

WATER PERMIT NO. 2488-2

Name of Applicant: B & V Thompson Ranch, Inc.

Address: HC 56 Box 65A, Oral SD 57766 Phone: 605 424-2085

Amount of Water Claimed: 37.6 AF Total Acres: NA

Source of Water Supply: runoff

Water to be used for: fish & wildlife propagation County: Fall River

Type of Waste Disposal System:

Location: 18 miles east of Hot Springs

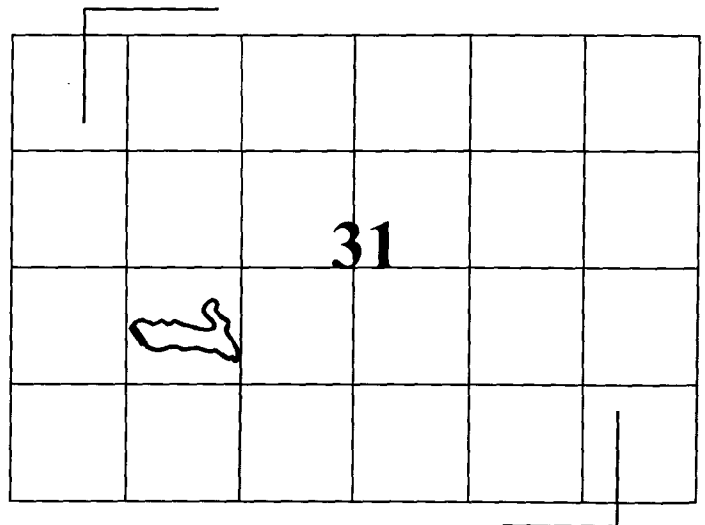
PRIORITY Date Received: 8-30-02 Application/License Fee: \$200

Corrected Application Received: Period of Annual Use: January 1 – December 31

Remarks:

Diversion Point: NW ¼ SW ¼ Sec 31-T7S-R9E

Water Impounded: NW ¼ SW ¼ Sec 31-T7S-R9E



Depth of Well: NA

Well Driller: : NA

Remarks:

Type of Map: topo

Prepared by: Gerald Miller, NRCS

Reviewed and the Number Assigned on: 9-3-2002

By: Karen Schlaak

Notice of Hearing - date to intervene: _____

**SOUTH DAKOTA
WATER PERMIT NO. 2488-2**

Date of first receipt of application August 30, 2002.

Date of return to applicant for corrections, amendments or changes September 4, 2002.

Date of receipt of corrected application September 9, 2002.

The Chief Engineer, on behalf of the Water Management Board, issues Water Permit No. 2488-2 to B & V Thompson Ranch, Inc., HC 56 Box 65A, Oral SD 57766 authorizing the construction of the dam and the placing of water to beneficial use subject to the following limitations, conditions and qualifications:

1. Water Permit No. 2488-2 authorizes impoundment of 37.6 acre-feet of water from runoff by constructing a dam on a tributary to Hay Canyon located in the NW $\frac{1}{4}$ SW $\frac{1}{4}$ Section 31 with water impounded in the NW $\frac{1}{4}$ SW $\frac{1}{4}$ Section 31; all in T7S-R9E.
2. The water appropriated shall be used for the purpose supplying water for fish and wildlife propagation and livestock water purposes and may not exceed the amount of water needed for beneficial use.
3. The water is to be used during the following described annual period: January 1 – December 31.
4. The date of approval of Permit No. 2488-2 is October 25, 2002.
5. The date from which applicant may claim right is August 30, 2002.
6. One-fifth of the construction is to be completed on or before April 25, 2004.
7. All construction is to be completed on or before October 25, 2007.
8. Water is to be put to beneficial use on or before October 25, 2011.
9. Water rights obtained in compliance with the laws of the State of South Dakota may not be unlawfully impaired by this appropriation.

QUALIFICATIONS

1. Water Permit No. 2488-2 authorizes a dam with a storage capacity of 37.6 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.

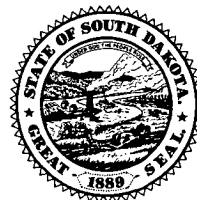
WATER MANAGEMENT BOARD

By: Garland Erbele

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

NOV 04 2002

date



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

Mail to: Water Rights Program Joe Foss Building 523 E. Capitol Pierre, SD 57501-3181 (605) 773-3352	No. <u>2488-2</u>	(office use only) Hydrologic Unit <u>10120109</u>
	Basin <u>Upper Cheyenne</u>	
	Newspaper <u>Hot Springs Star, Hot Springs</u>	

RECEIVED
AUG 30 2002
WATER RIGHTS
PROGRAM

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	

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

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

- Name of Applicant B+V THOMPSON RANCH INC. (check one) Owner Phone 605-414-2085
Mailing Address HC 56 Box 65A, ORAL State S.D. 57766
(Street, RR, or Box and City) (Zip Code)
- Amount of water claimed _____ *CFS or _____ **GPM 37.6 ***AF
(*Cubic Feet per Second) (**Gallons per Minute) (***)Acre Feet - storage capacity of dam/dugout or annual use if applicable)
- Source of water supply RUNOFF
- Location of point of diversion (example - 3 wells in SW1/4 NE1/4 section 12-T104N-R53W) NW1/4 SW1/4 Sec 31-T7S-R9E
Approximate location 115rds N and 12rds E of the SW Corner
Sec 31-T7S-R9E water impounded NW1/4 SW1/4 County FALL RIVER
- County or counties where water will be used FALL RIVER
- Annual period during which water is to be used ANNUALLY Jan. 1 - Dec 31
- Give a description of the project. When available include any preliminary engineering report or other reports or information that will help explain the project. (Attach sheet if more space is needed) A small Dam will be constructed across a tributary to Hay Canyon

STATE OF SOUTH DAKOTA) SS
County of FALL RIVER

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, Leonard Benson, 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.

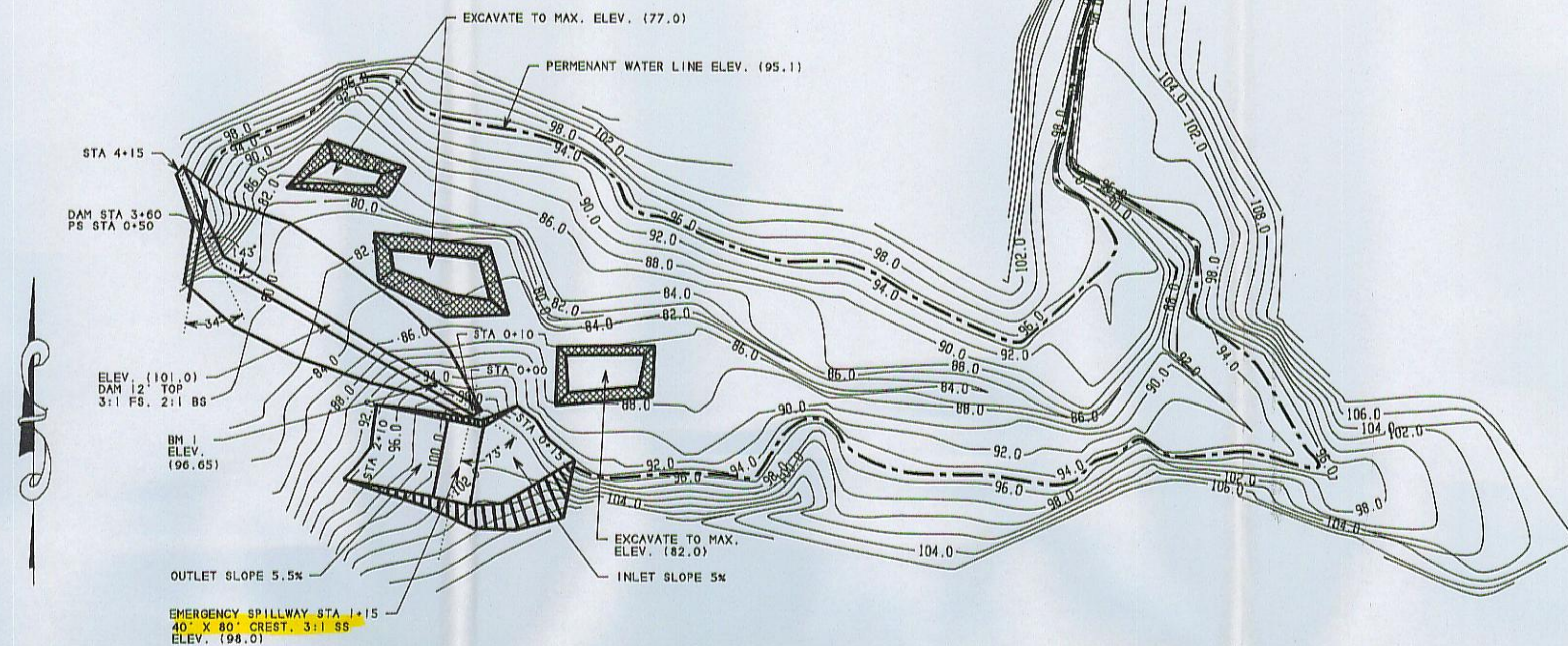
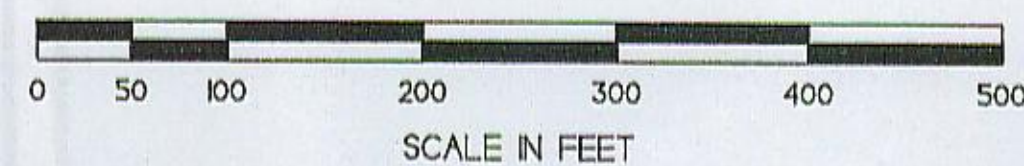
Applicant's signature Leonard Benson

Subscribed and sworn to before me this 29th day of August 20 02

Michael L. Imig
Notary Public signature

Expires 12-17-2007

PLAN VIEW



ATTACHMENTS TO PLAN

SAND ANTISEEP DRAIN (Job Plan 3.8-P)
TIMBER PIPE SUPPORT (Job Plan 4.0)
CANOPY INLET W/ ANTIVORTEX BAFFLE & GUARD
POST SUPPORT (Job Plan 5.5B)
SOUTH DAKOTA CONSTRUCTION AND MATERIAL SPECIFICATIONS

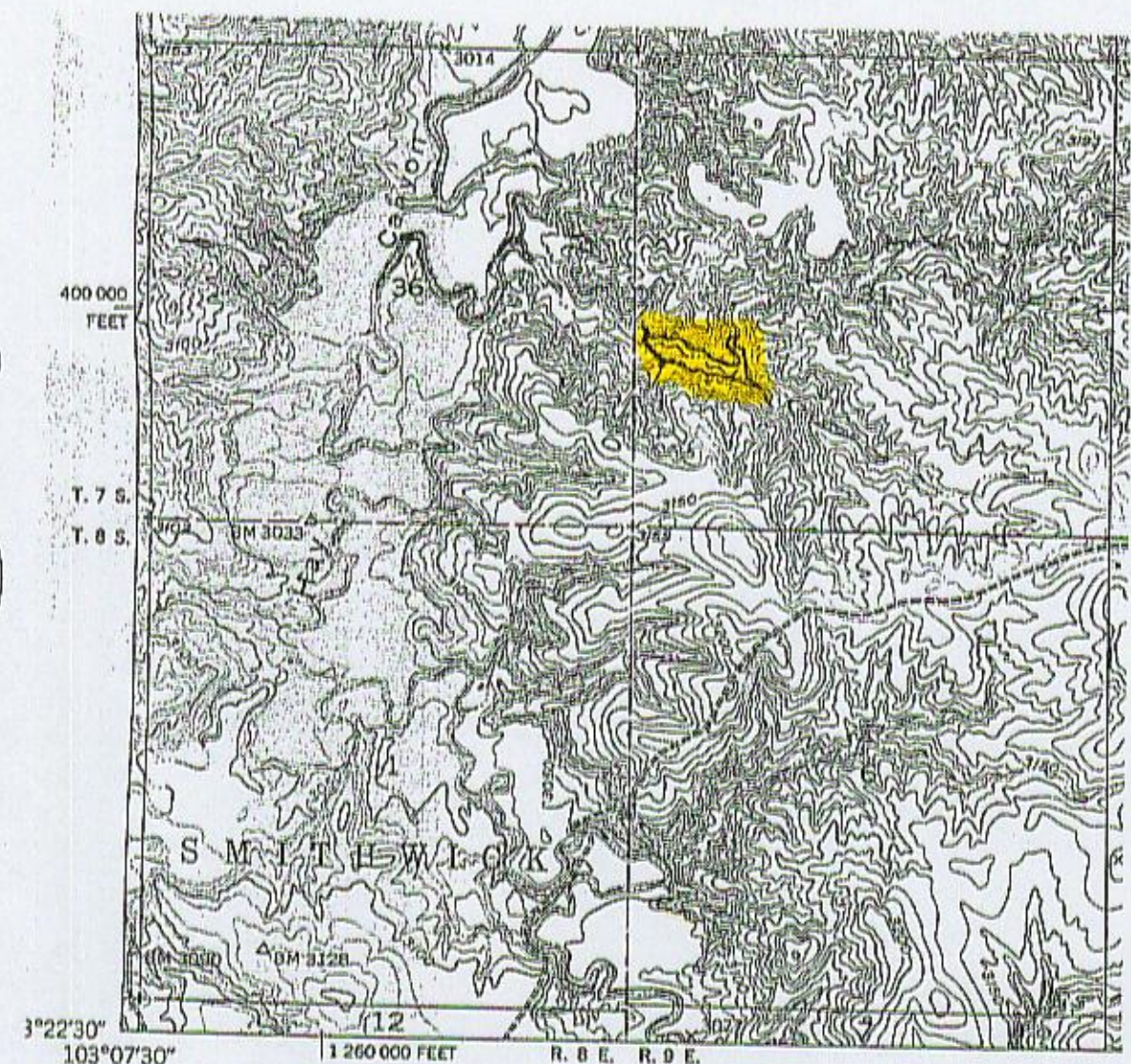
TABLE OF QUANTITIES

ITEM OR MATERIAL	UNIT	QUANTITIES BUILT
1. 15" PVC SDR 26 (160 PSI) PIP (includes elbow)	lf.	100
2. CANOPY INLET W/ ANTIVORTEX BAFFLE & GUARD POST SUPPORT (see Job Plan 5.5B, sheet 3 of 5)	ea.	1
3. 15" PVC 7.5° ELBOW	ea.	1
4. SAND ANTISEEP DRAIN (see Job Plan 3.8, sheet 4 of 5)	ea.	1
5. TIMBER PIPE SUPPORT (see Job Plan 4.0, sheet 5 of 5)	ea.	1
6. PIPE INSTALLATION		Lump Sum
7. EARTH FILL (Dam)	cy.	1500
8. EXCAVATION CORE TRENCH	cy.	350
STRIPPING	cy.	650
9. EXCAVATION BORROW AREA	cy.	1000
EMERGENCY SPILLWAY	cy.	1500

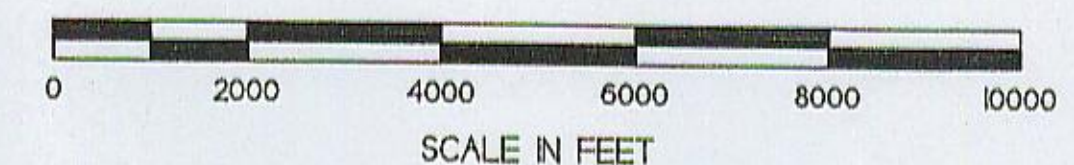
NOTE: Yardage amounts are estimates. Actual yardage will be based on calculations made from construction staking notes.

SOUTH DAKOTA CONSTRUCTION AND MATERIAL SPECIFICATIONS

SD-4 STRIPPING
SD-5 EXCAVATION
SD-7S EARTH FILL - CLASS S- (Method Type Compaction)
SD-9 DRAIN FILL AND FILTER
SD-16 TIMBER FABRICATION AND INSTALLATION
SD-55 PLASTIC PIPE



LOCATION MAP



STRUCTURE DATA

DRAINAGE AREA - 984 AC.

LENGTH OF FILL - 420 FT.

HEIGHT OF FILL - 22 FT. (Top of dam to Downstream toe)

EFFECTIVE HEIGHT - 18.7 FT.

(Elev. difference between E.S. and lowest point along CL. of Dam)

NRCS DAM SAFETY HAZARD CLASS (a)

SD DAM SAFETY:

HAZARD POTENTIAL PER S.D. 74-02:08:05

CATEGORY 3, SMALL SIZE

STORAGE X EFFECTIVE HEIGHT - 1024

STORAGE: • TOP OF DAM 77.8 AC-FT.

• EMERGENCY SPILLWAY 54.6 AC-FT. (S.A. 6.7 AC.)

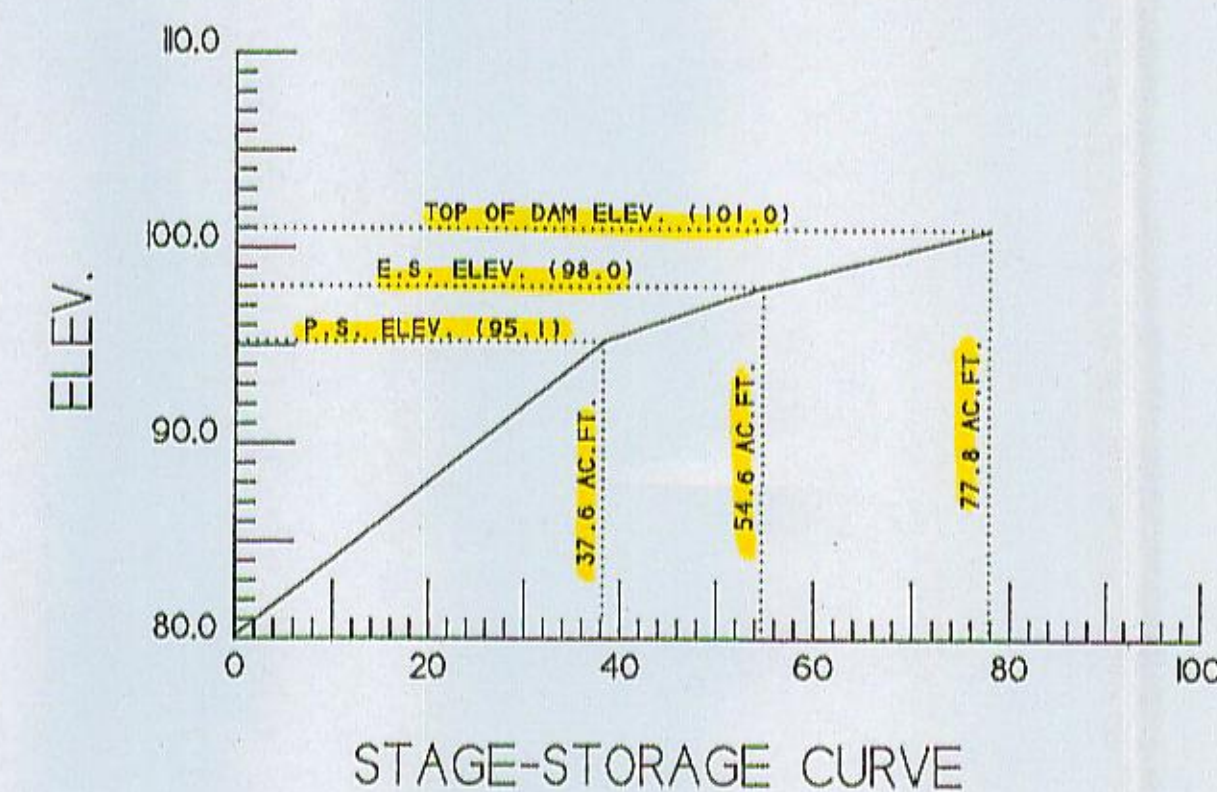
• PRINCIPAL SPILLWAY 37.6 AC-FT. (S.A. 5.5 AC.)

PRINCIPAL SPILLWAY DESIGN STORM - 2 YR

EMERGENCY SPILLWAY DESIGN STORM - 25 YR

EMERGENCY FREEBOARD STORM - 50 YR

Emergency Spillway would pass a 50 YR storm w/o overtopping Dam (0.7' freeboard).



LEONARD BENSON
DAM (FISH & WILDLIFE AND LIVESTOCK)
FALL RIVER CO., SD. - FALL RIVER CD.
NW1/4 SW1/4 31-T7S-R9E
USDA U.S. Department of Agriculture
Natural Resources Conservation Service

DESIGNED...g.miller

APPROVED BY *Shall R. Miller*

DRAFTED...g.miller

TITLE *Carl Eng. Technician*

DATE...9/01

DWG NO.

SHEET 1 OF 5 bvt/hmpl

(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

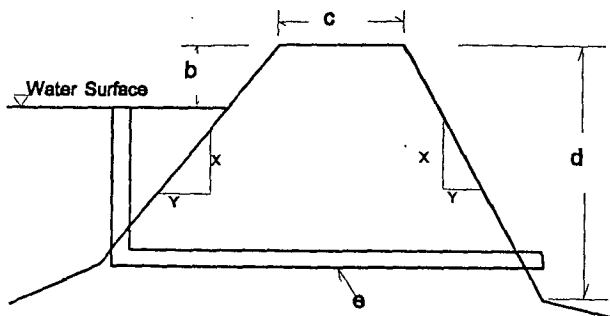
- a) Surface Dimensions _____ Depth _____
- b) Depth to water (ground surface to water level) _____

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:

Gerald T Miller, CET, NRCS
1530 Samco Rd, Suite 4, Rapid City, SD
57702-8007



- b) Freeboard 5.9 ft.
- c) Crest Width 12 ft.
 Crest Length 420 ft.
- d) Height 22 ft.
- e) Primary Outlet Capacity 23 cfs
 If pipe, diameter 15" PVC
- f) Secondary Spillway Capacity 559 cfs.
 Spillway Width 80 ft.
- g) X & Y Slope
 Upstream 3:1
 Downstream 2:1
- h) Surface Area of Impoundment 5.5 Ac.
- i) Storage 37.6 Acre Feet
- j) Drainage Area Above Dam 984 Acres

RECEIPT

WATER RIGHTS PROGRAM

South Dakota Department of Environment and Natural Resources

Date August 30, 20 02

RECEIVED OF Leonard Benson, HC 56 Box 65A, Oral SD 57766

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

Fee for Application for Permit No. <u>2488-2</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. _____		
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	150.00

No.

20263

By

Darland Erbe

Chief Engineer

gm

RECEIPT

WATER RIGHTS PROGRAM

South Dakota Department of Environment and Natural Resources

Date September 9, 2002

RECEIVED OF B & V Thompson Ranch Inc., Leonard Benson, HC 56 Box 65A, Oral SD 57766

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

Fee for Application for Permit No. _____ to Appropriate Water, to construct and to put water to beneficial use	50	00
Fee for Application for Permit No. _____ to Appropriate Water for Future use		
Fee to retain Future Use Permit No. _____ after period of seven years.		
Fee for Inspecting Constructed Works, confirming beneficial use and issuing Water License No. <u>2488-2</u>		
Fee for Filing Transfer Form _____		
Fee for _____		
Fee for Issuing New Well Driller's License No. _____ for C.Y. _____		
Fee for Renewal of Well Driller's License No. _____ for C.Y. _____		
Fee for Issuing Well Pump Installer's License No. _____ for C.Y. _____		
Fee for Renewal of Well Pump Installer's License No. _____ for C.Y. _____		
(Any Other Work Provided by Law)	TOTAL	50.00

No.

000272

By

Darland Erbe
Chief Engineer
gm



United States
Department of
Agriculture

Natural Resources
Conservation
Service

1530 Samco Road
Suite 4
Rapid City, SD 57702-8007

August 20, 2002

Tim Schaal
DENR, Safety of Dams
Foss Building
523 East Capitol
Pierre, SD 57501-3182

RECEIVED

SEP 03 2002

WATER RIGHTS
PROGRAM

Tim,

Attached for review and approval by your staff is a set of plans and specifications for a fish & wildlife and Livestock pond for Leonard Benson, NW1/4 SW1/4 S31 T7S R9E, Fall River Co. South Dakota. Dam is located on a tributary of Hay Canyon, approximately 2300' upstream of tributary outlet to Hay Canyon, dam is classified as "hazard class a" as per NRCS criteria. Documentation for arriving at the hazard class is included with the design documentation. Structure Data is as follows:

Drainage Area - 984ac.

Storage - Principal Spillway elev. 95.1 - 37.6 ac-ft. (S.A. 5.5 ac-ft.)

Emergency Spillway elev. 98.0 - 54.6 ac-ft. (S.A. 6.7 ac-ft.)

Top of Dam elev. 101.0 - 77.8 ac-ft.

Fill Height - 22.0 ft., Effective Height - 18.7 ft.

Water Depth - 21.0 ft.

Storage X Height - 1024

Principal Spillway Design Storm - 2 yr.

Emergency Spillway Design Storm - 25 yr. (559 cfs.) (passes with 2.0 ft. depth in ES.)

Freeboard Hydrograph - 50 yr. (748 cfs.) (passes with 2.3 ft. depth in E.S.)

Principal Spillway - 15" PVC Hood Inlet (23 cfs. capacity)

Gerald T. Miller
Civil Engineer Tech,
Natural Resources Conservation Service
1530 Samco Rd, suite 4
Rapid City, SD 57702-8007

cc. Ron Siers, DC, NRCS, Hot Springs, SD

Emergency Spillway routing

1*****

SITES XEQ 09/13/2001 WATER RESOURCE SITE ANALYSIS COMPUTER PROGRAM
VER 96.1 (USER MANUAL - DATED MAY 1996)
TIME 07:50:48

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

SITES 03/01/1996BenSW31 Leonard Benson SW 31-T7S-R9E H

*

* Planned Emergency Spillway Elev - 98.0 (54.6 AC-FT)

* Sediment required Storage - 16.36 AC-FT

* 2yr 24hr Storm Volume - 36.1 AC-FT

* $54.6 - 16.36 = 38.24 > 18.04$ (36.1/2) PS not required

* PS recommended due to Emergency Spillway having high
erodibility Soil

* 2yr. 24hr. Storm Vol. Elev. - 94.8 (36.1 AC-FT)

* Planned Principal Spillway Crest Elev. 95.1 (37.6 AC-FT)

* 15" PVC SDR 26 160 PSI

STRUCTURE

79.0	0.01
80.0	0.07
82.0	0.59
84.0	2.02
88.0	8.96
92.0	22.02
94.0	31.13
94.8	36.0
95.0	36.9
95.4	39.5
98.0	54.63
100.0	69.33
102.0	86.33
104.0	105.95

ENDTABLE

WSDATA A1 AC 80 984 1.19
PDIRECT 1.8 3.3 3.8
POOLDATA ELEV 95.1 95.1 95.1 79.3 79.3 HD
PSDATA 1 15 0.009 80.8
PSHOOD 87 20 81.3 80.3 0.6 1 B
GRAPHICS I
ASDATA 41 135 3 .055
ASCREST ELEV 98.0
ASINSURF 41 0.04 0.04
ASINLET 41 0.0 0.0 40 0.0 3
120 4.0 135 8.0

ENDTABLE

ASEXSURF 41 0.04 0.04
0.65 0.65
3 3
2 2
0.02

ENDTABLE

ASEXIT 41 N 190
BTMWIDTH FEET 80
GO,DESIGN HLP TYPE2 24 TYPE2378 24 95.1
ENDJOB

1SITES XEQ 09/13/2001 ----- COMMENT PAGE -----
VER 96.1 Leonard Benson SW 31-T7S-R9E WSID = BenSW31

Planned Emergency Spillway Elev - 98.0 (54.6 AC-FT)

Sediment required Storage - 16.36 AC-FT

2yr 24hr Storm Volume - 36.1 AC-FT

54.6 - 16.36 = 38.24 > 18.04 (36.1/2) PS not required

PS recommended due to Emergency Spillway having high
erodibility Soil

2yr. 24hr. Storm Vol. Elev. - 94.8 (36.1 AC-FT)

Planned Principal Spillway Crest Elev. 95.1 (37.6 AC-FT)

15" PVC SDR 26 160 PSI

***** 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 09/13/2001 Leonard Benson SW 31-T7S-R9E WSID= BenSW31
VER 96.1 SUBW= A
TIME 07:50:48 SITE = S 1 PASS= 1 PART= 1

***** 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
1.80	.00	3.30	3.80

WSDATA -	CN	DA-SM	TC/L	-/H	QRF
80.00	1.54	1.19	.00	.00	

SITEDATA- PERM POOL CREST PS FP SED VALLEY FL 378?
95.10 95.10 95.10 79.30 YES

BASEFLOW INITIAL EL EXTRA VOL SITE TYPE
.00 .00 .00 DESIGN

PSDATA - NO. COND COND L DIA/W -/H
1.00 .00 15.00 .00

PS N KE WEIR L TW EL
.009 .00 .00 80.80

2ND STG ORF H ORF L START AUX.
.00 .00 .00 95.10

PSHOOD - OUTLET MITER LENGTH LENGTH
ELEV. ELEV. INLET TO MITER TO
MITER(FT) OUTLET(FT)
80.30 81.30 87.0 20.0

ASCRESTS - AUX.1 AUX.2 AUX.3 AUX.4 AUX.5
98.00 .00 .00 .00 .00

AUX.DATA - REF.NO. RETARD. C TIE STATION INLET LENGTH
41 .00 .00 135

AUX.DATA - INLET N SIDE SLOPE EXIT N EXIT SLOPE ACTUAL AUX?
.040 3.00 .040 .055 NO

BTM WIDTH - BW1 BW2 BW3 BW4 BW5
ft 80.00 .00 .00 .00 .00

AUXILIARY SPILLWAY RATING DEVELOPED USING WSPVRT.

1SITES -----
XEQ 09/13/2001 Leonard Benson SW 31-T7S-R9E WSID= BenSW31
VER 96.1 SUBW= A
TIME 07:50:48 SITE = S 1 PASS= 1 PART= 2

PERM POOL 95.10 FT 37.5 ACFT .00 AC .0 CFS

CREST PS 95.10 FT 37.5 ACFT .00 AC .0 CFS

SED ACCUM 95.10 FT 37.5 ACFT .00 AC .0 CFS

START ELEV 95.10 FT 37.5 ACFT .00 AC .0 CFS

RATING TABLE DEVELOPED, SITE = S 1:
BY PROGRAM FOR PS AND AUX. SPILLWAYS
AUX. RATING USED WSPVRT METHOD.

RATING TABLE NUMBER 1

	ELEV. FEET	Q-TOTAL CFS	Q-PS CFS	Q-AUX. CFS	VOLUME AC-FT	AREA ACRE
1	95.10	.00	.00	.00	37.55	.00
2	95.56	.66	.66	.00	40.44	.00
3	96.02	2.46	2.46	.00	43.14	.00
4	96.49	4.20	4.20	.00	45.83	.00
5	96.59	10.00	10.00	.00	46.43	.00
6	96.70	15.83	15.83	.00	47.04	.00
7	96.80	21.86	21.86	.00	47.65	.00
FULL CONDUIT FLOW, ELEV = 96.80 FT						
8	97.35	22.24	22.24	.00	50.87	.00
9	97.91	22.61	22.61	.00	54.09	.00
10	98.46	22.97	22.97	.00	58.02	.00
11	99.02	23.33	23.33	.00	62.09	.00
12	99.57	23.69	23.69	.00	66.16	.00
13	100.12	24.04	24.04	.00	70.38	.00

1SITES

XEQ 09/13/2001 Leonard Benson SW 31-T7S-R9E WSID= BenSW31
 VER 96.1 SUBW= A
 TIME 07:50:48 SITE = S 1 PASS= 1 PART= 3

AUX. CREST 98.00 FT 54.6 ACFT .00 AC 22.7 CFS

PS STORAGE 17.1 ACFT, BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

START ELEV 95.10 FT 37.5 ACFT .00 AC .0 CFS

EFFECTIVE HEIGHT(H)= 18.7 FEET, PRODUCT= 1022. (H * STORAGE AT CREST AUX.).

INPUT DESIGN CLASS = A1 = LT 3000. PRODUCT.

NRCS-SDH D= 24.00 HR P= 3.30 IN Q= 1.48 IN DA= 1.54 SM
 TC= 1.19 HR CN= 80.00 VOL= 121.2 ACFT

PEAK = 664.4 CFS, AT 12.7 HRS.

NRCS-FBH D= 24.00 HR P= 3.80 IN Q= 1.88 IN DA= 1.54 SM
 TC= 1.19 HR CN= 80.00 VOL= 153.8 ACFT

PEAK = 849.8 CFS, AT 12.7 HRS.

 RATING TABLE DEVELOPED, SITE = S 1:
 BY PROGRAM FOR PS AND AUX. SPILLWAYS
 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	95.10	.00	.00	.00	37.55	.00

2	95.56	.66	.66	.00	40.44	.00
3	96.02	2.46	2.46	.00	43.14	.00
4	96.49	4.20	4.20	.00	45.83	.00
5	96.59	10.00	10.00	.00	46.43	.00
6	96.70	15.83	15.83	.00	47.04	.00
7	96.80	21.86	21.86	.00	47.65	.00
FULL CONDUIT FLOW, ELEV = 96.80 FT						
8	97.00	22.00	22.00	.00	48.81	.00
9	97.20	22.13	22.13	.00	49.97	.00
10	97.40	22.27	22.27	.00	51.14	.00
11	97.60	22.40	22.40	.00	52.30	.00
12	97.80	22.54	22.54	.00	53.47	.00
13	98.00	22.67	22.67	.00	54.63	.00
14	98.30	40.61	22.87	17.74	56.84	.00
15	98.60	80.49	23.07	57.42	59.04	.00
16	99.14	220.17	23.42	196.75	63.01	.00
17	99.80	468.86	23.84	445.03	67.86	.00
18	101.00	1144.80	24.58	1120.22	77.83	.00
19	102.50	2253.59	25.48	2228.10	91.24	.00
20	104.00	3666.33	26.35	3639.97	105.95	.00

SUMMARY OF AUXILIARY SPILLWAY SURFACE CONDITIONS USED IN COMPUTATIONS BY REACH

REACH	FROM STA	TO STA	SLOPE CURVE	RETARDANCE COVER	VEGETAL CODE	MAINT. DEPTH	ROOTING LOCATION
	(ft)	(ft)	(%) INDEX@	FACTOR	(ft)	*	
1	-135.	-120.	-26.7	.040	**	**	** INLET
2	-120.	-40.	-5.0	.040	**	**	** INLET
3	-40.	0.	.0	.040	**	**	** CREST
4	0.	190.	5.5	.040	.65	3	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 4 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	80.0	99.98	69.2	.0	1.98	14.6

PEAK - CFS Q-PS Q-AUX. Q-TOT.
DISCHARGE = 23.9 535.3 559.3

	CRITICAL DEPTH	CRITICAL VELOCITY	CRITICAL SLOPE-Sc	25% OF Q Sc
AUXILIARY	FT	FT/SEC	FT/FT	FT/FT
SPILLWAY ---	1.10	5.84	.023	.031

AUXILIARY SPILLWAY DURATION FLOW = 13.3 HOURS

***** MESSAGE - NHCP378 CRITERIA USED BUT AUXILIARY SPILLWAY RATING NOT

BASED ON ASFILE RATINGS.

EXIT CHANNEL FLOW SUPERCRITICAL: MAX VELOCITY= 7.7 FT/SEC
 EXIT SLOPE = .055 FT/FT
 FLOW DEPTH = .8 FT

EFFECTIVE STRESS FOR STABILITY ANALYSIS OF AUX. EXIT CHANNEL
 (Refer to Ag. Handbook 667, Chapt. 3, for allowable stresses.)
 Aux. Discharge = 535. cfs; Bottom Width = 80. ft

REACH FROM TO SLOPE MANNING'S VELOCITY STRESS

NO. STA STA % n ft/s lb/ft^2
 4 0. 190. 5.50 .040 7.65 1.770

PLOT NRCS-SDH						1 IN = 100. CFS					EXIT SLOPE = .055			
					0.	100.	200.	300.	400.	500.	600.	700.		
Time	Qin	Qout	Elev	Vol	Area	ExtVel								
.00	0	0	95.1	37.5	.0	.00	.							
.28	0	0	95.1	37.5	.0	.00	.							
.55	0	0	95.1	37.5	.0	.00	.							
.83	0	0	95.1	37.5	.0	.00	.							
1.11	0	0	95.1	37.5	.0	.00	.							
1.39	0	0	95.1	37.5	.0	.00	.							
1.66	0	0	95.1	37.5	.0	.00	.							
1.94	0	0	95.1	37.5	.0	.00	.							
2.22	0	0	95.1	37.5	.0	.00	.							
2.49	0	0	95.1	37.5	.0	.00	.							
2.77	0	0	95.1	37.5	.0	.00	.							
3.05	0	0	95.1	37.5	.0	.00	.							
3.33	0	0	95.1	37.5	.0	.00	.							
3.60	0	0	95.1	37.5	.0	.00	.							
3.88	0	0	95.1	37.5	.0	.00	.							
4.16	0	0	95.1	37.5	.0	.00	.							
4.43	0	0	95.1	37.5	.0	.00	.							
4.71	0	0	95.1	37.5	.0	.00	.							
4.99	0	0	95.1	37.5	.0	.00	.							
5.27	0	0	95.1	37.5	.0	.00	.							
5.54	0	0	95.1	37.5	.0	.00	.							
5.82	0	0	95.1	37.5	.0	.00	.							
6.10	0	0	95.1	37.5	.0	.00	.							
6.37	0	0	95.1	37.5	.0	.00	.							
6.65	0	0	95.1	37.5	.0	.00	.							
6.93	0	0	95.1	37.5	.0	.00	.							
7.21	0	0	95.1	37.5	.0	.00	.							
7.48	0	0	95.1	37.5	.0	.00	.							
7.76	0	0	95.1	37.5	.0	.00	.							
8.04	0	0	95.1	37.5	.0	.00	.							
8.31	0	0	95.1	37.5	.0	.00	.							
8.59	0	0	95.1	37.5	.0	.00	.							
8.87	0	0	95.1	37.5	.0	.00	.							
9.15	0	0	95.1	37.5	.0	.00	.							
9.42	0	0	95.1	37.6	.0	.00	.							
9.70	0	0	95.1	37.6	.0	.00	.							

9.98	1	0	95.1	37.6	.0	.00 .
10.25	3	0	95.1	37.6	.0	.00 .
10.53	6	0	95.1	37.7	.0	.00 .I
10.81	10	0	95.2	37.9	.0	.00 .I
11.09	16	0	95.2	38.2	.0	.00 .I
11.36	24	0	95.3	38.6	.0	.00 .I
11.64	40	0	95.4	39.4	.0	.00 .I
11.92	114	1	95.7	41.1	.0	.00 . I
12.19	365	10	96.6	46.5	.0	.00 .P I
12.47	637	48	98.4	57.3	.0	2.31 . A I X
12.75	664	417	99.7	66.8	.0	6.79 . A X
13.03	517	559	100.0	69.2	.0	7.65 . I X
13.30	363	457	99.8	67.6	.0	7.05 . I A
13.58	266	352	99.5	65.6	.0	6.33 . I A
13.86	203	265	99.3	63.9	.0	5.62 . I A
14.13	161	207	99.1	62.6	.0	5.05 . I A
14.41	132	172	99.0	61.7	.0	4.65 . I A
14.69	112	144	98.8	60.8	.0	4.27 . IA
14.97	99	122	98.8	60.2	.0	3.95 . IA
15.24	89	106	98.7	59.8	.0	3.68 . IA
15.52	81	94	98.7	59.4	.0	3.47 . IA
15.80	75	85	98.6	59.2	.0	3.28 . IA
16.07	70	79	98.6	58.9	.0	3.15 . IA
16.35	65	75	98.6	58.7	.0	3.07 . A
16.63	61	71	98.5	58.5	.0	2.97 . IA
16.91	58	67	98.5	58.3	.0	2.88 . IA
17.18	56	64	98.5	58.1	.0	2.78 . A
17.46	53	60	98.4	57.9	.0	2.70 . IA
17.74	52	58	98.4	57.8	.0	2.62 . IA
18.02	50	55	98.4	57.6	.0	2.54 . IA
18.29	48	53	98.4	57.5	.0	2.47 . A
18.57	47	51	98.4	57.4	.0	2.41 . A
18.85	45	49	98.4	57.3	.0	2.34 . IA
19.12	43	48	98.4	57.2	.0	2.28 . IA
19.40	42	46	98.3	57.1	.0	2.22 . IA
19.68	40	44	98.3	57.0	.0	2.15 . A
19.96	38	42	98.3	56.9	.0	2.08 . A
20.23	37	41	98.3	56.8	.0	2.01 . A
20.51	35	40	98.3	56.7	.0	1.97 . A
20.79	34	39	98.3	56.6	.0	1.93 . IA
21.06	33	38	98.3	56.5	.0	1.88 . IA
21.34	32	37	98.2	56.4	.0	1.84 . IA
21.62	32	36	98.2	56.3	.0	1.79 . IA
21.90	32	36	98.2	56.2	.0	1.75 . IA
22.17	31	35	98.2	56.1	.0	1.71 . A
22.45	31	34	98.2	56.0	.0	1.68 . A
22.73	31	34	98.2	56.0	.0	1.64 . A
23.00	30	33	98.2	55.9	.0	1.61 . A
23.28	30	33	98.2	55.8	.0	1.58 . A
23.56	30	32	98.2	55.8	.0	1.55* . A
23.84	29	32	98.1	55.7	.0	1.52* . A
24.11	29	31	98.1	55.7	.0	1.49* . A
24.39	26	30	98.1	55.6	.0	1.44* . A
24.67	19	29	98.1	55.4	.0	1.33* .IA
24.94	12	27	98.1	55.1	.0	1.12* .IA
25.22	6	24	98.0	54.8	.0	.66* .IA

25.50 4 23 98.0 54.4 .0 .00 .P
 Time Qin Qout Elev Vol Area ExtVel | | | | | | | |
 0. 100. 200. 300. 400. 500. 600. 700.

END NRCS-SDH PLOT

DRAWDOWN USING FREEBOARD STORM FOLLOWS, STARTING AT ELEVATION 98.00 FT.

DRAWDOWN (DDT) TEST 95.10 FT 37.5 ACFT .00 CFS
 CONTROL IS .000 DETENTION STORAGE

TIME = 7.92 DAYS, TO .0 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	80.0	100.31	72.0	.0	2.31	17.3		

PEAK - CFS Q-PS Q-AUX. Q-TOT.
 DISCHARGE = 24.1 723.4 747.5

CRITICAL CRITICAL CRITICAL 25% OF Q
 DEPTH VELOCITY SLOPE-Sc Sc
 AUXILIARY FT FT/SEC FT/FT FT/FT
 SPILLWAY --- 1.34 6.42 .022 .029

AUXILIARY SPILLWAY DURATION FLOW = 13.6 HOURS
 ATTACK, OE/B = 1.4 ACFT/FT

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

EXIT CHANNEL FLOW SUPERCRITICAL: MAX VELOCITY= 8.6 FT/SEC
 EXIT SLOPE = .055 FT/FT
 FLOW DEPTH = 1.0 FT

>>>>> NHCP378 RUN - MINIMUM DEPTH, DESIGN FLOW TO TOP OF DAM; 1.00 FT REQUIRED
 FOR THIS PASS. NEW TOP OF DAM ELEVATION = 101.31.

ROUTED	BTM	WIDTH	MAX	ELEV	VOL-MAX	AREA-MAX	AUX.-HP	VOL-AUX.
RESULTS	FT	FT	ACFT	AC	FT	ACFT		
MINIMUM AUX.	80.0	101.31	80.6	.0	3.33	26.0		

PEAK - CFS Q-PS Q-AUX. Q-TOT.
 DISCHARGES = 24.8 1349.7 1374.4

CRITICAL CRITICAL CRITICAL 25% OF Q
 DEPTH VELOCITY SLOPE-Sc Sc
 AUXILIARY FT FT/SEC FT/FT FT/FT
 SPILLWAY --- 2.01 7.79 .019 .025

PLOT NRCS-FBH 1 IN = 200. CFS EXIT SLOPE = .055
 0. 200. 400. 600. 800. 1000. 1200. 1400.
 Time Qin Qout Elev Vol Area ExtVel | | | | | | | |
 .00 0 0 95.1 37.7 .0 .00 .
 .28 0 0 95.1 37.7 .0 .00 .

.55	0	0	95.1	37.7	.0	.00	
.83	0	0	95.1	37.7	.0	.00	
1.11	0	0	95.1	37.7	.0	.00	
1.39	0	0	95.1	37.7	.0	.00	
1.66	0	0	95.1	37.7	.0	.00	
1.94	0	0	95.1	37.7	.0	.00	
2.22	0	0	95.1	37.7	.0	.00	
2.49	0	0	95.1	37.7	.0	.00	
2.77	0	0	95.1	37.7	.0	.00	
3.05	0	0	95.1	37.7	.0	.00	
3.33	0	0	95.1	37.7	.0	.00	
3.60	0	0	95.1	37.7	.0	.00	
3.88	0	0	95.1	37.7	.0	.00	
4.16	0	0	95.1	37.7	.0	.00	
4.43	0	0	95.1	37.7	.0	.00	
4.71	0	0	95.1	37.7	.0	.00	
4.99	0	0	95.1	37.7	.0	.00	
5.27	0	0	95.1	37.7	.0	.00	
5.54	0	0	95.1	37.7	.0	.00	
5.82	0	0	95.1	37.7	.0	.00	
6.10	0	0	95.1	37.7	.0	.00	
6.37	0	0	95.1	37.7	.0	.00	
6.65	0	0	95.1	37.7	.0	.00	
6.93	0	0	95.1	37.7	.0	.00	
7.21	0	0	95.1	37.7	.0	.00	
7.48	0	0	95.1	37.7	.0	.00	
7.76	0	0	95.1	37.7	.0	.00	
8.04	0	0	95.1	37.7	.0	.00	
8.31	0	0	95.1	37.7	.0	.00	
8.59	0	0	95.1	37.7	.0	.00	
8.87	0	0	95.1	37.7	.0	.00	
9.15	1	0	95.1	37.7	.0	.00	
9.42	2	0	95.1	37.7	.0	.00	
9.70	4	0	95.1	37.8	.0	.00	
9.98	7	0	95.2	37.9	.0	.00	
10.25	10	0	95.2	38.1	.0	.00	
10.53	14	0	95.2	38.4	.0	.00	I
10.81	20	0	95.3	38.8	.0	.00	I
11.09	29	0	95.4	39.3	.0	.00	I
11.36	41	1	95.5	40.1	.0	.00	I
11.64	62	1	95.7	41.3	.0	.00	I
11.92	158	3	96.1	43.7	.0	.00	I
12.19	483	22	97.3	50.8	.0	.00	P
12.47	827	221	99.1	63.0	.0	5.19	A
12.75	850	716	100.3	71.5	.0	8.44	A
13.03	654	748	100.3	72.0	.0	8.59	A X ?
13.30	456	579	100.0	69.5	.0	7.76	I X
13.58	333	426	99.7	67.0	.0	6.85	I A
13.86	253	328	99.4	65.1	.0	6.14	I A
14.13	199	252	99.2	63.6	.0	5.50	I A
14.41	163	204	99.1	62.6	.0	5.02	I A
14.69	138	173	99.0	61.7	.0	4.66	I A
14.97	121	148	98.9	61.0	.0	4.34	I A
15.24	109	129	98.8	60.4	.0	4.06	I A
15.52	99	114	98.7	60.0	.0	3.83	I A
15.80	91	103	98.7	59.7	.0	3.64	A

16.07	85	95	98.7	59.4	.0	3.48	. IA
16.35	80	88	98.6	59.2	.0	3.34	. A
16.63	75	82	98.6	59.1	.0	3.22	. A
16.91	71	78	98.6	58.9	.0	3.14	. A
17.18	67	75	98.6	58.7	.0	3.07	. IA
17.46	65	72	98.5	58.6	.0	3.00	. IA
17.74	63	69	98.5	58.4	.0	2.93	. A
18.02	61	67	98.5	58.3	.0	2.86	. A
18.29	58	64	98.5	58.1	.0	2.80	. A
18.57	56	62	98.5	58.0	.0	2.73	. A
18.85	54	60	98.4	57.9	.0	2.67	. A
19.12	52	58	98.4	57.8	.0	2.61	. A
19.40	50	55	98.4	57.7	.0	2.55	. A
19.68	48	53	98.4	57.5	.0	2.48	. IA
19.96	46	51	98.4	57.4	.0	2.42	. IA
20.23	44	49	98.4	57.3	.0	2.35	. A
20.51	43	47	98.4	57.2	.0	2.27	. A
20.79	41	45	98.3	57.1	.0	2.20	. A
21.06	40	44	98.3	57.0	.0	2.14	. A
21.34	39	42	98.3	56.9	.0	2.08	. A
21.62	39	41	98.3	56.9	.0	2.03	. A
21.90	38	40	98.3	56.8	.0	1.99	. A
22.17	38	40	98.3	56.8	.0	1.97	. A
22.45	37	40	98.3	56.7	.0	1.95	. A
22.73	37	39	98.3	56.7	.0	1.93	. A
23.00	36	39	98.3	56.6	.0	1.91	. A
23.28	36	38	98.3	56.6	.0	1.89	. A
23.56	36	38	98.3	56.5	.0	1.87	. A
23.84	35	37	98.2	56.4	.0	1.85	. A
24.11	35	37	98.2	56.4	.0	1.83	. A
24.39	31	36	98.2	56.3	.0	1.80	. A
24.67	23	35	98.2	56.1	.0	1.71	. IA
24.94	14	32	98.2	55.8	.0	1.55*	. IA
25.22	8	28	98.1	55.3	.0	1.28*	. A
25.50	4	25	98.0	54.9	.0	.83*	. A
25.78	2	23	98.0	54.4	.0	.00	. P

Time Qin Qout Elev Vol Area ExtVel | | | | | | | |

0. 200. 400. 600. 800. 1000. 1200. 1400.

END NRCS-FBH PLOT

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

BenSW31 Leonard Benson SW 31-T7S-R9E

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

1 SUMMARY TABLE 1 SITES VERSION 96.1
DATED 03/01/1996

WATERSHED ID	RUN DATE	RUN TIME
BenSW31	09/13/2001	07:50:48

>>>	SITE ID	SUBWS ID	SUBWS (SQ MI)	DA NO.	CURVE (HRS)	TC (SQ MI)	TOTAL DA DESIGN	TYPE CLASS	STRUC	<<<
	S 1	A	1.54	80.	1.19	1.54	378CR	A1		

PASS NO.	DIA./ (IN/FT)	AUX. ELEV (FT)	CREST ELEV (FT)	BTM. WIDTH (FT)	MAX. HP (FT)	MAX. ELEV (CY)	EMB. VOL. (FT)	INTEGR. DIST. (FT/SEC)	* EXIT VEL.	* TYPE HYD
1	15.0	98.0	80.0	3.3	101.3	0.	0.	8.6	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 96.1 ,03/01/1996
BenSW31 FILES

INPUT

C:\Engineer\sites32\benSONA\benSONES,80.D2C

OUTPUT - DATED 09/13/2001 07:50:48

C:\Engineer\sites32\benSONA\benSONES,80.OUT

GRAPHICS FILES GENERATED

OPTION "L" DATED 09/13/2001 07:50:48

C:\Engineer\sites32\benSONA\benSONES,80.DRG

OPTION "P" DATED 09/13/2001 07:50:48

C:\Engineer\sites32\benSONA\benSONES,80.DHY

OPTION "E" DATED 09/13/2001 07:50:48

C:\Engineer\sites32\benSONA\benSONES,80.DEM

STATE <u>SOUTH DAKOTA</u>		PROJECT <u>LEONARD BENSON DAM</u>		
BY <u>G MILLER</u>	DATE <u>9/01</u>	CHECKED BY	DATE	JOB NO.
SUBJECT <u>MIN. PRINCIPAL SPILLWAY REQUIREMENT</u>				SHEET <u>1</u> OF <u>1</u>

Emergency Spillway Elev. (Storage) - 98.0 (54.6 Ac.-ft.)

Sediment Yield					
Erodibility Area	Gross Rate A.F./AC./YR.	Drainage Area Ac.	Delivery Rate %	Design Period Yrs.	Req'd Sediment Vol.
<u>P</u>	<u>0.0035</u>	<u>984</u>	<u>19</u>	<u>25</u>	<u>16.36</u>

2 yr. 24 hr. storm Volume - 36.1 Ac.-ft.
50% of the 2 yr. 24 hr. storm Volume - 18.04 Ac.-ft.

$$54.6 - 16.36 = 38.24 > 18.04 \text{ AS not required}$$

Principal Spillway is required due to
Emergency Spillway having high erodibility soil.

Storage @ (50% of the 2 yr. 24 hr. storm Volume)
18.04 Ac.-ft. = 90.8

Principal Spillway min. flow required

$$PSQ = (A)(C)(QIN) + (B)$$

$$PSQ = (0.35)(0.17)(183) = 10.9 \text{ cfs.}$$

$$A = 0.35$$

$$C = VP/UR$$

$$VP = 38.24 \text{ Ac.-ft.}$$

$$UR = 36.1 \text{ Ac.-ft.}$$

$$= 38.24 / 36.1$$

$$= 1.06$$

$$C = 0.17$$

$$B = 0$$

Principal Spillway routing.

1*****
 SITES XEQ 09/13/2001 WATER RESOURCE SITE ANALYSIS COMPUTER PROGRAM
 VER 96.1 (USER MANUAL - DATED MAY 1996)
 TIME 08:00:26

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

SITES 03/01/1996BenSW31 Leonard Benson SW 31-T7S-R9E H

* Planned Emergency Spillway Elev - 98.0 (54.6 AC-FT)
 * Sediment required Storage - 16.36 AC-FT
 * 2yr 24hr Strom Volume - 36.1 AC-FT
 * $54.6 - 16.36 = 38.24 > 18.04$ (36.1/2) PS not required
 * PS recommended due to Emergency Spillway having high
 * erodibility Soil
 * 2yr. 24hr. Storm Vol. Elev. - 94.8 (36.1 AC-FT)
 * Planned Principal Spillway Crest Elev. 95.1 (37.6 AC-FT)
 * 15" PVC SDR 26 160 PSI

STRUCTURE

79.0	0.01
80.0	0.07
82.0	0.59
84.0	2.02
88.0	8.96
92.0	22.02
94.0	31.13
94.8	36.0
95.0	36.9
95.4	39.5
98.0	54.63
100.0	69.33
102.0	86.33
104.0	105.95

ENDTABLE

WSDATA	A1	AC 80	984	1.19				
PDIRECT		1.8	0	0				
POOLDATA	ELEV	95.1	95.1	95.1	79.3	79.3	HD	
PSDATA	1	15		0.009	80.8			
PSHOOD	87	20	81.3	80.3	0.6	1	B	
GRAPHICS	I							
ASDATA	41	135	3		.055			
ASINSURF	41		0.04	0.04				
ASINLET	41	0.0	0.0	40	0.0	3		
	120	4.0	135	8.0				

ENDTABLE

ASEXSURF	41		0.04	0.04				
		0.65	0.65					
	3	3						
	2	2						
		0.02						

ENDTABLE

ASEXIT	41	N		190				
BTMWIDTH	FEET	80						
GO,DESIGN	HLP	TYPE2	24	TYPE2378	24	95.1		
ENDJOB								

1SITES XEQ 09/13/2001 ----- COMMENT PAGE -----
VER 96.1 Leonard Benson SW 31-T7S-R9E WSID = BenSW31

Planned Emergency Spillway Elev - 98.0 (54.6 AC-FT)

Sediment required Storage - 16.36 AC-FT

2yr 24hr Strom Volume - 36.1 AC-FT

54.6 - 16.36 = 38.24 > 18.04 (36.1/2) PS not required

PS recommended due to Emergency Spillway having high
erodibility Soil

2yr. 24hr. Storm Vol. Elev. - 94.8 (36.1 AC-FT)

Planned Principal Spillway Crest Elev. 95.1 (37.6 AC-FT)

15" PVC SDR 26 160 PSI

***** 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.

***** WARNING - RATING CURVES SHOULD BE DEVELOPED BY THE WSPVRT PROCEDURE FOR
CONSISTENCY WITH THE INTEGRITY AND STABILITY ANALYSIS.

1SITES -----
XEQ 09/13/2001 Leonard Benson SW 31-T7S-R9E WSID= BenSW31
VER 96.1 SUBW= A
TIME 08:00:26 SITE = S 1 PASS= 1 PART= 1

***** 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	Q-SD	Q-FB
1.80	.00	.00	.00

WSDATA -	CN	DA-SM	TC/L	-/H	QRF
----------	----	-------	------	-----	-----

80.00	1.54	1.19	.00	.00	
SITEDATA- PERM POOL		CREST PS	FP SED	VALLEY FL	378?
95.10	95.10	95.10	79.30	YES	

BASEFLOW	INITIAL EL	EXTRA VOL	SITE TYPE
.00	.00	.00	DESIGN

PSDATA - NO. COND	COND L	DIA/W	-/H
1.00	.00	15.00	.00

PS N	KE	WEIR L	TW EL
.009	.00	.00	80.80

2ND STG	ORF H	ORF L	START AUX.
.00	.00	.00	95.10

PSHOOD - OUTLET	MITER	LENGTH	LENGTH
ELEV.	ELEV.	INLET TO	MITER TO
	MITER(FT)	OUTLET(FT)	
80.30	81.30	87.0	20.0

ASCRESTS - AUX.1	AUX.2	AUX.3	AUX.4	AUX.5
.00	.00	.00	.00	.00

AUX.DATA - REF.NO.	RETARD. CI	TIE STATION	INLET LENGTH
41	.00	.00	135

AUX.DATA - INLET N	SIDE SLOPE	EXIT N	EXIT SLOPE	ACTUAL AUX?
.000	3.00	.000	.055	NO

BTM WIDTH - BW1	BW2	BW3	BW4	BW5
ft 80.00	.00	.00	.00	.00

***** NOTE - THIS IS ONLY A PRELIMINARY AUX. SPILLWAY RATING CURVE OF DISCHARGE/FT OF WIDTH AND DOES NOT INCLUDE SIDESLOPE CORRECTION OR A REVISED RATING USING THE ACTUAL AUX. SPILLWAY CONFIGURATION.

AUX. SPILLWAY ID CODE ... ELEVATION INCREMENT (FT)= 1.000

DISCHARGES-Q1	Q2	Q3	Q4
3.288	8.968	16.345	25.054

Q5	Q6	Q7	Q8
34.903	45.780	57.607	70.322

Q9	Q10	Q11	Q12
83.848	98.121	113.144	128.862

AUXILIARY SPILLWAY RATING DEVELOPED USING FRICTIONLESS SIDE SLOPE METHOD.

1SITES -----
 XEQ 09/13/2001 Leonard Benson SW 31-T7S-R9E WSID= BenSW31
 VER 96.1 SUBW= A
 TIME 08:00:26 SITE = S 1 PASS= 1 PART= 2

PERM POOL 95.10 FT 37.5 ACFT .00 AC .0 CFS
 CREST PS 95.10 FT 37.5 ACFT .00 AC .0 CFS
 SED ACCUM 95.10 FT 37.5 ACFT .00 AC .0 CFS
 START ELEV 95.10 FT 37.5 ACFT .00 AC .0 CFS

NRCS-PSH D= 24.00 HR P= 1.80 IN Q= .44 IN DA= 1.54 SM
 TC= 1.19 HR CN= 80.00 VOL= 36.5 ACFT

PEAK = 176.4 CFS, AT 12.7 HRS.

ROUTED RESULT - HYD TYPE EMAX VOL-MAX AMAX QMAX
 NRCS-PSH 98.28 FT 56.7 ACFT .00 AC 22.9 CFS

PS STORAGE 19.1 ACFT, BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

DRAWDOWN (DDT) TEST 95.10 FT 37.5 ACFT .00 CFS
 CONTROL IS .000 DETENTION STORAGE

TIME = 8.14 DAYS, TO .0 CFS (LIMIT = 10.00 DAYS)

PLOT OF PRINCIPAL SPILLWAY HYDROGRAPH, 1 INCH= 50. CFS

					0.	50.	100.	150.	200.	250.	300.	350.
Time	Qin	Qout	Elev	Vol	Area	ExtVel						
.00	0	0	95.1	37.5	.0	.						
.28	0	0	95.1	37.5	.0	.						
.55	0	0	95.1	37.5	.0	.						
.83	0	0	95.1	37.5	.0	.						
1.11	0	0	95.1	37.5	.0	.						
1.39	0	0	95.1	37.5	.0	.						
1.66	0	0	95.1	37.5	.0	.						
1.94	0	0	95.1	37.5	.0	.						
2.22	0	0	95.1	37.5	.0	.						
2.49	0	0	95.1	37.5	.0	.						
2.77	0	0	95.1	37.5	.0	.						
3.05	0	0	95.1	37.5	.0	.						
3.33	0	0	95.1	37.5	.0	.						
3.60	0	0	95.1	37.5	.0	.						
3.88	0	0	95.1	37.5	.0	.						
4.16	0	0	95.1	37.5	.0	.						
4.43	0	0	95.1	37.5	.0	.						
4.71	0	0	95.1	37.5	.0	.						
4.99	0	0	95.1	37.5	.0	.						
5.27	0	0	95.1	37.5	.0	.						
5.54	0	0	95.1	37.5	.0	.						
5.82	0	0	95.1	37.5	.0	.						
6.10	0	0	95.1	37.5	.0	.						
6.37	0	0	95.1	37.5	.0	.						
6.65	0	0	95.1	37.5	.0	.						
6.93	0	0	95.1	37.5	.0	.						
7.21	0	0	95.1	37.5	.0	.						
7.48	0	0	95.1	37.5	.0	.						

7.76	0	0	95.1	37.5	.0	.
8.04	0	0	95.1	37.5	.0	.
8.31	0	0	95.1	37.5	.0	.
8.59	0	0	95.1	37.5	.0	.
8.87	0	0	95.1	37.5	.0	.
9.15	0	0	95.1	37.5	.0	.
9.42	0	0	95.1	37.5	.0	.
9.70	0	0	95.1	37.5	.0	.
9.98	0	0	95.1	37.5	.0	.
10.25	0	0	95.1	37.5	.0	.
10.53	0	0	95.1	37.5	.0	.
10.81	0	0	95.1	37.5	.0	.
11.09	0	0	95.1	37.5	.0	.
11.36	0	0	95.1	37.5	.0	.
11.64	0	0	95.1	37.6	.0	.
11.92	12	0	95.1	37.7	.0	.I
12.19	72	0	95.3	38.6	.0	.I
12.47	154	1	95.7	41.2	.0	.I
12.75	176	4	96.3	44.9	.0	.P X
13.03	147	22	96.9	48.4	.0	.P
13.30	108	22	97.3	50.8	.0	.P
13.58	83	22	97.6	52.5	.0	.P
13.86	66	23	97.8	53.6	.0	.P
14.13	54	23	98.0	54.5	.0	.P
14.41	46	23	98.1	55.1	.0	.P
14.69	40	23	98.1	55.6	.0	.P
14.97	35	23	98.2	55.9	.0	.P
15.24	32	23	98.2	56.2	.0	.P
15.52	30	23	98.2	56.4	.0	.P
15.80	28	23	98.3	56.5	.0	.P
16.07	26	23	98.3	56.6	.0	.P
16.35	25	23	98.3	56.7	.0	.P
16.63	23	23	98.3	56.7	.0	.X
16.91	22	23	98.3	56.7	.0	.IP
17.18	21	23	98.3	56.7	.0	.IP
17.46	20	23	98.3	56.6	.0	.IP
17.74	20	23	98.3	56.5	.0	.IP
18.02	19	23	98.2	56.5	.0	.IP
18.29	18	23	98.2	56.4	.0	.IP
18.57	18	23	98.2	56.3	.0	.IP
18.85	17	23	98.2	56.1	.0	.IP
19.12	17	23	98.2	56.0	.0	.IP
19.40	16	23	98.2	55.9	.0	.IP
19.68	16	23	98.1	55.7	.0	.IP
19.96	15	23	98.1	55.5	.0	.IP
20.23	14	23	98.1	55.3	.0	.IP
20.51	14	23	98.1	55.1	.0	.IP
20.79	13	23	98.0	54.9	.0	.IP
21.06	13	23	98.0	54.7	.0	.IP
21.34	13	23	98.0	54.5	.0	.IP
21.62	13	23	97.9	54.3	.0	.IP
21.90	12	23	97.9	54.0	.0	.IP
22.17	12	23	97.9	53.8	.0	.IP
22.45	12	23	97.8	53.6	.0	.IP
22.73	12	23	97.8	53.3	.0	.IP
23.00	12	22	97.7	53.1	.0	.IP

23.28	12	22	97.7	52.8	.0	.IP
23.56	12	22	97.6	52.6	.0	.IP
23.84	12	22	97.6	52.3	.0	.IP
24.11	11	22	97.6	52.1	.0	.IP
24.39	10	22	97.5	51.8	.0	.IP
24.67	8	22	97.5	51.5	.0	.IP
24.94	5	22	97.4	51.1	.0	.IP
25.22	3	22	97.3	50.7	.0	.IP
25.50	1	22	97.2	50.3	.0	.P
25.78	1	22	97.2	49.8	.0	.P
26.05	0	22	97.1	49.3	.0	.P
26.33	0	22	97.0	48.8	.0	.P
26.61	0	22	96.9	48.3	.0	.P
26.88	0	22	96.8	47.8	.0	.P
27.16	0	19	96.7	47.3	.0	.P
27.44	0	15	96.7	46.9	.0	.P
27.72	0	12	96.6	46.6	.0	.P
27.99	0	10	96.6	46.4	.0	.P
28.27	0	8	96.5	46.2	.0	.P
28.55	0	6	96.5	46.0	.0	.P
28.82	0	5	96.5	45.9	.0	.P
29.10	0	4	96.5	45.8	.0	.P
29.38	0	4	96.5	45.7	.0	.P
29.66	0	4	96.5	45.6	.0	.P
29.93	0	4	96.4	45.5	.0	.P
30.21	0	4	96.4	45.4	.0	.P
30.49	0	4	96.4	45.3	.0	.P
30.76	0	4	96.4	45.2	.0	.P
31.04	0	4	96.4	45.2	.0	.P
31.32	0	4	96.4	45.1	.0	.P
31.60	0	4	96.3	45.0	.0	.P
31.87	0	4	96.3	44.9	.0	.P
32.15	0	4	96.3	44.8	.0	.P
32.43	0	4	96.3	44.7	.0	.P
32.70	0	3	96.3	44.7	.0	.P
32.98	0	3	96.3	44.6	.0	.P
33.26	0	3	96.3	44.5	.0	.P
33.54	0	3	96.2	44.4	.0	.P
33.81	0	3	96.2	44.4	.0	.P
34.09	0	3	96.2	44.3	.0	.P
34.37	0	3	96.2	44.2	.0	.P
34.64	0	3	96.2	44.1	.0	.P
34.92	0	3	96.2	44.1	.0	.P
35.20	0	3	96.2	44.0	.0	.P
35.48	0	3	96.2	43.9	.0	.P
35.75	0	3	96.1	43.9	.0	.P
36.03	0	3	96.1	43.8	.0	.P
36.31	0	3	96.1	43.7	.0	.P
36.58	0	3	96.1	43.7	.0	.P
36.86	0	3	96.1	43.6	.0	.P
37.14	0	3	96.1	43.5	.0	.P
37.42	0	3	96.1	43.5	.0	.P
37.69	0	3	96.1	43.4	.0	.P
37.97	0	3	96.1	43.4	.0	.P
38.25	0	3	96.1	43.3	.0	.P
38.52	0	3	96.0	43.2	.0	.P

38.80	0	2	96.0	43.2	.0
39.08	0	2	96.0	43.1	.0
39.36	0	2	96.0	43.1	.0
39.63	0	2	96.0	43.0	.0
39.91	0	2	96.0	43.0	.0
40.19	0	2	96.0	42.9	.0
40.46	0	2	96.0	42.9	.0
40.74	0	2	96.0	42.8	.0
41.02	0	2	96.0	42.8	.0
41.30	0	2	96.0	42.7	.0
41.57	0	2	95.9	42.7	.0
41.85	0	2	95.9	42.6	.0
42.13	0	2	95.9	42.6	.0
42.40	0	2	95.9	42.5	.0
42.68	0	2	95.9	42.5	.0
42.96	0	2	95.9	42.4	.0
43.24	0	2	95.9	42.4	.0
43.51	0	2	95.9	42.3	.0
43.79	0	2	95.9	42.3	.0
44.07	0	2	95.9	42.2	.0
44.34	0	2	95.9	42.2	.0
44.62	0	2	95.9	42.2	.0
44.90	0	2	95.8	42.1	.0
45.18	0	2	95.8	42.1	.0
45.45	0	2	95.8	42.0	.0
45.73	0	2	95.8	42.0	.0
46.01	0	2	95.8	42.0	.0
46.28	0	2	95.8	41.9	.0
46.56	0	2	95.8	41.9	.0
46.84	0	2	95.8	41.8	.0
47.12	0	2	95.8	41.8	.0
47.39	0	2	95.8	41.8	.0
47.67	0	2	95.8	41.7	.0
47.95	0	2	95.8	41.7	.0
48.23	0	1	95.8	41.7	.0
48.50	0	1	95.8	41.6	.0
48.78	0	1	95.8	41.6	.0
49.06	0	1	95.8	41.6	.0
49.33	0	1	95.8	41.5	.0
49.61	0	1	95.7	41.5	.0
49.89	0	1	95.7	41.5	.0
50.17	0	1	95.7	41.4	.0
50.44	0	1	95.7	41.4	.0
50.72	0	1	95.7	41.4	.0
51.00	0	1	95.7	41.4	.0
51.27	0	1	95.7	41.3	.0
51.55	0	1	95.7	41.3	.0
51.83	0	1	95.7	41.3	.0
52.11	0	1	95.7	41.2	.0
52.38	0	1	95.7	41.2	.0
52.66	0	1	95.7	41.2	.0
52.94	0	1	95.7	41.2	.0
53.21	0	1	95.7	41.1	.0
53.49	0	1	95.7	41.1	.0
53.77	0	1	95.7	41.1	.0
54.05	0	1	95.7	41.1	.0

54.32	0	1	95.7	41.0	.0														
54.60	0	1	95.7	41.0	.0														
54.88	0	1	95.7	41.0	.0														
55.15	0	1	95.7	41.0	.0														
55.43	0	1	95.6	40.9	.0														
55.71	0	1	95.6	40.9	.0														
55.99	0	1	95.6	40.9	.0														
56.26	0	1	95.6	40.9	.0														
56.54	0	1	95.6	40.9	.0														
56.82	0	1	95.6	40.8	.0														
57.09	0	1	95.6	40.8	.0														
57.37	0	1	95.6	40.8	.0														
57.65	0	1	95.6	40.8	.0														
57.93	0	1	95.6	40.8	.0														
58.20	0	1	95.6	40.7	.0														
58.48	0	1	95.6	40.7	.0														
58.76	0	1	95.6	40.7	.0														
59.03	0	1	95.6	40.7	.0														
59.31	0	1	95.6	40.7	.0														
59.59	0	1	95.6	40.6	.0														
59.87	0	1	95.6	40.6	.0														
60.14	0	1	95.6	40.6	.0														
60.42	0	1	95.6	40.6	.0														
60.70	0	1	95.6	40.6	.0														
60.97	0	1	95.6	40.6	.0														
61.25	0	1	95.6	40.5	.0														
61.53	0	1	95.6	40.5	.0														
61.81	0	1	95.6	40.5	.0														
62.08	0	1	95.6	40.5	.0														
62.36	0	1	95.6	40.5	.0														
62.64	0	1	95.6	40.5	.0														
62.91	0	1	95.6	40.4	.0														
63.19	0	1	95.6	40.4	.0														
63.47	0	1	95.6	40.4	.0														
63.75	0	1	95.6	40.4	.0														
64.02	0	1	95.6	40.4	.0														
64.30	0	1	95.5	40.4	.0														
64.58	0	1	95.5	40.4	.0														
64.85	0	1	95.5	40.3	.0														
65.13	0	1	95.5	40.3	.0														
65.41	0	1	95.5	40.3	.0														
65.69	0	1	95.5	40.3	.0														
65.96	0	1	95.5	40.3	.0														
66.24	0	1	95.5	40.3	.0														

Time Qin Qout Elev Vol Area ExtVel | | | | | | | | | |

0. 50. 100. 150. 200. 250. 300. 350.

END NRCS-PSH PLOT

RATING TABLE DEVELOPED, SITE = S 1:

BY PROGRAM FOR PS AND AUX. SPILLWAYS

AUX. RATING USING ASFILE METHOD.

RATING TABLE NUMBER 1

	ELEV. FEET	Q-TOTAL CFS	Q-PS CFS	Q-AUX. CFS	VOLUME AC-FT	AREA ACRE
1	95.10	.00	.00	.00	37.55	.00
2	95.56	.66	.66	.00	40.44	.00
3	96.02	2.46	2.46	.00	43.14	.00
4	96.49	4.20	4.20	.00	45.83	.00
5	96.59	10.00	10.00	.00	46.43	.00
6	96.70	15.83	15.83	.00	47.04	.00
7	96.80	21.86	21.86	.00	47.65	.00
FULL CONDUIT FLOW, ELEV = 96.80 FT						
8	97.35	22.24	22.24	.00	50.87	.00
9	97.91	22.61	22.61	.00	54.09	.00
10	98.46	22.97	22.97	.00	58.02	.00
11	99.02	23.33	23.33	.00	62.09	.00
12	99.57	23.69	23.69	.00	66.16	.00
13	100.12	24.04	24.04	.00	70.38	.00

1SITES -----
 XEQ 09/13/2001 Leonard Benson SW 31-T7S-R9E WSID= BenSW31
 VER 96.1 SUBW= A
 TIME 08:00:26 SITE = S 1 PASS= 1 PART= 3

AUX. CREST 98.28 FT 56.7 ACFT .00 AC 22.9 CFS

PS STORAGE 19.1 ACFT, BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

START ELEV 95.13 FT 37.7 ACFT .00 AC .0 CFS

EFFECTIVE HEIGHT(H)= 19.0 FEET, PRODUCT= 1076. (H * STORAGE AT CREST AUX.).

INPUT DESIGN CLASS = A1 = LT 3000. PRODUCT.

***** MESSAGE - EXIT CHANNEL SLOPE SET TO 4%; INSUFFICIENT DESIGN INPUT DATA.

RATING TABLE DEVELOPED, SITE = S 1:
 BY PROGRAM FOR PS AND AUX. SPILLWAYS
 AUX. RATING USING ASFILE METHOD.

RATING TABLE NUMBER 2

	ELEV. FEET	Q-TOTAL CFS	Q-PS CFS	Q-AUX. CFS	VOLUME AC-FT	AREA ACRE
1	95.10	.00	.00	.00	37.55	.00
2	95.56	.66	.66	.00	40.44	.00
3	96.02	2.46	2.46	.00	43.14	.00
4	96.49	4.20	4.20	.00	45.83	.00
5	96.59	10.00	10.00	.00	46.43	.00
6	96.70	15.83	15.83	.00	47.04	.00
7	96.80	21.86	21.86	.00	47.65	.00
FULL CONDUIT FLOW, ELEV = 96.80 FT						
8	97.05	22.03	22.03	.00	49.08	.00
9	97.29	22.20	22.20	.00	50.52	.00

10	97.54	22.36	22.36	.00	51.95	.00
11	97.79	22.53	22.53	.00	53.39	.00
12	98.03	22.69	22.69	.00	54.88	.00
13	98.28	22.86	22.86	.00	56.69	.00
14	98.57	99.12	23.04	76.08	58.79	.00
15	98.85	176.39	23.23	153.16	60.90	.00
16	99.37	334.66	23.56	311.10	64.68	.00
17	100.00	638.50	23.96	614.54	69.30	.00
18	101.14	1338.49	24.67	1313.83	79.02	.00
19	102.57	2500.19	25.52	2474.67	91.92	.00
20	104.00	3937.28	26.35	3910.92	105.95	.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)	LOCATION
1	-135.	-120.	-26.7	.040	**	**	**	INLET
2	-120.	-40.	-5.0	.040	**	**	**	INLET
3	-40.	0.	.0	.040	**	**	**	CREST
4	0.	190.	4.0	.040	.65	3	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 4 used in computing exit channel velocities.

***** WARNING - DRAWDOWN INFLOW HYDROGRAPH POINTER (61) OUT OF RANGE.
 POINTER IS HYDROGRAPH POINT USED TO LOCATE START OF DRAWDOWN.
 DRAWDOWN MAY NOT BE CORRECT, RUN CONTINUING.

DRAWDOWN USING FREEBOARD STORM FOLLOWS, STARTING AT ELEVATION 79.00 FT.

***** MESSAGE - INPUT(.00) TO INTERPOLATION ROUTINE IS BELOW
 ARRAY LIMIT(37.55).

DRAWDOWN (DDT) TEST 95.10 FT 37.5 ACFT .00 CFS
 CONTROL IS .000 DETENTION STORAGE

TIME = .00 DAYS, TO .0 CFS (LIMIT = 10.00 DAYS)

***** WARNING - DRAWDOWN INFLOW HYDROGRAPH POINTER (61) OUT OF RANGE.
 POINTER IS HYDROGRAPH POINT USED TO LOCATE START OF DRAWDOWN.
 DRAWDOWN MAY NOT BE CORRECT, RUN CONTINUING.

***** MESSAGE - NO RUNOFF TO ROUTE NRCS-FBH WITH AUX. SPILLWAY CREST
 ELEVATION AT 98.28 AND BOTTOM WIDTH = 80.0 FEET.

PASS NUMBER 1, STOPPED.

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

BenSW31 Leonard Benson SW 31-T7S-R9E

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

1 SUMMARY TABLE 1 SITES VERSION 96.1
DATED 03/01/1996

WATERSHED ID	RUN DATE	RUN TIME
BenSW31	09/13/2001	08:00:26

>>> SITE	SUBWS	SUBWS DA	CURVE	TC	TOTAL DA	TYPE	STRUC	<<<
ID	ID	(SQ MI)	NO.	(HRS)	(SQ MI)	DESIGN	CLASS	
S	1	A	1.54	80.	1.19	1.54	378NR	A1

PASS	DIA./	AUX.CREST	BTM.	MAX.	MAX.	EMB.	INTEGR.*	EXIT*	TYPE
NO.	WIDTH	ELEV	WIDTH	HP	ELEV	VOL.	DIST.	VEL.	HYD
(IN/FT)	(FT)	(FT)	(FT)	(FT)	(CY)	(FT)	(FT/SEC)		

SITES.....SUMMARY TABLE 1 COMPLETED.

NRCS SITES VERSION 96.1 ,03/01/1996
BenSW31 FILES

INPUT
C:\Engineer\sites32\bensonA\bensonPS,15.D2C

OUTPUT - DATED 09/13/2001 08:00:26
C:\Engineer\sites32\bensonA\bensonPS,15.OUT

GRAPHICS FILES GENERATED

OPTION "L" DATED 09/13/2001 08:00:26
C:\Engineer\sites32\bensoA\bensoPS,15.DRG

OPTION "P" DATED 09/13/2001 08:00:26
C:\Engineer\sites32\bensoA\bensoPS,15.DHY

OPTION "E" DATED 09/13/2001 08:00:26
C:\Engineer\sites32\bensoA\bensoPS,15.DEM



DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES

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

September 4, 2002

B & V Thompson Ranch, Inc.
Leonard Benson, President
HC 56, Box 65A
Oral SD 57766

Dear Mr. Benson:

Thank you for submitting the *Application for a Permit to Appropriate Water* for a storage dam. In order to complete the application the following is required.

We have received the \$150 application filing fee. In addition to the application filing fee, the Water Rights Program collects the \$50 licensing fee at the time of filing. Please submit \$50 for the licensing of the water permit.

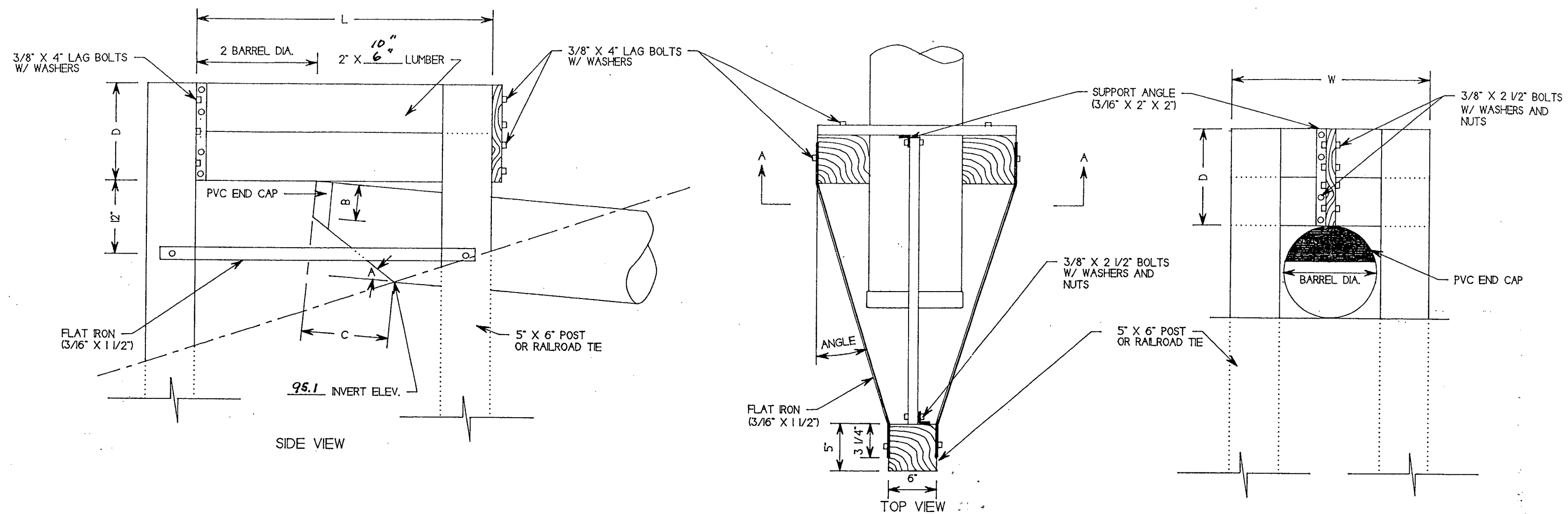
If you have any questions, please contact me.

Sincerely,

Karen Schlaak

Karen Schlaak
Water Rights Program
605 773-3352

2488-B



ANTIVORTEX BAFFLE AND GUARD POST SUPPORT QUANTITIES

BARREL DIA.	D	L LENGTH FT.-IN.	NO. REQ'D	FLAT IRON LENGTH FT.-IN.	NO. REQ'D	3/8" X 4" LAG BOLTS & WASHERS NO. REQ'D	SUPPORT ANGLE LENGTH FT.-IN.	NO. REQ'D	POSTS LENGTH FT.-IN.	NO. REQ'D	W LENGTH FT.-IN.	NO. REQ'D	3/8" X 2 1/2" BOLTS, NUTS & WASHERS EA.	ANGLE
15"	1'-2 3/4"	(2" X 10") X 4'-4 1/2" (2" X 6") X 4'-4 1/2"	1 1	4'-7"	2	16	1'-2 3/4"	2	6'-0"	3	(2" X 10") X 2'-3" (2" X 6") X 2'-3"	1 1	12 (24 WASHERS)	13°
18"	1'-6 1/2"	(2" X 10") X 5'-3"	2	5'-5"	2	16	1'-6 1/2"	2	8'-0"	3	(2" X 10") X 2'-6"	2	12 (24 WASHERS)	12°
24"	1'-10 1/2"	(2" X 12") X 7'-0"	2	7'-3"	2	16	1'-10 1/2"	2	8'-0"	3	(2" X 12") X 3'-0"	2	12 (24 WASHERS)	11°

NOTE: ALL LUMBER AND POSTS WILL BE PRESSURE TREATED

CONAPY INLET DIMENSIONS

PIPE DIA. IN.	PIPE GRADE %	A DEG	B IN.	C IN.	H FT.	PIPE DIA. IN.	PIPE GRADE %	A DEG	B IN.	C IN.	H FT.	PIPE DIA. IN.	PIPE GRADE %	A DEG	B IN.	C IN.	H FT.
15	0-5	56	2 7/8	8 1/8	1.8	18	0-5	56	3 3/8	9 3/4	2.1	24	0-5	56	4 1/2	13	2.8
	5.1-15	45	3	12	1.9		5.1-15	45	3 5/8	14 3/8	2.3		5.1-15	45	4 3/4	19 1/4	3.0
	15.1-25	33	4	16 1/2	2.0		15.1-25	33	4 7/8	19 3/4	2.4		15.1-25	33	6 1/2	26 3/8	3.2
							25.1-32	27	6 1/4	23 3/8	2.6						

PVC CANOPY INLET
W/ ANTIVORTEX BAFFLE
AND GUARD POST SUPPORT
FOR 15" thru 24" PIPE

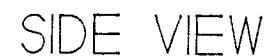
LEONARD BENSON
DAM (FISH & WILDLIFE AND LIVESTOCK)
FALL RIVER CO., SO. - FALL RIVER CO.
NW 1/4 SW 1/4 SEC 31-T75-R9E

USDA U.S. Department of Agriculture
Natural Resources Conservation Service

DESIGNED g. miler APPROVED BY _____
DRAFTED _____ TITLE _____
DATE _____ SHEET 3 OF 5 DWG NO. CAN-PVCL



SIEVE SIZE	PERCENT PASSING
3/8"	100
4	85-100
8	80-100
16	50-85
30	25-60
50	10-30
100	2-10



LIST OF MATERIALS			
ITEM NO.	ITEM	UNIT	QUANTITY
1	4" PVC PERFORATED PIPE	lf.	7.75
2	4" PVC NON-PERFORATED PIPE	lf.	53
3	4" PVC END CAP	ea.	2
4	4" PVC TEE	ea.	1
5	SAND	cy.	3.5
6	ANIMAL GUARD (see note 2)	ea.	1

- NOTE: 1. THE 4" DIA. PIPE SHALL BE SDR 35 PVC OR STRONGER .
2. PROVIDE AN ANIMAL GUARD ON DRAIN OUTLET PIPE. DRILL 2-2 1/2" HOLES ON G 6" FROM END OF PIPE AND PLACE A 3/8" DIA. 5 1/2" LONG GALVANIZED STEEL BOLT THRU THEM AND SECURE WITH A NUT (PLACE BOLT HORIZONTAL).
3. FILTER SAND WILL BE CLEAN PEA AGGREGATE OR CONCRETE SAND.
4. 4" PIPE WILL BE SECURED TO PIPE SUPPORT AND EXTEND A MIN. OF 2' BEYOND SUPPORT.
5. DISTANCE EQUALS 18" MINIMUM IF BARREL AND 4" PIPE ARE LOCATED IN ORIGINAL FOUNDATION MATERIAL AND 2D MINIMUM IF LOCATED IN FILL MATERIAL FOR DAM.

SAND ANTISEEP COLLAR

LEONARD BENSON
DAM (FISH & WILDLIFE AND LIVESTOCK)
FALL RIVER CO., SD. - FALL RIVER C.D.
NW 1/4 SW 1/4 SEC 31-T75-R9E



U.S. Department of Agriculture
Natural Resources Conservation Service

DESIGNED <u>G. Miller</u>	APPROVED BY _____
DRAFTED _____	TITLE _____
DATE _____	DWG NO. _____
SHEET <u>4</u> OF <u>5</u>	

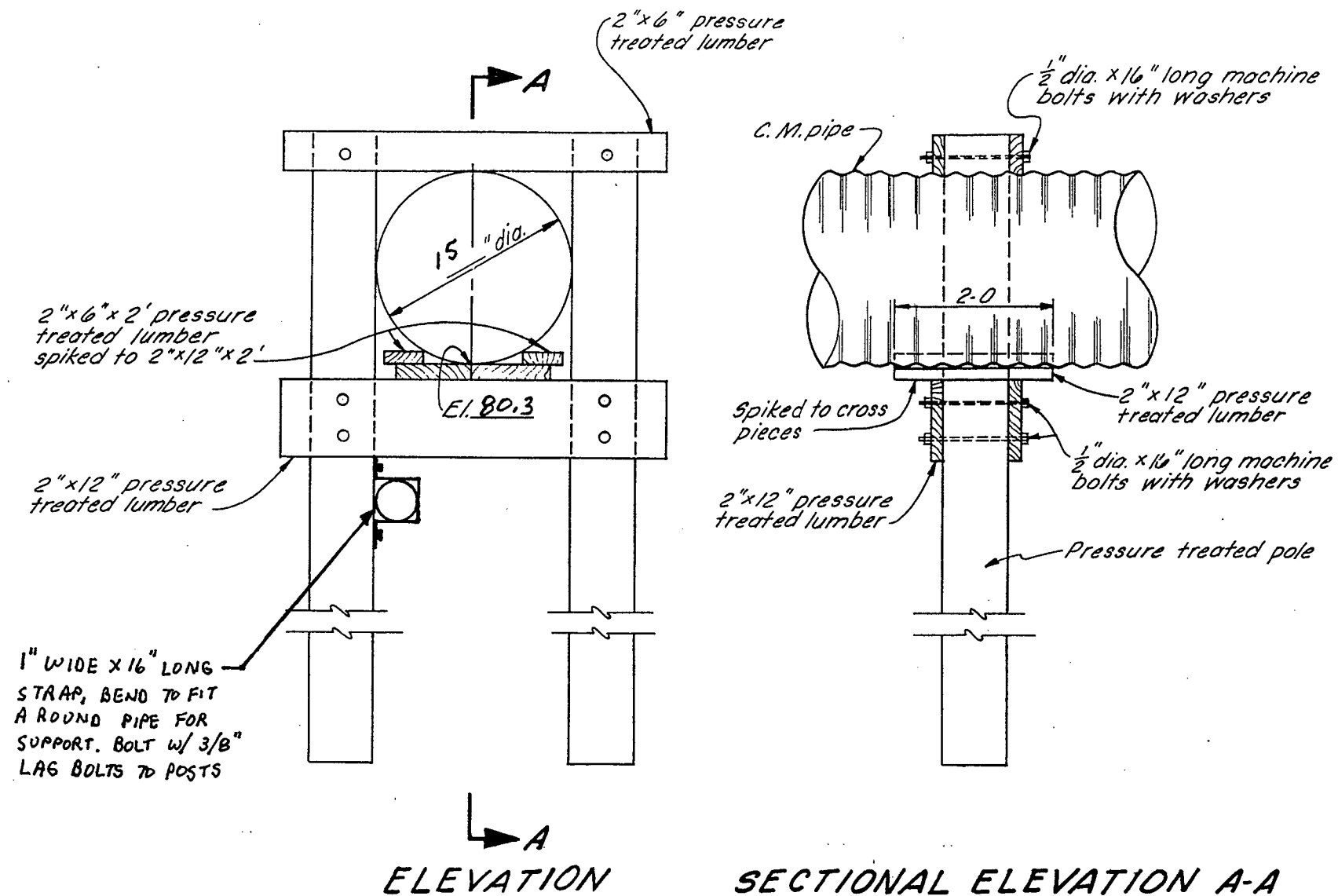


TABLE OF QUANTITIES

ITEM	LENGTH FOR 15" DIA. C.M. PIPE	UNIT	QUANTITY
PRESSURE TREATED POLE 8" DIA.	8'-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		EACH	10
1/2" DIA. WASHERS		EACH	20

NOTES:

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

TIMBER PIPE SUPPORT

OPERATOR: <u>LEONARD BENSON</u>	
CONSERVATION DISTRICT: <u>FALL RIVER</u>	
U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE	
Designed <u>G Miller</u> Date <u>9/21</u>	Approved by _____
Drawn _____	Title _____
Traced _____	Title _____
Checked _____	Sheet <u>5</u> of <u>5</u> Drawing No. _____

REFERENCE: GUIDE PLAN NO. 4.0

JOB PLAN NO. 4.0

5,N-29,073.4a

Water Permit Application #2488-2

B&V Thompson Ranch, Inc.

Cat. 3 - Low Hazard Dam

Top of Dam Elev. - 101
 2nd Spillway Elev. - 98
 P. Spillway Elev. - 95.1
 O/S Toe Elev. - 79 } Hh. = 22 ft.

Normal Storage Capacity - 37.6 Ac.-Ft
 Int. Storage Capacity - 54.6 Ac.-Ft
 Max Storage Capacity - 77.8 Ac.-Ft

Int. Capacity x Eff. Hh. = $54.6 \times 18.7 = 1021 < 3000 \therefore 25 \text{ yr}$
Mid. Spillway Design

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

DA = 984 Ac = 1.54 mi²
 Slope = 150 Hh:1
 SI = 1.76

$$\begin{aligned} Q_{25} &= 83.4 A^{.44} S^{.44} S^{-.72} \\ &= 83.4 (1.54)^{.44} (150)^{.44} (1.76)^{-.72} \\ &= 83.4 (1.30) (9.07) (0.6666) \\ &= \underline{655 \text{ cfs}} \end{aligned}$$

$$\begin{aligned} Q_{100} &= 132 A^{.45} S^{.46} S^{-.67} \\ &= 132 (1.54)^{.45} (150)^{.46} (1.76)^{-.67} \\ &= 132 (1.32) (10.02) (0.6847) \\ &= \underline{1195 \text{ cfs}} \end{aligned}$$

2nd Spillway Flow

$$\begin{aligned} Q &= C L H^{3/2} \quad C = 2.6 \\ &= (2.6)(80)(3)^{1.5} \quad L = 80 \\ &= \underline{1080 \text{ cfs}} \quad H = 3 \end{aligned}$$

NRCS Annual Yield

$$DA = 984 \quad CN = 80 \quad ISO = 1 \frac{1}{2}$$

Section 74:02:08:09

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

$$\begin{aligned} 80\% \text{ chance} &= 0.18 \\ 0.18 \times 984/12 &= \underline{15 \text{ Ac.-Ft}} \end{aligned}$$

$$\begin{aligned} 50\% \text{ chance} &= 0.45 \\ 0.45 \times 984/12 &= \underline{37 \text{ Ac.-Ft}} \end{aligned}$$

$$\begin{aligned} 10\% \text{ chance} &= 2.0 \\ 2.0 \times 984/12 &= \underline{164 \text{ Ac.-Ft}} \end{aligned}$$



DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES

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

October 1, 2002

B & V Thompson Ranch, Inc.
Leonard Benson, President
HC 56, Box 65A
Oral, SD 57766

Dear Mr. Benson:

We have reviewed the plans and specifications for your dam project located in the SW 1/4 of Section 31-T7S-R9E, in Fall River County. The plans and specifications as submitted are approved. Approval of the plans and specifications does not authorize construction of the dam. The construction of the dam may not begin until Water Permit No. 2488-2 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 Thompson Ranch Dam will be classified as a small size Category 3, Low Hazard dam with a dam height of 22 feet and a normal storage capacity of 37.6 acre-feet and a maximum storage capacity of 78 acre-feet.

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

Sincerely,

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

c: Gerald Miller, NRCS, Rapid City

REPORT ON
WATER PERMIT APPLICATION NO. 2488-2
B & V Thompson Ranch, Inc.
September 24, 2002

Water Permit Application No. 2488-2 has been filed by B & V Thompson Ranch Inc. to impound 37.6 acre-feet of water by constructing a dam located in the NW 1/4 SW 1/4 of Section 31-T7S-R9E, in Fall River County. The application also requests impoundment of sufficient water to maintain water at the outlet elevation. The water will be used for fish and wildlife production and livestock use.

Discussion:

The dam will be classified as a small size, Category 3, Low Hazard dam. The Natural Resources Conservation Service (NRCS) has designed the dam. The plans and specifications have been reviewed and will be approved.

The Thompson Ranch Dam will be 22 feet high with a normal storage capacity of 37.6 acre-feet with a reservoir level at the primary spillway elevation, and a maximum storage capacity of 78 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 984 acres or 1.54 square miles. A 25-year frequency event for this drainage area produces a peak runoff of approximately 655 cfs. A 100-year frequency event produces a peak of approximately 1195 cfs. The dam was designed to have an 15 inch diameter PVC pipe with 5.9 feet of available freeboard as the primary spillway, and a 80 foot wide earthcut spillway with 3.0 feet of available freeboard as the secondary spillway. The 80 foot wide earthcut spillway has a capacity of approximately 1080 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 15 acre-feet. The annual yield with a 50 percent chance of occurrence, or 1 out of 2 years, is expected to be 37 acre-feet and the annual yield with a 10 percent chance, or 1 out of 10 years, is expected to be 164 acre-feet.

The B & V Thompson Ranch Dam will be located in the NW 1/4 SW 1/4 of Section 31-T7S-R9E on an unnamed tributary to Hay Canyon about one-half mile upstream of its confluence with Hay Canyon and about 5 miles upstream of the confluence of Hay Canyon and the Cheyenne River. The B & V Thompson Ranch holds Vested Water Right No. 807-2, which appropriates 2.42 cfs from Hay Canyon to irrigate 172 acres located in Sections 1, 2 & 11-T8S-R8E and Section 36-T7S-R8E. About 30 of the acres in Section 36-T7S-R8E are located below the confluence of the unnamed tributary one-half mile below the proposed dam. There are no other Water Permits/Rights on the unnamed tributary or Hay Canyon between the proposed dam and the Cheyenne River.

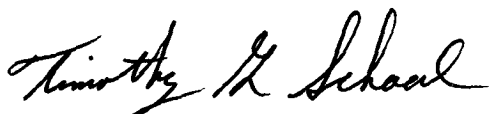
Page 2

Application No. 2488-2

B & V Thompson Ranch, Inc.

Conclusions:

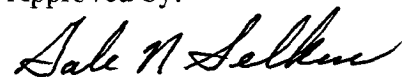
1. Water Permit Application No. 2488-2 should be approved since unappropriated water is available and approval should not have an adverse effect on existing Water Permits/Rights.
2. If approved, the low flow bypass requirement for downstream domestic use and existing prior Water Permits/Rights should be a qualification on Water Permit Application No. 2488-2.



Timothy G. Schaal, P.E.

Natural Resources Engineer Specialist

Approved by:



Gale N. Selken, P.E.

Natural Resources Engineer Director



**DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES**

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

**RECOMMENDATION OF CHIEF ENGINEER FOR WATER PERMIT
APPLICATION NO. 2488-2, B & V Thomspen Ranch, Inc.**

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. 2488-2, B & V Thompson Ranch, Inc., Leonard Benson, President, HC 56, Box 65A, Oral SD 57766.

The Chief Engineer is recommending APPROVAL of Application No. 2488-2 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. 2488-2 authorizes a dam with a storage capacity of 37.6 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
October 1, 2002

RECEIVED
OCT 21 2002
WATER RIGHTS
PROGRAM

PROOF OF PUBLICATION

STATE OF SOUTH DAKOTA)
) SS
County of Fall River)

I, Brett Nachtigall

certify that the attached printed Notice was taken

from the Hot Springs Star

printed and published in Hot Springs

County of Fall River and

state of South Dakota. The notice was published

in the newspaper on the following two dates:

October 8, 2002

October 15, 2002

Cost of Printing \$39.74


(Signature)

Publisher
(Title)

October 15, 2002
(Date Signed)

280 NOTICE OF APPLICATION NO. 2488-2

to Appropriate Water

Notice is given that B & V Thompson Ranch, Inc., Leonard Benson, President, HC 56, Box 65A, Oral, SD 57766, has filed an application for a water permit to impound 37.6 acre-feet of water from runoff by constructing a dam on a tributary to Hay Canyon, located in the NW1/4SW1/4 Section 31 with water impounded in the NW1/4SW1/4 Section 31; all in T7S-R9E. this application requests impoundment of sufficient water to maintain water to the outlet elevation. The water is for fish and wildlife propagation and livestock water purposes.

Pursuant to SDCL 46-2A-2, the Chief Engineer recommends APPROVAL of Application No. 2488-2 because 1) unappropriated water is available, 2) existing rights will not be unlawfully impaired, 3) it is a beneficial use of water, and 4) it is in the public interest. In accordance with SDCL 46-2A-23, the Chief Engineer will act on the application, as recommended, unless a petition is filed opposing the application or the applicant files a petition contesting the Chief Engineer's recommendation. If a petition opposing the application or contesting the recommendation is filed, then a hearing will be scheduled and the Water Management Board will consider the application. Notice of 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 October 25, 2002.

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.

Oct. 8, 15



DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES

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

October 2, 2002

Hot Springs Star
PO Box 1000
Hot Springs, SD 57747-1000

ATTENTION: Legal Public Notice

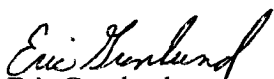
Enclosed is a Notice of Hearing on Application No. 2488-2 to Appropriate Water to be published twice. Please publish the first notice on October 8, 2002 with the second publication 7 days later.

The applicant must verify to you that the notice is to be published, before you make the first publication **Please BILL the APPLICANT for the cost of publication.** The APPLICANT is B & V Thompson Ranch Inc., Leonard Benson, President, HC 56, Box 65A, Oral SD 57766 (Ph # 605-424-2085).

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

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

Sincerely,


Eric Gronlund
Natural Resources Engineer
605 773-3352

enclosures

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

No. 2488-2

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

Date _____

We are in receipt of your letter of October 1, 2002 enclosing Notice of Hearing to Appropriate Water by Application No. 2488-2 which was first published in our issue of _____. **ENCLOSED IS A COPY OF THIS FIRST PUBLICATION.**

Name

Newspaper



**DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES**

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.**

October 2, 2002

B & V Thompson Ranch Inc.
Leonard Benson, President
HC 56, Box 65A
Oral SD 57766

Dear Mr. Benson:

Water Permit Application No. 2488-2 for fish and wildlife propagation use has been examined and found to comply with the South Dakota Water Laws and applicable rules. A notice of hearing has been sent to the Publisher of the Hot Springs Star printed at Hot Springs, SD (Ph # 605-745-4170). You will need to contact the newspaper and authorize publication of this notice. For your information, a copy of the notice, the recommendation of the Chief Engineer and a report on the application are enclosed. Please review the notice prior to publication and notify this office, if you have any corrections or questions.

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

Sincerely,


Eric Gronlund
Natural Resources Engineer
(605) 773-3352

enclosures

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 October 8, 2002 with the second publication 7 days later. The applicant is responsible for payment.

NOTICE OF APPLICATION NO. 2488-2 to Appropriate Water

Notice is given that B & V Thompson Ranch, Inc., Leonard Benson, President, HC 56, Box 65A, Oral SD 57766 has filed an application for a water permit to impound 37.6 acre-feet of water from runoff by constructing a dam on a tributary to Hay Canyon located in the NW ¼ SW ¼ Section 31 with water impounded in the NW ¼ SW ¼ Section 31; all in T7S-R9E. This application requests impoundment of sufficient water to maintain water to the outlet elevation. The water is for fish and wildlife propagation and livestock water purposes.

Pursuant to SDCL 46-2A-2, the Chief Engineer recommends APPROVAL of Application No. 2488-2 because 1) unappropriated water is available, 2) existing rights will not be unlawfully impaired, 3) it is a beneficial use of water, and 4) it is in the public interest. In accordance with SDCL 46-2A-23, the Chief Engineer will act on the application, as recommended, unless a petition is filed opposing the application or the applicant files a petition contesting the Chief Engineer's recommendation. If a petition opposing the application or contesting the recommendation is filed, then a hearing will be scheduled and the Water Management Board will consider the application. Notice of the hearing will be given to the applicant and any person filing a petition.

Any person interested in opposing or supporting this application or recommendation must file a written petition with BOTH the applicant and Chief Engineer. The applicant must file a petition if contesting the Chief Engineer's recommendation. The Chief Engineer's address is "Water Rights Program, Foss Building, 523 E Capitol, Pierre SD 57501 (605 773-3352)" and the applicant's mailing address is given above. A petition filed by either an interested person or the applicant must be filed by October 25, 2002.

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.



NOV 04 2002

**DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES**

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

B & V Thompson Ranch Inc.
Leonard Benson, President
HC 56 Box 65A
Oral SD 57766

Dear Mr. Benson:

Enclosed is Water Permit No. 2488-2 authorizing construction of your water diversion system and beneficial use of the water, not exceeding the limits as specified in the Water Permit.

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

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

Sincerely,

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

enclosures

Permit No. 2488-2
Upper Cheyenne River - Water District

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

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

I have this day, **May 21, 2008**, made a thorough examination of the water use system constructed by **B & V Thompson Ranch, Inc.** of **HC 56 Box 65A, Oral, SD 57766** holder of Permit No. **2488-2**, bearing the priority of **August 30, 2002** authorizing the storage of **37.6** acre-feet of the waters of **runoff** for **fish & wildlife propagation and livestock water** purposes, in **Fall River** County.

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

A. Works used to divert the water:

A 22 ft. high earthen dam with a normal storage capacity of 37.6 ac-ft.

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

N/A

C. Works used to apply water to beneficial use:

A 22 ft. high earthen dam with a normal storage capacity of 37.6 ac-ft.

The system is in the following condition **good**. The point of diversion is located **1900 ft. north & 200 ft. east of the SW corner of Sec. 31-T7S-R9E (NW ¼ SW ¼) (Lat. 43.395658 & Long. -103.104284)**. The works are capable of diverting storing **37.6** acre-feet of water which is to be used for **fish & wildlife propagation and livestock water**. Water has been put to beneficial use to the maximum extent as follows:

A 22 ft. high earthen dam with a normal storage capacity of 37.6 ac-ft.

and the license should be issued for **37.6** acre-feet of storage.

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

Exceptions to compliance are: **none** Date Report Completed: **August 17, 2009**



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

REPORT ON INSPECTION OF PERMIT NO. 2488-2

DATE OF INSPECTION: May 21, 2008

NAME & ADDRESS OF PERMIT HOLDER: B & V Thompson Ranch, Inc., HC Box 65A,
Oral, SD 57766

DIVERSION POINT LEGAL LOCATION: 1900 ft. north & 200 ft. east of the SW corner of
Sec. 31-T7S-R9E (NW ¼ SW ¼) (Lat. 43.395658 & Long. -103.104284).

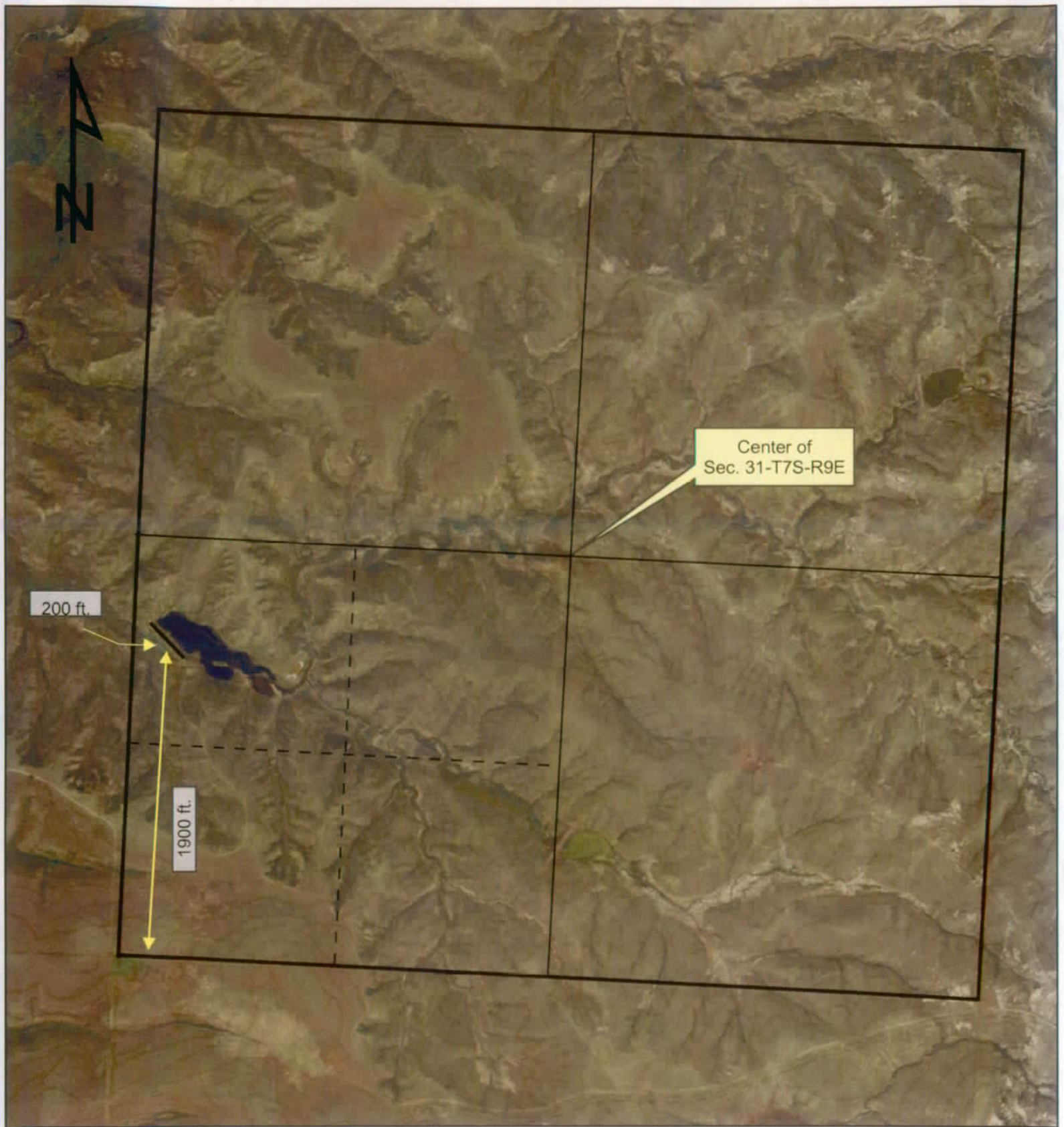
DAM INFORMATION:

- 1) Height to crest 22 ft. feet
- 2) Height to primary spillway 16 feet
- 3) Height to secondary spillway 19 feet
- 4) Crest width 12 feet
- 5) Crest length 420 feet
- 6) Spillway length XXX feet
- 7) Spillway width 80 feet
- 8) Approx. storage (Normal) 37.6 acre-feet
- 9) Approx. storage (Maximum) 77.8 acre-feet
- 10) Date constructed: 2003

PERMIT QUALIFICATIONS AND REGULATIONS:

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

Water Permit No. 2488-2



0 0.25 0.5 1 Miles



South Dakota Department of
Environment and Natural Resources



Protecting South Dakota's Tomorrow ... Today



Timothy G. Schaal

8/17/09

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



**DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES**

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

AUG 24 2009

2488-2

Leonard Benson
B & V Thompson Ranch Inc
HC 56 Box 65A
Oral SD 57766

Dear Mr. Benson:

Enclosed is your Water License No. 2488-2. Water License No. 2488-2 is the final document which completes the process of obtaining a water right. Also enclosed 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. 2488-2

(1) B & V Thompson Ranch, Inc, HC 56 Box 65A, Oral SD 57766 made Application No. 2488-2, August 30, 2002 for a water permit to impound 37.6 acre feet of runoff water by constructing a dam on a tributary to Hay Canyon located in Fall River County, South Dakota for fish & wildlife propagation and livestock watering purposes. Permit No. 2488-2, with a priority date of August 30, 2002 was approved October 25, 2002 and issued to the applicant for diversion of water with construction of the impoundment to be completed on or before October 24, 2007 and the application to beneficial use of water on or before October 25, 2011.

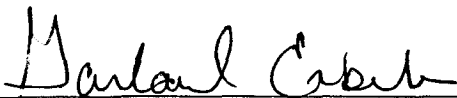
(2) The storage dam has been completed and water applied to beneficial use in accordance with South Dakota State Law. Pursuant to South Dakota Codified Law 46-5-30.1, B & V Thompson Ranch, Inc, HC 56 Box 65A, Oral SD 57766 the holder and/or owner of Water Right No. 2488-2 is issued a license, bearing a priority date of August 30, 2002 to impound 37.6 acre feet of runoff water for fish & wildlife propagation and livestock watering purposes.

The 22 feet high earthen storage dam (spillway) is located:

- 1,900 feet north and 200 feet east of the SW corner of Section 31, T7S, R9E (NW ¼ SW ¼).
- Water is impounded in the NW ¼ SW ¼ Section 31, T7S, R9E

(3) This license is subject to South Dakota Water Law, any limitations or conditions listed in Water Permit No. 2488-2 including the following qualifications:

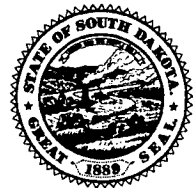
- Water Permit No. 2488-2 authorizes a dam with storage capacity of 37.6 acre feet of water and sufficient water annually to maintain the water level to the outlet elevation.
- Low flows as needed for downstream domestic use, including livestock water and prior water rights must be by-passed.



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

AUG 24 2009

date



RECEIVED

MAR 04 2015

WATER RIGHTS
PROGRAM

NOTICE OF TRANSFER OF OWNERSHIP

To: Chief Engineer
Water Rights Program, DENR
523 E. Capitol
Pierre, SD 57501-3181

No. 2488-2

Date: 2-25-15

I/We request that Water Right No. 2488-2

formerly owned by: B & V Thompson Ranch Inc

be transferred to: (name & address) Carl & Mari Sanders

14366 WG Flt

Oral SD 57266 Telephone No. 605.890-2113

Title to the following described land(s)/property has been transferred as described above:

Storage dam located in the NW ¼ SW ¼ Section 31, T7S, R9E

I/We understand that the validity of Water Right No. 2488-2 has not been determined by this transfer action. If I/We have any questions on validity, I/We understand that only the Water Management Board has the authority to determine if a water permit/right is valid (see note).

You are requested to file this "Notice of Transfer" in the appropriate file with the Water Rights Program, as evidence of the change of ownership.

A fee of Fifty Dollars (\$50.00) is required to cover the filing fees as required under SDCL 46-2-13. This form must be signed by the new owner.

I/We Carl Sanders, the new owner, certify that the above information is true and correct.

SLH

(Signed by new owner)

NOTE: Water permits may be cancelled for nonconstruction after the five year construction period has expired. Once a water permit is developed and the water used, the permit becomes a right. A water right may be lost for three reasons:

1. Abandonment - no intent to use water and use is abandoned.
2. Forfeiture - no use of water for three year period without legal excuse.
3. For a third violation of a condition of a water permit/right.

RECEIPT

WATER RIGHTS PROGRAM

South Dakota Department of Environment and Natural Resources

Date 3/4, 2015

RECEIVED OF Carl Sanders 14366 WG Flat Oral SD 57766

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

Fee for Application for Permit No. _____ to Appropriate Water, to construct and to put water to beneficial use	50	00
Fee for Application for Permit No. _____ to Appropriate Water for Future use		
Fee to retain Future Use Permit No. _____ after period of seven years.		
Fee for Inspecting Constructed Works, confirming beneficial use and issuing Water License No. _____		
Fee for Filing Transfer Form <u>2488-2</u>		
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. _____	50	00
Fee for Renewal of Well Pump Installer's License No. _____ for C.Y. _____		
(Any Other Work Provided by Law)	TOTAL	50 00

No. 07311

By *James Hoodman*
Chief Engineer

2488-2



DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES

JOE FOSS BUILDING
PMB 2020
523 EAST CAPITOL
PIERRE SOUTH DAKOTA 57501-3182
www.denr.sd.gov

March 5, 2015

807-2
1873-2
2488-2

Carl & Kari Sanders
14366 WG Flat
Oral SD 57766

Dear Mr. & Mrs. Sanders:

I am writing to acknowledge receipt of the transfer forms and filing fees you submitted for changing ownership on Vested Water Right Nos. 807-2 & 1873-2 and Water Right No. 2488-2.

The ownership changes have been completed. Vested Water Right No. 807-2 and Water Right No. 2488-2 formerly held by B & V Thompson Ranch Inc., is now listed in your names. Vested Water Right No. 1873-2, formerly held by William Fitzner is also now listed in your names.

Enclosed for your records are Receipt Nos. 07309, 07310 and 07311. The receipts are for the filing fees you paid for the ownership changes.

If you have any questions, please contact me.

Sincerely,

A handwritten signature in cursive script that reads "Genny McMath".

Genny McMath
Water Rights Program
(605) 773-3352
email: genny.mcmath@state.sd.us

enclosures