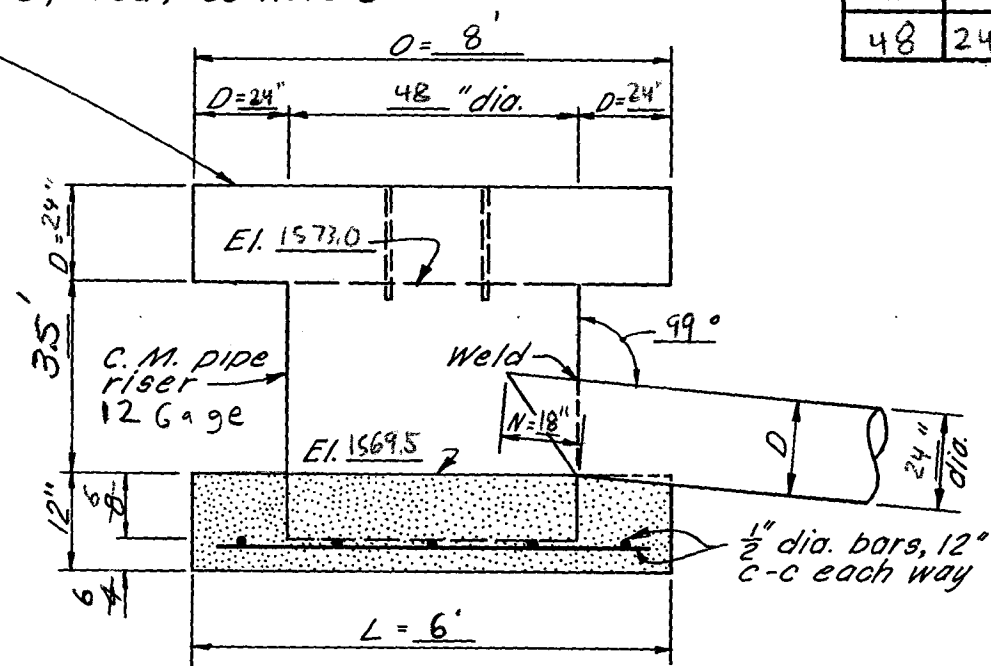
1 1/2" x 1 1/2" x 3/8" angle with 1 hole drilled in each end of each side and bolted to riser and anti-vortex baffle (2 required)



STRUCTURAL STEEL AND ANTIVORTEX BAFFLE QUANTITIES

RISER DIA. IN.	D IN.	N IN.	O FT.-IN.	BAFFLE AREA SQ.FT.	BAFFLE WT. LB.	1/4" X 1 1/2" FLAT BAR LENGTH, FT. IN.	NO. REQ'D.	FLAT BAR WT. LB.	1 1/2" X 3/16" ANGLE INCHES	NO. REQ'D.	ANGLE WT. LB.
48	24	18	8-0	16	90	3'-2"	4	17	8	2	2.4

Antivortex baffle required, 0.138" thick, if trash rack is required, see note 3

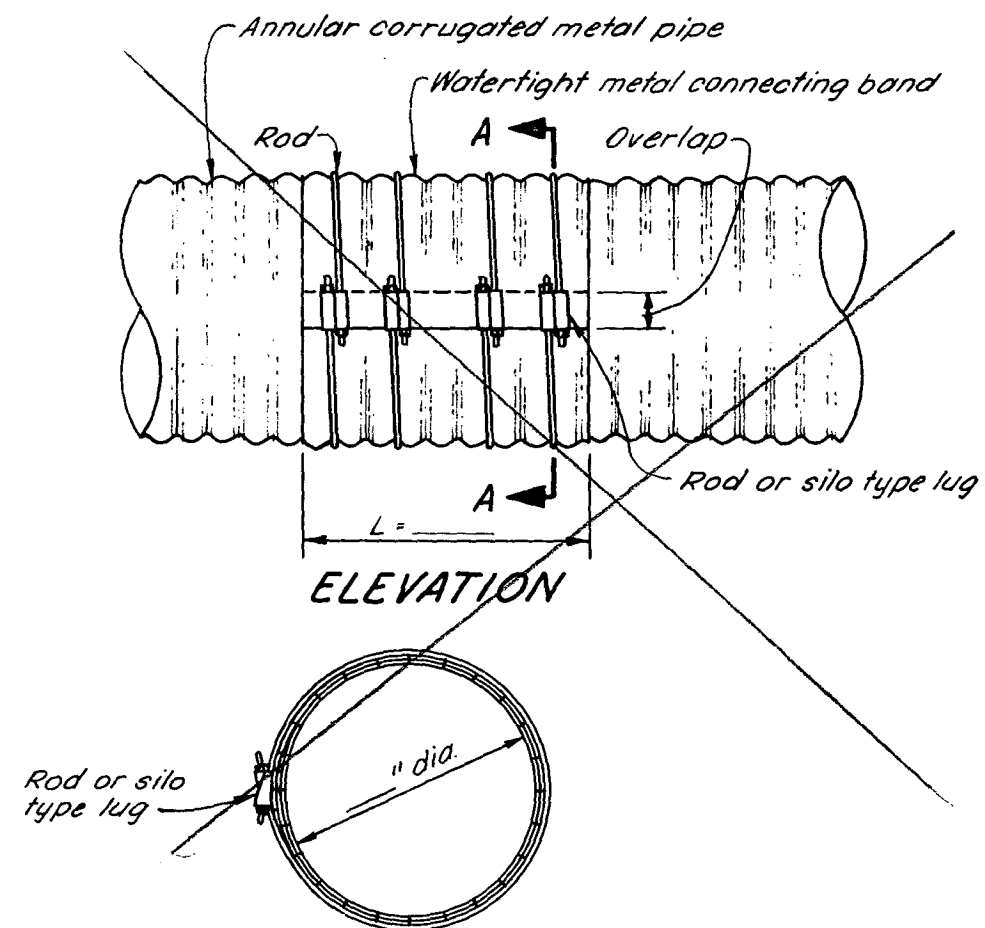


NOTES:

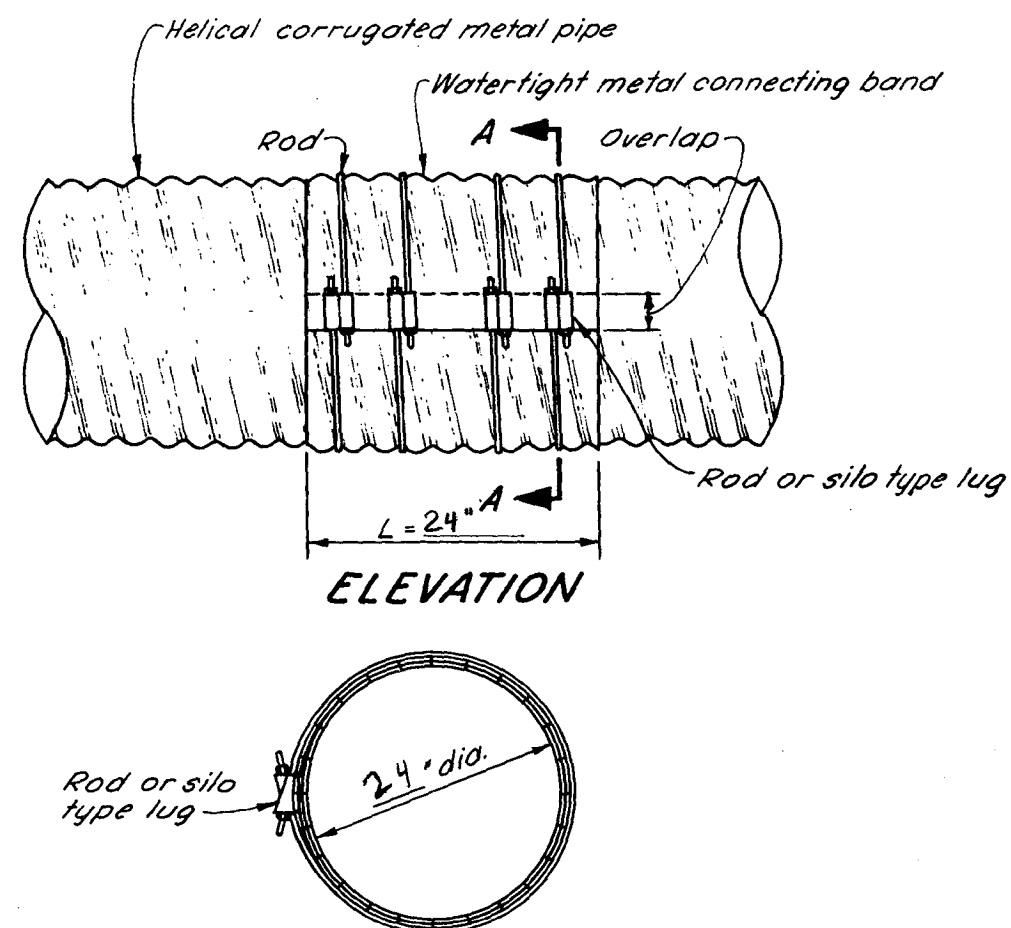
1. ALL CUTS SHALL BE SAW OR SHEAR CUTS.
2. ALL GALVANIZING DAMAGED BY CUTTING, DRILLING, OR WELDING SHALL BE REPAIRED BY PAINTING WITH TWO COATS OF ZINC DUST-ZINC OXIDE PRIMER.
3. FOR TRASH RACK AND BAFFLE DETAILS, SEE PLAN SERIES 6.
4. ALL BOLTS SHALL HAVE A NUT AND SPLIT WASHER.
5. ALL BOLTS, NUTS, AND WASHERS SHALL BE GALVANIZED, CADMIUM PLATED, OR STAINLESS STEEL.
6. HOLES IN BRACES SHALL BE SPACED AND LOCATED TO MATCH CORRUGATIONS IN PIPE AND BAFFLE.

RISER AND HOOD INLET COMBINATION

OPERATOR: TOM WOLF	
CONSERVATION DISTRICT: LAKE	
U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE	
Designed: STERN	Date: 1/69
Drawn: STERN	1/69
Traced:	
Checked:	
Approved by:	Title:
Sheet No. 5	Drawing No. 13



SECTIONAL ELEVATION A-A



SECTIONAL ELEVATION A-A

DIMENSIONS AND QUANTITIES

PIPE DIA. INCHES	MINIMUM "L" INCHES	APPROX. OVERLAP INCHES	NUMBER OF RODS & LUGS	MINIMUM ROD DIA. IN.	NEOPRENE GASKET WIDTH INCHES	ASPHALT MASTIC GAL.
6-18	12	2	2	1/2	12	1/2
21-30	24	3	4	1/2	12	1 1/2
36-48	24	6	4	1/2	12	2

NOTES:

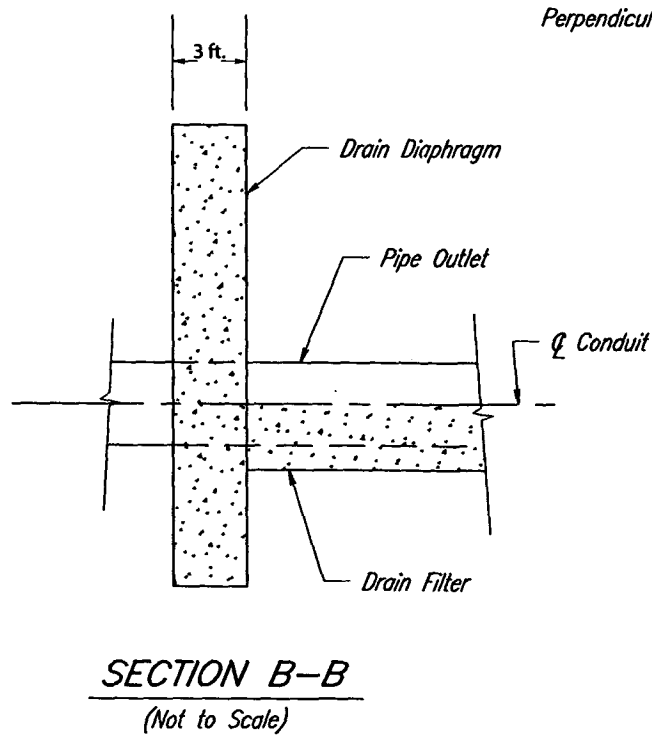
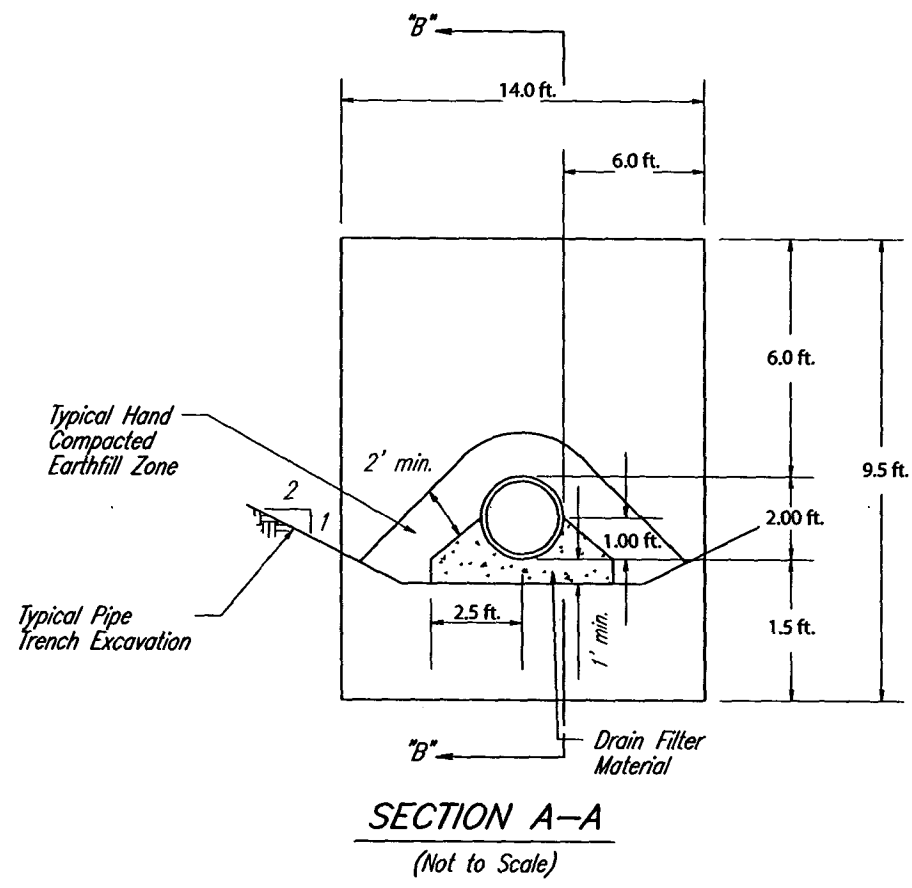
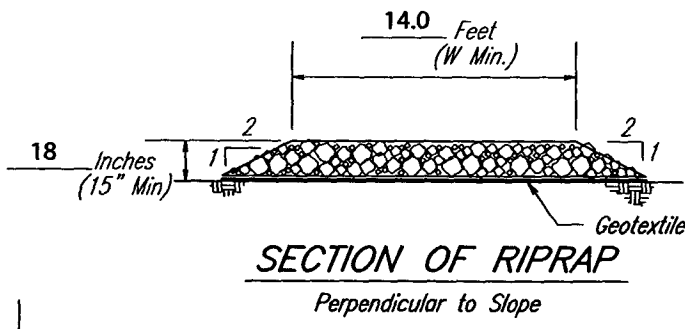
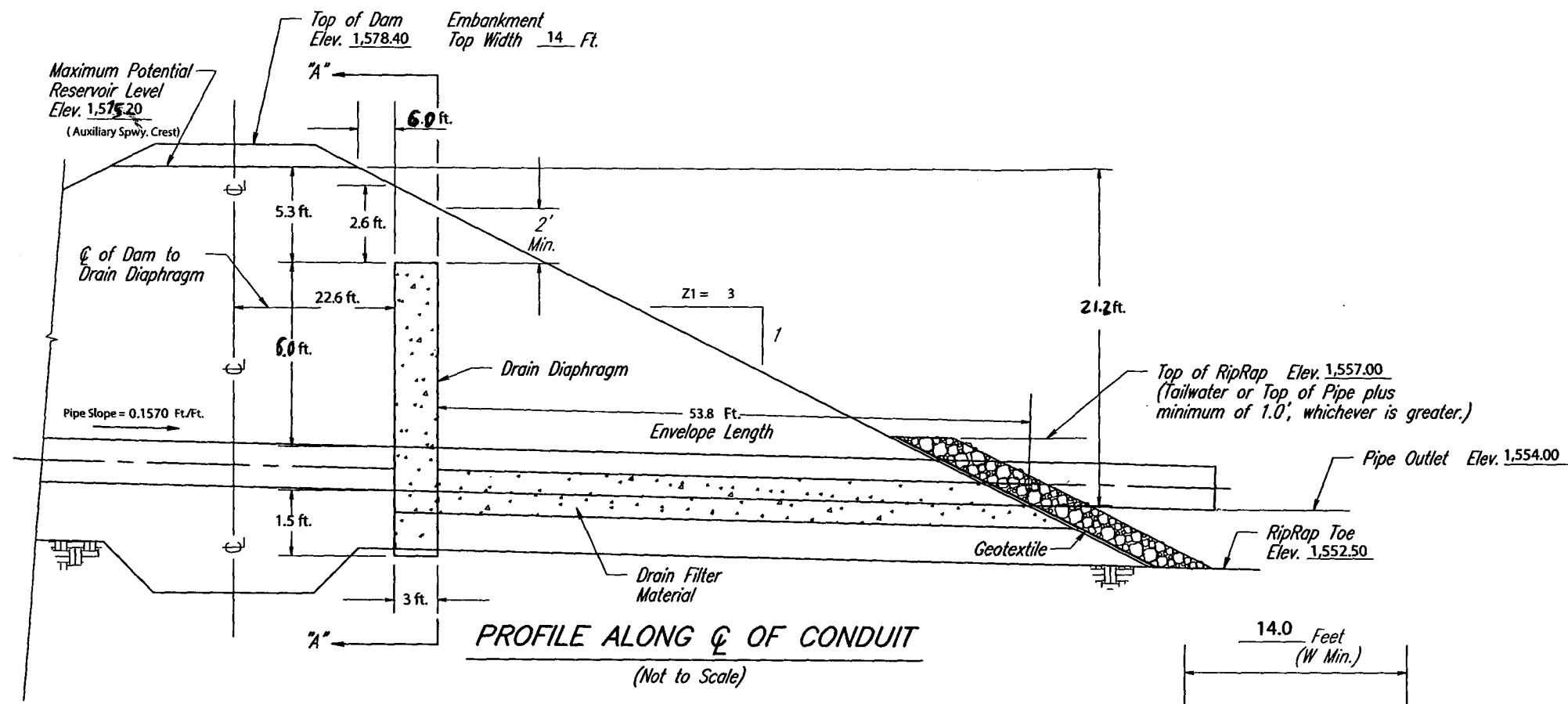
1. WATERTIGHTNESS WILL BE OBTAINED BY USE OF (1) 3/8" THICK NEOPRENE GASKET (WIDTH AS SHOWN) OR (2) ASPHALT MASTIC SEALING MATERIAL TO COVER FULL WIDTH OF BAND.
2. CROSS OUT BAND AND QUANTITIES NOT APPLICABLE.

WATERTIGHT CONNECTING BAND FOR ANNULAR AND HELICAL CORRUGATED METAL PIPE

OPERATOR: <u>TOM WOLF</u>	
CONSERVATION DISTRICT: <u>LAKE</u>	
U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE	
Designed <u>STERN</u>	Date <u>1/09</u>
Drawn <u>STERN</u>	Approved by _____
Traced _____	Title _____
Checked _____	Sheet No. <u>6</u> of <u>13</u>
	Drawing No. _____

JOB PLAN NO. 3.0

5, N-29, 073.30



SUMMARY OF DESIGN AND DIMENSIONS

DESIGN DATA	
H = 5.3 Feet	Hd = 21.2 Feet
X = 6.0 Feet	D = 24 Inches
R = 1.5 Feet	Y = 6.0 Feet
C = 6.0 Feet	Aggregate Gradation #1
Embankment Backslope (Z1) = 3 Pipe Slope (S) 0.1570 Ft./Ft.	
DIMENSIONS	
W = 14.0 Feet	(Total Width of Drain Diaphragm)
T = 9.5 Feet	(Total Height of Drain Diaphragm)
t = 3 Feet	(Thickness of Single Filter)

ESTIMATED QUANTITIES

Drain Filter Material	28.2 Cubic Yards
Geotextile	31.6 Square Yards
Rock Riprap	13.4 Cubic Yards

DRAIN FILTER MATERIAL GRADATION

SIEVE SIZE	PERCENT PASSING
3/8 in.	100
#4	95-100
#8	80-100
#16	50-85
#30	25-60
#50	2-30
#100	0-10

ASTM C-#33
FINE CONCRETE
AGGREGATE GRADATION

ROCK RIPRAP GRADATION

PERCENT SMALLER	WEIGHT RANGE (LBS.)	AVERAGE CUBIC DIMENSION
100	50 lb.	10"
50-80	30 lb.	7"
15-50	10 lb.	5"
0-15	3 lb.	3"

CONSTRUCTION NOTES

- 1.) No compaction of the Drain Filter Material extending from the Diaphragm to the D.S. embankment face is required beyond that resulting from the placing and spreading operations.
- 2.) The Drainage Diaphragm and envelope will be installed by placing Drain Filter Material in 15 inch thick lifts prior to compaction. Each lift will be saturated uniformly with approximately 1.2 gallons of water per cubic foot of loose Drain Filter Material prior to compaction. Each lift will be compacted by a minimum of two passes of a hand-directed vibratory compactor over the entire lift surface. No compaction of the drain envelope above the pipe invert is necessary.
- 3.) The maximum height of drop of the Riprap onto the Geotextile in the pipe outlet area shall be 3 feet.

MATERIAL NOTES

- 1.) The Geotextile shall conform to the Class 1 requirements specified in Table 2 for Nonwoven Geotextiles in Material Specification SD-592.

DRAINAGE DIAPHRAGM DETAILS

REVISIONS		
DATE	APPROVED	TITLE
01/25/2008	Jay B. Cole	State Conservation Engineer

4-3-09

Stern

Designed

Drawn

Checked

Approved

Tom Wolf

PRODUCER

SECTION 20 T. 106 R. 52

Lake COUNTY

Lake CONSERVATION DISTRICT

USDA - NRCS

State Office Engineering Staff

200 Fourth Street SW

Huron, South Dakota 57350

NRCS

Natural Resources Conservation Service

United States Department of Agriculture

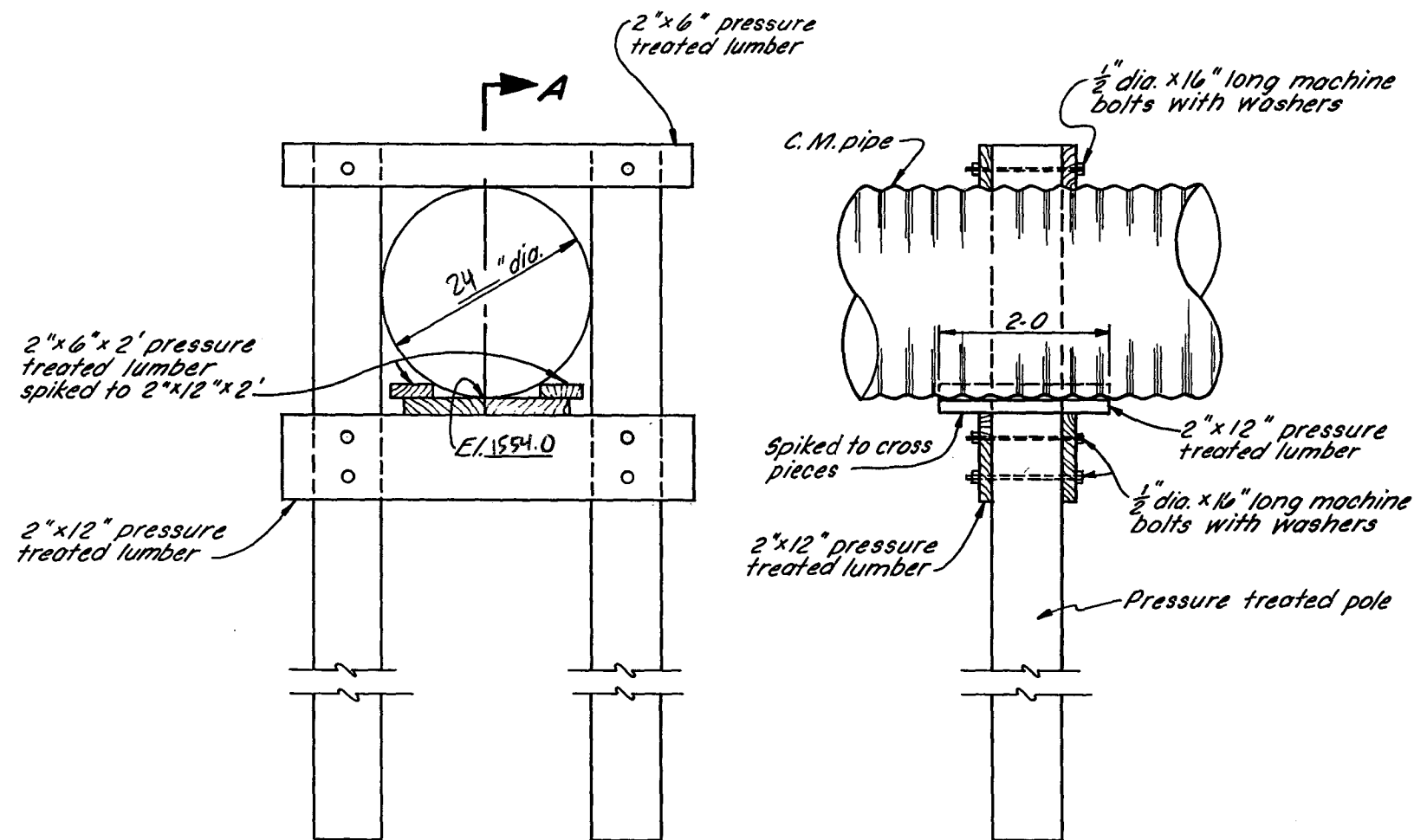
File Name:

000000_Drainage Diaphragm_01_01_08.dwg

Drawing No.

2/11/2008 3:51PM

Sheet 7 of 13



ELEVATION

SECTIONAL ELEVATION A-A

TABLE OF QUANTITIES

ITEM	LENGTH FOR 24" DIA. C.M. PIPE	UNIT	QUANTITY
PRESSURE TREATED POLE 10" DIA.	12-0	EACH	2
2" X 12" PRESSURE TREATED LUMBER	4-0	EACH	2
2" X 6" PRESSURE TREATED LUMBER	4-0	EACH	2
2" X 12" PRESSURE TREATED LUMBER	2-0	EACH	2
2" X 6" PRESSURE TREATED LUMBER	2-0	EACH	2
1/2" DIA. MACHINE BOLTS WITH NUTS	1-4	EACH	6
1/2" DIA. WASHERS		EACH	12

NOTES:

- HAND OR MACHINE TAMP BACKFILL THOROUGHLY AROUND FOOTINGS AND COLUMNS.

TIMBER PIPE SUPPORT

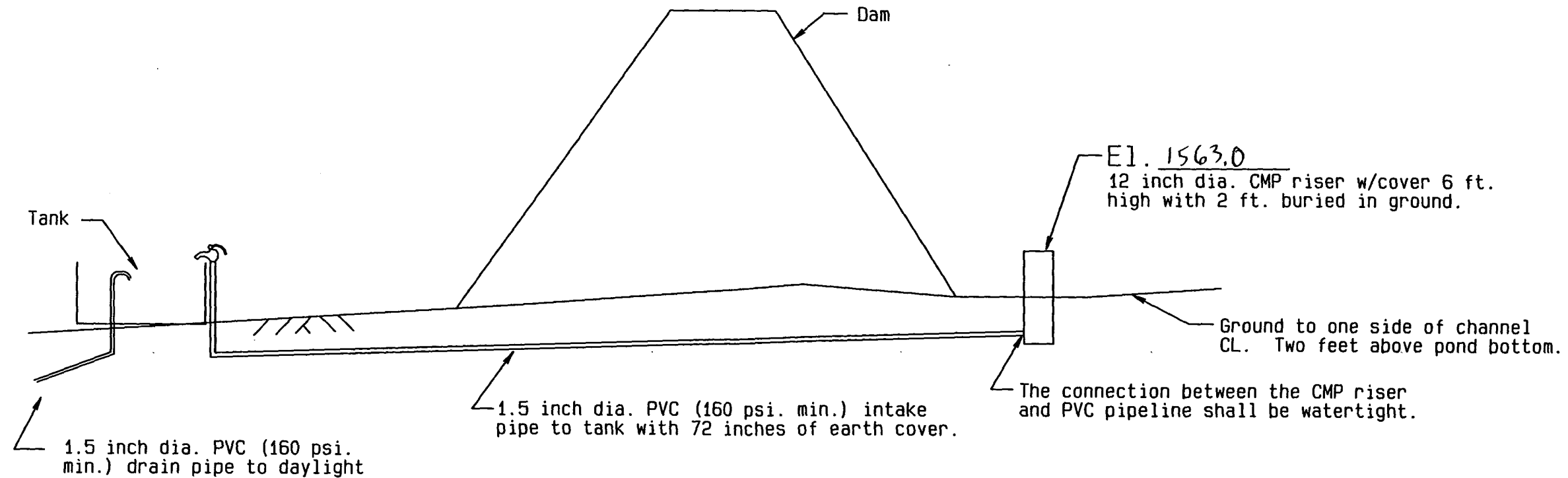
OPERATOR: TOM WOLF
 CONSERVATION DISTRICT: LAKE

U. S. DEPARTMENT OF AGRICULTURE
 SOIL CONSERVATION SERVICE

Designed STERN Date 1/09 Approved by _____
 Drawn STERN Date 1/09 Title _____
 Traced _____ Title _____
 Checked _____ Sheet No. 2 Drawing No. _____
 of 12

NOTES for RISER & INLET PIPE to TANK:

- 1.) Riser for intake pipe (to the tank) shall be a slotted 12" diameter CMP. Only the top 4 feet of 12" dia. CMP shall be slotted. One method of obtaining the 'slots' is by drilling a minimum of two dozen 5/8" diameter holes in the top 4 feet of the pipe. CMP riser is 6 feet long and buried 2 feet in original ground. Insert 1.5" dia. PVC pipe in the bottom portion of 12" dia. CMP. Top of 12" dia. CMP shall be covered. Locate riser on original ground in pool area, approximately 20 feet upstream of the front toe of dam. PVC pipe is 160 psi minimum.
- 2.) The 1.5" dia. PVC pipeline from the intake to the tank shall be buried 6 feet deep.
- 3.) Maintain 18 inches of cover over drain pipe from tank as long as practical to protect the pipe. Protect drain pipe from tank with gravel at the outlet.



PROFILE OF RISER w/INTAKE LINE to TANK
no scale

USDA U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

RISER INLET for a dam
w/ WATERTANK for:

Drawing No.
DamPipeTank
Sheet No. 1 of 13

SW4 sec. 20 T. 106 N. R. 52 W.
LAYE County, South Dakota

Designed by: STERN
Date: 4/1/09
Drawn by: Pete Anderson
Checked by: AE 9-28-04
Title:

Approved by:

Water source	Pond
Number of livestock	32
Pipeline design flow (gpm)	4
No. days storage required	0.5
Minimum capacity required (gal.)	738

[illegible]

Pump Type	Pump Rate (GPM)	Head (TDH)	Brand & Model No. (or equal)
No Pump			

Minimum Size (gal.)	Min Press. Rating	Pressure Switch Setting On/Off (psi)	Selected Tank Size	Brand & Model No. (or equal)
				No Pressure Tank

1. SD STATE LAW requires that no excavator may begin any excavation without first notifying the ONE-CALL notification center of the proposed excavation. (1-800-781-7474)
2. Pipelines designed for potable water shall use pipe carrying the NSF label, and and the lines shall be shock chlorinated.
3. Guard posts are required at all above ground appurtenances.
4. Pipeline is to be buried deep enough to obtain a minimum depth of cover of 6.0 feet, measured from original ground.
5. Water bars are to be installed at locations selected by the NRCS technician.

JOB PLAN 12B (Appurtenances for Pipelines)
JOB PLAN 14.5C (Stockwater Tank)

[illegible]

The pipeline shall not have multiple rises, falls, and flat spots in it as this would increase the chances of an air lock occurring in the pipeline. The pipeline shall maintain a positive grade from the dam intake to the point where the pipeline crosses the stream. After crossing the stream, the pipeline shall maintain a negative grade to the location of the tanks.

1. The work shall consist of furnishing and installing plastic pipe, fittings and appurtenances.
2. The pipe shall be free of all defects and conform to all applicable ASTM specifications for the type of plastic specified.
3. All joints and connections shall carry the design flow without leakage. Manufacturers recommendations must be followed.
4. Dissimilar metals must not be in contact with each other. Steel or other corrosive metals must be protected from corrosion.
5. Trenches containing rocks which could damage the pipe shall be over excavated and backfilled with suitable material. Pipelines may be "plowed-in" where soils are suitable.
6. All backfill recommendations of the manufacturer shall be met with the initial 6" being free of rocks. Mound soil over trench to allow for settlement.
7. Pipe not connected with gasketed couplers must be "snaked" in the trench. The pipe shall be allowed to come within a few degrees of subsoil temperature before backfilling.

1. The work shall consist of furnishing wood guard posts and protective structures.
2. All wood plywood, OSB, and lumber shall be pressure treated or exterior grade.
3. All wood material shall be new or like new, and free of major defects.
4. All timber structures shall be installed in a workmanlike manner.

Section 20 Town. 106 Range 52

Scale 1 inch = Ft.

I certify that this pipeline and related appurtenances were installed in accordance with these approved/"as-built" NRCS plans and specifications. The information included on this form is a true and factual record of the job performed by me.

The contractor shall furnish the owner a one-year guarantee covering materials and construction.

Construction (was) (was not) completed in accordance with approved construction plans and specifications.

Designed:	Laura Stern	Date: 3/18/09
Drawn:	Laura Stern	Date: 3/18/09
Checked:		Date:
Approved:		Date:

Tom Wolf
Sect. 20 Township 106 Range 52
Lake County
South Dakota



NRC
Natural Resources Conservation Service
United States Department of Agriculture

File Name
Drawing Name
JOB PLAN 12.1 5/08
Sheet 10 of 12

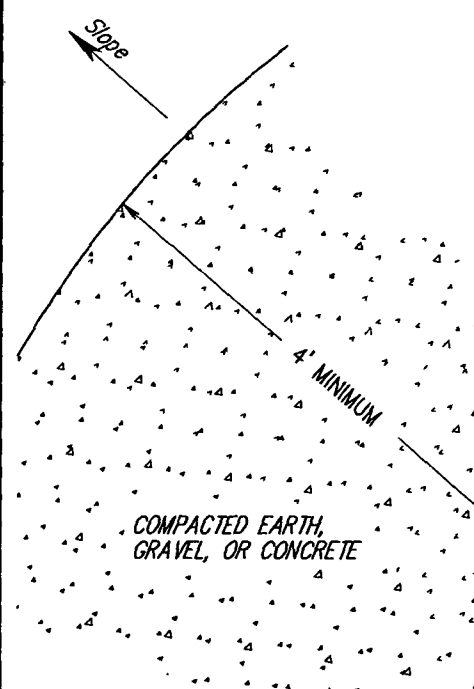


TABLE OF QUANTITIES

ITEM NO.	ITEM	UNIT	QUANTITY PER TANK (A)	NUMBER OF TANKS REQUIRED (B)	TOTAL QUANTITY FOR PROJECT (A * B)	"AS BUILT"
1	USED RUBBER TIRE CASING	EA	1	1	1	
2	CONCRETE (SACKCRETE)	BAGS	15		15	
3	BENTONITE	BAGS	4.75		4.75	
4	2" X 6" TREATED LUMBER	EA	2		2	
5	6" dia. 6'-0" long TREATED POSTS	EA	2		2	
6	30" X 2" CASING W/LID	EA	1		1	
7	FROST FREE HYDRANT	EA	1		1	
8	STOP & DRAIN	FT	AS NEEDED			
9	PVC DRAIN	FT	AS NEEDED			
10	ANIMAL ESCAPE RAMP (Optional)	EA	0		0	

VOLUMES TO SEAL TIRE CENTER		
TANK DIA.	SACKCRETE (80 lb. Bags)	BENTONITE (50 lb. Bags)
8'	16 BAGS	5 BAGS
10'	20 BAGS	6 BAGS
12'	24 BAGS	7 BAGS

TANK SELECTION TABLE
(Based on 20 inches of depth)

TANK INSIDE DIA. - GAL.	TANK INSIDE DIA. - GAL.
6.0' Tank -- 353 Gal.	10.5' Tank -- 1,081 Gal.
6.5' Tank -- 414 Gal.	11.0' Tank -- 1,187 Gal.
7.0' Tank -- 480 Gal.	11.5' Tank -- 1,297 Gal.
7.5' Tank -- 552 Gal.	12.0' Tank -- 1,412 Gal.
8.0' Tank -- 628 Gal.	12.5' Tank -- 1,532 Gal.
8.5' Tank -- 708 Gal.	13.0' Tank -- 1,657 Gal.
9.0' Tank -- 794 Gal.	13.5' Tank -- 1,787 Gal.
9.5' Tank -- 885 Gal.	14.0' Tank -- 1,922 Gal.
10.0' Tank -- 981 Gal.	

TANK SELECTION

TANK DIA. 7.5 Feet, 552 Gallons

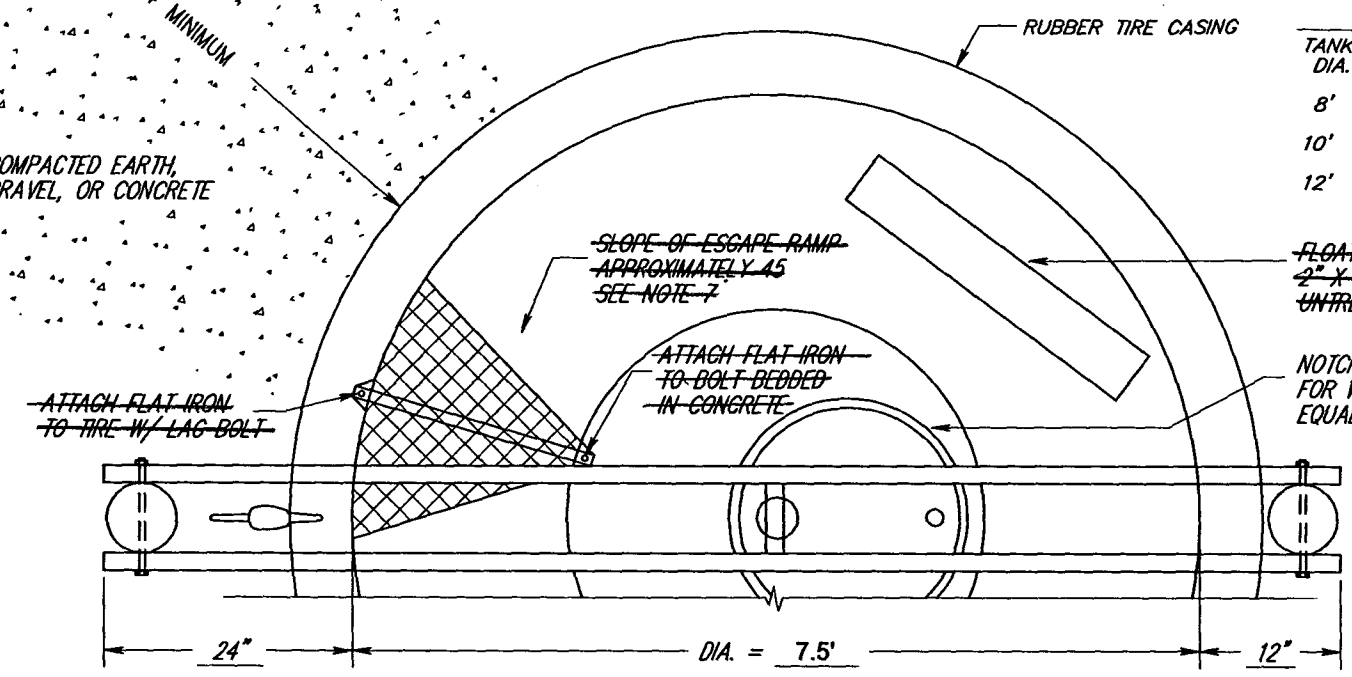
TANK "AS BUILT"

TANK DIA. -- GALLONS --

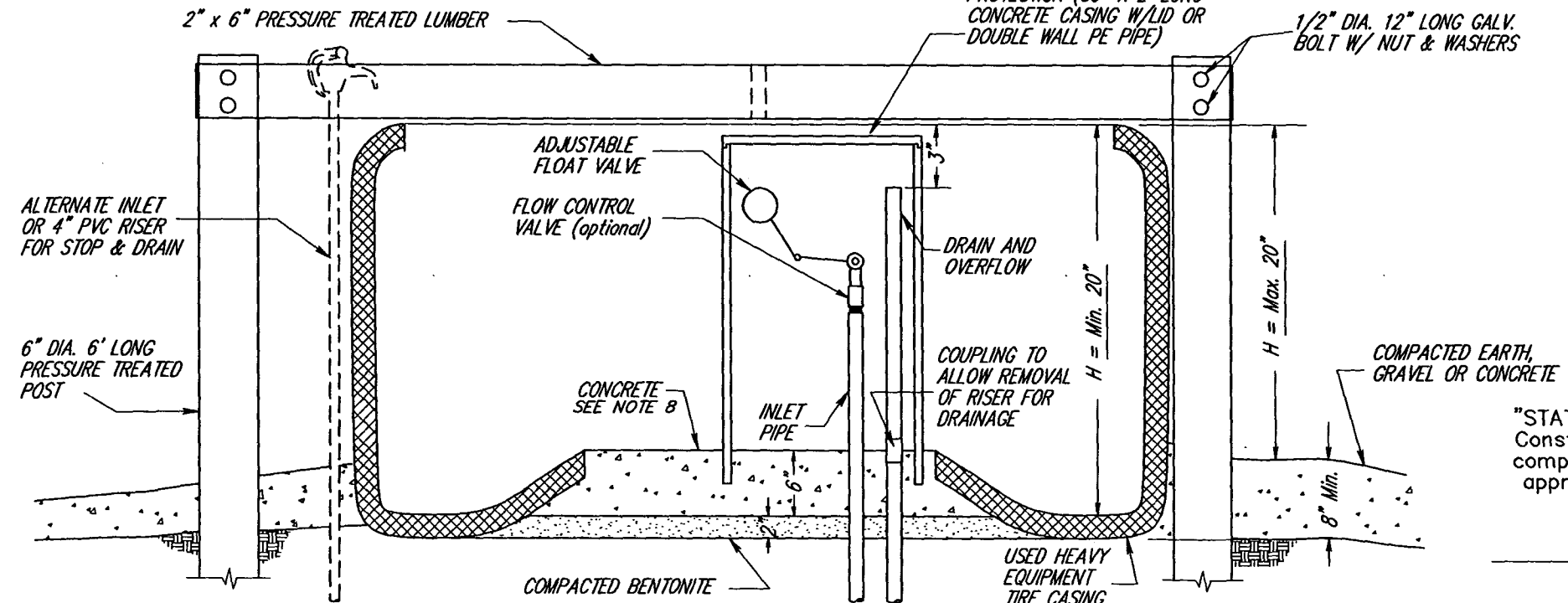
("As Built" - Verify that the tank is 20 or more inches deep, measure the inside tank diameter, round to the nearest 1/2 foot and select the gallons for payment from this table.)

NOTES:

1. OVERFLOW & DRAIN PIPE SHALL BE MINIMUM 2" DIA.
2. DRAIN PIPE SHALL BE GRADED TO ALLOW DRAINAGE.
3. PROTECT DRAIN PIPE AT OUTLET END BY BACKFILLING OVER PIPE WITH FIELD STONE, MINIMUM 1 1/2" DIA.
4. SET BOTTOM OF TANK APPROX. 8" BELOW EXISTING GROUND LEVEL.
5. USE PRE-MIXED BAGS OF SACKCRETE OR EQUAL FOR CONCRETE.
6. USED TIRE CASING SHALL BE FREE OF CUTS, RIPS, AND HOLES. TIRE CASING MUST NOT BE WORN BEYOND TREAD DEPTH.
7. AS A MINIMUM A FLOATING "BIRD BOARD" IS REQUIRED IN TANK. HOWEVER, THE RECOMMENDED METHOD IS TO INSTALL AN ESCAPE RAMP WHICH WILL PROVIDE A POSITIVE MEANS OF ESCAPE FOR ANY BIRD OR ANIMAL.
8. ALTERNATIVE METHODS TO SEALING BOTTOM WITH CONCRETE AND BENTONITE INCLUDE: 1/2" THICK STEEL PLATE, 1" THICK RUBBER (CONVEYOR BELT MATERIAL), OR 3/16" THICK FIBERGLASS SECURED TO TIRE BEAD WITH LAG BOLTS AND CAULKED WITH A SILICONE SEALANT TO INSURE A GOOD WATER TIGHT SEAL.
9. A 4" PVC RISER W/CAP SHALL BE USED FOR A STOP AND DRAIN.
10. HYDRANT OR FLOAT AND OVERFLOW MUST BE PROTECTED BY ONE OF THE SHOWN PROTECTION SYSTEMS OR AN APPROVED ALTERNATE.



PLAN VIEW



SIDE VIEW

"STATEMENT OF COMPLIANCE"
Construction (was) (was not)
completed in accordance with
approved construction plans
and specifications.

JAA Date

USED
HEAVY EQUIPMENT
TIRE CASING
STOCKWATER TANK
WITH BENTONITE
AND CONCRETE BOTTOM

(NOT DRAWN TO SCALE)

JOB PLAN 14.5 C 04/2008

REVISIONS			DATE	APPROVED	TITLE
NO.	DESCRIPTION	BY			
01	09/07/03	Jay B. Cobb		SCE-SD	
02	04/01/08	Jay B. Cobb		SCE-SD	

File Name: WRubberTank14.5C_010408.pro
Drawing No. 3/21/2008 0:56PM
Sheet 1 of 13

Date 1-30-09
Designed Stern
Drawn Stern
Checked
Approved

PRODUCER Tom Wolf
SECTION 20 T.106 R.52
Lake COUNTY
Madison CONSERVATION DISTRICT

USDA - NRCS
State Office Engineering Staff
200 Fourth Street SW
Huron, South Dakota 57350

Natural Resources Conservation Service
United States Department of Agriculture

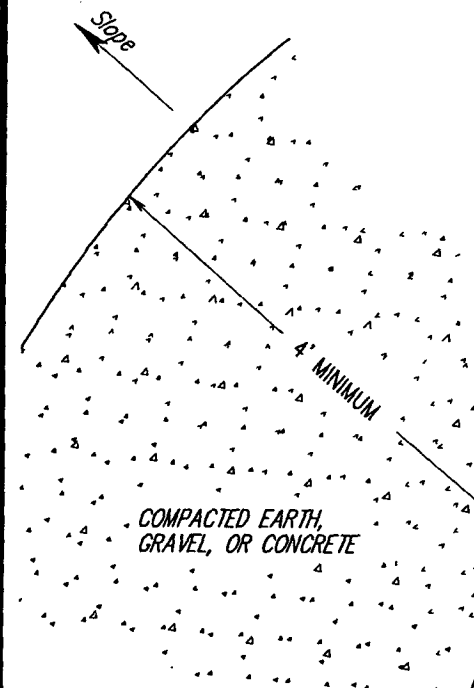


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4	2" X 6" TREATED LUMBER	EA	2		2	
5	6" dia. 6'-0" long TREATED POSTS	EA	2		2	
6	30" X 2" CASING W/LID	EA	1		1	
7	FROST FREE HYDRANT	EA	1		1	
8	STOP & DRAIN	FT	AS NEEDED			
9	PVC DRAIN	FT	AS NEEDED			
10	ANIMAL ESCAPE RAMP (Optional)	EA	0		0	

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10.0' Tank -- 981 Gal.	

TANK SELECTION

TANK DIA. 6.0 Feet, 353 Gallons

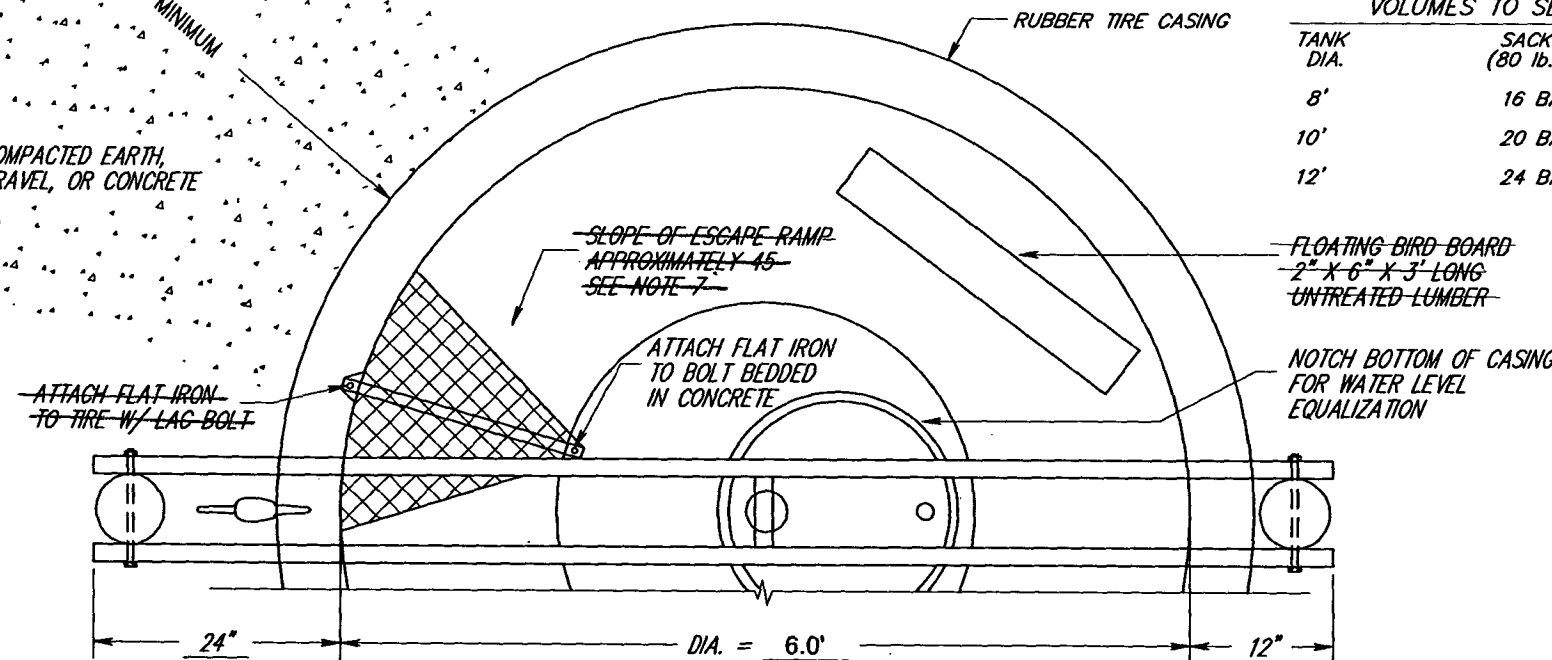
TANK "AS BUILT"

TANK DIA. -- GALLONS --

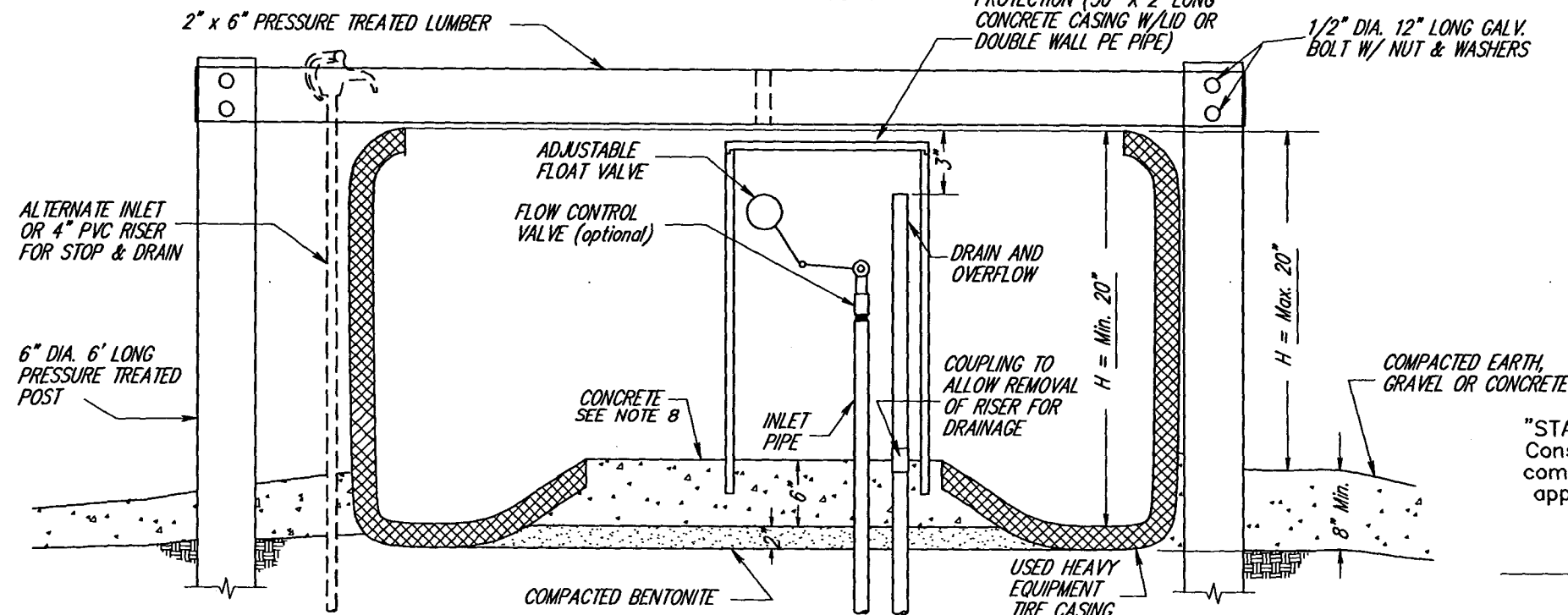
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PLAN VIEW



SIDE VIEW

"STATEMENT OF COMPLIANCE"
Construction (was) (was not)
completed in accordance with
approved construction plans
and specifications.

JAA Date

USED
HEAVY EQUIPMENT
TIRE CASING
STOCKWATER TANK
WITH BENTONITE
AND CONCRETE BOTTOM

REVISIONS		
DATE	APPROVED	TITLE
09/07/05	Jay B. Cobb	SCE-SD
04/01/08	Jay B. Cobb	SCE-SD

Date 1-30-09

Designed Stern

Drawn Stern

Checked

Approved

PRODUCER Tom Wolf

SECTION 20.1.106 R. 52

Lake COUNTY

Madison CONSERVATION DISTRICT

USDA - NRCS

State Office Engineering Staff

200 Fourth Street SW

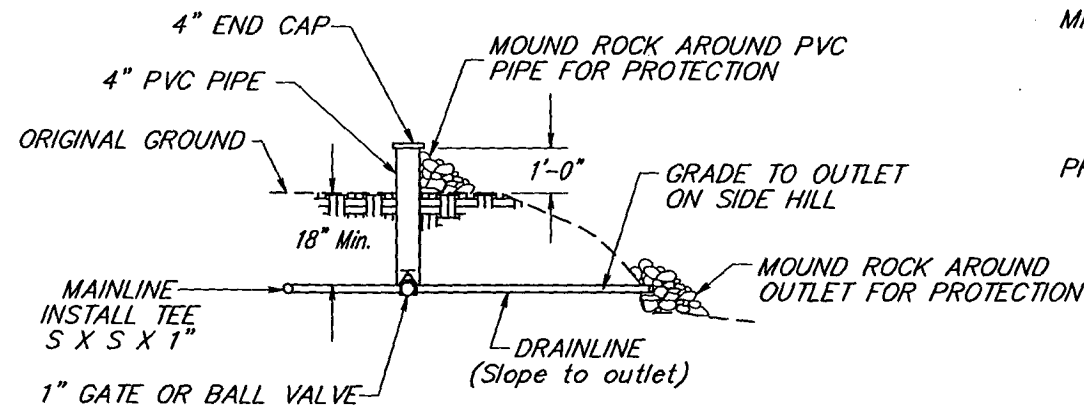
Huron, South Dakota 57350

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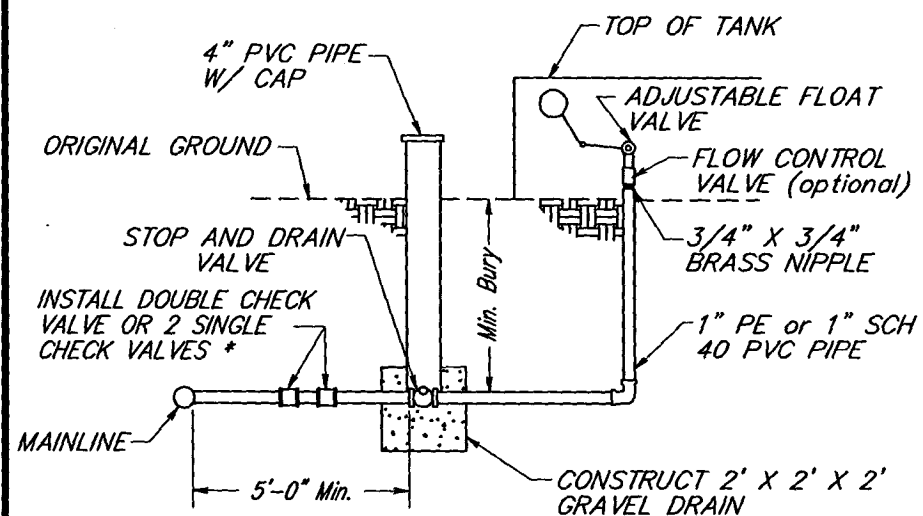
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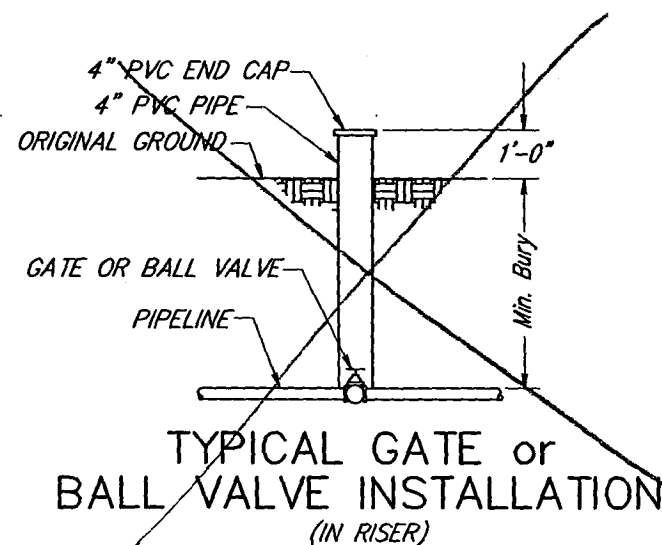
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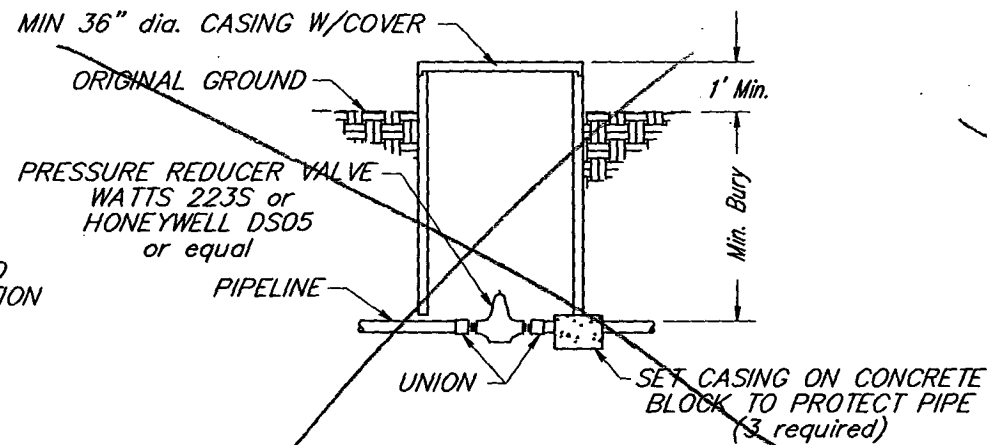
TYPICAL DRAIN INSTALLATION
FOR SHALLOW BURY PIPELINES



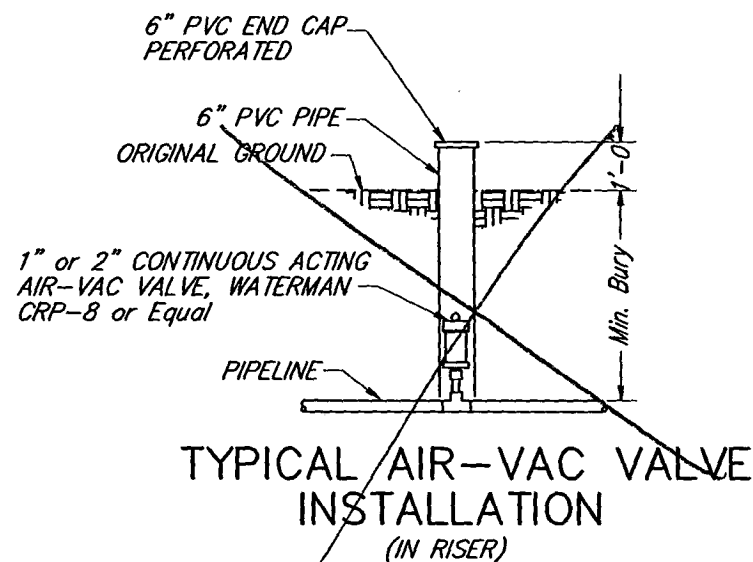
TYPICAL STOP AND DRAIN INSTALLATION



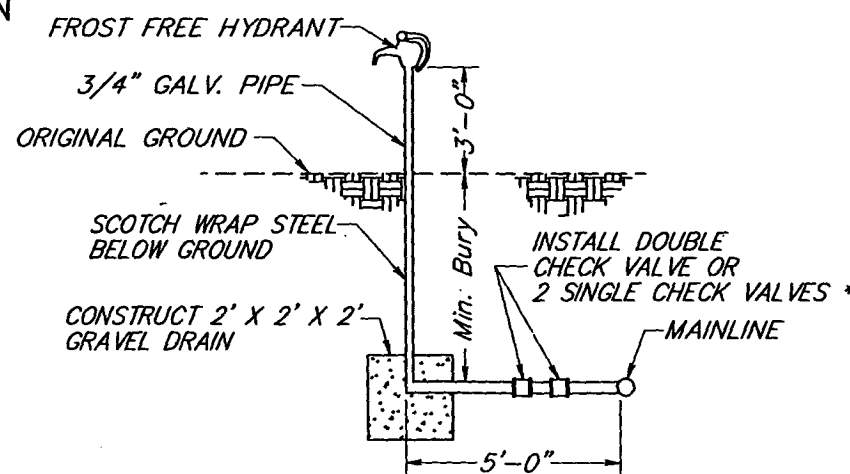
TYPICAL GATE or
BALL VALVE INSTALLATION
(IN RISER)



TYPICAL PRESSURE REDUCER
INSTALLATION

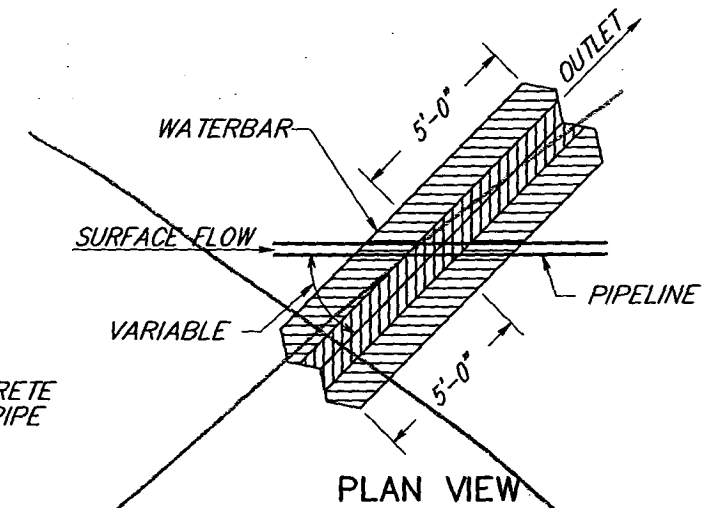


TYPICAL AIR-VAC VALVE
INSTALLATION
(IN RISER)

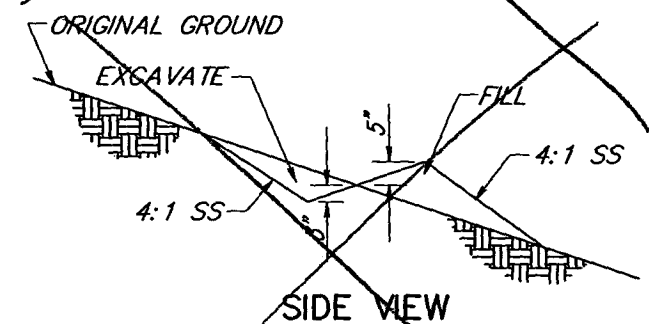


TYPICAL HYDRANT INSTALLATION

* REQUIRED IF MAINLINE SERVES
HOUSEHOLD OR OTHER POTABLE USE.

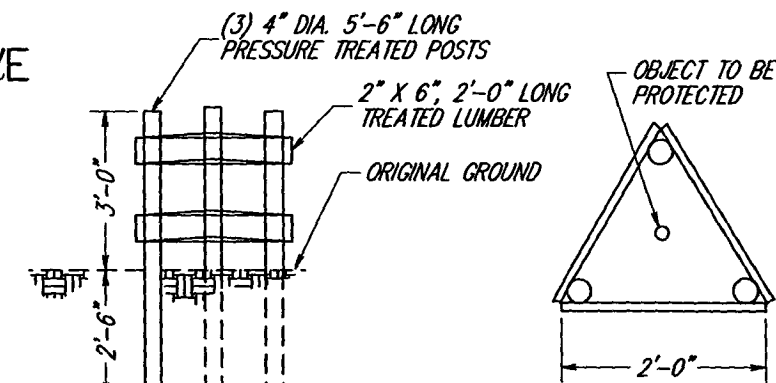


PLAN VIEW



SIDE VIEW

TYPICAL WATERBAR
INSTALLATION



TYPICAL GUARD POST INSTALLATION
(USE TO PROTECT ABOVE GROUND APPURTENANCES FROM LIVESTOCK)

MATERIAL LIST

ITEM	QUANTITY
4" dia. 5'-6" long pressure treated posts	3
2" x 6" x 2'-0" pressure treated lumber	6
3/8" dia. 4" long lag screws or #16 ring shank nails	24

STOCKWATER PIPELINE APPURTENANCES

DATE	APPROVED	TITLE
01/24/2005	Steve A. Gifford	AF-130
04/04/2005	Jay E. Ode	SE-30

JOB PLAN 12B 04/2005

Date 1-30-09
Stern 1-30-09
Designed Stern
Drawn Stern
Checked
Approved

PRODUCER Tom Wolf
SECTION 20 T.106 R.52
Lake COUNTY
Madison CONSERVATION DISTRICT

USDA - NRCS
State Office Engineering Staff
200 Fourth Street SW
Huron, South Dakota 57350

NRCS
Natural Resources Conservation Service
United States Department of Agriculture

File Name: PipeAppur12B_040405.pro
Drawing No.
4/4/2005 2:12PM
Sheet 13 of 13

TOM WOLF DAM
SW4, 20-106-52
LAKE COUNTY

RECEIVED

APR 17 2009

WATER RIGHTS
PROGRAM

HAZARD CLASSIFICATION

AND

DESIGN DOCUMENTATION

DOCUMENTATION FOR HAZARD CLASSIFICATION

Producer: **Tom Wolf** Name of Site
County: **Lake**
Field #: Watershed **760**
Location
1/4 Section: **SW4** Section: **20** Township: **106** Range: **52**
Latitude: Longitude

Dam in Series: **No**
Explain: **Dam that shows up on the USGS quad map in the middle of section 29 has been breached.**

Dam and Reservoir Data

Assumed Job Class
Assumed Hazard Class
Centerline Elevation Channel Bottom*
Centerline Elevation Flood Plain*
Centerline Elevation Top of Dam*
Centerline Elevation Auxiliary Spillway Crest*
*Elevation is based on Mean Sea Level Datum

IV
A
1553
1555.2
1578.4
1575.2

Max. Depth of Water within Reservoir **20 Ft.**

Storage

Storage Below Principal Spillway
Storage between Principal Spillway and Auxiliary Spillway
Storage between Auxiliary Spillway and Top of Dam
Other
Total Storage to Top of Dam

67.9 Ac.-Ft.
21.6 Ac.-Ft.
38.6 Ac.-Ft.
0 Ac.-Ft.
128.1 Ac.-Ft.

Downstream Conditions

1. Valley Conditions Downstream of Structure

Approximate Slope of Channel

2. Stream Channel Size

Depth **2** Ft.
Bottom Width **10** Ft.
Top Width **15** Ft.

Parallel
1%

3. Valley Characteristics

Width **800** Ft.
Roughness Coefficient **0.055**
Slope **1%**

800 Ft.
0.055
1%

Downstream valley may be described in breach routing rather than on this form.

Describe Type of Infrastructure, Distance Downstream and Distance Above Floodplain Elevation	Distance Downstream From Dam	Approx. Distance Above Floodplain Elevation	Location in Potential Impact Area?	
			YES	NO
Roads				
Township or County Paved Road, D<2'			☐	☒
Other, Describe:			☐	☒
timber bridge with low girders			☐	☒
Bridges: Describe type and opening size			☐	☒
Railroads:				
Major Railroad, Describe:			☐	☒
Buildings and Utilities:				
Farm Building(s)			☐	☒
Public, Industrial or Commercial Buildings			☐	☒
Rel. Import. Utility serving mult. rural users			☐	☒
Township gravel road is approximately 0.95 miles downstream of the dam. If the dam broke, Simple Dam Break showed the crest would be 3.2' above the lowest point of the road.				

Location:

Is Dam located within five miles of urban development?

No

Describe Potential Development:

Homes do surround Lake Madison which is 2 miles downstream; however, the breached water would dissipate in a large wetland area before running through the lake home area.

Rational For Determining Hazard Class:

Damage to gravel township road on the east side of section 20 will occur. After that, the breach flows through section 21, one third of which is wetland area. The road on the east side of section 21 is Highway 19.

Method Used for Evaluation of Impact Area

Simple Dam Break

Further Evaluation Needed

No

Attached: Breach Routings ☒

Maps ☒

Other supporting documents:

Actual Hazard Class*

A

Final Job Class

IV

Hazard Analysis by:

Laura Stern

Date: 2/2/2009

Approved by

Date:

*Definition of Hazard Classification in National Engineering Manual 520.21 and SD Amendment 19



For convenience of reference, the results of the tests on the hood drop inlet are summarized under the headings: drop inlet size, priming head, entrance loss coefficient, pressure coefficient inside the barrel entrance, and type of hood drop inlet. The correct ranges of application of the equations specified in this summary must be used because the equations representing the entrance loss and pressure coefficients apply to all three hood drop inlet entrances—the square reentrant, circular reentrant, and square flush—but over different ranges of inlet proportions. Also the equations for circular drop inlets and flush hood barrel entrances must be corrected as explained under the recommendation summary heading, Type of hood drop inlet.

Drop inlet size

Performance criteria based on the head required to cause the barrel to prime are the basis for determining the minimum size B/D of the hood drop inlet. The minimum size varies with the type of hood drop inlet and the drop inlet height Z_1 . The minimum recommended values of B/D are listed in table XIII-4.

Priming head

The head H over the crest of the drop inlet at which the barrel will prime or begin to flow full depends on whether the control is the hood inlet or the drop inlet crest. It varies with the drop inlet height for low drop inlets of adequate size. For high drop inlets of adequate size, the priming head is determined by the drop inlet size—actually the length of the drop inlet crest. The priming heads are:

For the low drop inlets, $Z_1/D \leq 1.0$

TABLE XIII-4.—Minimum size of the hood drop inlet

Drop inlet height	Drop inlet —		
	Square	Circular	Square
	Hood —		
	Reentrant	Reentrant	Flush
	Minimum B/D		
$Z_1/D \leq 1.00$	4.0	3.77	1.5
$1.00 < Z_1/D < 1.25$	4.0	3.77	1.5
$Z_1/D \geq 1.25$	1.5	2.0	1.25

$B = \text{RISER DIAMETER} = 4 \text{ ft}$

$D = \text{BARREL DIAMETER} = 2 \text{ ft}$

$Z_1 = 3.5 \text{ ft}$

$$\frac{H}{D} = 1.2 - 0.8 \frac{Z_1}{D} \quad (\text{XIII-6})$$

For intermediate height drop inlets, $1.0 < Z_1/D < 1.25$

No data are available to define the priming head. The authors suggest that the higher of the priming heads given by equations XIII-6 and XIII-9 be used to estimate the priming head for intermediate height drop inlets.

For high drop inlets, $Z_1/D \geq 1.25$

$$\frac{H}{D} = C_1 \left(\frac{B}{D} \right)^{-1.7} \quad (\text{XIII-9})$$

where, for the

square drop inlet, reentrant hood $C_1 = 0.54$

circular drop inlet, reentrant hood $C_1 = 0.63$

square drop inlet, flush entrance hood $C_1 = 0.54$

Entrance loss coefficient

The entrance loss coefficient K_e for hood drop inlets is multiplied by the velocity head in the barrel $V_p^2/2g$ to obtain the actual head loss h_e caused by the drop inlet and the hood barrel entrance. The magnitude of the coefficient depends on the barrel wall thickness t_p/D , the drop inlet size B/D , the barrel slope S , and the drop inlet height Z_1/D . The relationships are summarized in mathematical and graphical form in figure XIII-35.

The entrance loss coefficient is presented in figure XIII-35(a) for a drop inlet $5D$ deep with the barrel on a zero slope. To obtain $t_{p,cr}/D$, the expressions for K_e given by equations XIII-10 and XIII-11 are equated and solved for t_p/D .

The barrel slope correction is a variable for thin barrels and a constant for thick barrels. The entrance loss correction for barrel slopes other than zero $\Delta K_{e,s}$ is given in figure XIII-35(b). This correction is added algebraically to K_e obtained from figure XIII-35(a). Note that the ordinate of figure XIII-35(b) must be multiplied by S to obtain $\Delta K_{e,s}$.

The effect of the drop inlet height on the entrance loss coefficient varies with the drop inlet size. The correction for drop inlet height $\Delta K_{e,z}$ to be algebraically added to K_e determined from figure XIII-35(a) is given in figure XIII-35(c). Unfortunately data are not available to evaluate $\Delta K_{e,z}$ for relative drop inlet heights between 0.0 and 0.25. The authors suggest that the value of

THIS PUBLICATION JUSTIFIES USING A 4' DIA RISER WITH A 2' DIA BARREL. PER EQUATION (XIII-9), THE BARREL WILL PRIME AT A HEAD OF 1.1' ATTACHED IOWA DOCUMENTATION (PG 8). WEIR AND INLET ORIFICE FLOW LIMITING TO A HEAD OF 1.1'

WEIR FLOW UNTIL 74.2 WHERE IT SWITCHES TO

Project Name: Wolf Dam

Computed by: Stern

Date: 2/21/2008

Checked by:

Date:

laDropInlet.xls Ver 1.02

Full
PipeFlow
(pg. 9)

Input Data	
Riser Type & Diameter (in)	Circular 48
Length of Weir Obstruction (ft)	0.5
Principal Spillway Crest Elev (ft)	73
Invert of Barrel Elevation (ft)	69.5
Barrel Orifice Coefficient (C)	0.6
Pipe Diameter (in)	24
Pipe Length (ft)	130
Entrance Coefficient 'Ke'	1
Mannings 'n'-value	0.019
Elbow Elev (if None, Leave 'BLANK')	54.5
Length of Outlet ('BLANK' if none)	20
Outlet Type	Cantilever
Outlet Elevation (ft)	54
Tailwater Elev (if unknown, leave 'Blank')	55
Auxiliary Spillway Elev (ft)	77.4
Maximum Headwater Elev (ft)	79.5
Elev Increment After Full Pipe Flow	0.1

Basic Output	
Full Pipe Flow - Max. Outflow (cfs):	0.00
Full Pipe Flow - Max. Velocity (fps):	0.00
Useable Weir Length (Ft):	12.07
Riser Area (Sq Ft):	12.57
Barrel Area (Sq Ft):	3.14
Kp:	0.026527
Friction Slope (HW at the A.S. Crest):	0.10808
Pipe Slope:	0.13765
Outlet Elbow Angle (deg):	6.0
Maximum Barrel Invert Elevation for avoiding Barrel Orifice Control:	63.56
Km:	0.03800
Tailwater Elev Used For Full Pipe Flow:	55.2

Notes & Warnings

NOTE: Pipe slope computed to be greater than friction slope - a 2D riser might improve flow characteristics.

NOTE: Barrel Orifice control can be eliminated by increasing the riser depth.

Elev	HW Ft	Outflow, CFS				Structure Outflow, CFS	Controlling Factor
		Weir	Inlet Orifice	Barrel Orifice	Full Pipe		
73.0	0.0	0.00	0.00	23.92	45.41	0.00	Weir Flow
73.1	0.1	1.18	19.13	24.39	45.54	1.18	Weir Flow
73.2	0.2	3.35	27.06	24.86	45.66	3.35	Weir Flow
73.3	0.3	6.15	33.14	25.31	45.79	6.15	Weir Flow
73.4	0.4	9.46	38.27	25.76	45.92	9.46	Weir Flow
73.5	0.5	13.22	42.78	26.20	46.04	13.22	Weir Flow
73.6	0.6	17.38	46.87	26.63	46.17	17.38	Weir Flow
73.7	0.7	21.91	50.62	27.06	46.29	21.91	Weir Flow
73.8	0.8	26.77	54.12	27.48	46.42	26.77	Weir Flow
73.9	0.9	31.94	57.40	27.89	46.54	27.89	Barrel Orifice
74.0	1.0	37.41	60.51	28.30	46.67	28.30	Barrel Orifice
74.1	1.1	43.15	63.46	28.70	46.79	28.70	Barrel Orifice
74.2	1.2	49.17	66.28	29.10	46.92	29.10	Barrel Orifice
74.3	1.3	55.44	68.99	29.49	47.04	29.49	Barrel Orifice
74.4	1.4	61.96	71.59	29.87	47.16	29.87	Barrel Orifice
74.5	1.5	68.72	74.11	30.25	47.29	30.25	Barrel Orifice
74.6	1.6	75.70	76.54	30.63	47.41	30.63	Barrel Orifice
74.7	1.7	82.91	78.89	31.00	47.53	31.00	Barrel Orifice
74.8	1.8	90.33	81.18	31.37	47.65	31.37	Barrel Orifice
74.9	1.9	97.96	83.40	31.73	47.77	31.73	Barrel Orifice
75.0	2.0	105.80	85.57	32.09	47.89	32.09	Barrel Orifice
75.1	2.1	113.83	87.68	32.44	48.01	32.44	Barrel Orifice
75.2	2.2	122.06	89.75	32.79	48.13	32.79	Barrel Orifice
75.3	2.3	130.48	91.76	33.14	48.26	33.14	Barrel Orifice
75.4	2.4	139.08	93.74	33.48	48.37	33.48	Barrel Orifice
75.5	2.5	147.86	95.67	33.82	48.49	33.82	Barrel Orifice
75.6	2.6	156.82	97.56	34.16	48.61	34.16	Barrel Orifice
75.7	2.7	165.95	99.42	34.49	48.73	34.49	Barrel Orifice
75.8	2.8	175.26	101.25	34.82	48.85	34.82	Barrel Orifice
75.9	2.9	184.73	103.04	35.15	48.97	35.15	Barrel Orifice
76.0	3.0	194.37	104.80	35.48	49.09	35.48	Barrel Orifice
76.1	3.1	204.16	106.53	35.80	49.21	35.80	Barrel Orifice
76.2	3.2	214.12	108.24	36.11	49.32	36.11	Barrel Orifice
76.3	3.3	224.24	109.92	36.43	49.44	36.43	Barrel Orifice
76.4	3.4	234.51	111.57	36.74	49.56	36.74	Barrel Orifice
76.5	3.5	244.93	113.20	37.05	49.67	37.05	Barrel Orifice
76.6	3.6	255.50	114.80	37.36	49.79	37.36	Barrel Orifice
76.7	3.7	266.22	116.39	37.67	49.91	37.67	Barrel Orifice
76.8	3.8	277.09	117.95	37.97	50.02	37.97	Barrel Orifice
76.9	3.9	288.09	119.49	38.27	50.14	38.27	Barrel Orifice
77.0	4.0	299.25	121.01	38.57	50.25	38.57	Barrel Orifice
77.1	4.1	310.54	122.52	38.86	50.37	38.86	Barrel Orifice
77.2	4.2	321.97	124.00	39.15	50.48	39.15	Barrel Orifice
77.3	4.3	333.53	125.47	39.45	50.60	39.45	Barrel Orifice
77.4	4.4	345.24	126.92	39.73	50.71	39.73	Barrel Orifice
77.5	4.5	357.07	128.35	40.02	50.83	40.02	Barrel Orifice
77.6	4.6	369.04	129.77	40.31	50.94	40.31	Barrel Orifice
77.7	4.7	381.14	131.18	40.59	51.05	40.59	Barrel Orifice
77.8	4.8	393.37	132.56	40.87	51.17	40.87	Barrel Orifice
77.9	4.9	405.73	133.94	41.15	51.28	41.15	Barrel Orifice
78.0	5.0	418.21	135.30	41.43	51.39	41.43	Barrel Orifice
78.1	5.1	430.82	136.64	41.70	51.51	41.70	Barrel Orifice
78.2	5.2	443.55	137.98	41.97	51.62	41.97	Barrel Orifice
78.3	5.3	456.41	139.30	42.25	51.73	42.25	Barrel Orifice
78.4	5.4	469.38	140.61	42.52	51.84	42.52	Barrel Orifice
78.5	5.5	482.48	141.90	42.78	51.95	42.78	Barrel Orifice
78.6	5.6	495.70	143.19	43.05	52.07	43.05	Barrel Orifice
78.7	5.7	509.04	144.46	43.32	52.18	43.32	Barrel Orifice
78.8	5.8	522.49	145.72	43.58	52.29	43.58	Barrel Orifice
78.9	5.9	536.06	146.97	43.84	52.40	43.84	Barrel Orifice
79.0	6.0	549.75	148.21	44.10	52.51	44.10	Barrel Orifice
79.1	6.1	563.55	149.44	44.36	52.62	44.36	Barrel Orifice
79.2	6.2	577.47	150.66	44.62	52.73	44.62	Barrel Orifice
79.3	6.3	591.49	151.87	44.87	52.84	44.87	Barrel Orifice
79.4	6.4	605.63	153.07	45.13	52.95	45.13	Barrel Orifice
79.5	6.5	619.88	154.26	45.38	53.06	45.38	Barrel Orifice
79.6	6.6	634.24	155.44	45.63	53.17	45.63	Barrel Orifice

Project Name: Wolf Dam

laHoodInlet.xls Ver 1.10

Computed by: Stern

Date: 2/18/2009

Checked by: _____

Date: _____

			Outflow, CFS				Structure Outflow, CFS	Controlling Factor
			Elev	HW Ft	Weir	Slug Flow	Full Pipe	
Input Data			69.5	0.0	0.00	0.00	40.70	0.00 Weir Flow
			69.6	0.1	0.23	0.00	40.84	0.23 Weir Flow
			69.7	0.2	0.45	0.00	40.99	0.45 Weir Flow
			69.8	0.3	0.68	0.00	41.13	0.68 Weir Flow
Principal Spillway Crest Elev (ft)	69.5		69.9	0.4	0.91	0.00	41.27	0.91 Weir Flow
			70.0	0.5	1.33	0.00	41.41	1.33 Weir Flow
Inside Wall - Type	Corrugated		70.1	0.6	1.75	0.00	41.55	1.75 Weir Flow
Pipe Diameter (in)	24		70.2	0.7	2.18	0.00	41.69	2.18 Weir Flow
Pipe Length (ft)	130		70.3	0.8	2.60	0.00	41.82	2.60 Weir Flow
Entrance Coefficient 'Ke'	1		70.4	0.9	3.14	0.00	41.96	3.14 Weir Flow
Mannings 'n-value'	0.019		70.5	1.0	3.68	0.00	42.10	3.68 Weir Flow
Elbow Elev (if None, Leave 'BLANK')	54.5		70.6	1.1	4.33	0.00	42.24	4.33 Weir Flow
Length of Outlet ('BLANK' if none)	20		70.7	1.2	4.98	0.00	42.38	4.98 Weir Flow
Outlet Type	Cantilever		70.8	1.3	5.94	0.00	42.51	5.94 Weir Flow
Outlet Elevation (ft)	54		70.9	1.4	6.90	0.00	42.65	6.90 Weir Flow
Tailwater Elev (if unknown, leave 'Blank')	55		71.0	1.5	7.86	0.00	42.78	7.86 Weir Flow
Auxiliary Spillway Elev (ft)	76.5		71.1	1.6	8.82	0.00	42.92	8.82 Weir Flow
Maximum Headwater Elev (ft)	82		71.2	1.7	9.73	0.00	43.05	9.73 Weir Flow
Elev Increment After Full Pipe Flow	0.1		71.3	1.8	10.63	0.00	43.19	10.63 Weir Flow
			71.4	1.9	11.54	0.00	43.32	11.54 Weir Flow
Basic Output			71.5	2.0	12.45	0.00	43.45	12.45 Weir Flow
Full Pipe Flow - Max. Outflow (cfs):	55.72		71.6	2.1	13.29	0.00	43.59	13.29 Weir Flow
Full Pipe Flow - Max. Velocity (fps):	17.74		71.7	2.2	14.14	3.04	43.72	14.14 Weir Flow
			71.8	2.3	14.99	6.07	43.85	14.99 Weir Flow
			71.9	2.4	15.84	9.11	43.98	15.84 Weir Flow
Barrel Area (Sq Ft):	3.14		72.0	2.5	16.55	12.14	44.12	16.55 Weir Flow
Kp:	0.026527		72.1	2.6	17.25	15.18	44.25	17.25 Weir Flow
Friction Slope (HW at the A.S. Crest):	0.10370		72.2	2.7	17.96	18.22	44.38	18.22 Slug Flow
Pipe Slope:	0.13765		72.3	2.8	18.67	21.25	44.51	21.25 Slug Flow
Outlet Elbow Angle (deg):	6.0		72.4	2.9	19.37	24.29	44.64	24.29 Slug Flow
			72.5	3.0	20.08	27.32	44.77	27.32 Slug Flow
			72.6	3.1	20.79	30.36	44.90	30.36 Slug Flow
Km:	0.03800		72.7	3.2	21.50	33.39	45.03	33.39 Slug Flow
Tailwater Elev Used For Full Pipe Flow:	55.2		72.8	3.3	22.20	36.43	45.15	36.43 Slug Flow
			72.9	3.4	22.91	39.47	45.28	39.47 Slug Flow
Notes & Warnings			73.0	3.5	23.62	42.50	45.41	42.50 Slug Flow
			73.1	3.6	24.32	45.54	45.54	45.54 Slug Flow
			73.2	3.7			45.66	45.66 Full Pipe Flow
			73.3	3.8			45.79	45.79 Full Pipe Flow
			73.4	3.9			45.92	45.92 Full Pipe Flow
			73.5	4.0			46.04	46.04 Full Pipe Flow
			73.6	4.1			46.17	46.17 Full Pipe Flow
			73.7	4.2			46.29	46.29 Full Pipe Flow
			73.8	4.3			46.42	46.42 Full Pipe Flow
			73.9	4.4			46.54	46.54 Full Pipe Flow
			74.0	4.5			46.67	46.67 Full Pipe Flow
			74.1	4.6			46.79	46.79 Full Pipe Flow
			74.2	4.7			46.92	46.92 Full Pipe Flow
			74.3	4.8			47.04	47.04 Full Pipe Flow
			74.4	4.9			47.16	47.16 Full Pipe Flow
			74.5	5.0			47.29	47.29 Full Pipe Flow
			74.6	5.1			47.41	47.41 Full Pipe Flow
			74.7	5.2			47.53	47.53 Full Pipe Flow
			74.8	5.3			47.65	47.65 Full Pipe Flow
			74.9	5.4			47.77	47.77 Full Pipe Flow
			75.0	5.5			47.89	47.89 Full Pipe Flow
			75.1	5.6			48.01	48.01 Full Pipe Flow
			75.2	5.7			48.13	48.13 Full Pipe Flow
			75.3	5.8			48.26	48.26 Full Pipe Flow
			75.4	5.9			48.37	48.37 Full Pipe Flow
			75.5	6.0			48.49	48.49 Full Pipe Flow

FULL PIPE FLOW →

Project Name: Wolf Dam

Computed by: Stem

Date: 2/18/2009

Checked by: _____

Date: _____

Elev	HW Ft	Outflow, CFS				Controlling Factor
		Weir	Slug Flow	Full Pipe	Structure Outflow, CFS	
75.6	6.1			48.61	48.61	Full Pipe Flow
75.7	6.2			48.73	48.73	Full Pipe Flow
75.8	6.3			48.85	48.85	Full Pipe Flow
75.9	6.4			48.97	48.97	Full Pipe Flow
76.0	6.5			49.09	49.09	Full Pipe Flow
76.1	6.6			49.21	49.21	Full Pipe Flow
76.2	6.7			49.32	49.32	Full Pipe Flow
76.3	6.8			49.44	49.44	Full Pipe Flow
76.4	6.9			49.56	49.56	Full Pipe Flow
76.5	7.0			49.67	49.67	Full Pipe Flow
76.6	7.1			49.79	49.79	Full Pipe Flow
76.7	7.2			49.91	49.91	Full Pipe Flow
76.8	7.3			50.02	50.02	Full Pipe Flow
76.9	7.4			50.14	50.14	Full Pipe Flow
77.0	7.5			50.25	50.25	Full Pipe Flow
77.1	7.6			50.37	50.37	Full Pipe Flow
77.2	7.7			50.48	50.48	Full Pipe Flow
77.3	7.8			50.60	50.60	Full Pipe Flow
77.4	7.9			50.71	50.71	Full Pipe Flow
77.5	8.0			50.83	50.83	Full Pipe Flow
77.6	8.1			50.94	50.94	Full Pipe Flow
77.7	8.2			51.05	51.05	Full Pipe Flow
77.8	8.3			51.17	51.17	Full Pipe Flow
77.9	8.4			51.28	51.28	Full Pipe Flow
78.0	8.5			51.39	51.39	Full Pipe Flow
78.1	8.6			51.51	51.51	Full Pipe Flow
78.2	8.7			51.62	51.62	Full Pipe Flow
78.3	8.8			51.73	51.73	Full Pipe Flow
78.4	8.9			51.84	51.84	Full Pipe Flow
78.5	9.0			51.95	51.95	Full Pipe Flow
78.6	9.1			52.07	52.07	Full Pipe Flow
78.7	9.2			52.18	52.18	Full Pipe Flow
78.8	9.3			52.29	52.29	Full Pipe Flow
78.9	9.4			52.40	52.40	Full Pipe Flow
79.0	9.5			52.51	52.51	Full Pipe Flow
79.1	9.6			52.62	52.62	Full Pipe Flow
79.2	9.7			52.73	52.73	Full Pipe Flow
79.3	9.8			52.84	52.84	Full Pipe Flow
79.4	9.9			52.95	52.95	Full Pipe Flow
79.5	10.0			53.06	53.06	Full Pipe Flow
79.6	10.1			53.17	53.17	Full Pipe Flow
79.7	10.2			53.28	53.28	Full Pipe Flow
79.8	10.3			53.38	53.38	Full Pipe Flow
79.9	10.4			53.49	53.49	Full Pipe Flow
80.0	10.5			53.60	53.60	Full Pipe Flow
80.1	10.6			53.71	53.71	Full Pipe Flow
80.2	10.7			53.82	53.82	Full Pipe Flow
80.3	10.8			53.92	53.92	Full Pipe Flow
80.4	10.9			54.03	54.03	Full Pipe Flow
80.5	11.0			54.14	54.14	Full Pipe Flow
80.6	11.1			54.25	54.25	Full Pipe Flow
80.7	11.2			54.35	54.35	Full Pipe Flow
80.8	11.3			54.46	54.46	Full Pipe Flow
80.9	11.4			54.56	54.56	Full Pipe Flow
81.0	11.5			54.67	54.67	Full Pipe Flow
81.1	11.6			54.78	54.78	Full Pipe Flow
81.2	11.7			54.88	54.88	Full Pipe Flow

82

55.72

10/26

1*****
 SITES XEQ 02/18/2009 WATER RESOURCE SITE ANALYSIS COMPUTER PROGRAM
 VER 2005.1.3 (USER MANUAL - DATED OCTOBER 2007)
 TIME 09:29:55

***** 80-80 LIST OF INPUT DATA *****

SITES 01/01/2005 1.21875 H7
 SAVMOV 0 101
 SAVMOV 101 1 1
 * Routing used 2 year storm for PS and 50 year storm for ES
 * 2' dia hooded inlet conduit 4' dia riser
 * below 2000 product

STRUCTURE

1554	0
1556	0.2
1559	1.2
1562	2.3
1565	4.1
1568	5.7
1571	7.6
1573	8.9
1573.2	9.04
1574	9.6
1574.1	9.69
1574.2	9.78
1577	12.2
1578	13
1580	14.6
1582	16

PIPE EL. 73.0
 AS EL. 75.2
 DAM WP - 78.4
 20' WAVE BERM FROM
 EL 1571.6 TO
 EL 1573.7

0
 3.35
 37.41
 43.15
 46.92
 50.25
 51.39
 53.6
 55.72

FROM IOWA

ENDTABLE							
WSDATA	5A1	AC	75	780	11300	5.2	
BASEFLOW			.03				
PDIRECT			2.6		5.20	1.00	
POOLDATA	ELEV		1573	1554		1553.0	1555
ASDATA	41	200	200		3	.05	2
ASINSURF	41		7.6				B
ASINLET	41	0.0	0.0	100	0.0		3
		200	2				

ENDTABLE				
ASEXSURF	41		.035	
			.75	0
			2	
			2	0
			.02	

ENDTABLE						
ASEXIT	41	N			100	
BTMWIDTH	FEET	150				
GRAPHICS	I					
GO,DESIGN	HL	TYPE2	24	TYPE2378	24	
SAVMOV	2	101	1			
ENDJOB						

1SITES XEQ 02/18/2009 ----- COMMENT PAGE -----
 VER 2005.1.3 WSID =

Routing used 2 year storm for PS and 50 year storm for ES

2' dia hooded inlet conduit 4' dia riser

below 2000 product

***** MESSAGE - ALTERNATE STRUCTURE ID (S 1) BEING USED
SINCE USER DID NOT INPUT AN ID.

***** MESSAGE - ALTERNATE SUBWATERSHED ID (A) BEING USED SINCE
USER DID NOT INPUT AN ID.

***** MESSAGE - DRAINAGE AREA FROM WSDATA CONTROL BEING CONVERTED FROM
ACRES TO SQUARE MILES FOR COMPUTATION PURPOSES.

1SITES -----
XEQ 02/18/2009
VER 2005.1.3
TIME 09:29:55 SITE = S 1 PASS= 1 PART= 1 WSID=
SUBW= A

***** BASIC DATA *****
CLIMATE AREA - NOT DEFINED DESIGN CLASS A1 = LT 3000.

STORM DISTRIBUTION-PSH 24 HOUR TYPE II RAINFALL DISTRIBUTION

STORM DISTRIBUTION AUX. -24 HOUR TYPE II RAINFALL DISTRIBUTION

PRECIP. - P-PS,1-DAY	P-PS,10-DAY	P-SD	P-FB	
2.60	0.00	5.20	1.00	
WSDATA - CN	DA-SM	TC/L	-/H	ORF
75.00	1.22	11300.00	5.20	0.00
SITEDATA- PERM POOL	CREST PS	FP SED	VALLEY FL	378?
1573.00	1554.00	0.00	1555.00	YES
BASEFLOW	INITIAL EL	EXTRA VOL	SITE TYPE	
0.03	0.00	0.00	DESIGN	
PSDATA - NO. COND	COND L	DIA/W	-/H	
0.00	0.00	0.00	0.00	
PS N	KE	WEIR L	TW EL	
0.000	0.00	0.00	0.00	
2ND STG	ORF H	ORF L	START AUX.	
0.00	0.00	0.00	0.00	
ASCRESTS - AUX.1	AUX.2	AUX.3	AUX.4	AUX.5
0.00	0.00	0.00	0.00	0.00
AUX.DATA - REF.NO.	RETARD. Ci	TIE STATION	INLET LENGTH	
41	0.00	200.00	200	

AUX.DATA - INLET Ci	SIDE SLOPE	EXIT N	EXIT SLOPE	ACTUAL AUX?
7.600	3.00	0.035	0.050	NO

BTM WIDTH -	BW1	BW2	BW3	BW4	BW5
ft	150.00	0.00	0.00	0.00	0.00

AUXILIARY SPILLWAY RATING DEVELOPED USING WSPVRT.

1SITES -----
 XEQ 02/18/2009
 VER 2005.1.3
 TIME 09:29:55 SITE = S 1 PASS= 1 WSID= SUBW= A PART= 2

PERM POOL	1573.00 FT	68.3 ACFT	8.90 AC	0.0 CFS
CREST PS	1554.00 FT	0.0 ACFT	0.00 AC	0.0 CFS
SED ACCUM	1554.00 FT	0.0 ACFT	0.00 AC	0.0 CFS
BASEFLOW	1573.00 FT	68.3 ACFT	8.90 AC	0.0 CFS
START ELEV	1573.00 FT	68.3 ACFT	8.90 AC	0.0 CFS
NRCS-PSH	D= 24.00 HR TC= 1.88 HR	P= 2.60 IN CN= 75.00	Q= 0.71 IN VOL= 46.2 ACFT	DA= 1.22 SM

PEAK = 167.0 CFS, AT 13.3 HRS.

ROUTED RESULT - HYD TYPE	EMAX	VOL-MAX	AMAX	QMAX
NRCS-PSH	1574.92 FT	86.7 ACFT	10.40 AC	47.7 CFS

PS STORAGE 86.7 ACFT, BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

DRAWDOWN (DDT) TEST 1573.00 FT 68.3 ACFT 0.04 CFS
 CONTROL IS 0.000 DETENTION STORAGE

DRAWDOWN TIME = 1.77 DAYS, TO 0.1 CFS (LIMIT = 10.00 DAYS)

RATING TABLE DEVELOPED, SITE = S 1:
 WITH PS GIVEN AND AUX. COMPUTED BY PROGRAM
 AUX. RATING USED WSPVRT METHOD.

RATING TABLE NUMBER 1						
	ELEV.	Q-TOTAL	Q-PS	Q-AUX.	VOLUME	AREA
	FEET	CFS	CFS	CFS	AC-FT	ACRE
1	1554.00	0.00	0.00	0.00	0.00	0.00
2	1556.00	0.00	0.00	0.00	0.20	0.20
3	1559.00	0.00	0.00	0.00	2.30	1.20
4	1562.00	0.00	0.00	0.00	7.55	2.30
5	1565.00	0.00	0.00	0.00	17.15	4.10

6	1568.00	0.00	0.00	0.00	31.85	5.70
7	1571.00	0.00	0.00	0.00	51.80	7.60
8	1573.00	0.00	0.00	0.00	68.30	8.90
9	1573.20	3.35	3.35	0.00	70.09	9.04
10	1574.00	37.41	37.41	0.00	77.55	9.60
11	1574.10	43.15	43.15	0.00	78.51	9.69
12	1574.20	46.92	46.92	0.00	79.49	9.78
13	1577.00	50.25	50.25	0.00	110.26	12.20
14	1578.00	51.39	51.39	0.00	122.86	13.00
15	1580.00	53.60	53.60	0.00	150.46	14.60
16	1582.00	55.72	55.72	0.00	181.06	16.00

1SITES -----
 XEQ 02/18/2009
 VER 2005.1.3
 TIME 09:29:55 SITE = S 1 PASS= 1 WSID= SUBW= A PART= 3

AUX. CREST 1574.92 FT 86.7 ACFT 10.40 AC 47.7 CFS

PS STORAGE 86.7 ACFT, BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

START ELEV 1573.00 FT 68.3 ACFT 8.90 AC 0.1 CFS
 EFFECTIVE HEIGHT(H)= 21.9 FEET, PRODUCT= 1901. (H * STORAGE AT CREST AUX.). *1991 WAS at 1575.2*

INPUT DESIGN CLASS = A1 = LT 3000. PRODUCT.

NRCS-SDH D= 24.00 HR P= 5.20 IN Q= 2.61 IN DA= 1.22 SM
 TC= 1.88 HR CN= 75.00 VOL= 169.8 ACFT

PEAK = 698.1 CFS, AT 13.2 HRS.

NRCS-FBH D= 24.00 HR P= 1.00 IN Q= 0.03 IN DA= 1.22 SM
 TC= 1.88 HR CN= 75.00 VOL= 2.0 ACFT

PEAK = 2.6 CFS, AT 15.2 HRS.

RATING TABLE DEVELOPED, SITE = S 1:
 WITH PS GIVEN AND AUX. COMPUTED BY PROGRAM
 AUX. RATING USED WSPVRT METHOD.

RATING TABLE NUMBER 2

	ELEV. FEET	Q-TOTAL CFS	Q-PS CFS	Q-AUX. CFS	VOLUME AC-FT	AREA ACRE
1	1554.00	0.00	0.00	0.00	0.00	0.00
2	1555.74	0.00	0.00	0.00	0.15	0.17
3	1557.49	0.00	0.00	0.00	0.87	0.70
4	1559.23	0.00	0.00	0.00	2.58	1.28
5	1560.97	0.00	0.00	0.00	5.38	1.92
6	1562.72	0.00	0.00	0.00	9.35	2.73
7	1564.46	0.00	0.00	0.00	15.02	3.77
8	1566.20	0.00	0.00	0.00	22.46	4.74

1575.2
1578.4

89.7
128.1

9	1567.94	0.00	0.00	0.00	31.53	5.67
10	1569.69	0.00	0.00	0.00	42.37	6.77
11	1571.43	0.00	0.00	0.00	55.13	7.88
12	1573.17	2.91	2.91	0.00	69.85	9.02
13	1574.92	47.77	47.77	0.00	86.72	10.40
14	1575.27	59.14	48.19	10.95	90.45	10.71
15	1575.62	70.51	48.61	21.90	94.30	11.01
16	1576.26	118.83	49.37	69.46	101.50	11.56
17	1577.04	674.35	50.30	624.05	110.77	12.23
18	1578.46	2219.70	51.90	2167.80	128.90	13.37
19	1580.23	4680.63	53.84	4626.79	153.82	14.76
20	1582.00	7723.13	55.72	7667.41	181.06	16.00

SUMMARY OF AUXILIARY SPILLWAY SURFACE CONDITIONS USED IN COMPUTATIONS BY REACH

REACH	FROM STA (ft)	TO STA (ft)	SLOPE (%)	RETARDANCE CURVE INDEX@	VEGETAL COVER FACTOR	MAINT. CODE	ROOTING DEPTH (ft)	REACH LOCATION *
1	0.	100.	-2.0	7.6	**	**	**	INLET
2	100.	200.	0.0	7.6	**	**	**	CREST
3	200.	300.	5.0	0.035	0.75	2	2.0	EXIT !

@ The program interprets retardance curve index entries of less than 1 as Manning's n values.

* Upper case indicates a reach of constructed spillway channel.

** The program does not use vegetal cover factor, maintenance code, and rooting depth for inlet and crest reaches in computations.

! Reach 3 used in computing exit channel velocities.

ROUTED RESULTS	BTM WIDTH FT	MAX ELEV FT	VOL-MAX ACFT	AREA-MAX AC	AUX.-HP FT	VOL-AUX. ACFT
NRCS-SDH	150.0	1577.01	110.3	12.2	2.09	23.6

PEAK - CFS	Q-PS	Q-AUX.	Q-TOT.
DISCHARGE =	50.3	597.5	647.7

	CRITICAL DEPTH FT	CRITICAL VELOCITY FT/SEC	CRITICAL SLOPE-Sc FT/FT	25% OF Q Sc FT/FT
AUXILIARY SPILLWAY ---	0.79	4.99	0.020	0.026

AUXILIARY SPILLWAY DURATION FLOW = 13.1 HOURS

***** MESSAGE - NHCP378 CRITERIA USED BUT AUXILIARY SPILLWAY RATING NOT BASED ON ASFILE RATINGS.

EXIT CHANNEL FLOW SUPERCRITICAL: MAX VELOCITY= 6.6 FT/SEC
EXIT SLOPE = 0.050 FT/FT
FLOW DEPTH = 0.6 FT

EROSIONALLY EFFECTIVE STRESS FOR STABILITY ANALYSIS OF AUX. EXIT CHANNEL
(Refer to Ag. Handbook 667, Chapt. 3, for allowable stresses.)

Aux. Spillway Discharge = 597. cfs; Bottom Width = 150. ft

REACH NO.	FROM STA	TO STA	SLOPE %	MANNING'S n	VELOCITY ft/s	TOTAL STRESS lb/ft^2	EFFECTIVE STRESS lb/ft^2
3	200.	300.	5.00	0.035	6.64	1.85	0.367

DRAWDOWN USING FREEBOARD STORM FOLLOWS, STARTING AT ELEVATION 1574.89 FT.

DRAWDOWN (DDT) TEST 1571.45 FT 55.3 ACFT 0.04 CFS
CONTROL IS 0.000 DETENTION STORAGE

TIME LIMIT REACHED = 10.00 DAYS. FLOW WAS 0.12 CFS, ELEV = 1571.50

ROUTED RESULTS	BTM WIDTH FT	MAX ELEV FT	VOL-MAX ACFT	AREA-MAX AC	AUX.-HP FT	VOL-AUX. ACFT
NRCS-FBH	150.0	1574.89	86.5	10.4	0.00	0.0

^^^^ NOTE -- ACTUAL Hp OF 0.00 RAISED TO MEET MIN. 378 CRITERIA.

PEAK - CFS	Q-PS	Q-AUX.	Q-TOT.
DISCHARGE =	47.2	0.0	47.2

	CRITICAL DEPTH FT	CRITICAL VELOCITY FT/SEC	CRITICAL SLOPE-Sc FT/FT	25% OF Q Sc FT/FT
AUXILIARY SPILLWAY ---	0.00	0.00	0.000	0.000

AUXILIARY SPILLWAY DURATION FLOW =	0.0 HOURS
ATTACK, OE/B =	0.0 ACFT/FT

***** MESSAGE - NHCP378 CRITERIA USED BUT AUXILIARY SPILLWAY RATING NOT BASED ON ASFILE RATINGS.

***** WARNING - USER SUPPLIED RATING CURVE DID NOT MEET CRITERIA FOR MINIMUM FLOW THROUGH AUXILIARY SPILLWAY (261.28 CFS).

>>>> NHCP378 RUN - MINIMUM DEPTH, CREST AUX. TO TOP OF DAM IS 2.00 FT.
NEW TOP OF DAM ELEVATION = 1576.92.

ROUTED RESULTS	BTM WIDTH FT	MAX ELEV FT	VOL-MAX ACFT	AREA-MAX AC	AUX.HP FT	VOL-AUX. ACFT
MINIMUM AUX.	150.0	1576.92	109.3	12.1	2.00	22.6

PEAK - CFS	Q-PS	Q-AUX.	Q-TOT.
DISCHARGES =	50.1	535.1	585.2

	CRITICAL DEPTH FT	CRITICAL VELOCITY FT/SEC	CRITICAL SLOPE-Sc FT/FT	25% OF Q Sc FT/FT
AUXILIARY SPILLWAY ---	0.73	4.81	0.020	0.027

Inflow Hyd 1 PSH-Peak = 47.70 CFS at 15.78 hrs., Location Point

Inflow Hyd 1 SDH-Peak = 647.74 CFS at 13.46 hrs., Location Point
 Inflow Hyd 1 FBH-Peak = 47.17 CFS at 13.09 hrs., Location Point
 HYDOUT 1

1SITES.....JOB NO. 1 COMPLETE.

0 SUBWATERSHED(S) ANALYZED.

1 STRUCTURE(S) ANALYZED.

3 HYDROGRAPHS ROUTED AT LOWEST SITE.

0 TRIALS TO OBTAIN BOTTOM WIDTH FOR SPECIFIED STRESS OR VELOCITY.

SITES.....COMPUTATIONS COMPLETE

>>>										<<<
	SITE ID	SUBWS ID	SUBWS DA (SQ MI)	CURVE NO.	TC (HRS)	TOTAL DA (SQ MI)	TYPE DESIGN	STRUC CLASS		
	S 1	A	1.22	75.	1.88	1.22	378NR	A1		

PASS NO.	DIA./ WIDTH (IN/FT)	AUX.CREST ELEV (FT)	BTM. WIDTH (FT)	MAX. HP (FT)	MAX. ELEV (FT)	EMB. VOL. (CY)	INTEGR.* DIST. (FT)	EXIT* VEL. (FT/SEC)	TYPE HYD
1	0.0	1574.9	150.0	2.0	1576.9	0.	0.	0.0	MIN. AUX.

* INTEGRITY DIST. AND EXIT VEL. ARE BASED ON THE ROUTED HYDROGRAPH
 AND WILL NOT RELATE TO THE MAX. ELEV. (TOP OF DAM),
 WHICH IS SET BY MINIMUM DESIGN CRITERIA.

SITES.....SUMMARY TABLE 1 COMPLETED.

NRCS SITES VERSION 2005.1.3 ,01/01/2005
 FILES

INPUT = C:\Program Files\USDA\SITES\Wolf24PSBelow2000Iowa.D2C
 OUTPUT = C:\Program Files\USDA\SITES\Wolf24PSBelow2000Iowa.OUT
 DATED 02/18/2009 09:29:55

1*****
 SITES XEQ 02/18/2009 WATER RESOURCE SITE ANALYSIS COMPUTER PROGRAM
 VER 2005.1.3 (USER MANUAL - DATED OCTOBER 2007)
 TIME 09:53:48

***** 80-80 LIST OF INPUT DATA *****

SITES 01/01/2005 1.21875 H6
 SAVMOV 0 101
 SAVMOV 101 1 1
 * Routing used 2 year storm for PS and 50 year storm for ES
 * 2' dia hooded inlet conduit 4' dia riser
 * below 2000 product

STRUCTURE

1554	0
1556	0.2
1559	1.2
1562	2.3
1565	4.1
1568	5.7
1571	7.6
1573	8.9
1573.2	9.04
1574	9.6
1574.1	9.69
1574.2	9.78
1577	12.2
1578	13
1580	14.6
1582	16

IN THIS SITES RUN, THE
 A.S. ELEVATION IS SET AT
 1575.2. THE HEIGHT X
 STORAGE FACTOR IS 1991
 WHICH IS BELOW 2000.

ENDTABLE							
WSDATA	5A1	AC 75	780	11300	5.2		
BASEFLOW		.03					
PDIRECT				5.20	1.00		
POOLDATA	ELEV	1573	1554		1553.0	1555	
ASDATA	41 200	200		3		.05	2
ASCREST	ELEV	1575.2					
ASINSURF	41		7.6				B
ASINLET	41	0.0	0.0	100	0.0		3
		200	2				

ENDTABLE							
ASEXSURF	41		.035				
			.75	0			
			2				
			2	0			
			.02				

ENDTABLE							
ASEXIT	41	N			100		
BTMWIDTH	FEET	150					
GRAPHICS	I						
GO,DESIGN	HL	TYPE2	24	TYPE2378	24		
SAVMOV	2	101	1				
ENDJOB							

1SITES XEQ 02/18/2009 ----- COMMENT PAGE -----

VER 2005.1.3

WSID =

Routing used 2 year storm for PS and 50 year storm for ES

2' dia hooded inlet conduit 4' dia riser

below 2000 product

***** MESSAGE - ALTERNATE STRUCTURE ID (S 1) BEING USED
SINCE USER DID NOT INPUT AN ID.

***** MESSAGE - ALTERNATE SUBWATERSHED ID (A) BEING USED SINCE
USER DID NOT INPUT AN ID.

***** MESSAGE - DRAINAGE AREA FROM WSDATA CONTROL BEING CONVERTED FROM
ACRES TO SQUARE MILES FOR COMPUTATION PURPOSES.

1SITES -----
XEQ 02/18/2009
VER 2005.1.3
TIME 09:53:48
SITE = S 1
PASS= 1
PART= 1
WSID=
SUBW= A

***** BASIC DATA *****
CLIMATE AREA - NOT DEFINED
DESIGN CLASS A1 = LT 3000.

STORM DISTRIBUTION-PSH 24 HOUR TYPE II RAINFALL DISTRIBUTION

STORM DISTRIBUTION AUX. -24 HOUR TYPE II RAINFALL DISTRIBUTION

PRECIP. - Q-PS, 1-DAY	Q-PS, 10-DAY	P-SD	P-FB	
0.00	0.00	5.20	1.00	
WSDATA - CN	DA-SM	TC/L	-/H	QRF
75.00	1.22	11300.00	5.20	0.00
SITEDATA- PERM POOL	CREST PS	FP SED	VALLEY FL	378?
1573.00	1554.00	0.00	1555.00	YES
BASEFLOW	INITIAL EL	EXTRA VOL	SITE TYPE	
0.03	0.00	0.00	DESIGN	
PSDATA - NO. COND	COND L	DIA/W	-/H	
0.00	0.00	0.00	0.00	
PS N	KE	WEIR L	TW EL	
0.000	0.00	0.00	0.00	
2ND STG	ORF H	ORF L	START AUX.	
0.00	0.00	0.00	0.00	
ASCRESTS - AUX.1	AUX.2	AUX.3	AUX.4	AUX.5
1575.20	0.00	0.00	0.00	0.00
AUX.DATA - REF.NO.	RETARD. Ci	TIE STATION	INLET LENGTH	

41	0.00	200.00	200	
AUX.DATA - INLET Ci	SIDE SLOPE	EXIT N	EXIT SLOPE	ACTUAL AUX?
7.600	3.00	0.035	0.050	NO
BTM WIDTH - BW1	BW2	BW3	BW4	BW5
ft 150.00	0.00	0.00	0.00	0.00

AUXILIARY SPILLWAY RATING DEVELOPED USING WSPVRT.

1SITES -----
 XEQ 02/18/2009
 VER 2005.1.3
 TIME 09:53:48 SITE = S 1 PASS= 1 WSID= SUBW= A PART= 2

PERM POOL	1573.00 FT	68.3 ACFT	8.90 AC	0.0 CFS
CREST PS	1554.00 FT	0.0 ACFT	0.00 AC	0.0 CFS
SED ACCUM	1554.00 FT	0.0 ACFT	0.00 AC	0.0 CFS
BASEFLOW	1573.00 FT	68.3 ACFT	8.90 AC	0.0 CFS
START ELEV	1573.00 FT	68.3 ACFT	8.90 AC	0.0 CFS

1SITES -----
 XEQ 02/18/2009
 VER 2005.1.3
 TIME 09:53:48 SITE = S 1 PASS= 1 WSID= SUBW= A PART= 3

AUX. CREST	1575.20 FT	89.7 ACFT	10.64 AC	48.0 CFS
PS STORAGE 89.7 ACFT, BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.				
START ELEV	1573.00 FT	68.3 ACFT	8.90 AC	0.0 CFS
EFFECTIVE HEIGHT(H)= 22.2 FEET, PRODUCT= 1991. (H * STORAGE AT CREST AUX.).				
INPUT DESIGN CLASS = A1 = LT 3000. PRODUCT.				

NRCS-SDH	D= 24.00 HR	P= 5.20 IN	Q= 2.61 IN	DA= 1.22 SM
	TC= 1.88 HR	CN= 75.00	VOL= 169.8 ACFT	

PEAK = 698.1 CFS, AT 13.2 HRS.

NRCS-FBH	D= 24.00 HR	P= 1.00 IN	Q= 0.03 IN	DA= 1.22 SM
	TC= 1.88 HR	CN= 75.00	VOL= 2.0 ACFT	

PEAK = 2.6 CFS, AT 15.2 HRS.

 RATING TABLE DEVELOPED, SITE = S 1:

WITH PS GIVEN AND AUX. COMPUTED BY PROGRAM
AUX. RATING USED WSPVRT METHOD.

RATING TABLE NUMBER 2

	ELEV. FEET	Q-TOTAL CFS	Q-PS CFS	Q-AUX. CFS	VOLUME AC-FT	AREA ACRE
1	1554.00	0.00	0.00	0.00	0.00	0.00
2	1555.77	0.00	0.00	0.00	0.16	0.18
3	1557.53	0.00	0.00	0.00	0.90	0.71
4	1559.30	0.00	0.00	0.00	2.68	1.31
5	1561.07	0.00	0.00	0.00	5.56	1.96
6	1562.83	0.00	0.00	0.00	9.67	2.80
7	1564.60	0.00	0.00	0.00	15.56	3.86
8	1566.37	0.00	0.00	0.00	23.25	4.83
9	1568.13	0.00	0.00	0.00	32.61	5.78
10	1569.90	0.00	0.00	0.00	43.82	6.90
11	1571.67	0.00	0.00	0.00	57.01	8.03
12	1573.43	13.26	13.26	0.00	72.22	9.20
13	1575.20	48.11	48.11	0.00	89.69	10.64
14	1575.54	59.01	48.51	10.50	93.36	10.94
15	1575.88	69.93	48.92	21.01	97.13	11.23
16	1576.49	103.66	49.65	54.02	104.17	11.76
17	1577.24	601.71	50.52	551.19	113.20	12.39
18	1578.60	2038.27	52.05	1986.22	130.80	13.48
19	1580.30	4347.17	53.92	4293.26	154.87	14.81
20	1582.00	7188.36	55.72	7132.64	181.06	16.00

SUMMARY OF AUXILIARY SPILLWAY SURFACE CONDITIONS USED IN COMPUTATIONS BY REACH

REACH	FROM STA (ft)	TO STA (ft)	SLOPE (%)	RETARDANCE CURVE INDEX@	VEGETAL COVER FACTOR	MAINT. CODE	ROOTING DEPTH (ft)	REACH LOCATION *
1	0.	100.	-2.0	7.6	**	**	**	INLET
2	100.	200.	0.0	7.6	**	**	**	CREST
3	200.	300.	5.0	0.035	0.75	2	2.0	EXIT !

@ The program interprets retardance curve index entries of less than 1 as Manning's n values.

* Upper case indicates a reach of constructed spillway channel.

** The program does not use vegetal cover factor, maintenance code, and rooting depth for inlet and crest reaches in computations.

! Reach 3 used in computing exit channel velocities.

ROUTED RESULTS	BTM WIDTH FT	MAX ELEV FT	VOL-MAX ACFT	AREA-MAX AC	AUX.-HP FT	VOL-AUX. ACFT
NRCS-SDH	150.0	1577.28	113.8	12.4	2.09	24.1

PEAK - CFS Q-PS Q-AUX. Q-TOT.
DISCHARGE = 50.6 597.2 647.7

AUXILIARY CRITICAL CRITICAL CRITICAL 25% OF Q
 DEPTH VELOCITY SLOPE-Sc Sc
 FT FT/SEC FT/FT FT/FT

SPILLWAY --- 0.79 4.99 0.020 0.026

AUXILIARY SPILLWAY DURATION FLOW = 13.2 HOURS

***** MESSAGE - NHCP378 CRITERIA USED BUT AUXILIARY SPILLWAY RATING NOT
BASED ON ASFILE RATINGS.

EXIT CHANNEL FLOW SUPERCRITICAL: MAX VELOCITY= 6.6 FT/SEC
EXIT SLOPE = 0.050 FT/FT
FLOW DEPTH = 0.6 FT

EROSIONALLY EFFECTIVE STRESS FOR STABILITY ANALYSIS OF AUX. EXIT CHANNEL
(Refer to Ag. Handbook 667, Chapt. 3, for allowable stresses.)
Aux. Spillway Discharge = 597. cfs; Bottom Width = 150. ft

REACH	FROM	TO	SLOPE	MANNING'S	VELOCITY	TOTAL	EFFECTIVE
NO.	STA	STA	%	n	ft/s	lb/ft^2	lb/ft^2
3	200.	300.	5.00	0.035	6.64	1.85	0.367

DRAWDOWN USING FREEBOARD STORM FOLLOWS, STARTING AT ELEVATION 1575.18 FT.

DRAWDOWN (DDT) TEST 1571.67 FT 57.0 ACFT 0.04 CFS
CONTROL IS 0.000 DETENTION STORAGE

TIME TO DDT TEST DISCHARGE IS 3.73 DAYS - DRAWDOWN CONTINUING.

DRAWDOWN TIME = 3.73 DAYS, TO 0.1 CFS (LIMIT = 10.00 DAYS)

ROUTED	BTM WIDTH	MAX ELEV	VOL-MAX	AREA-MAX	AUX.-HP	VOL-AUX.
RESULTS	FT	FT	ACFT	AC	FT	ACFT
NRCS-FBH	150.0	1575.18	89.5	10.6	0.00	0.0

^^^^ NOTE -- ACTUAL Hp OF 0.00 RAISED TO MEET MIN. 378 CRITERIA.

PEAK - CFS	Q-PS	Q-AUX.	Q-TOT.
DISCHARGE =	47.7	0.0	47.7

	CRITICAL	CRITICAL	CRITICAL	25% OF Q
	DEPTH	VELOCITY	SLOPE-Sc	Sc
AUXILIARY	FT	FT/SEC	FT/FT	FT/FT
SPILLWAY ---	0.00	0.00	0.000	0.000

AUXILIARY SPILLWAY DURATION FLOW = 0.0 HOURS
ATTACK, OE/B = 0.0 ACFT/FT

***** MESSAGE - NHCP378 CRITERIA USED BUT AUXILIARY SPILLWAY RATING NOT
BASED ON ASFILE RATINGS.

***** WARNING - USER SUPPLIED RATING CURVE DID NOT MEET CRITERIA FOR
MINIMUM FLOW THROUGH AUXILIARY SPILLWAY (261.28 CFS).

>>>> NHCP378 RUN - MINIMUM DEPTH, CREST AUX. TO TOP OF DAM IS 2.00 FT.
NEW TOP OF DAM ELEVATION = 1577.20.

ROUTED RESULTS	BTM WIDTH FT	MAX ELEV FT	VOL-MAX ACFT	AREA-MAX AC	AUX.HP FT	VOL-AUX. ACFT
MINIMUM AUX.	150.0	1577.20	112.7	12.4	2.00	23.0

PEAK - CFS DISCHARGES =	Q-PS	Q-AUX.	Q-TOT.
	50.5	524.4	574.9

AUXILIARY SPILLWAY ---	CRITICAL DEPTH FT	CRITICAL VELOCITY FT/SEC	CRITICAL SLOPE-Sc FT/FT	25% OF Q Sc FT/FT
	0.72	4.78	0.020	0.027

Inflow Hyd 1 SDH-Peak = 647.73 CFS at 13.46 hrs., Location Point

Inflow Hyd 1 FBH-Peak = 47.66 CFS at 13.09 hrs., Location Point
HYDOUT 1

1SITES.....JOB NO. 1 COMPLETE.

0 SUBWATERSHED(S) ANALYZED.

1 STRUCTURE(S) ANALYZED.

2 HYDROGRAPHS ROUTED AT LOWEST SITE.

0 TRIALS TO OBTAIN BOTTOM WIDTH FOR SPECIFIED STRESS OR VELOCITY.

SITES.....COMPUTATIONS COMPLETE

>>>	SITE ID	SUBWS ID	SUBWS DA (SQ MI)	CURVE NO.	TC (HRS)	TOTAL DA (SQ MI)	TYPE DESIGN	STRUC CLASS	<<<
	S 1	A	1.22	75.	1.88	1.22	378NR	A1	

PASS NO.	DIA./ WIDTH (IN/FT)	AUX.CREST ELEV (FT)	BTM. WIDTH (FT)	MAX. HP (FT)	MAX. ELEV (FT)	EMB. VOL. (CY)	INTEGR.* DIST. (FT)	EXIT* VEL. (FT/SEC)	TYPE HYD
1	0.0	1575.2	150.0	2.0	1577.2	0.	0.	0.0	MIN. AUX.

* INTEGRITY DIST. AND EXIT VEL. ARE BASED ON THE ROUTED HYDROGRAPH
AND WILL NOT RELATE TO THE MAX. ELEV. (TOP OF DAM),

WHICH IS SET BY MINIMUM DESIGN CRITERIA.

SITES.....SUMMARY TABLE 1 COMPLETED.

NRCS SITES VERSION 2005.1.3 ,01/01/2005
FILES

INPUT = C:\Program Files\USDA\SITES\Wolf24PSBelow2000IowaSetES.D2C
OUTPUT = C:\Program Files\USDA\SITES\Wolf24PSBelow2000IowaSetES.OUT
DATED 02/18/2009 09:53:48

GRAPHICS FILES GENERATED

OPTION "L" = C:\Program Files\USDA\SITES\Wolf24PSBelow2000IowaSetES.DRG DATED 02/18/2009
OPTION "P" = C:\Program Files\USDA\SITES\Wolf24PSBelow2000IowaSetES.DHY DATED 02/18/2009
OPTION "E" = C:\Program Files\USDA\SITES\Wolf24PSBelow2000IowaSetES.DEM DATED 02/18/2009

RECEIVED

APR 17 2019

WATER RIGHTS
PROGRAM

TOM WOLF DAM
SW4, 20-106-52
LAKE COUNTY

CONSTRUCTION AND MATERIAL
SPECIFICATIONS

CONSTRUCTION SPECIFICATION

SD-4 STRIPPING

1. Scope

The work shall consist of removing topsoil and other undesirable materials from borrow areas and foundations of structures and earth fills.

2. General

Required stripping excavation depth will be the depth needed to expose subsoil reasonably free of roots and other perishable material. Excavated earth material suitable for fill shall be placed in earth fills as appropriate. Stripped material suitable for topsoil shall be stockpiled and placed over disturbed areas as shown on the drawings or as approved by the Natural Resources Conservation Service (NRCS) inspector. All waste material shall be disposed of as shown on the drawings or as approved by the NRCS inspector.

3. Foundation Stripping

Remove loose soil and extend stripping to a reasonably smooth surface in consolidated subsoil. Except as shown on the drawings, foundation slopes shall be excavated to one horizontal to one vertical, or flatter.

4. Borrow Area Stripping

Borrow areas shall be stripped to expose material suitable for earth fill.

CONSTRUCTION SPECIFICATION

SD-5 EXCAVATION

1. Scope

The work shall consist of excavation required by the drawings and specifications and disposal of the excavated material.

2. Classification

Common Excavation is defined as the excavation of all materials that can be excavated, transported, and unloaded using heavy ripping equipment and heavy rubber tired loaders or scrapers with pusher tractors. This classification includes rocks smaller than one cubic yard.

Rock Excavation is defined as the excavation of all hard, compacted, or cemented materials that require blasting or the use of unusually large ripping and excavating equipment. This classification includes the removal of isolated rocks larger than one cubic yard.

Unclassified Excavation is defined as the excavation of all materials (including rock) encountered, regardless of the nature of the material or the excavation method needed.

3. Use of Excavated Materials

To the extent needed, all suitable materials from excavations shall be used in the construction of specified earth or rock fills. Suitability of materials for specific purposes will be determined by the Natural Resources Conservation Service (NRCS) inspector. The contractor shall not waste or otherwise dispose of suitable excavated materials.

4. Disposal of Waste Materials

All surplus and unsuitable excavated materials will be disposed of at the locations shown on the drawings or designated by the landowner or NRCS inspector. The disposal site shall be left in a neat condition and sloped to provide drainage.

5. Excavation Limits

Excavated surfaces too steep to be safe without support, shall be supported as necessary to safeguard the work and workers. The width of the excavation shall be increased if necessary to provide space for sheeting, bracing, shoring, and other supporting installations. The contractor shall furnish, place, and subsequently remove such supporting installations. Excavation side slopes may be flattened for safety reasons where approved by the NRCS inspector.

Excavations shall be completed to specified lines and grades prior to placement of earth fill or construction of structures.

7. Borrow Excavation

When suitable materials from specified excavations are insufficient to construct specified fills, additional material shall be obtained from designated borrow areas. The extent and depth of borrow pits shall be as approved by the NRCS inspector. Borrow pits must be shaped to eliminate unsightly conditions and steep or unstable slopes.

CONSTRUCTION SPECIFICATION

SD-7S EARTHFILL-CLASS S

1. Scope

The work shall consist of the construction of compacted earth fills where the amount of compaction is to be controlled by specifying a construction method.

2. Materials

All fill materials shall be obtained from required excavations and designated borrow areas. Selection, blending, placement, and compaction of fill will be subject to approval of the Natural Resources Conservation Service inspector.

Fill materials shall contain no frozen material, sod, roots or other perishable material, or rocks larger than eight inches in diameter. Fill shall not be placed on a frozen surface.

3. Foundation Preparation

All foundation (including abutment) surfaces shall be shaped one horizontal to one vertical or flatter except as otherwise specified.

After stripping (see stripping specification), the foundation shall be loosened thoroughly by scarifying or plowing to a minimum depth of four inches. The foundation shall then be compacted by the process specified for the fill.

4. Placement

All foundation excavation and preparation shall be completed before placing fill. Except as required by the drawings, fill material shall be mixed and uniformly placed throughout the entire fill without lenses, streaks, pockets, or layers of material that differ significantly from surrounding material.

Placement and compaction methods must prevent damage to structures and allow the structure to assume backfill loads gradually and uniformly. Within 2 feet of any structure, fill layer thickness must not exceed 4 inches and equipment loads must not exceed 400 pounds.

Fill shall be placed in approximately horizontal layers. Except as described above, fill layer thickness shall not exceed nine inches for compaction by large machines or four inches for small hand directed power tampers.

If the surface of any layer becomes too hard and smooth for proper bond with the succeeding layer, it shall be scarified parallel to the axis of the fill, to a depth of not less than two inches, before the next layer is placed.

Except as otherwise specified, openings temporarily left in dam fills (for pipe installation, stream flow, etc.) shall have side slopes three horizontal to one vertical or flatter. When filling the opening, the bonding surface of the fill in place shall be stripped of all material not meeting the requirements of this specification and shall be scarified, moistened, and recompacted as new earthfill is placed.

5. Control of Moisture Content

At the time of compaction, earth fill shall have a moisture content that when kneaded in the hand will form a ball that does not easily crumble when pressed between the hands. If the soil is too wet, it will yield free water when kneaded in the hand.

Fill materials must be wetted or dried as needed to achieve proper moisture prior to compaction.

6. Compaction (Class S)

Fill layers shall be compacted by one of the following methods.

- a. By routing the hauling and spreading equipment such that all points of the fill are traversed by at least one tread track of the loaded equipment traveling parallel to the centerline of the fill.
- b. By at least 2 passes of a tamping (sheepsfoot) roller weighing at least 100 pounds per square inch of bearing area.

Fill adjacent to structures shall be compacted to a density equivalent to that of the surrounding fill by means of hand tamping or manually directed power tampers or plate vibrators. Within 2 feet of any structure, equipment loads must not exceed 400 pounds.

Compaction of fill adjacent to concrete structures shall not be started for at least the following number of days after placement of the concrete.

Concrete Structure	Days After Concrete Placement
Vertical or near-vertical walls with earth load on one side only	14
Walls backfilled on both sides simultaneously	7
Conduits and spillway risers, cast-in-place (with inside forms in place)	7
Conduits and spillway risers, cast-in-place (forms removed)	14
Conduits, pre-cast, cradled	2
Conduits, pre-cast, bedded	1
Anti-seep collars and cantilever pipe supports (backfill both sides simultaneously)	3

CONSTRUCTION SPECIFICATION

SD-8 ROCK RIPRAP AND BEDDING

1. Scope

The work shall consist of furnishing and installing loose rock riprap and blankets, including filter layers, bedding, or geotextiles as shown on the drawings.

2. Materials

Rock Riprap - Individual rock fragments shall be dense, hard, durable, and free from cracks, seams, and other defects conducive to accelerated weathering. Except as otherwise specified, rock fragments shall be angular or sub-rounded. The least dimension of an individual rock fragment shall be not less than one-third the greatest dimension of the fragment. ASTN D4992 provides guidance on selecting rock from a source.

Rock that fails to meet the above requirements will be accepted only if similar rock from the same source has been demonstrated to be sound after three years of exposure to conditions similar to conditions where the riprap is to be placed.

The rock shall conform to the grading limits shown on the drawings. Sand, rock fines, and dirt shall be less than five percent of the total weight of the riprap.

Sand, Gravel Filter - Filter aggregates shall be sand, gravel, crushed stone, or mixtures thereof. Aggregates shall be composed of clean, hard, durable mineral particles free of organic matter, clay balls, soft particles, or other substances that would interfere with free-draining properties of the aggregates.

Not more than 5 percent of the material of the material may be limestone and not more than 15 percent may be flat, elongated particles.

Except as otherwise shown on the drawings, the aggregate shall meet the following gradation requirements after placement.

Filter Aggregate Size	Percent Finer by Weight
3"	100
1"	90 to 100
#4	50 to 85
#50	10 to 40
#200	0 to 5

Geotextile - Geotextiles shall conform to the National Engineering Handbook Material Specification 592-Geotextile. The geotextile fabric shall be protected from moisture, dust, dirt, debris, and ultraviolet light prior to installation.

3. Subgrade Preparation

Subgrade surfaces on which riprap, bedding, or geotextile will be placed shall be cut or filled to the lines and grades shown on the drawings. When fill to subgrade lines is required, it shall consist of approved materials and shall conform to the requirements of the specified class of fill.

Riprap, bedding, or geotextile shall not be placed until the foundation preparation is completed and the surfaces have been inspected and approved by the Natural Resources Conservation Service inspector.

4. Equipment-placed Rock Riprap

Rock riprap shall be placed by equipment on the surface and to the depth specified. It shall be installed to the full course thickness in one operation and in a manner as to avoid serious displacement of the underlying material. The rock shall be delivered and placed in a manner that ensures the riprap in place is reasonably homogenous with the larger rocks uniformly distributed and firmly in contact one to another and with the smaller rocks and spalls filling the voids between the larger rocks. Some hand placing may be required to provide a neat and uniform surface.

Rock riprap shall be placed in a manner to prevent damage to structures. Hand placing is required as necessary to prevent damage to new and existing structures.

5. Hand-placed Rock Riprap

The rock riprap shall be placed on the surface and to the depth specified. It shall be securely bedded with the larger rocks firmly in contact one to another without bridging. Spaces between the larger rocks shall be filled with smaller rocks and spalls. Smaller rocks shall not be grouped as a substitute for larger rocks. Flat slab rock shall be laid on its vertical edge except where it is laid like paving stone and the thickness of the rock equals the specified depth of the riprap course.

6. Filters, Bedding, or Geotextiles

When the drawings specify filters, bedding, or geotextile beneath the rock riprap, the designated material shall be placed on the prepared subgrade surface as specified. Compaction of filter or bedding aggregate is not required, but the surface of such material shall be furnished reasonably smooth and free of mounds, dips, or windrows.

Where drawings require geotextiles beneath riprap, the geotextile shall be laid on the prepared subgrade surfaces with no folds or ripples. The geotextile fabric should be in direct contact with the subgrade surface. Except as otherwise specified, the fabric should be placed parallel to stream alignments and perpendicular to lake shorelines. Except as otherwise specified, the geotextile splices shall overlap at least 18 inches, or shall be sewn following the geotextile manufacturer's recommendations. Anchoring pins shall be placed as recommended by the geotextile manufacturer except as otherwise specified.

CONSTRUCTION SPECIFICATION

SD-10 SALVAGING AND SPREADING TOPSOIL

1. Scope

The work shall consist of salvaging topsoil from borrow pits or other excavations and spreading it in the designated areas to the specified depths.

2. Quality of Topsoil

Topsoil shall consist of friable soil reasonably free of grass, roots, weeds, sticks, stones, or other foreign materials.

3. Excavation

Topsoil shall be removed after clearing, grubbing and removing vegetation and shall be stockpiled. Objectionable materials shall be removed and buried, or disposed of, at locations approved by the Natural Resources Conservation Service inspector.

4. Spreading

Spreading shall not be done when the ground or topsoil is frozen, excessively wet, or otherwise in a condition detrimental to the work. Surfaces to be covered shall be lightly scarified just prior to the spreading operation.

All earth fills not to be submerged shall be covered with topsoil to a depth of 6 to 18 inches measured perpendicular to the surface of the fill and placed to the neat lines shown on the drawings.

After placement is completed, the topsoil surface shall be left in a condition that will permit seeding equipment to be operated without excessive smoothing.

CONSTRUCTION SPECIFICATION
SD-12B CONCRETE FOR MINOR STRUCTURES
(GENERALLY FOR STRUCTURES <10 CU. YD.)

1. Scope

The work shall consist of proportioning, forming, placing, finishing, and curing Portland cement concrete.

2. Materials

Portland Cement shall conform to ASTM C150, Type II or IIA, and shall be low alkali. Partially hydrated or damaged cement shall not be used.

Aggregates shall conform to the requirements of ASTM C33. Coarse aggregates shall be size 467 (1/2 inch to #4 sieve) unless otherwise specified. Aggregates must be free of contamination and segregation.

Water shall be clean, free of harmful chemicals, and suitable for drinking.

Air-entraining admixtures must follow the Manufacturer's recommendations.

3. Concrete Mix Design

The contractor or person in charge of construction shall be responsible for designing a concrete mix that will produce 3,000 pounds per square inch compressive strength at 28 days and meet the following requirements:

The concrete mix must contain less than six gallons of water per bag of cement.

The mix must contain at least six bags of cement per cubic yard of concrete.

Air-entrainment shall be between four and seven percent by volume.

Concrete slump after mixing must be between two and five inches.

Use of ready mixed concrete meeting this specification is encouraged. Upon request, the vendor must provide the owner and the Natural Resources Conservation Service inspector a signed delivery ticket giving the quantities of concrete, cement, fine aggregate, coarse aggregate, and water contained in the batch.

Calcium chloride, Sodium chloride (salt) or other corrosive accelerators shall not be used.

4. Concrete Forms

Forms shall be wood, plywood, metal, fiberglass, or other approved material. The forms and associated false work shall be substantial and unyielding and shall be constructed so that the finished concrete will conform to the specified dimensions and contours. Form surfaces shall be smooth and free from holes, dents, sags, or other irregularities. Forms shall not be embedded in the concrete.

5. Placing Concrete

Concrete shall be placed in final position within one and one-half hours after adding cement (water if using sack-crete premix) to the mix.

Earth surfaces under concrete shall be compacted and free of debris, frost, ice, or flowing water. Concrete shall not be dropped more than five feet vertically without use of equipment designed to prevent segregation.

Each layer of concrete must be completely consolidated by spading, hand tamping, and/or mechanical vibration. Vibration shall compact the concrete and bring it into intimate contact with the forms, reinforcing steel, and other embedded items while removing voids and pockets of trapped air.

Unformed concrete surfaces (excluding slip-formed surfaces) exposed in the completed work shall be accurately struck off to grade and then float finished. Concrete edges exposed in the final work shall be chamfered or finished with molding tools.

Concrete shall be placed at air temperatures between 40°F and 80°F unless special measures are taken to protect the concrete. Concrete must be protected from freezing for 24 hours after placement.

6. Curing

All concrete shall be cured by keeping all exposed surfaces wet for 7 days (counting only days above 50°F). Alternately, the wet cure process can be stopped when curing compound is applied as recommended by the manufacturer.

7. Defective Concrete

Honey combed areas and other voids in concrete must be promptly repaired with mortar patching immediately upon discovery.

Damaged concrete and concrete not meeting requirements of this specification will be rejected.

CONSTRUCTION SPECIFICATION

SD-15 CORRUGATED METAL PIPE

1. Scope

The work shall consist of furnishing and placing circular, arched, or elliptical corrugated metal pipe and fittings as shown on the drawings.

2. Materials

Corrugated steel pipe shall conform to Material Specification SD-50. Aluminum corrugated pipe shall conform to Material Specification SD-51.

3. Handling the Pipe

The contractor shall furnish equipment as necessary to install the pipe without damaging the pipe or coating. The pipe shall be transported and handled in a manner that will prevent damage to the pipe, coating, or appurtenances.

4. Repair of Damaged Coating

Damage to metallic coating shall be repaired as follows. Clean the damaged surface area by sand blasting, power disk sanding, or wire brushing. Remove all dirt, products of corrosion, and loose and cracked coating. Remove oil and grease material with a solvent. Paint the clean and dry surface using one of the following options.

- a. Zinc dust - zinc oxide primer, ASTM D79 and D520
- b. Zinc dust paint, ASTM 4146

When metallic coating is damaged in any individual area larger than 12 square inches or when more than 0.2 percent of the total surface area of a single pipe section is damaged, that section of pipe will be rejected.

Breaks, scuffs, or weld damage areas in bituminous coatings shall be repaired by a coat of cold-applied bituminous mastic at least 0.05 inch thick. When individual breaks exceed 36 square inches or when the total area of breaks exceeds 0.5 percent of the total surface of an individual pipe section, that section will be rejected.

Breaks, scuffs, or weld damage areas in polymer coatings shall be repaired by application of a polymer material similar to and compatible with the durability, adhesion, and appearance of the original polymer coating, as described in ASTM A849, paragraph 6.8. When individual breaks exceed 36 square inches in area or when the total area of breaks exceeds 0.5 percent of the total surface area of the individual pipe section, that section of pipe will be rejected.

5. Laying and Bedding the Pipe

Unless otherwise specified, the pipe shall be installed in accordance with the manufacturer's recommendations. Pipe shall be installed so no reversal of grade exists between joints except as shown on the drawings. The pipe shall be installed with the outside laps of circumferential joints pointed upstream and with longitudinal laps at the sides near the vertical mid-height of the pipe.

Field welding of corrugated steel pipe is not permitted. Pipe sections shall be joined with specified, fabricator-supplied coupling bands. Couplings shall be installed as recommended by the fabricator.

Perforated pipe shall be installed with the perforations down and oriented symmetrically about a vertical centerline. Perforations shall be clear at the time of installation.

The pipe shall be firmly and uniformly bedded throughout its full length. Except as shown on the drawings, pipe must be laid on moist, compacted foundation, with a two-to-three-inch layer of loose moist soil adjacent to the bottom of the pipe.

6. Earth, Sand or Gravel Backfill

Backfill shall be as shown on the drawings. During backfilling, the pipe shall be loaded sufficiently to prevent displacement.

Except as otherwise specified, backfill around the pipe shall be placed in layers not more than four inches thick before compaction. Each layer of backfill shall be compacted to the density and moisture requirements specified for adjacent fill. Backfill around the pipe shall be brought up uniformly on both sides and shall extend a minimum of two feet over the pipe before large machines travel over the pipe.

7. Concrete Backfill

Where concrete backfill is shown on the drawings, the specified requirements must be met. The pipe must be loaded or anchored sufficiently to prevent displacement during concrete placement. The pipe must not be in contact with other embedded metal items such as steel reinforcement.

Where aluminum or aluminum coated pipe is shown to be embedded in concrete, the pipe surfaces to be in contact with concrete shall be coated with two coats of a bituminous paint of the cutback type.

CONSTRUCTION SPECIFICATION

SD-16 WOOD FABRICATION AND INSTALLATION

1. Scope

The work shall consist of furnishing and constructing wood structures and wood parts of composite structures.

2. Plywood Material

Plywood and Oriented Strand Board for use in above ground sheltered construction (buildings etc.,) shall meet Product Standard PS-1 and shall conform to the requirements shown on the drawings.

Plywood for use in exposed above ground construction shall be exterior grade, meet Product Standard PS-1 and shall conform to the requirements shown on the drawings.

Treated plywood for use above ground shall meet Product Standard PS-1 and be pressure treated with waterborne preservatives (Arsenicals) to a retention level of at least 0.4 pounds per cubic foot except as shown on the drawings.

Treated plywood that is to be in permanent contact with water or the earth must meet Product Standard PS-1 and be pressure treated with waterborne preservatives (Arsenicals) to a retention level of 0.6 pounds per cubic foot, except as shown on the drawings.

3. Structural Timber and Lumber Material

All wood material shall be sound wood free from decay and disease damage, shall be straight, not cracked, and shall meet the requirements shown on the drawings. Structural timber and lumber shall be structural grade or better.

Unless otherwise specified, all timber and all nominal lumber sizes 2X10 or larger shall be pressure treated by one of the following preservatives:

Cresote

Pentachlorophenol

Waterborne Preservatives (Arsenicals) treated to 0.4 pounds per cubic foot retention

Unless otherwise specified, all nominal lumber sizes 2X8 or smaller shall be pressure treated using waterborne preservatives (Arsenicals). Wood for use above ground shall be treated to a retention level of at least 0.4 pounds per cubic foot. Wood for use in permanent contact with water or earth shall be treated to a retention level of at least 0.6 pounds per cubic foot.

4. Metal Hardware

Bolts, nuts, washers, rods, angle iron, and other metal hardware shall be an appropriate grade of steel, and if installed underground, shall be galvanized, or have equal corrosion protection.

5. Installation

All framing shall be true and exact. Timber and lumber shall be accurately cut and assembled to close fit. Nails and spikes shall be driven with just sufficient force to set the heads flush with the surface of the wood.

Bolt holes shall be drilled for snug fit. Holes for lag screws shall be bored with a bit not larger than the body of the screw at the base of the thread.

Washers shall be used in contact with all bolt heads and nuts that would otherwise be in contact with wood.

CONSTRUCTION SPECIFICATION

SD-17 METAL FABRICATION AND INSTALLATION

1. Scope

This specification is applicable to metalwork items not covered by other specifications. It is applicable to such items as trash guards, anti-vortex devices, and similar structures or parts. It is not applicable to concrete reinforcing steel, water control gates, fences, wells, piles, or pipe conduits.

2. Materials

Steel - Except as otherwise specified, steel shall be malleable, weldable, carbon steel.

Bolts, nuts, washers, rods, rivets, etc., shall be a material equal to the steel being fastened.

Aluminum - Except as otherwise specified, aluminum shall be ASTM alloy 6061-T6.

3. Fabrication

Metal items shall be fabricated to close fit, following requirements shown on the drawings. Welds shall be made all around in a manner developing as much strength as possible.

4. Protective Coatings

Galvanizing - Except as otherwise specified, items shown on the drawings to be galvanized, shall be galvanized according to ASTM A123, except bolts, screws, and other fasteners 0.5 inch or less in diameter may be coated with electro-deposited zinc or cadmium coating following ASTM B766 or B633.

Zinc Painting - For items specified to be painted with zinc paint, the surfaces shall be cleaned and painted as follows:

Cleaning - Surfaces to be painted must be clean and dry. Remove oil and grease using a solvent. Clean surfaces to be painted using sand blasting, power disk sanding, or wire brushing.

Paint - Apply 2 coats of zinc-rich cold galvanized compound using brush, or aerosol application (example: Rust-Oleum Professional Galvanizing Compound) or zinc dust - zinc oxide primer ASTM D79, D520, or D4146.

4. Erection

All parts of the metal structure shall be properly aligned and erected true and plumb, closely conforming to the drawings.

CONSTRUCTION SPECIFICATION
SD-20A PLASTIC PIPELINE
(STOCK WATER AND/OR DOMESTIC)

1. Scope

The work consists of furnishing and installing Poly-vinyl Chloride (PVC), Polyethylene (PE), High Density Polyethylene (HDPE), and Acrylonitrile-Butadiene-Styrene (ABS) plastic pipe complete with fittings and appurtenances, as shown on the drawings.

2. Materials

Plastic pipe and fittings shall conform to Material Specification SD-55.

3. Handling and Storage

Pipe shall be delivered to the site and handled by means that provide adequate support to the pipe. Plastic pipe shall be protected from bending, impact, abrasion, and cutting damage. Manufacturer's recommendations must be followed. Special care shall be taken to avoid impact damage below 40°F temperature. Pipe that is not ultraviolet resistant must not be exposed to sunlight for more than 15 days.

4. Joints and Connections

All joints and connections shall be made to carry design flows without significant pressure loss and to withstand the maximum design working pressure without leakage. Manufacturer's recommendations must be followed.

Dissimilar metals must not be in contact with each other. Steel or other metals subject to corrosion must be protected from corrosion using high quality materials.

5. Trench Construction

Except as shown on the drawings, pipe trenches shall be not wider than 30 inches.

Where trench bottoms contain rocks or other material that may contact and damage the pipe, the trench bottom shall be excavated at least four inches below pipe grade and backfilled with bedding material consisting of sand or fine-grained soil.

Pipelines may be installed by "plow-in" where soils are suitable and rocks will not damage the pipe system.

6. Thrust Blocks

Except as otherwise specified, for pipelines greater than 1 1/2 inch diameter, thrust control shall be provided at all elbows greater than 45°, all tee connections, and at any location of potential thrust damage.

Thrust blocks must be formed against solid, compact earth. Except as otherwise shown on the drawings, thrust blocks shall consist of filling the space between the pipe and trench wall with concrete to the top of the pipe and for a distance of one foot along the pipe in each direction from center of the thrust.

7. Placement

Pipe that is not connected with flexible "slip-joint" connections must be installed in a "snake-like" position. The pipe shall be allowed to come to within a few degrees of subsoil temperature before backfilling or being connected to other facilities.

For pipe over four inches diameter, small holes shall be excavated in bedding material under pipe bells, fittings, and appurtenances as needed to assure the pipeline is uniformly supported on bedding at line and grade throughout its entire length. Blocking or mounding beneath the pipeline to bring it to design grade is not permitted. Care shall be taken to prevent distortion or damage and to exclude foreign material from entering the pipeline.

8. Testing

The pipeline shall be completely tested for 2 hours at design pressure (but not less than 10 feet of head) for pressure, leakage, and proper functioning. Lines must be slowly filled (to avoid damage) and flushed clean.

Conditions requiring repair and retest include excessive water hammer, continuing unsteady delivery of water, damage to the pipe, detrimental discharge from control valves, visible leaks, and/or loss of more than one-half gallon of water per hour per inch diameter per mile of pipe.

9. Backfill

All backfill recommendations of the pipe manufacturer shall be met. Vehicles or construction equipment shall not cross the pipe until earth cover over the pipe exceeds two feet.

Initial backfill to six inches above top of pipe is required. Except as otherwise specified, earth haunching and initial backfill shall consist of soil that is free of rocks, hard clods, or other objects more than one inch in diameter. Except where the pipe trench is precision excavated with pipe fitting bottom and with trench width not more than 110 percent of the pipe diameter, earth fill shall be worked and compacted under the haunches of the pipe to provide continuous support in layers not more than 6 inches thick. Care shall be taken to insure the pipe is not deformed, damaged, or displaced.

Final backfill shall consist of remaining backfill from top of initial backfill to ground surface, including mounding for settlement. Final backfill within two feet of the pipe shall be free of debris, rocks, or other objects three inches nominal diameter or larger. Final backfill shall be placed in approximately uniform, void free, compacted layers.

10. Potable Water Pipelines

All equipment and pipelines used for water for human consumption shall meet all requirements (including shock chlorinating) of the South Dakota Department of Health. Manufacturer's recommendations must be followed.

11. Certification and Guarantee

The installing contractor shall certify that his or her installation complies with this specification. The contractor shall furnish the installation owner a one-year written guarantee protecting the installation from defective materials and construction. Material manufacturers and pipe markings must also be supplied to the owner in writing.

CONSTRUCTION SPECIFICATION SD-28 SEEDING

1. Scope

The work shall consist of furnishing all labor, equipment, and materials needed for seeding the areas shown on the drawings.

2. General

Permanent Seeding and related operations shall be performed in the following time period:

Early Spring prior to 5/15 or

Late Summer 8/1 to 9/1 or

Dormant 11/1 to Spring Thaw

Permanent seeding must be completed as soon as possible during the first allowable seeding time period after construction. If construction ends between 5/15 and 9/15, a cover crop shall be planted immediately after construction.

3. Fertilizer

Fertilizer is ☒ Required ☐ Not Required

If fertilizer is used it shall be supplied and applied as follows: Apply fertilizer based on the recommendations from a soil test or apply 30 to 40 pounds of actual N and 40 to 60 pounds of P₂O₅ per acre. Ten to 15 tons of manure per acre may be used in lieu of the commercial fertilizer and will also increase organic matter. Five to 10 pounds of zinc per acre may be added to speed up growth on medium-textured soils. Thoroughly mix all fertilizer and/or manure into the upper three to five inches of the soil during final seedbed preparation.

4. Permanent Seeding

Seed requirements and seeding rates are listed below. Documentation must be provided showing the seed meets current South Dakota laws and regulations. The seed must be planted within one year of its latest germination test.

	Grass	Seeding Rate (PLS/Acre)	
		Drilled	Broadcast
✓	Smooth Brome ¹	16	20
	Western Wheatgrass	10	12
	Intermediate Wheatgrass	10	12
	Slender Wheatgrass	3	3
	Western Wheatgrass	20	25
	Reed Canarygrass	5	7
	Other, See Attached Seeding Sheet		

¹ Smooth brome¹ is not recommended where the adjacent vegetation is predominantly native, as smooth brome¹ is highly invasive

5. **Cover Crops**

If permanent seeding is not completed during the early spring period, a cover crop meeting the following rates and dates will be planted immediately after construction.

Cover Crop	Seeding rate (lbs./acre)	Spring Dates	Fall Dates
Millet	10-15	May 15-Aug. 15	None

The cover crop will be clipped to 8-10 inches in height or chemically killed during the boot stage to prevent seed formation. Remove or spread excess residues that would interfere with drilling the perennial species.

6. **Companion Crops**

Companion Crops are ☒ Required ☐ Not Required
to be seeded during the permanent seeding period. The companion crops shall be seeded as follows:

Crop	Seeding rate (lbs./acre)
Oats	10

The companion crop should be clipped and removed or mowed before it becomes competitive with the perennial species or sets seed.

7. **Seedbed Preparation**

The area to be seeded shall be made reasonably smooth and firm. Ditches shall be filled to conform to design lines and grades before seedbed preparation is begun. The seedbed will be worked to a depth of three to five inches. Drag or pack to break up large clods and firm the seedbed. Prior to seeding, required fertilizer shall be applied and mixed with the soil surface to a depth of three inches. The seedbed should be firm enough so that the boot heel of an average adult penetrates the soil to a depth of approximately one-half inch. The contractor shall suspend operations when the soil is too wet.

8. **Sowing Seed**

Except as otherwise specified, seeding shall be performed immediately after seedbed preparation. Seeding shall be drilled or broadcast and incorporated in a manner that will achieve uniform distribution of seed placed at appropriate soil depth. Optimum seeding depths are $\frac{1}{4}$ to $\frac{3}{4}$ inch.

When seeding waterways or similar water flow areas, machinery operations must be performed in a direction that is not parallel to water flow (use figure 8, serpentine, etc.).

9. **Mulching**

Mulching is ☒ Required ☐ Not Required

Except as otherwise specified, required mulching must be performed as soon as possible after seeding. Mulch shall be applied uniformly as follows. Straw will be applied uniformly at a rate of 3,000 pounds minimum to 4,000 pounds maximum per acre. The straw will be anchored using an anchoring tool (or a farm disk set straight with adequate weight) that has serrated straight disk blades spaced 6-10" apart that punches mulch into the ground with a depth of approximately 2 inches. All anchoring should be at right angles to the slope.

If late summer or dormant seeding dates are used, seed just prior to mulching.

COATED CORRUGATED STEEL PIPE (SD-50)

MATERIAL SPECIFICATION

1. Scope

This specification covers the quality of zinc-coated, aluminum-coated, aluminum-zinc alloy-coated, and polymer-coated corrugated steel pipe and fittings.

2. Pipe

All pipe shall be metallic zinc-coated, aluminum-coated, or aluminum-zinc alloy-coated corrugated steel pipe and fittings conforming to the requirements of ASTM A742, A760, A761, A762, A849, A875, A885, and A929 for the specified type, class, fabrication of pipe and coating, and to the following additional requirements.

When close riveted pipe is specified, the pipe shall be fabricated with circumferential seam rivet spacing that does not exceed 3 inches except that 12 rivets are sufficient to secure circumferential seams in 12-inch pipe. Longitudinal seams that will be within the coverage area of a coupling band shall be connected by flat head rivets or welding.

Where double riveting or double spot welding for pipe less than 42 inches in diameter is required, riveting or welding procedures shall be as specified for pipe 42 inches or greater in diameter.

3. Coatings

Coatings described herein equally refer to the inside and outside pipe surfaces. When coatings in addition to metallic coatings are specified, they shall conform to the requirements of ASTM A742, A760, A761, A762, A849, A875, A885, and A929 for the specified type.

Polymer-coated pipe shall be coated on each side to a minimum thickness of 0.01 inches (10 mils) (ASTM A762 grade 10/10).

4. Coupling Bands

Coupling bands must be provided to connect the pipe sections. The completed pipe joint shall be watertight and have tensile strength equal to the pipe sections. Gaskets must fit without warping, twisting, or bending.

5. Fittings

Fittings shall be steel and coated the same as adjacent pipe.

Welded (and adjacent) surfaces shall be cleaned of flux and weld splatter and coated following ASTM A780.

PLASTIC PIPE (SD-55)

MATERIAL SPECIFICATION

1. Scope

This specification covers the quality of Poly Vinyl Chloride (PVC), Polyethylene (PE), High Density Polyethylene (HDPE), and Acrylonitrile-Butadiene-Styrene (ABS) plastic pipe, fittings, and joint materials.

2. Material

The pipe and fittings shall be free of visible cracks, holes, foreign inclusions, or other defects, and shall have dimensions measured as prescribed in ASTM D2122. Joints and fittings shall be as described in the pipe AWWA or ASTM specification and shall be compatible with and have pressure ratings at least equal to the specified pipe. Rubber gaskets for pipe joints shall conform to ASTM F477 Elastomeric Seals (Gaskets for Joining Plastic Pipe). Except as otherwise specified, pipe must conform to the following specifications.

Poly vinyl chloride (PVC) Pipe

Plastic pipe - Schedule 40, 80, or 120	ASTM D1785 or D2466
Pressure rated pipe - SDR Series	AWWA C900 or ASTM D2241
Plastic drain, waste, and vent pipe and fittings	ASTM D2665
Composite sewer pipe	ASTM D2680
Type PSM PVC sewer pipe and fittings	ASTM F3034
Large-diameter gravity sewer pipe and fittings	ASTM F679
Smooth-wall Underdrain Systems for Highway, Airport, and Similar Drainage	ASTM F758
Type PS-46 gravity flow sewer pipe and fittings	ASTM F789
Profile gravity sewer pipe and fittings based on controlled inside diameter	ASTM F794
Corrugated sewer pipe with a smooth interior and fittings	ASTM F949
Pressure pipe, 4-inch through 12-inch for water distribution	AWWA C900
Water transmission pipe, nominal diameters 14-inch through 36-inch	AWWA C905

Polyethylene (PE) pipe

Schedule 40	ASTM D2104
SIDR-PR based on controlled inside diameter	ASTM D2239
Schedules 40 and 80 based on outside diameter	ASTM D2447
SDR-PR based on controlled outside diameter	ASTM D3035

High density polyethylene (HDPE) pipe

Plastic pipe and fittings	ASTM D3350
SDR-PR based on controlled outside diameter	ASTM F714
Plastic moldings and extrusion compounds	ASTM D1248
Heat joining polyolefin pipe and fittings	ASTM D2657

Acrylonitrile-butadiene-styrene (ABS) pipe

Plastic pipe, schedules 40 and 80	ASTM D1527
Plastic pipe, SDR-PR	ASTM D2282
Schedule 40 plastic drain, waste, and vent pipe	ASTM D2661
Composite sewer pipe	ASTM D2680
Sewer pipe and fittings	ASTM 2751

3. Perforations

Except as otherwise specified, perforations of perforated pipe shall meet the following requirements:

- a. Perforations may be circular or slots, but must be free of materials that reduce effective openings.
- b. Circular perforations shall be 3/16 to 5/16 inch diameter holes arranged in rows parallel to the axis of the pipe. Center-to-center perforation spacing along rows shall not exceed 2.5 inches. Perforations may appear at the ends of short and random lengths. Rows shall be arranged in equal groups at equal distance from pipe bottom vertical centerline. Lowermost rows shall be separated by 60 to 125 degrees. Uppermost rows shall be separated by an arc of 166 degrees or less. Other rows shall be uniformly spaced.

- c. Slot perforations shall be located within two rows, with one row in each of the lower quadrants of the pipe. Slots shall be no wider than 1/8 inch and spaced no more than 1.5 inches apart.
- d. Row numbers and minimum openings must be as follows.

Nominal pipe size, inch	Perforations		Minimum opening/foot, square inches
	Minimum number of rows circular	slot	
3 to 4	2	2	0.22
6 to 10	4	2	0.44
12 or larger	6	2	0.66

4. Potable use pipeline

Pipelines specified for use to carry potable water shall meet requirements of the National Sanitation Foundation (NSF).

CONSTRUCTION SPECIFICATION

SD-95 GEOTEXTILE

1. Scope

The work shall consist of furnishing all material, equipment, and labor necessary for the installation of geotextiles.

2. Quality

Geotextiles shall conform to the requirements of Material Specification SD-592 and this specification.

3. Storage

Before installation, geotextile shall be protected from damage by weather, sunlight, and other causes.

4. Surface Preparation

The surface on which geotextile is to be placed shall be graded to the lines and grades shown on the drawings. Except as shown on the drawings, the surface shall be reasonably free of loose rock and clods, holes, depressions, projections, water, and muddy conditions.

5. Placement

Before geotextile is placed, the soil surface will be inspected for quality assurance. Geotextile shall be unrolled along the placement area and loosely laid without stretching so that it will conform to surface irregularities without tearing when upper materials are placed. The geotextile may be folded and/or overlapped as needed for proper placement. Geotextile sections shall be joined by sewing or overlapping.

Geotextile sections joined by sewing shall have seams producing minimum seam strength equal to 90 percent of minimum fabric strength. The sewn overlap shall be at least six inches, and the sewing shall consist of at least two parallel stitched rows at least one-half inch apart with rows at least two inches from fabric edges. The stitching must be a lock-type stitch. Installed geotextile must be secured to prevent movement during construction.

Geotextile sections joined by overlapping shall be overlapped a minimum of 18 inches and secured to the underlying soil surface using securing pins as provided and recommended by the geotextile manufacturer. Upstream or upslope geotextile sections shall overlap abutting downslope geotextile.

Geotextile tears shall be repaired by overlap (described above) of additional geotextile placed in contact with the torn geotextile.

GEOTEXTILE (SD-592)

MATERIAL SPECIFICATION

1. Scope

This specification covers the quality of geotextile.

2. General Requirements

Geotextiles shall be a minimum of 85 percent by weight polypropylenes, polyesters, polyamides, polyethylene, polyolefins, or polyvinylidenechlorides. They shall be formed into a stable network of filaments or yarns retaining dimensional stability relative to each other. The geotextile shall be defect free and conform to Table 1 or 2 requirements as applicable to the material specified. The geotextile shall be free of chemical treatments or coatings that reduce its porosity. Geotextiles shall have enhanced resistance to ultraviolet light.

Thread used for sewing shall be high strength polypropylene, polyester, or polyamide, and shall be at least as resistant to ultraviolet light as the geotextile.

3. Classification

Woven - Fabrics formed by interweaving monofilament yarn, creating distinct and measurable openings. The edges of woven fabric shall be selvaged or otherwise finished to prevent the outer yarn from unraveling.

Nonwoven - Fabrics formed by random placement of threads in a mat and bonded by needle punching.

4. Shipping and Storage

Geotextile shall be shipped in rolls wrapped with a cover. Each roll shall be labeled to clearly identify the brand, class, and production run following ASTM D4873.

Table 1. Requirements for Woven Geotextile

Property	Test Method	Class I	Class II&III	Class IV
Tensile strength, lb. ^{1/}	ASTM D4632	200 min.	120 min.	180 min.
Elongation at failure, % ^{1/}	ASTM D4632	<50	<50	<50
Puncture, lb. ^{1/}	ASTM D4833	90 min.	60 min.	60 min.
Ultraviolet light, % residual tensile strength	ASTM D4355 150-hr. exposure	70 min.	70 min.	70 min.
Apparent opening size (AOS)	ASTM D4751	As specified, but >.212mm (#70 ^{2/})	As specified, but >.212 mm (#70)	As specified, but >.212mm (#70)
Percent open area (%)	CWO-02215-86 ^{3/}	4.0 min.	4.0 min.	1.0 min.
Permeability, permittivity Sec. ⁻¹	ASTM D4491	0.10 min.	0.10 min.	0.10 min.

Table 2. Requirements for Needle-Punched Nonwoven Geotextile

Property	Test Method	Class I	Class II	Class III	Class IV
Tensile Strength, lb. ^{1/}	ASTM D4632	180 min.	120 min.	90 min.	115 min.
Elongation at failure, % ^{1/}	ASTM D4632	≥ 50	≥ 50	≥ 50	≥ 50
Puncture, lb.	ASTM D4833	80 min.	60 min.	40 min.	40 min.
Ultraviolet light, % residual tensile strength	ASTM D4355 150-hr. exposure	70 min.	70 min.	70 min.	70 min.
Apparent Opening Size (AOS)	ASTM D4751	As specified max. #40 ^{2/}	As specified max. #40 ^{2/}	As specified max. #40 ^{2/}	As specified max. #40 ^{2/}
Permeability permittivity sec ⁻¹	ASTM D4491	0.70 min.	0.70 min.	0.70 min.	0.70 min.

^{1/} Minimum average roll value (weakest principal direction).

^{2/} US standard sieve size.

^{3/} CWO is a US Army Corps of Engineers reference.

Water Permit Application No. 7093-3
Thomas Wolf

Top of Dam Elev - 1578.4
2nd Spillway Elev - 1575.2
P. Spillway Elev - 1573.0
Dis Emb Toe Elev - 1552.0 } Ht. = 26.4 ft. Cat. 3 - Low Hazard Dam

Normal Storage Capacity - 68 Ac-Ft
Int. Storage Capacity - 89.5
Max Storage Capacity - 128

Int. Capacity x Eff. Ht. =

From USGS WRI 98-4055 "Tech. Ltr Est. Peak Flows ... in SO"
Region A DA = 760 Ac = 1.19 mi² P_{II} = 1.1

$$Q_{25} = 218 CA^{.513} P_{II}^{4.80}$$

$$= 218 (1.19)^{.513} (1.1)^{4.80}$$

$$= 218 (1.0933) (1.5801)$$

$$= \underline{376 \text{ cfs}}$$

$$Q_{100} = 362 CA^{.521} P_{II}^{4.47}$$

$$= 362 (1.19)^{.521} (1.1)^{4.47}$$

$$= 362 (1.0949) (1.5312)$$

$$= \underline{607 \text{ cfs}}$$

Secondary Spillway Capacity

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

$$C = 2.6$$

$$L = 150$$

$$H = 3.2$$

$$= 2.6 (150)^{1.5} (3.2)^{1.5}$$

$$= \underline{2235 \text{ cfs}}$$

NRCS Annual Yield

$$DA = 760 \text{ Ac}, CN = 72 ISD = 242$$

Section 74:02:08:09

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

$$80\% \text{ chance} = 0.11$$

$$0.11 \times 760^{1/2} = \underline{7 \text{ Ac-Ft}}$$

$$50\% \text{ chance} = 0.33$$

$$0.33 \times 760^{1/2} = \underline{21 \text{ Ac-Ft}}$$

$$10\% \text{ chance} = 1.8$$

$$1.8 \times 760^{1/2} = \underline{114 \text{ Ac-Ft}}$$

Schaal, Tim

From: Stern, Laura - Brookings, SD [laura.stern@sd.usda.gov]
Sent: Friday, January 30, 2009 9:00 AM
To: Schaal, Tim
Subject: RE: Thomas Wolf dam

Top of Dam: El. 1578.4
Auxiliary Spillway: El. 1575.2
Principal Spillway: El. 1573.0
Storage to Top of the Dam: 128.1 ac-ft

Please let me know if you need any further information. As the dam design will be through the first round of inhouse review the first part of next week, I could send you preliminary plans the middle of next week if it would be beneficial. Otherwise, I can send you the approved set of plans the following week (February 9). Thank you.

Laura Stern, PE

Agricultural Engineer/FWPM
USDA-NRCS
520 Third Avenue
P.O. Box 626
Brookings, SD 57006-0626
laura.stern@sd.usda.gov
Phone: 605-692-2344 ext. 2

From: Tim.Schaal@state.sd.us [mailto:Tim.Schaal@state.sd.us]
Sent: Friday, January 30, 2009 8:31 AM
To: Stern, Laura - Brookings, SD
Subject: Thomas Wolf dam

Hi Laura--could you tell me the elevations (spillways & top of dam) and the top of dam storage capacity, thanks

Tim

United States Department of Agriculture



Natural Resources Conservation Service
520 Third Avenue, PO Box 626
Brookings, South Dakota 57006-0626

Phone: (605) 692-2344
Fax: (605) 697-5374

April 15, 2009

RECEIVED

APR 17 2009

**WATER RIGHTS
PROGRAM**

Water Rights Program
SD DENR
Joe Foss Building
523 E Capitol
Pierre, SD 57501

To whom it may concern:

Please find enclosed plans, design documentation, construction and material specifications, and a hazard classification for the Tom Wolf Dam located in the SW4, 20-106-52 in Lake County. This dam needs to go through the Water Rights Permit Process as it stores 68.3 acre-feet of water at the principal spillway. The dam also needs a Safety of Dams Review as it has a height of 26 feet and storage of 128.1 acre-feet at the top of the dam. If you have any questions, please contact me.

Sincerely,

A handwritten signature in cursive script, appearing to read "Laura Stern".

Laura Stern, PE
Agricultural Engineer

Attachment: Tom Wolf Dam Plans, Design Documentation, Construction Specifications, and Hazard Classification

cc: Chuck Lebeda, District Conservationist, NRCS, 123 SW 2nd Street, Madison, SD 57042-1956



**DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES**

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

**RECOMMENDATION OF CHIEF ENGINEER FOR WATER PERMIT
APPLICATION NO. 7093-3, Thomas Wolf**

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. 7093-3, Thomas Wolf, 416 N Chicago Avenue, Madison SD 57042.

The Chief Engineer is recommending APPROVAL of Application No. 7093-3 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. 7093-3 authorizes a dam with a storage capacity of 68.0 acre feet of water and sufficient water annually to maintain the water level to the outlet elevation.
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
May 13, 2009

REPORT ON
WATER PERMIT APPLICATION No. 7093-3
Thomas Wolf
April 27, 2009

Water Permit Application No. 7093-3 has been filed by Thomas Wolf to impound 68 acre-feet of water from runoff and springs by constructing a dam located in the SE $\frac{1}{4}$ SW $\frac{1}{4}$ of Section 20-T106N-R52W, in Lake County. The application also requests impoundment of sufficient water to maintain water to the outlet elevation. The water will be used for fish and wildlife production and livestock water purposes. A diversion of 4 gallons per minute will take place to serve livestock watering tanks.

Discussion:

The dam will be classified as a small size, Category 3, Low Hazard dam. The dam has been designed by the Natural Resources Conservation Service (NRCS). The plans and specifications have been reviewed and will be approved; however, construction of the dam can not begin until Water Permit Application No. 7093-3 is approved.

The dam will be 26.4 feet high with a normal storage capacity of 68 acre-feet with a reservoir level at the primary spillway elevation, and a maximum storage capacity of 128 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 25-year frequency event.

The dam has a drainage area of 701 acres or 1.19 square miles. The dam is designed to have a 48 inch diameter CMP riser with a 24 inch diameter CMP barrel with 5.4 feet of freeboard as the primary spillway, and a 150 foot wide earthcut secondary spillway with 3.2 feet of freeboard. A 25 year frequency event produces a peak runoff of approximately 376 cfs and a 100 year frequency event produces a peak runoff of approximately 607 cfs. The earthcut spillway will have a capacity of approximately 2235 cfs.

The annual yield for this drainage area with an 80 percent chance of occurrence, or 8 out of 10 years, is expected to be 7 acre-feet. The annual yield with a 50 percent chance of occurrence, or 1 out of 2 years, is expected to be 21 acre-feet and the annual yield with a 10 percent chance, or 1 out of 10 years, is expected to be 114 acre-feet.

The Wolf Dam will be located in the SE $\frac{1}{4}$ SW $\frac{1}{4}$ of Section 20-T106N-R52W on an unnamed tributary to an inlet slough on Lake Madison located at the west end of Lake Madison, about one mile upstream of the confluence of the unnamed tributary and the inlet slough. There are no existing Water Permits/Rights filed on the unnamed tributary between the proposed dam and the inlet slough. The Department of Game, Fish & Parks holds Vested Right Claim No. 790-3 for the storage of 10,000 acre-feet of water in Lake Madison. Approval of Water Permit Application No. 7093-3 should not have any adverse effect on Lake Madison.

Conclusions:

1. Water Permit Application No. 7093-3 should be approved since unappropriated water is available and approval should not have any adverse effect on existing Water Permits/Rights.
2. If approved, the low flow bypass requirement for domestic use should be a qualification on Water Permit Application No. 7093-3.



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



**DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES**

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

May 15, 2009

Thomas Wolf
416 N. Chicago Ave.
Madison, SD 57042

Dear Mr. Wolf:

We have reviewed the plans and specifications for your dam project located in the SE ¼ SW ¼ of Sec. 20-T106N-R52W, in Lake County. The plans and specifications for your dam 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. 7093-3 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 Wolf Dam will be classified as a small size Category 3, Low Hazard dam with a dam height of 26.4 feet and a normal storage capacity of 68 acre-feet and a maximum storage capacity of 128 acre-feet.

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

Sincerely,

Timothy G. Schaal, P.E.
Natural Resources Engineering Specialist
for Garland Erbele, Chief Engineer
Water Rights Program
(605) 773-3352

c: Laura Stern, NRCS Brookings

JUN - 4 2009

AFFIDAVIT OF PUBLICATION

WATER RIGHTS PROGRAM

STATE OF SOUTH DAKOTA }
County of Lake } ss.

Sue Anne Artko

of the City of Madison, County of Lake, State of South Dakota, being first duly sworn on oath, deposes and says:

The Madison Daily Leader is a daily legal newspaper of general circulation, printed and published in the City of Madison, in said County of Lake, by Hunter Publishing, Inc., Jon M. Hunter, publisher, and has been such legal newspaper during the times hereinafter mentioned; that the said Madison Daily Leader has been in existence as such legal newspaper for more than one year prior to the publication of the notice hereunto attached, and has during all of said time had, and how has, more than 200 bona fide subscribers; that the undersigned, the affiant, is the Secretary of the said newspaper, in charge of the advertising department thereof and has personal knowledge of all the facts stated in this affidavit and the advertisement headed

Thomas Wolf

Notice of Application to Appropriate Water (DENR)

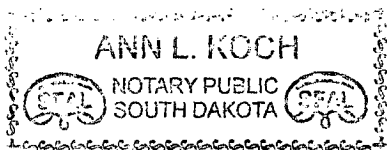
printed copy of which hereunto attached, was printed and published in the said newspaper for Two successive weeks, once each week and on the same day of the week, on the following dates, to-wit:

On Friday, the 22nd day of May, 2009;
On Friday, the 29th day of May, 2009;
On _____, the _____ day of _____, 20____;
On _____, the _____ day of _____, 20____;
On _____, the _____ day of _____, 20____;
On _____, the _____ day of _____, 20____;
On _____, the _____ day of _____, 20____;
On _____, the _____ day of _____, 20____;

That \$ 48.56 being the full amount of the fees for publication of the attached notice inures solely for the benefit of the publisher of the said newspaper; that no arrangement or understanding for a division thereof has been made with any other person and that no part thereof has been agreed to be paid to any other person whomsoever.

Sue Anne Artko

Subscribed and sworn to before me this 1st day of June, 2009



Ann L. Koch
Notary Public, Lake County, South Dakota

Friday, May 22 & 29

NOTICE OF APPLICATION
NO. 7093-3
TO APPROPRIATE WATER

Notice is given that Thomas Wolf, 416 N. Chicago Ave., Madison, SD 57042 has filed an application for a water permit to impound 68 acre-feet of water from runoff and springs by constructing a dam located in the SE 1/4 SW 1/4 Section 20 with water impounded in the SE 1/4 SW 1/4 Section 20 and the NE 1/4 NW 1/4 Section 29; all in T106N-R52W. This Application requests impoundment of sufficient water to maintain water to the outlet elevation. The water is for fish and wildlife

propagation, recreation and livestock water purposes. A diversion of 4 gallons per minutes will take place to serve livestock water tanks.

Pursuant to SDCL 46-2A-2, the Chief Engineer recommends APPROVAL of Application No. 7093-3 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 this 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 this 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 June 8, 2009.

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 petition's legal counsel, if legal counsel is obtained. Contact Eric Gronlund at the above address for request copies of information pertaining to this application.

Publicat Notary F

STEVEN M. PIRNER,

Secretary
Department of Environment
and Natural Resources

Received Payment,



DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES

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

May 13, 2009

Daily Leader
PO Box 348
Madison SD 57042

ATTENTION: Legal Public Notice

Enclosed is a Notice on Application No. 7093-3 to Appropriate Water to be published twice. Please publish the first notice on May 22, 2009 with the second publication 7 days later. The text of the notice can be e-mailed to your paper by contacting Karen Schlaak at (605) 773-3352.

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 Thomas Wolf, 416 N Chicago Ave., Madison SD 57042 (Ph # 605-427-3447).

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
Eric Gronlund
Natural Resources Engineer
605 773-3352

enclosures

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

No. 7093-3

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

Date _____

We are in receipt of your letter of May 13, 2009 enclosing Notice to Appropriate Water by Application No. 7093-3 which was first published in our issue of _____. ENCLOSED IS A COPY OF THIS FIRST PUBLICATION.

Name

Newspaper



**DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES**

PMB 2020
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.**

May 13, 2009

Thomas Wolf
416 N Chicago Ave
Madison SD 57042

Dear Mr. Wolf:

Water Permit Application No. 7093-3 for livestock and fish and wildlife use has been examined and found to comply with the South Dakota Water Laws and applicable rules. A notice has been sent to the Publisher of the Daily Leader printed at Madison SD (Ph # 605-256-4555). You will need to contact the newspaper and authorize publication of this notice. For your information, a copy of the notice, the recommendations of the Chief Engineer and reports on the applications 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 Notices 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. 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 applications.

Sincerely,

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.

Instruction to Newspaper - Publish first Notice on May 22, 2009 with the second publication 7 days later. The applicant is responsible for payment. The text of the notice can be e-mailed to your paper by contacting Karen Schlaak at (605) 773-3352 or email: Karen.schlaak@state.sd.us.

NOTICE OF APPLICATION NO. 7093-3 to Appropriate Water

Notice is given that Thomas Wolf, 416 N Chicago Ave, Madison SD 57042 has filed an application for a water permit to impound 68 acre-feet of water from runoff and springs by constructing a dam located in the SE $\frac{1}{4}$ SW $\frac{1}{4}$ Section 20 with water impounded in the SE $\frac{1}{4}$ SW $\frac{1}{4}$ Section 20 and the NE $\frac{1}{4}$ NW $\frac{1}{4}$ Section 29; all in T106N-R52W. This application requests impoundment of sufficient water to maintain water to the outlet elevation. The water is for fish and wildlife propagation, recreation and livestock water purposes. A diversion of 4 gallons per minute will take place to serve livestock water tanks.

Pursuant to SDCL 46-2A-2, the Chief Engineer recommends APPROVAL of Application No. 7093-3 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 this 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 this 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 June 8, 2009.

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.

RECEIVED

JUN - 1 2009

WATER RIGHTS
PROGRAM

Judy L. Myers
1219 S. Stoney Pointe Ct.
Sioux Falls, SD 57106

May 28, 2009

Mr. Garland Erbele, Chief Engineer
Water Rights Program
Joe Foss Building
523 East Capitol
Pierre, South Dakota 57501

Re: Petition in opposition to application number 7093-3

Dear Mr. Erbele:

I am the Trustee of the Hess Family Living Trust, the owner of real property described as: The SE 1/4 of Section 20, T106N, Range 52W, Lakeview Township, Lake County, South Dakota. The trust's interest in application number 7093-3 is due to the above-described land being adjacent to the property where Thomas Wolf is proposing construction of a pond/dam.

The Trust opposes the application for the following basic reasons:

1. Currently, water from runoff and springs naturally flows from the west through the proposed dam site in a stream onto our pasture land and has been historically used for domestic cattle watering. Installation of the pond and dam will prevent that flow until the water reaches a certain height in the dam, at which point it is released from an overflow pipe. However, when the water level is below that overflow pipe, the natural flow of water will be restricted, causing periods that prevent the use of that water for domestic cattle watering. This fact appears to be acknowledged in "Recommendation of Chief Engineer for Water Permit Application," i.e.; "Low flows as needed for downstream domestic use, including livestock water and prior water rights must be by-passed."

2. Early promises of a joint water easement regulating use of the water for both parties were not kept in good faith, causing the Hess Trust to incur substantial legal expenses relating to its preparation.

Mr. Garland Erbele, Chief Engineer

Page 2

May 28, 2009

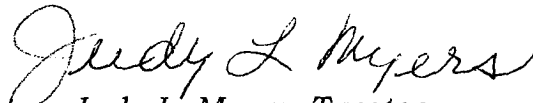
3. Due to the topography of the land, the pond and dam will sit high above the trust's cropland and building site. A dam failure would likely destroy crops (which would not be covered by crop insurance) and damage fertile farm land. Our farmer has expressed repeated concern on this issue.

4. Through inquiry, we expect the farm land and building site to significantly decrease in value due to the risks (real and perceived) associated with the dam.

5. We also have real concerns that a private citizen and all future owners are solely responsible for the continued maintenance and safety of this dam without oversight and regulation. Further, there would be no way to evaluate its condition and risk to other people's interests. Our conservation resource made us aware that unsafe alterations of dams have taken place.

Thank you for your review and consideration of the points outlined above.

Sincerely,

A handwritten signature in cursive script that reads "Judy L. Myers".

Judy L. Myers, Trustee
Hess Family Living Trust

cc: Thomas Wolf
416 North Chicago Avenue
Madison, SD 57042

Chuck Lebeda
NRCS

Richard L. Ericsson, Esq.



**DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES**

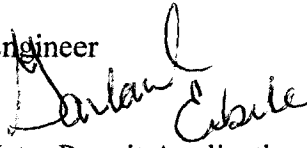
PMB 2020
JOE FOSS BUILDING
523 EAST CAPITOL
PIERRE, SOUTH DAKOTA 57501-3182
www.state.sd.us/denr

June 1, 2009

NOTICE

TO: Thomas Wolf
416 N Chicago Avenue
Madison SD 57042

Judy L. Myers
1219 S. Stoney Pointe, Ct
Sioux Falls SD 57106

FROM: Garland Erbele, Chief Engineer
Water Rights Program 

SUBJECT: Notice of Hearing on Water Permit Application No. 7093-3, Thomas Wolf

A petition in opposition to Water Permit Application No. 7093-3 has been filed by Judy L. Myers on behalf of the Hess Family Living Trust. The petition was filed in response to the Notice of Application published in the Madison Daily Leader printed and published in Madison SD. This notice schedules a hearing on the application before the South Dakota Water Management Board.

Application No. 1901-1 proposes to impound 68 acre-feet of water from runoff and springs by constructing a dam located in the SE ¼ SW ¼ Section 20 with water impounded in the SE ¼ SW ¼ Section 20 and the NE ¼ NW ¼ Section 29; all in T106N-R52W. This application requests impoundment of sufficient water to maintain water to the outlet elevation. The water is for fish and wildlife propagation, recreation and livestock water purposes. A diversion of 4 gallons per minute will take place to serve livestock water tanks.

The Water Management Board will conduct a hearing to consider Application No. 7093-3 at 3:00 PM on Wednesday, July 8, 2009 in the Floyd Matthew Training Center, Joe Foss Building, 523 E. Capitol Avenue, Pierre SD. Future notice will be provided to all parties if there are changes to the hearing time. Pursuant to SDCL 46-2-9, 46-2-11, and 46-2A-23, the Board has legal authority and jurisdiction to conduct this hearing.

Pursuant to SDCL 46-2A-2, the Chief Engineer recommends APPROVAL of Application No. 7093-3 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. 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 the application based on the evidence presented at the public hearing.

The July 8, 2009, hearing date will be automatically delayed for at least 20 days upon written request to the Chief Engineer from the applicant or any party of record opposing the application. The request for an automatic delay must be filed by June 29, 2009. In the event of a request for automatic delay, the hearing will be rescheduled for the next Board meeting to be held October 7 - 8, 2009.

This hearing may be an adversarial proceeding. Any party of record 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.

Enclosed is a copy of the report, recommendation and petition in the matter of Water Permit Application No. 7093-3. State law directs the Chief Engineer to provide Water Management Board members with a copy of all pleadings including petitions for each proceeding. This same information will be sent to the Board members in advance of the hearing. In addition, enclosed are two documents intended to acquaint parties with the hearing process entitled "Procedure for Hearings before the Water Management Board" and "Summary of South Dakota Water Laws and Rules". You are encouraged to review these documents prior to the hearing.

The 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, 46-2A-23; 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.

Questions regarding the hearing process may be directed to Eric Gronlund, Water Rights Program at (605) 773-3352. In addition, please notify the Department of Environment and Natural Resources at least 48 hours before the hearing if you have a disability for which special arrangements must be made at the hearing.

c: Diane Best, Assistant Attorney General

NOTE: Since this matter does not involve a monetary controversy in excess of \$2,500.00 or termination of a property right in accordance with SDCL 1-26-18.3, the Chief Engineer has determined this contested case need not be referred to the Office of Hearing Examiners. If any party disagrees with this determination, the Chief Engineer shall be notified by June 29, 2009.

CERTIFICATION

I hereby certify that on June 1, 2009, I have personally deposited with the United States mail at Pierre, South Dakota, first class postage, prepaid envelopes containing a Notice dated June 1, 2009, regarding hearing for Water Right Permit Application No. 7093-3, as addressed below:

Thomas Wolf
416 N Chicago Avenue
Madison SD 57042

Judy L. Myers
1219 S. Stoney Pointe, Ct
Sioux Falls SD 57106

Diane Best, Assitant Attorney General
300 N. Dakota Avenue, Suite 403
Sioux Falls SD 57104



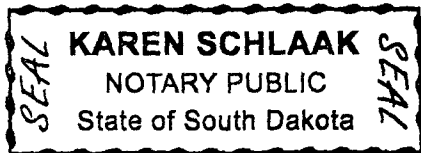
Gail Jacobson
Water Rights Program, DENR

STATE OF SOUTH DAKOTA)
) SS
COUNTY OF HUGHES)

Sworn to, before me, this 1st day of June 2009.



Karen Schlaak
Notary Public
My Commission expires April 1, 2013



RECEIVED

JUN 22 2009

WATER RIGHTS
PROGRAM

June 17, 2009

Garland Erbele, Chief Engineer
SD-DENR Water Rights Program
PMB 2020, Joe Foss Building
523 East Capitol
Pierre, South Dakota, 57501-3182

Dear Mr. Erbele:

I was very pleased to receive your letter dated June 1, 2009, stating that the SD-DENR recommendation is to approve my permit application No. 7093-3. My family has been working on the process of planning for this dam for several months and we are all very excited about the prospect of it finally being constructed.

I have been in communications with Judy L. Myers and her family, representing the Hess Family, to resolve the issue of providing water to their pastureland downstream from the proposed dam site. As you have noted in the design, we have an intake pipe above the dam with an underground water pipe transporting water to my property line with the Hess Family. Today, Ms. Meyers, representing the HAROLD AND GLADY HESS REVOCABLE TRUST, signed a mutual easement and agreement with me that would provide them water through a pipeline for the life of the dam structure. This easement will be filed at the Register of Deeds office in the Lake County Courthouse. Ms. Meyers told me at this signing that her family would not file a protest with DENR to my permit application. A copy of this document is enclosed for your records.

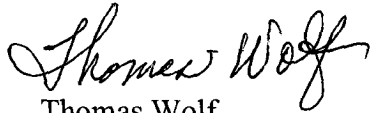
I never intended to block or prevent water flow from reaching the Hess property. I believe this dam and water pipeline will be beneficial to both the Hess Family and me by providing water through out the grazing season in the majority of the years. Currently this stream ceased running water more than a month ago and has never consistently provided adequate water to my pastures in the past. I have had to rely on dugouts for decades to provide water to these pastures.

Also enclosed is a copy of the filing with the Lake County Register of Deeds office by Lake View Township Board to abandon their right-of-way over which this dam would have impounded water. The Lake View Townships board chose to abandon the entire one-mile of ROW.

I have support from the local community on this project including the East Dakota Water Development District, the Lakes Area Improvement Association, SD-Game, Fish, & Parks, and the USDA-Natural Resources Conservation Service. This project should be very beneficial to the Lake Madison watershed and my family's personal interests.

Thank you very much for the recommendation to approve my permit application and your work on this permit application. I am looking forward to the completion of this project.

Sincerely,

A handwritten signature in black ink, reading "Thomas Wolf". The signature is written in a cursive style with a large, stylized 'T' and 'W'.

Thomas Wolf
416 N. Chicago Avenue
Madison, SD 57042

RECEIVED
JUN 22 2009
WATER RIGHTS
PROGRAM

COPY

Document prepared by:
Judy L. Myers
1219 S. Stoney Pointe Ct.
Sioux Falls, SD 57106
(605) 367-1177

MUTUAL EASEMENT AND AGREEMENT

THIS MUTUAL EASEMENT AND AGREEMENT is made and entered into by and between JUDY L. MYERS, as Trustee of the HAROLD AND GLADYS HESS REVOCABLE TRUST, of 1219 S. Stoney Pointe Ct., Sioux Falls, SD, 57106, hereinafter referred to as "HESS," and THOMAS H. WOLF and GRACE M. WOLF, Trustees of the THOMAS H. AND GRACE M. WOLF REVOCABLE TRUST dated September 14th, 1995, of 416 North Chicago Avenue, Madison, SD, 57042, hereinafter referred to as "WOLF," WITNESSETH:

WHEREAS, HESS is the fee owner of the following described real property:

The Southeast Quarter (SE ¼) of Section Twenty (20), Township One Hundred Six (106) North, Range Fifty Two (52), West of the 5th PM, Lakeview Township, Lake County, SD; AND

WHEREAS, WOLF is the fee owner of the following described real property:

The Southeast Quarter of the Southwest Quarter (SE ¼ SW ¼) of Section Twenty (20), Township One Hundred Six (106) North, Range Fifty Two (52), West of the 5th PM, Lakeview Township, Lake County, SD, and other affected lands; AND

WHEREAS, the parties desire to have an easement executed by HESS to WOLF and WOLF to HESS, in accordance with the terms of this Agreement; and

WHEREAS, it is understood that WOLF is planning the construction of a dam and is further in the process of acquiring the necessary permits and permission to build such dam on their property hereinbefore described; and

WHEREAS, such dam, if and when constructed, will be so constructed as to directly affect and impact the property of HESS as hereinbefore described; and that further, such dam will significantly affect and change the natural volume and flow of water from the WOLF property and other "upstream" properties to the HESS property; and

WHEREAS, such dam, while being beneficial to WOLF and further to downstream properties, other than the HESS property, and specifically for the proposed benefit of the water quality of Lake Madison, but being of no significant benefit to the HESS property; and

WHEREAS, the permission of HESS in the process to allow for the construction of the dam/pond/lake to directly affect and impact the HESS property and to allow the dam/pond/lake to change the normal and/or natural flow and/or volume of waters constitutes significant consideration and benefit to WOLF and its properties and the providing of continued water and access to water by and through the pipeline and/or water system, constitute significant consideration to HESS;

NOW THEREFORE, HESS and WOLF agree to allow for the direct effect and impact of the dam/pond/lake on the HESS property hereinbefore described and for the restriction of the natural flowage from the WOLF property and other "upstream" properties to the HESS property and for WOLF, its heirs and assigns, as to the above described property to be granted an easement for the life of the proposed dam structure for such dam/pond/lake and direct effect and impact as constructed and for access to and use of water from the dam/pond/lake by and through the pipeline and/or water system across the WOLF property to the HESS property, upon the following terms and conditions:

1. HESS, its heirs and assigns, as to the above described HESS property, shall not be in any way held financially responsible for the construction or maintenance and repair of the dam structure, pond/lake and/or pipeline system;

2. HESS, its heirs and assigns as to the above described HESS property, shall be entitled to have an equal share with WOLF, its heirs and assigns of an uninterrupted supply of water of four (4) gallons per minute (as needed for downstream domestic use, including livestock water) from the dam/pond/lake or reservoir created by the construction of the dam. WOLF, its heirs and assigns, will, at its sole cost and expense, install an underground pipeline system (including a shut off and hydrant) from the dam/pond/lake to the WOLF/HESS property line (see attached Exhibit "B" and paragraph nine) with water to be shared equally by HESS and WOLF, their heirs and assigns at the WOLF/HESS property line. The design will accommodate the four (4) gallon per minute flow and in no way restrict the flow of water before reaching said shut off and hydrant at the WOLF/HESS property line. The discontinued use of the pipeline system by WOLF, its heirs and assigns shall not in any way restrict or inhibit the flow of water to the shared shut off and hydrant of WOLF and HESS, and their heirs and assigns;

3. That further, WOLF, its heirs and assigns, as to the above described WOLF property shall insure the pipeline's uninterrupted use and flow from the dam/pond/lake to the WOLF/HESS property line above described; that further, any and all maintenance and repairs for

the pipeline system (including the shut off and hydrant at the WOLF/HESS property line) located on the WOLF property shall be the sole responsibility and expense of WOLF, its heirs and assigns. Additionally, said maintenance and repairs shall be arranged and implemented no later than fifteen (15) days from written notification of said needed maintenance and repairs to WOLF, its heirs and assigns;

4. It is further agreed that if the underground pipeline system is deemed by WOLF, its heirs and assigns to no longer be cost effective to maintain and repair, it shall be replaced with a functional substitute (for example an above ground pipeline) which continues to utilize the hydrant and shut off at the WOLF/HESS property line at the sole cost and expense of WOLF, its heirs and assigns. Such replacement must be in working order by no later than thirty (30) days from the date of written notification of said needed maintenance and repairs to WOLF, it heirs and assigns;

5. It is further agreed that WOLF, its heirs and assigns, shall in no way hinder or make unusable any portion of the pipeline system, including the shut-off valve and/or hydrant located on the WOLF/HESS property line;

6. It is further agreed should WOLF, its heirs and assigns, wish to discontinue its use of the pipeline system as to the above described WOLF property, such discontinued use shall be accomplished so as not to affect the use of the pipeline system, shut-off valve or hydrant for the benefit of HESS, or its heirs and assigns. However, it is further expressly understood and agreed that in the event WOLF, its heirs and assigns, should discontinue its use of the pipeline system as to the WOLF property, such discontinuation as to use as to the WOLF property shall NOT affect WOLfs', its heirs and assigns' duty and obligation, and WOLF, its heirs and assigns, shall have a continuing duty and obligation to maintain such pipeline system, shut-off valve and hydrant at its sole cost and expense to insure an uninterrupted flow of water to the HESS, its heirs and assigns' property for the life of the proposed dam structure as intended by this Agreement and Easement;

7. WOLF, its heirs and assigns shall indemnify, defend and hold HESS and its successors, assigns and tenants harmless from and against any and all claims, demands, losses, damages, liabilities and expenses of all suits, actions and judgments (including but not limited to, costs and reasonable attorneys' fees) of third parties, including but not limited to a party's employees, agents, contractors and invitees, arising out of or in any way related to the construction of and maintenance of the dam, pond and watering system on the WOLF property;

8. Attached is Exhibit "A" dated January, 2009 which is the U.S. Department of Agriculture, Natural Resources Conservation Service engineer's design (13 pages), showing the location, size and configuration of the dam, impounded area, proposed pipeline and watering system. Attached is Exhibit "B" which identifies the location of the shut off valve and hydrant at the WOLF/HESS property line. It is agreed by WOLF and HESS that Chuck Lebeda, District Conservationist at the Natural Resources Conservation Service, will oversee the construction and placement of the pipeline system, shut off and hydrant to insure compliance with this Agreement;

9. This Easement will be a continuing easement for both HESS and WOLF, their future heirs and assigns and future owners of the dam and its impounded surface waters in their entirety for the life of the proposed dam structure; herein the life of the dam structure is described as for as long a time that the dam structure exists and restricts, alters or in any way impedes the normal flow of water through this watercourse to the HESS property.

IN WITNESS WHEREOF, the parties have hereunto set their hands and seals on the dates hereinbelow written.

6-17-09
Date

Judy L. Myers (SEAL)
Judy L. Myers, Trustee of the Harold
and Gladys Hess Revocable Trust

6/17/09
Date

Thomas H. Wolf (SEAL)
Thomas H. Wolf, Trustee

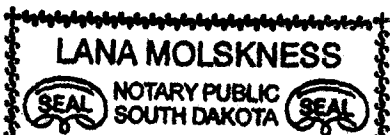
6/17/09
Date

Grace M. Wolf (SEAL)
Grace M. Wolf, Trustee of the Thomas
H. and Grace M. Wolf Revocable Trust

STATE OF SOUTH DAKOTA)
: SS
COUNTY OF LAKE)

On this the 17 day of June, 2009, before me, Lana Molskness the undersigned officer, personally appeared JUDY L. MYERS, as Trustee of the HAROLD AND GLADYS HESS REVOCABLE TRUST, known to me or satisfactorily proven to be the person whose name is subscribed to the within instrument and acknowledged that she executed the same for the purposes therein contained.

In witness whereof I hereunto set my hand and official seal.



Lana Molskness
Notary Public, South Dakota
My commission expires:

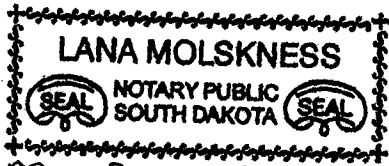
my Commission Expires 11/22/2013
STATE OF SOUTH DAKOTA)

: SS
COUNTY OF LAKE)

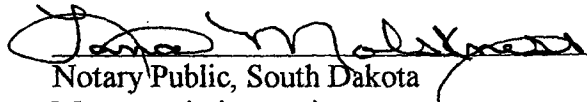
On this the 17 day of June, 2009, before me, Lana Molskness the undersigned officer, personally appeared THOMAS H. WOLF and GRACE M. WOLF, Trustees of the THOMAS H. AND GRACE M. WOLF REVOCABLE TRUST, known to me or

satisfactorily proven to be the persons whose names are subscribed to the within instrument and acknowledged that they executed the same for the purposes therein contained.

In witness whereof I hereunto set my hand and official seal.



my Commission
Expires 11/22/2013


Notary Public, South Dakota
My commission expires:

RECEIVED

JUN 17 2000

Lake County FSA

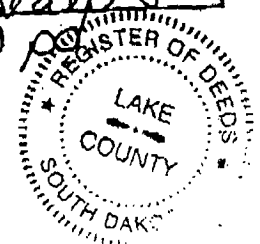
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Township: Lakeview
Name of person who prepared and filed
Resolution:
Lori Hansen
Address: 45619 235th Street
City: Madison State: SD Zip: 57042
Phone number (605) 254-7125

State of South Dakota, County of Lake
Filed for record this 17 day of June
09 2000 M., and
Recorded in Book 503 Page 450
Penny Boatwright
Register of Deeds

\$74.00



RESOLUTION AND ORDER VACATING ROADWAY

Supervisor Larry Kotten of Lakeview Township, Lake County, South Dakota, presented the following Resolution and Order and moved its adoption:

WHEREAS, a petition having been received asking for the vacation of the highway described as:

One half mile of the existing public right-of-way which includes the statutory right of way and any right of way acquired by Deed (s) lying on the section line highway running east and west commonly known as 236th Street bordered by 456th Avenue on the east and 455th Avenue on the west; and bordered on the north of Section 20 Township 106 North, Range 52W, Lakeview Township, Lake County, South Dakota and bordered on the south by Section 29, Township 106 North, Range 52W, Lakeview Township, Lake County, South Dakota; said road being approximately 66 feet in width and approximately 1/2 mile in length; west;

and further said petition being in proper form and executed by more than the required number of electors of Lakeview Township; and further it having been determined that a vacation of said highway will better serve the public convenience; and that further this petition having come on at a special meeting of the Board; and no one appearing in opposition thereto; and said Supervisors having considered said matter and being fully advised in the premises and considering it expediently advisable to do so;

NOW, THEREFORE, BE IT RESOLVED, AND IT IS HEREBY ORDERED:

That the said highway described as;

One half mile of the existing public right-of-way which includes the statutory right of way and any right of way acquired by Deed (s) lying on the section line highway running east and west commonly known as 236th Street bordered by 456th Avenue on the east and 455th Avenue on the west; and bordered on the north of Section 20 Township 106 North, Range 52W, Lakeview Township, Lake County, South Dakota and bordered on the south by Section 29, Township 106 North, Range 52W, Lakeview Township, Lake County,

451

South Dakota; said road being approximately 66 feet in width and approximately 1/2 mile in length: west be, and the same is hereby declared to be vacated; and further that a copy of this Resolution and Order be spread on the minutes of the Board;

IT IS FURTHER ORDERED that said resolution shall be published in the (newspaper) one each week for (2) consecutive weeks; and that after such publication, such highway shall be, after a lapse of thirty (30) days, vacated without further proceedings unless appealed as hereinafter provided; and that the Clerk herein is further ordered and directed to cause to be recorded a true and correct copy of this Resolution and Order in the office of the Register of Deeds in and for Lake County, South Dakota;

IT IS FURTHER ORDERED that all bridges, guardrails and culverts are hereby deemed to revert to and become the personal property and possession of the Lakeview Township.

The Motion was seconded by Supervisor Larry Kotten and upon roll call the vote was as follows:

Supervisor: Larry Kotten Yea
Lyman Laisy Yea
Tom Rook Yea

STATE OF SOUTH DAKOTA)
COUNTY OF LAKE)

I, Lori Hansen, being the duly elected, qualified and acting Clerk of the Board of Supervisors of Lakeview Township, Lake County, South Dakota, do hereby certify that the foregoing is a true and correct copy of the Resolution on the action thereon by the Board of Supervisors of Lakeview Township, Lake County, South Dakota, at a special meeting of said Board, held on the 22nd day of April, 2009, as the same appears and is now recorded in the minutes of the Clerk of the said Board of said Lakeview Township and that the same is a true and correct transcript thereof.

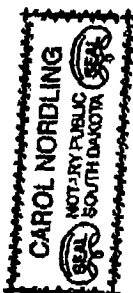
IN WITNESS WHEREOF, I have hereunto set my hand this 16th day of June, 2009.

Lori Hansen
Clerk

State of South Dakota)
County of Lake) SS

On this the 16th day of June, 2009, before me, CAROL NORDLING

the undersigned officer, personally appeared Lori Hansen, known to me or satisfactorily proven to be the person whose name is subscribed to the within Instrument and acknowledged that she executed the same for the purposes therein contained. I hereunto set my hand and official seal





**DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES**

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

JUL 22 2009

Thomas Wolf
416 N Chicago Ave
Madison SD 57042

Dear Mr. Wolf:

Enclosed is Water Permit No. 7093-3 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,

A handwritten signature in black ink, appearing to read 'Garland Erbele', written in a cursive style.

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

enclosures

Permit No. 7093-3
Sioux 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 date, October 23, 2011, made a thorough examination of the water use system constructed by Thomas Wolf of 416 N. Chicago Ave. Madison, SD 57042 holder of Permit No. 7092-3, bearing the priority of April 17, 2009 authorizing the storage of 68 acre-feet of the waters of runoff & springs for fish & wildlife propagation, recreation and livestock watering purposes, in Lake County.

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

A. Works used to divert the water:

A 26.4 foot high earthen dam with a normal storage capacity of 68 acre-feet of water with a siphon diversion of 4 gpm for livestock watering tanks.

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

1.5 inch PVC pipe siphon diversion system.

C. Works used to apply water to beneficial use:

A 26.4 foot high earthen dam with a normal storage capacity of 68 acre-feet of water with a siphon diversion of 4 gpm for livestock watering tanks.

The system is in the following condition good. The point of diversion is located 400 ft. north and 2000 ft. east of the SW corner of Sec. 20-T106N-R52W, (SE ¼ SW ¼), Lat. 43.965324 Long. -97.102144. The works are capable of storing 68 acre-feet of water which is to be used for fish & wildlife propagation, recreation and livestock watering. Water has been put to beneficial use to the maximum extent as follows:

A 26.4 foot high earthen dam with a normal storage capacity of 68 acre-feet of water with a siphon diversion of 4 gpm for livestock watering tanks.

and the license should be issued for 68 acre-feet of storage.

Applicable permit qualifications have been complied with: Yes X

Exceptions to compliance are: none Date Report Completed: February 3, 2012



Timothy G. Schaal, P.E.
Engineer IV
DENR, Water Rights Program

REPORT ON INSPECTION OF PERMIT NO. 7093-3

DATE OF INSPECTION: August 23, 2011

**NAME & ADDRESS OF PERMIT HOLDER: Thomas Wolf, 416 N. Chicago Ave.
Madison, SD 57042**

**DIVERSION POINT LEGAL LOCATION: 400 ft. north & 2000 ft. east of the SE corner of
Section 20-T106N-R52W, (SE ¼ SW ¼), Lat. 43.965324 Long. -97.102144.**

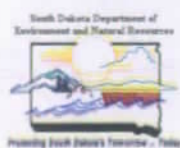
DAM INFORMATION:

- 1) Height to crest 26.4 feet
- 2) Height to primary spillway 21 feet
- 3) Height to secondary spillway 23.2 feet
- 4) Crest width 14 feet
- 5) Crest length 340 feet
- 6) Spillway length XXX feet
- 7) Spillway width 150 feet
- 8) Approx. storage (Normal) 68 acre-feet
- 9) Approx. storage (Maximum) 128 acre-feet
- 10) Date constructed: 2009

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. 7093-3



Timothy G. Schaal

Timothy G. Schaal, P.E.
Engineer IV
SD DENR, Water Rights Program

2/3/12



**DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES**

PMB 2020
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523 EAST CAPITOL
PIERRE, SOUTH DAKOTA 57501-3182
denr.sd.gov

MAR 08 2012

7093-3

Thomas Wolf
416 N Chicago Ave
Madison SD 57042

Dear Mr. Wolf:

Enclosed is your Water License No. 7093-3. The water license is the final document which completes the process of obtaining a water right. Included with your license is a map prepared by the staff engineer who conducted the field investigation.

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

STATE OF SOUTH DAKOTA

WATER LICENSE NO. 7093-3

(1) Thomas Wolf, 416 N Chicago Ave, Madison SD 57042 made Application No. 7093-3, January 26, 2009 for a water permit to impound 68 acre feet of water from runoff and springs in a dam located in Lake County, South Dakota and used for fish & wildlife propagation, recreation and domestic livestock water purposes. Permit No. 7093-3, with a priority date of April 17, 2009 was approved January 8, 2009 and issued to the applicant for impoundment of water with construction of the storage dam to be completed on or before July 8, 2014 and the application to beneficial use of water on or before July 8, 2018.

(2) It is certified that the permit holder has complied with the provisions of South Dakota State Law relating to completion of the construction of the storage dam and is entitled to impound 68 acre feet of water beneficial use with sufficient water annually to maintain the water level to the outlet elevation.

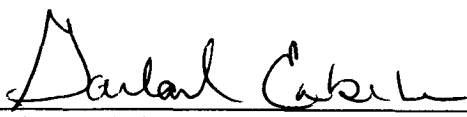
The location of the storage dam (spillway) is 400 feet north and 2,000 feet east of the SW corner of Section 20, T106N, R52W (SE ¼ SW ¼).

(3) The permit holder has complied with the provisions of South Dakota State Law relating to the application of water to beneficial use for fish and wildlife propagation, recreation and domestic livestock watering. A siphon diversion of 4 gallons per minute is also being made from the dam for filling of livestock watering tanks.

(4) Pursuant to South Dakota Water Law 46-5-30.1 Thomas Wolf, 416 N Chicago Ave, Madison SD 57042 the holder and/or owner of Water Right No. 7093-3 is issued a license to impound 68 acre feet water from runoff and springs in a storage dam with a priority date of April 17, 2009 from the location specified in (2) of this license. The water is used for fish and wildlife propagation, recreation and domestic livestock watering.

This license is subject to South Dakota Water Law, any limitations or conditions listed in Water Right No. 7093-3 and subject to the following qualifications:

- Water Right No. 7093-3 authorizes a dam with storage capacity of 68 acre feet of water and sufficient water annually to maintain the water level to the outlet elevation.
- Low flows as needed for downstream domestic use, including livestock water and prior water rights must be bypassed.



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

MAR 08 2012

date

