



# DAKOTA ENVIRONMENTAL, INC.

Engineers...Hydrogeologists...Geologists...Remedial Specialists

November 14, 2016

Robert Hill  
Brookings County Zoning & Drainage Dept.  
520 3<sup>rd</sup> Street, Suite 200  
Brookings, SD 57006

Re: Proposed Animal Waste Management System  
Oak Lake Dairy AWMS, Brookings County, SD  
DEC Project No. 1419

Dear Mr. Hill:

Please find included with this letter information regarding the conditional use application for the above referenced facility. These materials are provided on behalf of the applicant with the intent of addressing the required items listed in Article 22.00 page 19 of the ordinance.

**Appendix I** includes the design calculations summarizing the volume of manure produced by the proposed population, as well as the storage capacity available in the proposed storage structures. Manure will be collected from the manure alleys in the barn by vacuum trucks, which will transport it to a solids separation system. The barn will utilize separated manure solids as bedding. With the exception of a small concrete pad for temporary storage of excess separated solids, all waste at the facility will be handled as a liquid. The storage volume available exceeds 365 days of manure and wastewater production for the proposed population. Additional volume is also provided in the ponds for residual volume, stormwater events, annual precipitation, and freeboard of two feet.

**Appendix II** consists of an abbreviated Nutrient Management Plan for the proposed facility. The SD-CPA-7 spreadsheet contains details of the proposed population, storage and application methods, and land available for application. The spreadsheet indicates adequate land has been secured to apply manure from the facility in accordance with General Permit requirements. A map showing the current land parcels is included, though more may be added after the creation of this map. Copies of manure land application agreements allowing manure from the facility to be applied to nearby fields are also included. The section of the DENR General Permit listing the Nutrient Management Plan requirements is included for reference.

**Appendix III** contains the Operation and Maintenance Manual for the facility, which details the operational, upkeep, and inspection requirements for the facility, as well as best management practices for operation.

**Appendix IV** is the Management Plan for Fly and Odor Control, which was developed to summarize best management practices for dealing with these issues, as well as disposal of

mortalities. Any existing and proposed shelterbelts, which are recommended for odor reduction, are also shown on the site plan in Appendix VII.

**Appendix V** contains an aerial map showing the required setback of 2,640 feet from all nearby residences. No setbacks are indicated from the residence immediately south of the site, as the owner is aware of the potential development and has voiced no objection. It is believed all other required setbacks are met, as we are unaware of any listed features being present within the prescribed distances. A database search of the surrounding area indicated no documented wells within the required setback distance. The required setbacks from property lines and rights of way are shown, and are also shown on the site plan. The proposed structures are also placed to be in accordance with all yard requirements for the agricultural district.

**Appendix VI** contains information regarding soils at the site, aquifers, wellhead protection zones, and flood zones.

A copy of the soils map from the Brookings County Soil Survey is included, which shows the predominant surface soil types at the proposed site. A summary page is included identifying the individual groups, which are mostly clay loams.

Information is also included regarding preliminary soil borings performed at the site, including a map showing the boring locations, the boring logs, laboratory testing of a representative sample, and a copy of the United Soil Classification System chart. Initial borings were placed at the widest corners of the potential area of development in order to provide the greatest coverage of the site. The findings of these borings were consistent, with thick layers of lean clay beneath the topsoil, followed by darker clays at depth. Unweathered clay was encountered at depth in borings 2 through 4, and is suspected to be present slightly below the termination depth of boring 1.

The origin of these soils is glacial till (glacially deposited soils), which typically consist of thick deposits of mainly clay soils, though areas of sand, gravel, boulders, and silts can also be encountered. Till deposits often have good qualities for resisting the passage of water due to the high percentage of clay in the mixture. The till deposits in the area of the site are up to 700 feet thick and overlie the impermeable Pierre Shale. Permeability testing performed on samples obtained from the clays in the elevation range of the pond bottoms was favorable for meeting the permeability requirements of the DENR General Permit, and therefore adequate for use as liner material.

Water was encountered only in boring 3, where a thin wet gravel layer was encountered between 11 and 14 feet in depth. This deposit is believed to be a small deposit within the till and is not believed to represent an aquifer. Additionally, boring 3 is located well south of the proposed storage ponds. All initial borings performed at the proposed site were advanced to meet the deep boring requirements of the General Permit for proving separation from shallow aquifers. Additional borings will be required before submittal of the General Permit application at the rate of one boring per acre of storage structure.

Maps from the study titled "Water Resources of Brookings and Kingsbury Counties" (US Geological Survey, 1989) are included showing the site location relative to the Big Sioux, Rutland, Howard, and Altamont aquifers, which are the glacial aquifers potentially present in the surrounding area. The Big Sioux Aquifer is usually present at the surface or slightly below, and in this part of Brookings County consists of alluvial soils in creekbeds, such as to the west of the

site. The main body of the Big Sioux aquifer is not mapped as present beneath the site. The Rutland Aquifer is mapped as present beneath the site, but is separated from the surface by in excess of 200 feet of glacial till soils, well exceeding the requirement of the DENR General Permit. The Howard and Altamont aquifers, typically found at greater depths, are not mapped as present beneath the site.

The above corresponds with the map titled "First Occurrence of Aquifer Materials in Brookings County, South Dakota" (SD DENR, 2004), which indicates the site to be located in an area where no aquifers are encountered within 100 feet of the ground surface. The map titled "Brookings County Groundwater Protection Zones" also indicates the site is not located within the wellhead protection area or the shallow aquifer boundary. Copies of these maps are included.

A copy of the FEMA Flood Rate Insurance Map for the area is also included, which indicates the site is not located within the mapped flood plain (Zone A).

**Appendix VII** includes the site plan for the proposed facility, as well as additional drawings showing details of the proposed construction.

We hope you will find the included information helpful as you evaluate this application. Based on our initial research and findings to date, it is our opinion that the proposed facility can be constructed to meet the requirements of Brookings County and the South Dakota DENR General Permit. Please feel free to contact me if there are any questions, or if further information is required.

Sincerely,



Brian Friedrichsen, PE  
Senior Engineer

**APPENDIX I**  
**DESIGN CALCULATIONS**



11/14/16

**OAK LAKE DAIRY AWMS  
DAIRY WASTE VOLUME CALCULATIONS SUMMARY**

**Dairy Waste - Milking Herd**

Number	Weight	Manure, cf/day/cow	Manure, total cf/day	Storage Period, days	Manure Volume over Storage Period
3,900	1,000	2.4	9,360	365	<b>3,416,400</b>

**Dairy Washwater & Flushwater - Milking Herd**

Number	Weight	Wash water, cf/day/1000#	Wash water, total cf/day	Storage Period, days	Wash water Volume over Storage Period
3,900	1,000	0.6	2,340	365	<b>854,100</b>

**Annual Precipitation on Contributing Areas**

Annual precipitation runoff from solids stockpiling area, cf:	<b>6,922</b>
Annual precipitation runoff from feed storage area, cf:	<b>371,783</b>

**Total Volume of Manure, Wastewater, and Precipitation to Ponds, cubic feet** **4,649,205**

**Total Storage Pond Volume Available, cubic feet:** **6,601,365**

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**OAK LAKE DAIRY AWMS  
SOLIDS STORAGE AREA  
VOLUME CALCULATIONS**

<b>SOLIDS STORAGE PAD RUNOFF VOLUME</b>	
Length of stockpile area, ft	80
Width of stockpile area, ft	80
25 year 24 hour storm depth, ft	0.38
25 year 24 hour volume, cubic ft	<b>2,451</b>
Annual precipitation, ft	2.23
Runoff - percent of mean annual precipitation, % @ CN 97	48.5%
Annual precipitation volume, cubic ft	<b>6,922</b>

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**OAK LAKE DAIRY AWMS  
FEED STORAGE AREA  
RUNOFF VOLUME CALCULATIONS**

<b>FEED STORAGE PAD RUNOFF VOLUME</b>	
Length of stockpile area, ft	625
Width of stockpile area, ft	550
25 year 24 hour storm depth, ft	0.38
25 year 24 hour volume, cubic ft	<b>131,656</b>
Annual precipitation, ft	2.23
Runoff - percent of mean annual precipitation, % @ CN 97	48.5%
Annual precipitation volume, cubic ft	<b>371,783</b>

**Dakota Environmental, Inc.**

P.O. Box 636, 1122 21st Street SW Huron, SD 57350 Phone: (605) 352-5610 Fax: (605) 352-0951

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OAK LAKE DAIRY AWMS  
REQUIRED POND CAPACITY CALCULATIONS

**Storage Pond Capacity Balance**

**25 year / 24 hour storm volumes reporting to Pond 1**

Volume, cf

Solids storage pad and drainage area

2,451

Feed storage pad and drainage area

131,656

**Total, cubic feet** 134,107

**Volumes reporting to ponds for storage**

Volume, cf

Manure, washwater, and bedding volume from herd

4,270,500

Annual precipitation from solids storage pad and drainage area

6,922

Annual precipitation from feed storage pad and drainage area

371,783

**Total, cubic feet** 4,649,205

**Storage Volumes Available**

Volume, cf

Storage Pond 1

2,377,625

Storage Pond 2

3,276,338

Storage Pond 3

947,402

**Total pond storage volume provided, cubic feet**

**6,601,365**

Balance

1,952,160

OAK LAKE DAIRY AWMS  
POND 1 VOLUME CALCULATIONS

POND DESIGN VOLUME AND ELEVATION SUMMARY

DESCRIPTION	EQN.		DEPTH (FT)	ELEV.	ACTUAL DESIGN USED
Existing Grade	G			1945.00	
Inside Top of Berm Width (ft)	W	405			
Inside Width Slope, horizontal feet per foot drop	SW	3			
Inside Top of Berm Length (ft)	L	405			
Inside Length Slope, horizontal feet per foot drop	SL	3			
Constructed Top of Berm, including settlement	E+S			1950.00	1950.0
Settlement, % of embankment height	S=%(E-G)	0%	0.00		
Reference Elevation, operational top of berm (acres & elev. - ft.)	E	3.77		1950.00	
Freeboard (in)	F	24	2.00		
Surface Area at Top of 24hr/25yr storm (acres/elev)	AS=E-F	3.55		1948.00	
25yr/24hr Rainfall (in)	R	4.6			
Surface Area at Inside Top of Berm, incl. Contributing area (ac)	OB	3.77			
Volume of 25yr/24hr Rainfall (cf)	VR=R*OB	196,984			
Volume Provided for 25yr/24hr Rainfall (cf)	avg(AS,O)*(AS-O)	204,253	1.35		
Maximum Surface Area and Operating Level (acres/elev)	O=E-F-R	3.40		1946.65	1946.65
Mean Annual Rainfall (in)	MAR	26.74			
Direct Mean Annual Rainfall within berms (cf)	DM=OB*MAR	365,502			
Mean Annual Lake Evaporation (in)	ME	33			
Evaporation Midpoint (elev)				1933.83	
Surface Area at Evaporation Midpoint (ac)	ESA	2.18			
Net Evaporation at Midpoint (cf)	NE=ME*ESA	260,791			
Net Moisture used for design (evap[-] or rain[+]) (cf)	M	104,711	0.72		
Apparent Operation Level considering Net Moisture adj.	A=O-M	3.33		1945.93	
Volume Provided for Net Moisture (cf)	avg(O,A)*(O-A)	105,476			
Waste Storage Depth (ft) excluding residual depth	D	25.65			
Surface area at top of residual layer (acres/elev)	SS=O-D	1.23		1921.00	
Net Storage Depth provided	D-M	24.9	24.9		
Total Storage Volume from Net Storage Depth (cf)		<b>2,377,625</b>			
Residual Layer Depth (in)	SD	12	1.00		
Top of Liner, surface area, acres	SS-SD	1.16		1920.00	1920.0

**OAK LAKE DAIRY AWMS  
POND 2 VOLUME CALCULATIONS**

**POND DESIGN VOLUME AND ELEVATION SUMMARY**

DESCRIPTION	EQN.		DEPTH (FT)	ELEV.	ACTUAL DESIGN USED
Existing Grade	G			1945.00	
Inside Top of Berm Width (ft)	W	405			
Inside Width Slope, horizontal feet per foot drop	SW	3			
Inside Top of Berm Length (ft)	L	520			
Inside Length Slope, horizontal feet per foot drop	SL	3			
Constructed Top of Berm, including settlement	E+S			1950.00	1950.0
Settlement, % of embankment height	S=%(E-G)	0%	0.00		
Reference Elevation, operational top of berm (acres & elev. - ft.)	E	4.83		1950.00	
Freeboard (in)	F	24	2.00		
Surface Area at Top of 24hr/25yr storm (acres/elev)	AS=E-F	4.58		1948.00	
25yr/24hr Rainfall (in)	R	4.6			
Surface Area at Inside Top of Berm, incl. Contributing area (ac)	OB	4.83			
Volume of 25yr/24hr Rainfall (cf)	VR=R*OB	80,730			
Volume Provided for 25yr/24hr Rainfall (cf)	avg(AS,O)*(AS-O)	264,637	1.35		
Maximum Surface Area and Operating Level (acres/elev)	O=E-F-R	4.42		1946.65	1946.65
Mean Annual Rainfall (in)	MAR	26.74			
Direct Mean Annual Rainfall within berms (cf)	DM=OB*MAR	469,287			
Mean Annual Lake Evaporation (in)	ME	33			
Evaporation Midpoint (elev)				1933.83	
Surface Area at Evaporation Midpoint (ac)	ESA	2.99			
Net Evaporation at Midpoint (cf)	NE=ME*ESA	358,180			
Net Moisture used for design (evap[-] or rain[+]) (cf)	M	111,107	0.59		
Apparent Operation Level considering Net Moisture adj.	A=O-M	4.35		1946.06	
Volume Provided for Net Moisture (cf)	avg(O,A)*(O-A)	112,602			
Waste Storage Depth (ft) excluding residual depth	D	25.65			
Surface area at top of residual layer (acres/elev)	SS=O-D	1.83		1921.00	
Net Storage Depth provided	D-M	25.1	25.1		
Total Storage Volume from Net Storage Depth (cf)		<b>3,276,338</b>			
Residual Layer Depth (in)	SD	12	1.00		
Top of Liner, surface area, acres	SS-SD	1.76		1920.00	1920.0

**OAK LAKE DAIRY AWMS  
POND 3 VOLUME CALCULATIONS**

**POND DESIGN VOLUME AND ELEVATION SUMMARY**

DESCRIPTION	EQN.		DEPTH (FT)	ELEV.	ACTUAL DESIGN USED
Existing Grade	G			1945.00	
Inside Top of Berm Width (ft)	W	250			
Inside Width Slope, horizontal feet per foot drop	SW	3			
Inside Top of Berm Length (ft)	L	350			
Inside Length Slope, horizontal feet per foot drop	SL	3			
Constructed Top of Berm, including settlement	E+S			1950.00	1950.0
Settlement, % of embankment height	S=%(E-G)	0%	0.00		
Reference Elevation, operational top of berm (acres & elev. - ft.)	E	2.01		1950.00	
Freeboard (in)	F	24	2.00		
Surface Area at Top of 24hr/25yr storm (acres/elev)	AS=E-F	1.85		1948.00	
25yr/24hr Rainfall (in)	R	4.6			
Surface Area at Inside Top of Berm, incl. Contributing area (ac)	OB	2.01			
Volume of 25yr/24hr Rainfall (cf)	VR=R*OB	33,542			
Volume Provided for 25yr/24hr Rainfall (cf)	avg(AS,O)*(AS-O)	105,494	1.35		
Maximum Surface Area and Operating Level (acres/elev)	O=E-F-R	1.74		1946.65	1946.65
Mean Annual Rainfall (in)	MAR	26.74			
Direct Mean Annual Rainfall within berms (cf)	DM=OB*MAR	194,979			
Mean Annual Lake Evaporation (in)	ME	33			
Evaporation Midpoint (elev)				1933.83	
Surface Area at Evaporation Midpoint (ac)	ESA	0.89			
Net Evaporation at Midpoint (cf)	NE=ME*ESA	106,394			
Net Moisture used for design (evap[-] or rain[+]) (cf)	M	88,585	1.20		
Apparent Operation Level considering Net Moisture adj.	A=O-M	1.65		1945.45	
Volume Provided for Net Moisture (cf)	avg(O,A)*(O-A)	88,626			
Waste Storage Depth (ft) excluding residual depth	D	25.65			
Surface area at top of residual layer (acres/elev)	SS=O-D	0.31		1921.00	
Net Storage Depth provided	D-M	24.5	24.5		
Total Storage Volume from Net Storage Depth (cf)		<b>947,402</b>			
Residual Layer Depth (in)	SD	12	1.00		
Top of Liner, surface area, acres	SS-SD	0.27		1920.00	1920.0

***APPENDIX II***

***NUTRIENT MANAGEMENT PLAN***

# INITIAL NUTRIENT MANAGEMENT PLAN FOR SOUTH DAKOTA ANIMAL FEEDING OPERATIONS

1. Operator: Oak Lake Dairy		2. County: Brookings		3. Prepared By: Dakota Environmental Inc.		4. Date: November 14, 2016		
<b>Spreadsheet A.) Total Nitrogen And Phosphorus Produced From Operation</b>								
5. Animal Type:	6. No. of animals	7. Ave. weight (lbs.)	8. Days of Confinement		9. Total Manure as Excreted (lbs.)		16. Available for the crop (lbs.)	
			N	P <sub>2</sub> O <sub>5</sub>	N	P <sub>2</sub> O <sub>5</sub>		
			N / day / animal (lbs.)	P <sub>2</sub> O <sub>5</sub> / day / animal (lbs.)	10. N retained Handling/Storage %	11. Total N available for application (lbs.)	12. Time of application	
					13. N Retained Application Method %	14. Total N retained in field (lbs.)	15. 3-Yr. Mineralization Rate Manure Handling %	
<b>CATTLE</b>								
- Dairy (system 1)	3,900	1,000	0.450	0.16	70	448,403	Spring/Fall/Summer	
- Dairy (system 2)								
- Dairy (system 3)								
- Dairy (system 4)								
- Beef (system 1)								
- Beef (system 2)								
- Beef (system 3)								
- Beef (system 4)								
<b>SWINE</b>								
- Nursery pig								
- Growing pig								
- Finishing pig								
- Gestating sow								
- Replacement Gilt								
- Sow and litter								
<b>SHEEP</b>								
- Sheep								
<b>POULTRY</b>								
- Layers								
- Broilers								
- Turkey								
<b>HORSE</b>								
- Horse								
<b>FWL</b>								
- Ducks								
- Geese								
<b>Total Manure as Excreted:</b>					<b>312,000</b> lbs/day	<b>OR</b>	<b>113,880,000</b> lbs/year	<b>Total lbs. of N and P<sub>2</sub>O<sub>5</sub> available for the crop:</b>
								<b>285,632</b> 227,760

INITIAL NUTRIENT MANAGEMENT PLAN  
FOR  
SOUTH DAKOTA ANIMAL FEEDING OPERATIONS

Spreadsheet B1.) Field Information

Operator: *Oak Lake Dairy*

Date: *11/14/16*

Spreadsheet line #	17.	18.	19.	20.	21.	22.	23.										24.	
Field ID (Include maps to illustrate location)	Field Name or Tract	Field #	Soil map unit symbol	County	Field Location: (1/4 Section, Township, Range)	Owned	Total acres in field	Acres Excluded from Manure Application:										Irrigated
							Minimum Buffer Zones (Drainages & Wetlands)			Excluded Acres				Total acres Excluded				
							35' Vegetated	100' Un-vegetated	100' Vegetated	Drainages	Wetlands	Wells	Slope	Other	Total acres Excluded			
1	2014	1		Brookings	NE 1/4 Sec 10, T 112, R 48	<input type="checkbox"/>	34.9	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	5.2	5.2	<input type="checkbox"/>	
2	2014	2		Brookings	SW 1/4 Sec 3, T 112, R 48	<input type="checkbox"/>	104.7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	15.7	15.7	<input type="checkbox"/>	
3	2014	3		Deuel	SW 1/4 Sec 33, T 113, R 48	<input type="checkbox"/>	122.8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	18.42	18.4	<input type="checkbox"/>	
4	2014	4		Brookings	SW 1/4 Sec 12, T 112, R 49	<input type="checkbox"/>	141.8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	21.3	21.3	<input type="checkbox"/>	
5	2014	5		Brookings	SE 1/4 Sec 19, T 112, R 48	<input type="checkbox"/>	116.0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	17.4	17.4	<input type="checkbox"/>	
6	2014	6		Brookings	SW 1/4 Sec 20, T 112, R 48	<input type="checkbox"/>	106.1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	15.92	15.9	<input type="checkbox"/>	
7	2014	7		Brookings	E 1/2 Sec 7, T 112, R 48	<input type="checkbox"/>	258.9	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	38.84	38.8	<input type="checkbox"/>	
8	2014	8		Brookings	NW 1/4 Sec 19, T 112, R 48	<input type="checkbox"/>	107.0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	16.05	16.1	<input type="checkbox"/>	
9	2014	9		Brookings	E 1/2 Sec 1, T 112, R 49	<input type="checkbox"/>	295.0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	29.25	29.3	<input type="checkbox"/>	
10	2014	10		Brookings	NW 1/4 Sec 4, T 112, R 48	<input type="checkbox"/>	168.4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	25.26	25.3	<input type="checkbox"/>	
11	2014	11		Brookings	W1/2 SW Sec 6, T 112, R 48	<input type="checkbox"/>	59.1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	8.87	8.9	<input type="checkbox"/>	
12	2014	12		Deuel	SW 1/4 Sec 32, T 113, R 48	<input type="checkbox"/>	141.4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	21.21	21.2	<input type="checkbox"/>	
13	2014	13		Brookings	SE 1/4 Sec 6, T 112, R 48	<input type="checkbox"/>	123.7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	18.56	18.6	<input type="checkbox"/>	
14	2014	14		Brookings	SW 1/4 Sec 8, T 112, R 48	<input type="checkbox"/>	131.6	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	19.74	19.7	<input type="checkbox"/>	
15	2014	15		Brookings	SE 1/4 Sec 20, T 112, R 48	<input type="checkbox"/>	139.2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	20.88	20.9	<input type="checkbox"/>	
16	2014	16		Deuel	E 1/2 Sec 30, T 113, R 48	<input type="checkbox"/>	266.9	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	40.03	40.0	<input type="checkbox"/>	
17	2014	17		Deuel	SW 1/4 Sec 25, T 113, R 48	<input type="checkbox"/>	72.7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	10.91	10.9	<input type="checkbox"/>	
18	2014	18		Brookings	E 1/2 Sec 12, T 112, R 49	<input type="checkbox"/>	290.8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	43.62	43.6	<input type="checkbox"/>	
19	2014	19		Brookings	NW 1/4 Sec 12, T 112, R 49	<input type="checkbox"/>	136.3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	20.45	20.5	<input type="checkbox"/>	
20	2014	20		Brookings	SW 1/4 Sec 7, T 112, R 48	<input type="checkbox"/>	95.2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	14.28	14.3	<input type="checkbox"/>	
21	2014	21		Brookings	N 1/2 Sec 8, T 112, R 48	<input type="checkbox"/>	303.9	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	45.59	45.6	<input type="checkbox"/>	
22	2014	22		Brookings	NE 1/4 Sec 6, T 112, R 48	<input type="checkbox"/>	160.9	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	24.14	24.1	<input type="checkbox"/>	
23	2014	23		Brookings	N1/2 NW Sec 4, T 112, R 48	<input type="checkbox"/>	79.7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	11.96	12.0	<input type="checkbox"/>	
24	2014	24		Brookings	E1/2 SW Sec 6, T 112, R 48	<input type="checkbox"/>	71.1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	10.67	10.7	<input type="checkbox"/>	
25						<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	
							<b>Total Acres:</b>											<b>3,527.9</b>

**INITIAL NUTRIENT MANAGEMENT PLAN**  
**FOR**  
**SOUTH DAKOTA ANIMAL FEEDING OPERATIONS**  
**Spreadsheet B2.) Estimated Nutrient Requirement**

Spreadsheet line #	Operator: <i>Onk Lake Dairy</i>																	26.	27.	28.			29.			30.
	Date: <i>11/14/16</i>																			Additional N needed for crops:			Total manure N allowed per field (lbs.)			
	Crops in Rotation and Average Yield:																			Legume N credits (lbs.)				Estimated Nitrogen requirements (lbs.)		
Field ID (Include maps to illustrate location)	Prior year			Year 1			Year 2			Year 3			Est. soil test NO <sub>3</sub> -N (lbs.)	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3	Avg						
Name or Tract #	Crop	Yield	Crop	Yield	Crop	Yield	Crop	Yield	Crop	Yield	Crop	Yield	Crop	Yield	Crop	Yield	Crop	Yield	Crop	Yield	Avg					
1	2014	1	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	124					
2	2014	2	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	124					
3	2014	3	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	124					
4	2014	4	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	124					
5	2014	5	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	124					
6	2014	6	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	124					
7	2014	7	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	124					
8	2014	8	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	124					
9	2014	9	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	124					
10	2014	10	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	124					
11	2014	11	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	124					
12	2014	12	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	124					
13	2014	13	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	124					
14	2014	14	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	124					
15	2014	15	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	124					
16	2014	16	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	124					
17	2014	17	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	124					
18	2014	18	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	124					
19	2014	19	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	124					
20	2014	20	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	124					
21	2014	21	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	124					
22	2014	22	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	124					
23	2014	23	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	124					
24	2014	24	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	124					
25																										

Total N recommendation: 372,409

INITIAL NUTRIENT MANAGEMENT PLAN  
FOR  
SOUTH DAKOTA ANIMAL FEEDING OPERATIONS

Spreadsheet line #	Field ID (Include maps to illustrate location)	Name or Tract	Field #	Predicted soil loss using RUSLE2 (T/ac/yr)	Phosphorus Soil Test			Date (M/Y)	Phosphorus removal estimate (lbs.)				Estimated time to raise P soil test level to 50 ppm Olsen or 75 ppm Bray (years)	Manure application based on:	Initial Nutrient Mgt. Plan - N based fields (acres)
					ppm	Olsen	Bray-1		Year 1	Year 2	Year 3	Avg.			
1	2014	1		0.5	20	⊙	○	assumed	34	58	34	42	1,240	Nitrogen need	29.7
2	2014	2		0.5	20	⊙	○	assumed	34	58	34	42	3,713	Nitrogen need	89.0
3	2014	3		0.5	20	⊙	○	assumed	34	58	34	42	4,355	Nitrogen need	104.3
4	2014	4		0.5	20	⊙	○	assumed	34	58	34	42	5,031	Nitrogen need	120.5
5	2014	5		0.5	20	⊙	○	assumed	34	58	34	42	4,116	Nitrogen need	98.6
6	2014	6		0.5	20	⊙	○	assumed	34	58	34	42	3,764	Nitrogen need	90.2
7	2014	7		0.5	20	⊙	○	assumed	34	58	34	42	9,187	Nitrogen need	220.1
8	2014	8		0.5	20	⊙	○	assumed	34	58	34	42	3,798	Nitrogen need	91.0
9	2014	9		0.5	20	⊙	○	assumed	34	58	34	42	11,093	Nitrogen need	265.8
10	2014	10		0.5	20	⊙	○	assumed	34	58	34	42	5,974	Nitrogen need	143.1
11	2014	11		0.5	20	⊙	○	assumed	34	58	34	42	2,097	Nitrogen need	50.2
12	2014	12		0.5	20	⊙	○	assumed	34	58	34	42	5,017	Nitrogen need	120.2
13	2014	13		0.5	20	⊙	○	assumed	34	58	34	42	4,387	Nitrogen need	105.1
14	2014	14		0.5	20	⊙	○	assumed	34	58	34	42	4,669	Nitrogen need	111.9
15	2014	15		0.5	20	⊙	○	assumed	34	58	34	42	4,939	Nitrogen need	118.3
16	2014	16		0.5	20	⊙	○	assumed	34	58	34	42	9,469	Nitrogen need	226.9
17	2014	17		0.5	20	⊙	○	assumed	34	58	34	42	2,579	Nitrogen need	61.8
18	2014	18		0.5	20	⊙	○	assumed	34	58	34	42	10,318	Nitrogen need	247.2
19	2014	19		0.5	20	⊙	○	assumed	34	58	34	42	4,834	Nitrogen need	115.8
20	2014	20		0.5	20	⊙	○	assumed	34	58	34	42	3,378	Nitrogen need	80.9
21	2014	21		0.5	20	⊙	○	assumed	34	58	34	42	10,782	Nitrogen need	258.3
22	2014	22		0.5	20	⊙	○	assumed	34	58	34	42	5,708	Nitrogen need	136.7
23	2014	23		0.5	20	⊙	○	assumed	34	58	34	42	2,826	Nitrogen need	67.7
24	2014	24		0.5	20	⊙	○	assumed	34	58	34	42	2,522	Nitrogen need	60.4
25															

Operator: Oak Lake Dairy		Date: 11/14/16	
17.		35.	
31.		33.	
N		P205	
Total lbs of N and P205 available for crops:	285,632	227,760	
Total lbs of N and P205 required by fields:	372,409	125,794	
		Total Acres	
		3,013.7	

Adequate acres are available based on Nitrogen analysis  
However, P205 is in excess of removal. At this rate, it will take approximately 17 year(s) to build all listed fields up to 50 ppm P (Olsen).

# OAK LAKE DAIRY

## NMP FIELDS



1 inch = 5,000 feet



# Manure Application Agreement

Field Number	Legal Description	Acres Available for Application
<i>(Example: Field 6      W 1/2 of the NW 1/4 of Section 7, T 97 N, R 52 W, Hanson County, SD      125.8)</i>		
	<i>SW 1/4 of Section 12, T112 N, R 49 W, BROOKINGS COUNTY SD</i>	<i>160 ACRES</i>
	<i>SE 1/4 of Section 19, T112 N, R 48 W, BROOKINGS COUNTY SD</i>	<i>120 ACRES</i>
	<i>SW 1/4 of Section 20, T112 N, R 48 W, BROOKINGS COUNTY, SD</i>	<i>119 ACRES</i>
		<i>399 ACRES</i>

The undersigned hereby authorizes KILLESKILLEN LLC to spread manure on the above referenced land for a period of 5 year(s). This agreement will renew year to year unless canceled 30 days prior to the anniversary date of the agreement. Cancellation of this agreement will be made in writing to the above listed person.

*HOME*

Land Owner (Printed): CAROL TRUST  
*KE OLSON*

(Signature): *Carol Olson*

Date: *9/17/14*



# Manure Application Agreement

Field Number	Legal Description	Acres Available for Application
<i>(Example: Field 6      W 1/2 of the NW 1/4 of Section 7, T 97 N, R 52 W, Hanson County, SD      125.8)</i>		
	<i>E 1/2 of Section 1, T 112 N, R 49 W, BROOKINGS COUNTY SD</i>	<i>314 ACRE</i>
	<i>NW 1/4 of Section 4, T 112 N, R 48 W, BROOKINGS COUNTY SD</i>	<i>170 ACRE</i>
	<i>E 1/2 of SW 1/4 of Section 6, T 112 N, R 48 W, BROOKINGS COUNTY SD</i>	<i>77 ACRE</i>
	<i>SW 1/4 of Section 32, T 113 N, R 48 W, DEUEL COUNTY, SD</i>	<i>146 ACRE</i>
		<i>706 ACRES</i>

The undersigned hereby authorizes KILLESKILLEN LLC to spread manure on the above referenced land for a period of 5 year(s). This agreement will renew year to year unless canceled 30 days prior to the anniversary date of the agreement. Cancellation of this agreement will be made in writing to the above listed person.

Land Owner (Printed): WALTER IVERSON  
 (Signature): Walt Iverson  
 Date: 9/23/14



Field Number	Legal Description	Acres Available for Application
(Example: Field 6	W 1/2 of the NW 1/4 of Section 7, T 97 N, R 52 W, Hanson County, SD	125.8)
	SW 1/4 of Section 8, T 112 N, R 48 W, BROOKINGS COUNTY, SD	150 ACRES
	SE 1/4 of Section 20, T 112 N, R 48 W, BROOKINGS COUNTY, SD	160 ACRES
	E 1/2 of Section 30, T 113 N, R 48 W, Deuel County, SD	267 ACRES
	N 1/2 SW 1/4 & SW 1/4 SW 1/4 25-113-48 Deuel Co S.P.	120 Acres

The undersigned hereby authorizes KILLESKILLEN LLC to spread manure on the above referenced land for a period of 5 year(s). This agreement will renew year to year unless canceled 30 days prior to the anniversary date of the agreement. Cancellation of this agreement will be made in writing to the above listed person.

Land Owner (Printed): James Heimann James Heimann  
 (Signature): [Signature] Gary Grave  
 Date: 8-24-14



# Manure Application Agreement

Field Number	Legal Description	Acres Available for Application
(Example: Field 6	W 1/2 of the NW 1/4 of Section 7, T 97 N, R 52 W, Hanson County, SD	125.8)

<del>4.0</del>		
	N 1/2 of Section 8, T 112 N, R 48 W, BROOKINGS COUNTY, SD	320 ACRES
	NE 1/4 of Section 6, T 112 N, R 48 W, BROOKINGS COUNTY, SD	171 ACRES
	N 1/2 of SW 1/4 of Section 4, T 112 N, R 48 W, BROOKINGS COUNTY, SD	91 ACRES
	E 1/2 of SW 1/4 of Section 6, T 112 N, R 48 W, BROOKINGS COUNTY, SD	80 ACRES
		662

The undersigned hereby authorizes \_\_\_\_\_ to spread manure on the above referenced land for a period of \_\_\_\_\_ year(s). This agreement will renew year to year unless canceled 30 days prior to the anniversary date of the agreement. Cancellation of this agreement will be made in writing to the above listed person.

RENTER  
 Land Owner (Printed): DAVID IVERSON  
 (Signature): David Iverson  
 Date: 9/23/14

- 4) A total depth of 100 feet.

#### 1.4.4. Nutrient Management Requirements.

##### 1. Applicability.

- a. New and expanding operations with construction starting on or after February 12, 2003, must follow the nutrient management requirements in Section 1.4.4. and submit a nutrient management plan with the permit application for department review and approval.
- b. Operations existing prior to February 12, 2003, without previous permit coverage must follow the nutrient management requirements in Section 1.4.4. and submit a nutrient management plan with the permit application for department review and approval. However, these operations may use a nitrogen based nutrient management plan until December 31, 2006, when the phosphorus based portion of the nutrient management plan will become effective.
- c. Operations existing prior to February 12, 2003, with previously approved nitrogen-based nutrient management plans, may continue to implement the approved plan using the buffer zone requirements in Section 1.4.4. A revised nutrient management plan, in accordance with Section 1.4.4., must be submitted to the department for review and approval by July 1, 2006. This plan shall be implemented by December 31, 2006.

##### 2. Best Management Practices for Land Application of Manure. The producer is responsible for the safe land application of manure and process wastewater generated at the animal feeding operation. The producer shall comply with all mandatory best management practices listed below, and may use any or all of the recommended best management practices to ensure compliance with this permit and prevent pollution.

- a. The producer may apply manure for the purpose of growing crops.
- b. The producer shall develop, maintain, and follow a nutrient management plan to ensure safe disposal of manure and process wastewater and protection of surface and ground water.
- c. The Secretary must approve the nutrient management plan submitted with the permit application before land application of any manure and process wastewater.
- d. The initial nutrient management plan is a planning document to ensure the producer has enough land available to apply generated manure and process wastewater.
- e. The Department of Environment and Natural Resources and the Natural Resources Conservation Service have a Microsoft Excel spreadsheet available to assist with developing an initial nutrient management plan. The producer may use other initial planning tools provided the alternate plan contains all the information necessary to determine compliance with conditions of this general permit.
- f. Containment structures shall be equipped with irrigation, evaporation, liquid removal systems, a combination of these systems or the producer shall provide documentation pumping equipment will always be available if needed. These systems shall be capable of dewatering the containment structures for proper land application. The producer shall maintain freeboard in the manure containment structure at all times as required by Section 1.4.3.2.a. on page 16 of this permit. The producer shall restore the storage capacity necessary

applied to that field again until the applied phosphorus has been removed from the field via harvest and crop removal.

- b. Each producer must maintain on-site a copy of its site-specific nutrient management plan. Each producer must maintain on-site for a period of five years from the date they are created a complete copy of the nutrient management plan for their operation and the records specified below. The producer must make these records available to the Secretary upon request.
  - 1) Initial nutrient management plan;
  - 2) Expected crop yields;
  - 3) The date(s) manure, litter, or process waste water is applied to each field;
  - 4) Weather conditions at time of application and for 24 hours prior to and following application;
  - 5) Test methods used to sample and analyze manure, litter, process waste water, and soil;
  - 6) Results from manure, litter, process waste water, and soil sampling;
  - 7) Explanation of the basis for determining manure application rates, as provided in the technical standards established by this permit;
  - 8) Calculations showing the total nitrogen and phosphorus (if required) to be applied to each field, including sources other than manure, litter, or process wastewater;
  - 9) Total amount of nitrogen and phosphorus (if required) actually applied to each field, including documentation of calculations for the total amount applied;
  - 10) The method used to apply the manure, litter, or process wastewater; and
  - 11) Date(s) of manure application equipment inspection.

1.4.5. Inspection requirements. At a minimum, the following must be visually inspected:

1. Weekly inspections of all storm water diversion devices, runoff diversion structures, and devices channelling contaminated storm water to the wastewater and manure storage and containment structure;
2. Daily inspection of water lines, including drinking water or cooling water lines;
3. Weekly inspections of the manure, litter, and process wastewater impoundments; the inspection will note the level in liquid impoundments as indicated by the depth marker;
4. The producer, or agent acting on behalf of the producer, shall inspect the land application equipment, land application site and irrigation equipment, if used, on a daily basis while land application of process wastewater or manure is occurring. This inspection is to ensure that the land application equipment is not leaking and runoff from the land application site and irrigation system is not occurring. If a discharge or leaks are found where process wastewater or manure is reaching any surface waters of the state or flowing onto property not owned by the producer or not included in the nutrient management plan, the producer is responsible for taking immediate steps to stop the discharge or leaks and follow the reporting requirements of this permit. The

- a) The total nitrogen necessary to meet the expected yield goals in pounds of nitrogen per acre shall be determined using the most recent version of SDSU Extension Publication EC750, Fertilizer Recommendation Guide. This value is determined by the crop to be grown and the expected yield. In addition to the manure nitrogen allowed in the nutrient management plan, other nitrogen may be applied up to the amounts as indicated by soil nitrogen test results that are necessary to obtain the realistic yield goal.
  - b) Nitrogen credits must be subtracted from the total nitrogen value determined in item a) above. The following credits must be subtracted from this value.
    - i. The results from the two-foot nitrate soil test conducted in accordance with item a. on page 29. If a two to four-foot-deep nitrate test is required and the result of the test is greater than 30 pounds of nitrogen, then reduce the nitrogen recommendation an additional four pounds of nitrogen for each five pound increment above 30 pounds (for example, if there are 50 pounds of nitrate nitrogen in the 2-4 foot depth, 16 pounds of nitrogen in addition to the 0-2-foot-deep test must be subtracted).
    - ii. Any legume credits. For legume credits, please see the most recent SDSU Extension Publication EC 750, Fertilizer Recommendation Guide.
    - iii. Sampling date adjustment. Breakdown of organic material continues to release nitrates until soils cool in the fall. Therefore, the nitrogen requirement must be adjusted if the soil samples are taken between August 1 and September 15. To make this adjustment, reduce the nitrogen requirement by 0.5 pounds of nitrogen per day prior to September 15. The maximum adjustment would be 23 pounds (August 1 sampling). Samples taken in July should receive the same adjustments as those taken on August 1. Soil samples from fallow fields do not need to be adjusted for time of sampling because most of the residue from the previous crop should have mineralized during the fallow period.
    - iv. Any other sources of nitrogen used.
    - v. The resulting value in pounds of nitrogen per acre is the application rate of the additional nitrogen that may be applied to the field.
  - c) Based on the results of the manure testing required in item 3) on page 30, the producer shall apply manure to each field at a rate not to exceed the rate calculated in item 4)b)v. above. NOTE: If the yields that are used to calculate the application rate are not consistently attained, residual nitrogen will increase in subsequent years and will decrease the amount of manure that can be applied to that field. This nitrogen carry-over will be evident in future soil sampling.
- 5) Phosphorus based application. If the manure application is required to be based on phosphorus crop removal as determined by using Table 2 on page 29, the application rate shall be based on phosphorus removed in the harvested portion of the crop as listed in the most current version of SDSU Extension Publication EXEX 8009, Quantities of Plant Nutrients Contained in Crops. Application can be based on multi-year phosphorus crop removal but cannot exceed the one year nitrogen crop need, and no manure may be

1) Before manure application, each field shall be sampled to a depth of 0 to 6 inches for phosphorus and nitrate-nitrogen and to two feet for nitrate-nitrogen. The Secretary will determine on a case-by-case basis whether a land application site is located over a shallow aquifer. This will be done using the published South Dakota Geological Survey county studies, hydrologic reports, and first occurrence of aquifer materials maps, and well log information located near the fields. If manure application sites are located over shallow aquifers, the producer shall also either:

a) Take soil samples for nitrate-nitrogen from both 0 to 2 and 2 to 4 feet prior to manure application or

b) Take soil samples for nitrate-nitrogen to a depth of two feet both prior to manure application and within four weeks after harvesting the crop. This will apply to all fields in the nutrient management plan located over a shallow aquifer. Once the producer takes the post harvest soil samples, in lieu of the 2 to 4 foot samples, it will become a condition of this permit to continue taking post harvest samples for the fields located over shallow aquifers. If a producer does not take the required 2 to 4 foot samples prior to land application of manure, the post harvest sampling will then be required. In either case, the producer will no longer have the option of taking the deep soil samples.

If the post harvest soil sample results indicate the residual nitrate-nitrogen in the soil is above 100 pounds per acre, the yield goal shall be reduced by 25% the next time manure is applied to that field. If the residual post harvest nitrate-nitrogen in the soil remains above 100 pounds per acre, the department will remove that field from the approved nutrient management plan, and the producer will not be able to apply manure to this field for the life of this permit. Upon request of the producer, the department would evaluate adding back any removed field to the approved nutrient management plan when the general permit is reissued. The post harvest soil sampling information may be used to indicate permit compliance or noncompliance with the approved nutrient management plan.

2) A minimum of 15 soil sample cores shall be taken from each field or landscape position in the field. Soil sample cores that represent similar soil and landscape position may be composited into one sample.

3) The producer shall take a representative sample each year of the manure or process wastewater that will be land applied and have it tested for total nitrogen, inorganic nitrogen, and phosphorus. Organic nitrogen is equal to the total nitrogen minus the inorganic nitrogen.

4) Nitrogen based application. Based on a soil test, a manure test, type of crop, expected yield, legume credits, and sampling date, the producer shall determine the total nitrogen that can be applied to each field. When determining the application rate of nitrogen, the producer does not have to use the yield goals listed in the initial nutrient management plan. The producer may use the yield goal that is reasonably expected for that field. The total nitrogen that can be applied shall be determined as follows:

Table 2. Nitrogen Need/Phosphorus Crop Removal Manure Application Determination Table						
Soil Test Phosphorus ppm		Soil Loss – Erosion, Sheet and Rill Number (Tons per Acre)				Greater than 6
		Less than 4		4 to 6		
		100 Foot Vegetated Buffer		100 Foot Vegetated Buffer		
Olsen	Bray-1	Yes	No	Yes	No	
0-25	0-35	Nitrogen need	Nitrogen need	Nitrogen need	Nitrogen need	No application
26-50	36-75	Nitrogen need	Nitrogen need	Nitrogen need	Phosphorus crop removal <sup>1</sup>	No application
51-75	76-110	Nitrogen need	Phosphorus crop removal	Phosphorus crop removal	Phosphorus crop removal	No application
76-100	111-150	Phosphorus crop removal	Phosphorus crop removal	Phosphorus crop removal	Phosphorus crop removal	No application
Greater than 100	Greater than 150	No application	No application	No application	No application	No application

<sup>1</sup>Phosphorus crop removal is the amount of phosphorus a crop removes in a one year crop rotation.

- s. An estimate on the number of years it would take to raise all fields in the initial nutrient management plan to phosphorus soil test level over 50 parts per million using the Olsen test or 75 parts per million using the Bray-1 test.
  - t. Determination of the total amount of nitrogen (based on crop need) and phosphorus (based on crop removal) that can be applied to each field based on the crop planted at the field, the realistic yield goal, any residual nitrogen left in the field from past agricultural practices or crops, and the phosphorus soil test level.
  - u. Comparison of the total nitrogen requirement and crop removal of phosphorus for each field to the total nitrogen and phosphorus available in the manure. If the nitrogen in the manure exceeds the field nitrogen requirements, the producer shall identify additional fields that can be used for the application of manure.
  - v. A list indicating landowners who will be sold or given manure for its fertilizer value, the location and number of acres where manure will be applied, and the estimated amount of manure or process wastewater that will be given to each landowner. The producer must annually provide each landowner with the manure or process wastewater sample results for total nitrogen, inorganic nitrogen, and total phosphorus. Organic nitrogen is equal to the total nitrogen minus the inorganic nitrogen. Manure sold or given away may be subject to the South Dakota Department of Agriculture commercial fertilizer law, SDCL 38-19.
  - w. If any changes are made to the fields approved for use in the nutrient management plan, the producer shall submit an amendment to the department for review and approval prior to the change taking effect.
4. Annual Nutrient Management Requirements.
- a. Upon receiving permit coverage and prior to land applying manure, the producer shall use the following procedure to determine the appropriate application rates of manure and process wastewater based on a nitrogen or phosphorus plan (see Table 2). Upon determining the application rate, the producer shall apply the manure and process wastewater according to the calculated rate. Applying manure above the calculated rate is a violation of this permit. The following is the procedure for calculating the application rate:

- p. The results of a representative 0 to 6 inch soil phosphorus test from each field included in the nutrient management plan. To get a representative sample, a minimum of 15 soil sample cores shall be taken from each field or landscape position to determine the soil test phosphorus in the field.
- q. Identify the annual average soil loss value for sheet and rill erosion for each field to be included in the nutrient management plan using the most current soil loss prediction technology used by the South Dakota Natural Resources Conservation Service. References can be found in the South Dakota Natural Resources Conservation Service Field Office Technical Guide, Section 1, Erosion Prediction at the following web site: <http://efotg.nrcs.usda.gov/> or local Natural Resources Conservation Service office. The soil loss number may be adjusted by implementing alternative crop rotation and cropping practices, or implementing conservation practices such as contour farming, cross-slope farming, buffer strips, strip cropping, or terracing.
- r. Identify whether fields in the nutrient management plan can be used to land apply manure based on nitrogen need or phosphorus crop removal. Table 2 shall be used to make this determination for each field by considering the level of phosphorus in the soil, the soil loss number, and the presence or absence of a 100 foot vegetated buffer. Only fields identified as eligible for nitrogen based manure application can be included in the total acres needed to determine acres for manure application in the initial nutrient management plan. Fields requiring a phosphorous based plan can be listed in the plan and used for manure application. However, these acres cannot be used to show a producer has enough land to apply manure generated at the operation.

- d. An estimate of the total nitrogen and phosphorus in pounds that will be available for crop production. The producer may use either estimated nutrient concentrations for the animal manure or nutrient concentrations from laboratory analysis. If laboratory analysis is conducted, the analysis shall be included with the plan. If estimated concentrations are used to determine the total nutrients available, the source of the estimated concentrations of nitrogen for the animal manure shall be provided.
- e. The total number of days of storage in the manure containment structure(s).
- f. An estimate of the daily and annual amount of manure produced in tons of wet manure.
- g. The type or types of manure containment structures.
- h. The method(s) of manure application.
- i. The initial nutrient management plan shall include the proper mineralization rates for subsequent years of manure and process wastewater application to account for the potential buildup of nitrogen.
- j. The legal description of all fields to be used for land application, the crop to be planted on each field, the number of acres in each field, and whether the field is irrigated. Land identified or classified as wetlands, lakes, rivers, or streams, farmsteads, tree belts, or other buffer zones that cannot or will not be used for manure application shall not be included in the total number of acres available for land application. Wetlands may be used on a case-by-case basis if they are farmable and it would be a normal practice to apply fertilizer to them without impacting surface or ground water. Also, if either this permit or local governments require setback distances or buffer zones, areas within those buffer zones shall be identified on the field maps and cannot be included in the total number of acres.
- k. A copy of each written agreement executed with the owner of the land where manure will be applied. The written agreement shall indicate the acres that manure from the animal feeding operation may be applied and the length of the agreement. The producer shall ensure that there is enough land to apply manure consistent with the approved initial nutrient management plan.
- l. A detailed map showing the outline of each field listed in item j. above and all buffer zones and separation distances required by this permit.
- m. A soils map for the land application fields and a description of the predominate soil type(s) for each field.
- n. Realistic yield goals for each field and crop listed in item j. above. Yield goal calculations for initial nutrient management planning shall be determined from yields established for purchasing multi-peril crop insurance; proven yields on a field-by-field or farm-by-farm basis; or the South Dakota Agricultural Statistics Service using the published continuous five-year average yield plus ten percent. Proof of field-by-field or farm-by-farm yields shall be based on an average of actual crop receipts from a minimum of three consecutive years. If there is no information available for a crop and field listed in the nutrient management plan, documentation from the local extension service agronomy educator shall be included in the plan specifying that the yield is realistic for that crop in that area.
- o. Times of the year that land application is planned.

- q. All permanent manure stockpiles should be removed and land applied as soon as practicable. Example-When land is available or when stockpiling area is full.
  - r. Application of dry or solid manure on frozen or snow-covered ground should be avoided. If manure will be applied to frozen or snow-covered ground, the producer shall only apply manure on land with slopes less than 4%. The producer shall also maintain a minimum of a 100-foot buffer zone to any natural or manmade drainage.
  - s. To allow for normal winter operation in open lots, snow containing some manure removed from the concentrated animal feeding operation may be land applied and shall be placed on land with slopes less than 4%. The producer shall also maintain a minimum of a 100-foot buffer zone to any natural or manmade drainage.
  - t. Spray irrigation is allowed for land application of manure provided the producer incorporates the manure within 24 hours of application.
  - u. The producer shall inject, or incorporate any liquid manure or wastewater within 24 hours of application to nonvegetated cropland. If the manure is surface broadcast to cropped fields, grass, alfalfa, pasture land, or no till cropland, incorporation is not required.
  - v. The producer shall incorporate any solid or semi-solid manure within five days of application to nonvegetated cropland. If the application area is a cropped field, alfalfa, grass, pasture land, or no till cropland, incorporation is not required.
  - w. A producer may apply manure to property owned by other persons upon obtaining a written agreement from the property owner. Any lands owned by other persons that will be used for manure application shall be identified in the initial nutrient management plan. The producer shall be responsible for ensuring that the application of manure to the other person's property is in compliance with the terms and conditions of this permit and the nutrient management plan. Prior to such an application, a producer shall provide the person with a copy of the soil and manure test results and manure application rate calculation performed by the producer in accordance with the requirements of Sections 1.4.4.3. and 1.4.4.4. of this permit and a list of possible best management practices to ensure protection of surface and ground water.
  - x. Training and education. The producer shall participate in an approved environmental training program on proper operation and maintenance of a manure management system and proper natural resource management. Anyone wishing to provide an approved environmental training program must submit an outline of the training program to the Secretary for approval. Upon request, the Secretary will provide producers with a listing of approved environmental training programs. The producer shall submit training verification prior to receiving a Certificate of Compliance and coverage under this permit.
3. Initial Nutrient Management Plan Requirements for Permit Application. The initial nutrient management plan shall contain and address the following items:
- a. General information on local requirements and whether the producer has complied with those requirements.
  - b. The maximum amount of livestock that will be confined.
  - c. The average weight of the animals through the production cycle for all types of animals raised.

to contain the 25-year, 24-hour rainfall event or 100-year, 24-hour rainfall event for new swine, poultry and veal calf operations, within 14 days of any rainfall event or accumulation of manure or process wastewater that results in storage above the maximum operating level of the containment structure. If soil moisture conditions do not allow land application of manure or process wastewater within 14 days, the producer shall contact the department to discuss restoring the storage capacity of the containment structure. The maximum operating level is the elevation in the containment structure necessary to contain the designed storage of accumulated manure and process generated wastewater and any solids accumulation (see Appendix H). Producers that operate open lots shall have access at all times to equipment capable of dewatering the containment structures.

- g. The producer shall dispose of solids, sludges, manure, or other pollutants in a manner to prevent pollution of surface or ground water.
- h. Any permanent or temporary piping used to transfer manure to the irrigation system shall be designed, constructed and operated so liquid manure is not discharged to waters of the state at any time during start-up, operation, and shut down.
- i. The producer shall maintain at least a 100-foot buffer zone or 35-foot vegetated buffer between
  - 1) any manure land application areas and any natural or manmade drainage;
  - 2) any manure land application areas and open tile line intake structures or other conduits to surface water; and
  - 3) any irrigation of process wastewater and any natural or manmade drainage.

Depending on the results of a producer's soil phosphorus test and estimated field erosion, a 100-foot vegetated buffer zone shall be required if the producer wants to apply manure based on the nitrogen needs of the crop and not crop removal of phosphorus (see Table 2 on page 29).

- j. Fields should be diked or terraced to prevent the release of applied wastewater.
- k. Land to be irrigated or receive manure should have a slope less than 6%.
- l. Highly erodible soils due to water erosion should be avoided.
- m. Irrigation practices should be managed to prevent ponding of wastewater on the land application site.
- n. Application of manure shall not exceed the water storage capacity of the soil.
- o. Process wastewater or manure shall not be spray irrigated on frozen ground.
- p. Surface broadcast, injection, or incorporation of liquid manure or process wastewater should not be applied on frozen or snow-covered ground. If application to frozen or snow-covered ground is absolutely necessary, the producer should notify the department prior to application so the department may review buffer zone requirements with the producer and respond to inquiries from the public. The producer shall only apply liquid manure or process wastewater on land with slopes less than 4%. The producer shall also maintain a minimum of a 100-foot buffer zone to any natural or manmade drainage.

***APPENDIX III***

***MANURE MANAGEMENT AND OPERATION PLAN***

# **OPERATION AND MAINTENANCE MANUAL**

*for the*  
**OAK LAKE DAIRY  
ANIMAL WASTE MANAGEMENT SYSTEM**

*BROOKINGS COUNTY, SOUTH DAKOTA*

**November 14, 2016**

**DEC Project No. 1419**

**Producers:** Michael Crinion  
**Address:** 126 Pine Ridge Road  
Brookings, SD 57006  
**Phone:** (605) 691-1045  
**Project Location:** NE ¼ of Section 10, T112N R48W, Brookings County, SD

The Owner acknowledges responsibility for the proper operation and maintenance of the animal waste management system. Although the design is based on the best available technical knowledge, it must be recognized that any system creates some risks, and therefore needs to be properly operated and maintained, including periodic inspection. In addition, maximum efficiency cannot be obtained unless the system is properly operated and maintained so that it will function safely in its intended manner. Recognizing this, this Manual has been prepared for operating and maintaining the system. The following items list the anticipated major and uncommon items of Operation and Maintenance for this system. It is recommended that the following list be reviewed and be used as a checklist to ensure major elements of operation and maintenance are consistently being observed.

## I. Operation

### A. Inspection:

- \_\_\_ 1. Entire system weekly.
- \_\_\_ 2. Land application sites daily when application of manure is occurring.
- \_\_\_ 3. Fences and safety signs.
- \_\_\_ 4. Depth of waste.
- \_\_\_ 5. Inspect all components for signs of damage or leakage.
- \_\_\_ 6. Inspect earthwork for signs of seepage, rodent damage, settlement, misalignment, excessive vegetative growth, or erosion.
- \_\_\_ 7. Document all inspections on the form included with this manual, including all pertinent information.
- \_\_\_ 8. If a discharge from the manure management system or land application site is found to have occurred, the producer must report the discharge as soon as possible, but no later than twenty-four hours after the discharge was discovered. The discharge must be reported to the State of South Dakota at (605) 773-3351, or (605) 773-3231 after normal business hours.

### B. Daily Operation:

- \_\_\_ 1. All pond liner bottoms shall be kept submerged a minimum of one foot at all times. If there is less than one foot of water, additional water will need to be added to prevent the clay from shrinking and cracking. If cracking occurs, contact Dakota Environmental or the SD DENR to evaluate the liner.
- \_\_\_ 2. Divert stormwater and runoff from entering buildings, transfer structures, and the storage ponds.
- \_\_\_ 3. Confine travel of vehicles and livestock to designated areas to prevent erosion and enhance vegetation.
- \_\_\_ 4. Maintain grades around all components to assure positive surface drainage away from the structures in all directions. Fill any settled areas which may collect water.
- \_\_\_ 5. Piled feed should be kept covered to the maximum extent practical in order to prevent contact with stormwater. The open end of the piles should be kept as clean as possible so that no more

material than absolutely necessary is exposed. Good housekeeping practices shall be employed at the loading face of any pile to prevent loose material from piling up around the open face of the covered pile and becoming exposed.

- \_\_\_\_\_ 6. Manure must be removed from the freestall barn alleys by suction truck as needed to maintain adequate containment. Transfer of collected manure to the separator pit shall be via the opening in the pit cover.
- \_\_\_\_\_ 7. Manure from the freestall barn alleys must be manually scraped to the separator pit opening if the suction truck is unavailable.
- \_\_\_\_\_ 8. Land apply from the pond system as needed to maintain adequate freeboard and storage capacity. The liquid levels are not to exceed the maximum operating depth markers. If the maximum operating level is exceeded, storage capacity must be restored within 14 days by properly land applying wastewater from the pond according to the nutrient management plan.
- \_\_\_\_\_ 9. The contents of the storage ponds should be agitated during removal of wastes to prevent buildup of solids and sludge.
- \_\_\_\_\_ 10. Prepare an annual nutrient management plan based on actual analysis of nutrient levels in both the manure and the soil.
- \_\_\_\_\_ 11. As needed, apply wastes as determined by nutrients tests and the nutrient management plan. Whenever possible, apply downwind from any residences. Avoid applying on calm, humid days, since these conditions restrict the dispersion and dilution of odors. Application on weekends or holidays, when people in the area are more likely to be outdoors, should also be avoided.
- \_\_\_\_\_ 12. Do not apply waste on snow or frozen ground unless unavoidable. Consult the General Permit for conditions that must be followed in these circumstances.
- \_\_\_\_\_ 13. Do not apply waste material immediately after rain or within twelve hours of forecasted rain unless it can be immediately incorporated into the soil.
- \_\_\_\_\_ 14. Do not apply waste (solids and liquids) at a rate which exceeds the annual nitrogen needs of the crop or at a rate that produces runoff. No more than two inches should be applied at any one time.
- \_\_\_\_\_ 15. Keep records of the fields, days, temperature and wind direction when manure was applied using the form supplied with this manual.
- \_\_\_\_\_ 16. All provisions of the General Water Pollution Control Permit for Concentrated Animal Feeding Operations must be followed. The producer should be familiar with this permit in its entirety.
- \_\_\_\_\_ 17. For safety, cover all openings to pump pits and similar structures when not in use. Be certain the covers provide ventilation as explosive, poisonous, and suffocating gases are produced. This applies to all enclosed areas where manure is present.
- \_\_\_\_\_ 18. Extreme care must be exercised before entering any enclosure, such as pumping stations, for maintenance. This should include operations by experienced and knowledgeable workers **in pairs**, making use of appropriate safety equipment, such as a harness, forced ventilation, or the use of an oxygen mask. All operators should familiarize themselves with gas problems, special wiring needs and ventilation needs. **"NO SMOKING"** or similar signs to warn against ignition hazards should be posted to warn persons of

explosion danger at any pump pits or other enclosed, poorly ventilated areas in which combustible gases may accumulate.

## II. Maintenance

- \_\_\_\_ 1. Repair any earth work, or erosion thereof, to original grade. Grading must maintain a slope away from the buildings and storage pond in all directions to drain runoff.
- \_\_\_\_ 2. Repair and revegetate any areas of significant erosion.
- \_\_\_\_ 3. Repair any damaged system components.
- \_\_\_\_ 4. Seal any areas where seepage is noted. Cracks in concrete pit walls or floors must be sealed with a suitable high modulus sealant.
- \_\_\_\_ 5. Repair fences, covers, and safety signs, etc. to original specifications if damaged.
- \_\_\_\_ 6. Remove and dispose of trash and debris that will affect the aesthetics or functioning of the system.
- \_\_\_\_ 7. Remove any trees growing adjacent to pits, buildings, or ponds to prevent root damage to the structures.
- \_\_\_\_ 8. Apply herbicide as needed to retard growth of vegetation on the inside of the pond embankments so the integrity of the clay is not disturbed.

I have reviewed the above Operation and Maintenance Manual for my Waste Management System and agree to provide the necessary resources to properly implement its provisions.

\_\_\_\_\_  
Operator

\_\_\_\_\_  
Date





***APPENDIX IV***

***MANAGEMENT PLAN FOR FLY AND ODOR CONTROL***

# **MANAGEMENT PLAN FOR FLY AND ODOR CONTROL**

*for the*  
**OAK LAKE DAIRY**  
**ANIMAL WASTE MANAGEMENT SYSTEM**  
*BROOKINGS COUNTY, SOUTH DAKOTA*

**November 14, 2016**

**DEC Project No. 1419**

**Producers:** Michael Crinion  
**Address:** 126 Pine Ridge Road  
Brookings, SD 57006  
**Phone:** (605) 691-1045  
**Project Location:** NE ¼ of Section 10, T112N R48W, Brookings County, SD

This plan is provided to describe the Best Management Practices (BMPs) that are used to minimize any nuisance created by flies and odors from the proposed dairy facility. The BMPs described have been utilized at other facilities and have been reported to be useful. This plan deals with odor and fly control in the three most vital phases, which are the manure storage areas, the land application of manure, and the disposal of dead animals.

## **I. Manure Storage Areas**

The waste produced on the site will be contained in earthen storage ponds. The cattle will be housed in freestall barns from which manure is removed to a reception pit and solids separator before being discharged to the ponds. The ponds are designed in accordance with state law to provide adequate storage capacity as well as minimize odors. The storage ponds will likely form a semi-solid crust consisting of buoyant residues, which will serve to reduce odors by minimizing air contact with the raw manure.

The configuration of the buildings and manure collection reduce odors by removing manure from the housing areas as soon as possible. It is vital to the best interests of any dairy operation to keep the animals as clean and dry as possible, which is assurance that good housekeeping practices is maintained in the barn areas. A solids separator will be used to remove a significant percentage of the manure solids from the waste stream before it reports to the ponds. The solids will be dried and recycled as bedding, while any remaining solids will report to the ponds. Washwater used in the process of cleaning the milking parlor and holding area also dilutes the raw manure, resulting in less odor as well.

The site is located with consideration to applicable zoning ordinances and permit requirements for confined animal feeding operations. These include specific separation distances from roads, residences, churches, schools, businesses, and municipalities. These distances were established to prevent any nuisance to surrounding features from facilities of this type. Good ventilation of the buildings will be provided, which is also in the best interests of the animal herd and operator.

Final disposal of the manure will be by land application at rates that do not exceed the agronomic requirement of the crop to be grown and allow beneficial utilization of the manure nutrient content.

Since higher winds tend to disperse odors by agitating odors, windy days are when odors are usually noticed the least. On calm days, or days with light winds, odor is transported without being agitated. Therefore, trees, shrubs or other plantings will aid in the dispersion of airborne odors by agitation in either low or high wind conditions. Proposed shelterbelts are shown on the site plan.

Trees and vegetation also serve as habitat for species such as birds, which prey upon insects or insect larvae. For areas around the barns, pesticide, especially in powdered form, can also be used to control insects. The use of professional pest control services which utilize sprays or fogging to eliminate insects is also a common practice in the dairy industry.

Rodent control is aided by the fact that the configuration of the buildings offers little shelter for these animals. Control of rodents is also in the best interests of the dairy for reasons of sanitation and biosecurity, which is thoroughly inspected on a regular basis by state officials. For areas around the building walls, solid poison can be used to control rodents and keep burrowing from occurring near the concrete. Professional control services are also available, and are commonly used in the industry.

## **II. Manure Land Application**

Guidelines set forth in the South Dakota General Water Pollution Control Permit for Concentrated Animal Feeding Operations strictly regulate the land application of manure. Details of these guidelines can be found in the Nutrient Management Plan for this facility. Many of these guidelines were written with the control of odors in mind. Facilities must have adequate manure storage capacity to store manure over the winter, as manure should not be applied to frozen ground. The ponds are sized to contain a minimum of 365 days worth of manure and wastewater production from the facility. Manure solids removed from the waste stream by the solids separator will be recycled as bedding material within the barn. This manure will contain minimal moisture after separation, and is therefore not expected to produce significant odors. The ventilation of the barns will be reduced in the wintertime to minimize the amount of cold outside air into the barns resulting in greatly reduced odors at this time. Cold temperatures will accomplish insect control during this period as well.

Regardless of the type of manure, the times for manure land application should still be chosen carefully. Since higher winds tend to disperse odors faster, windy days are best. Days that are humid and calm, or have slight winds, should be avoided, as these conditions can result in the transport of odors over distances without dispersal. For the convenience of any neighbors, manure land application should be avoided on weekends, holidays, evenings, or any other times where people are likely to be involved in outdoor recreational or leisure activities. The Operation and Maintenance Manual for the facility outlines these best management practices (BMPs) for easy reference by the operator.

The General Permit requires liquid manure that is land applied to cropland (other than no-till) to be injected or incorporated immediately. In addition to greatly reducing the potential for surface water contamination, this practice serves to remove the source of odor by mixing it into the soil. This also will remove the source of attraction for flies and other insects. Equipment designed to inject or incorporate manure in this manner also keeps the manure totally contained between removal from the lagoon and incorporation by utilizing a pump and pipeline arrangement between the source and the field. Therefore, minimal odor will be produced during transport and land application, and the likelihood of spills will be greatly reduced. This method of application also results in much less wear of area roads.

In accordance with the Nutrient Management Plan, records must be kept regarding land application of manure. The date, time, location, wind direction, temperature, and amount of manure applied should be included whenever land application of manure takes place. These requirements were designed to eliminate over-application of manure and prevent runoff, excess odor, or other pollution by increasing the operator's awareness of proper land application practices.

### **III. Disposal of Dead Animals**

Disposal of dead animal is not expected to be a major concern at this facility, since death loss is generally very low at dairy operations not raising their own calves. The herd is generally culled on a regular basis, with animals which are not producing as desired being sold and removed. In this way, death loss is minimized by removing animals which are past their prime before they become chronically ill. A rendering service will be utilized in the infrequent occurrences of

mortality. This method is one of several approved by the State Animal Industry Board for removal of carcasses, and offers the most efficient option for the operator.

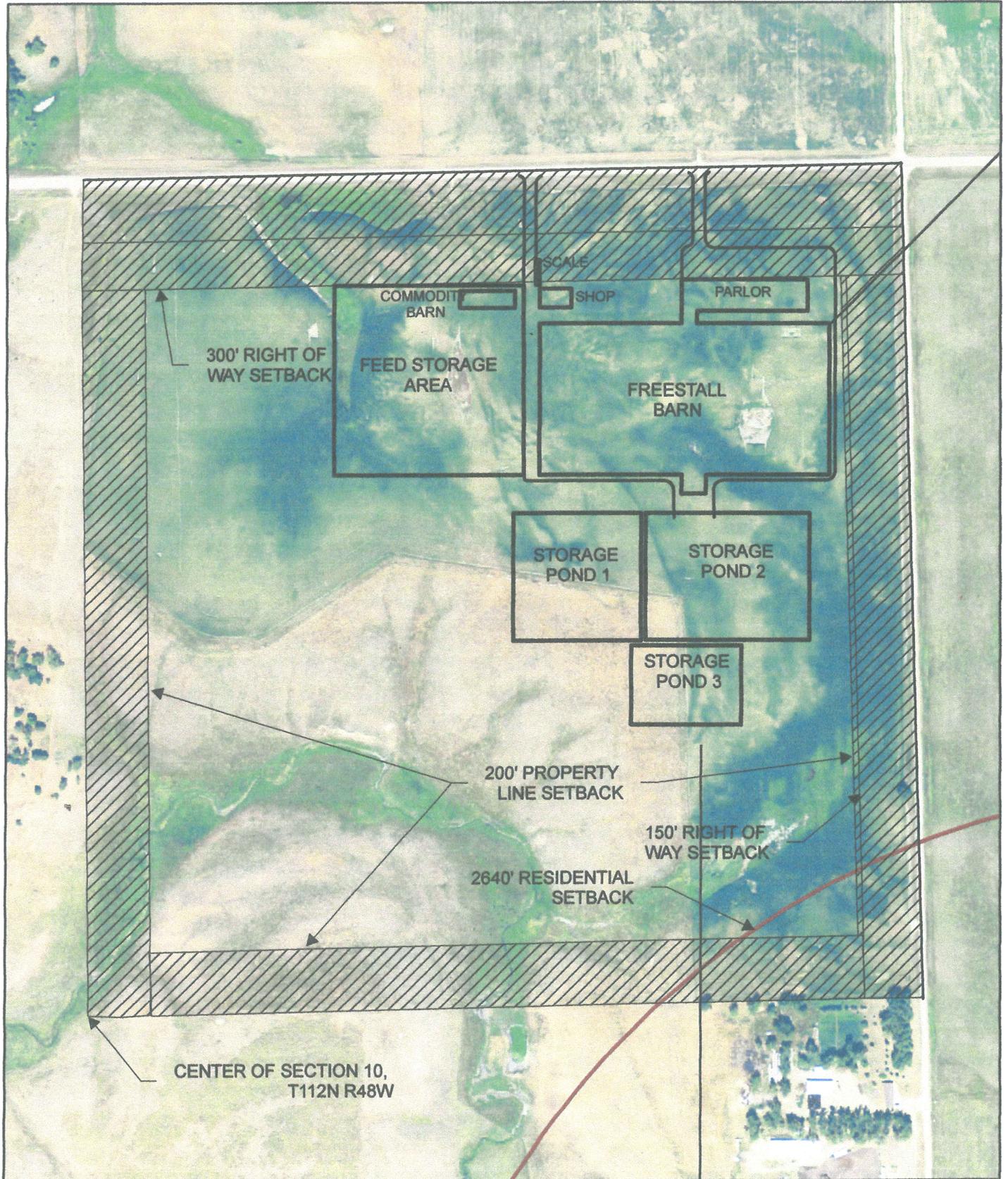
### **Summary**

The Best Management Practices that have been described above are fully expected to minimize nuisances from odors and insects at this facility. While some production of odor is inevitable, it is possible through concerted effort and careful attention to keep both the intensity and frequency of odors and insects at a level where area residents are not inconvenienced.

***APPENDIX V***  
***SETBACK MAP***

# OAK LAKE DAIRY

## SETBACK MAP

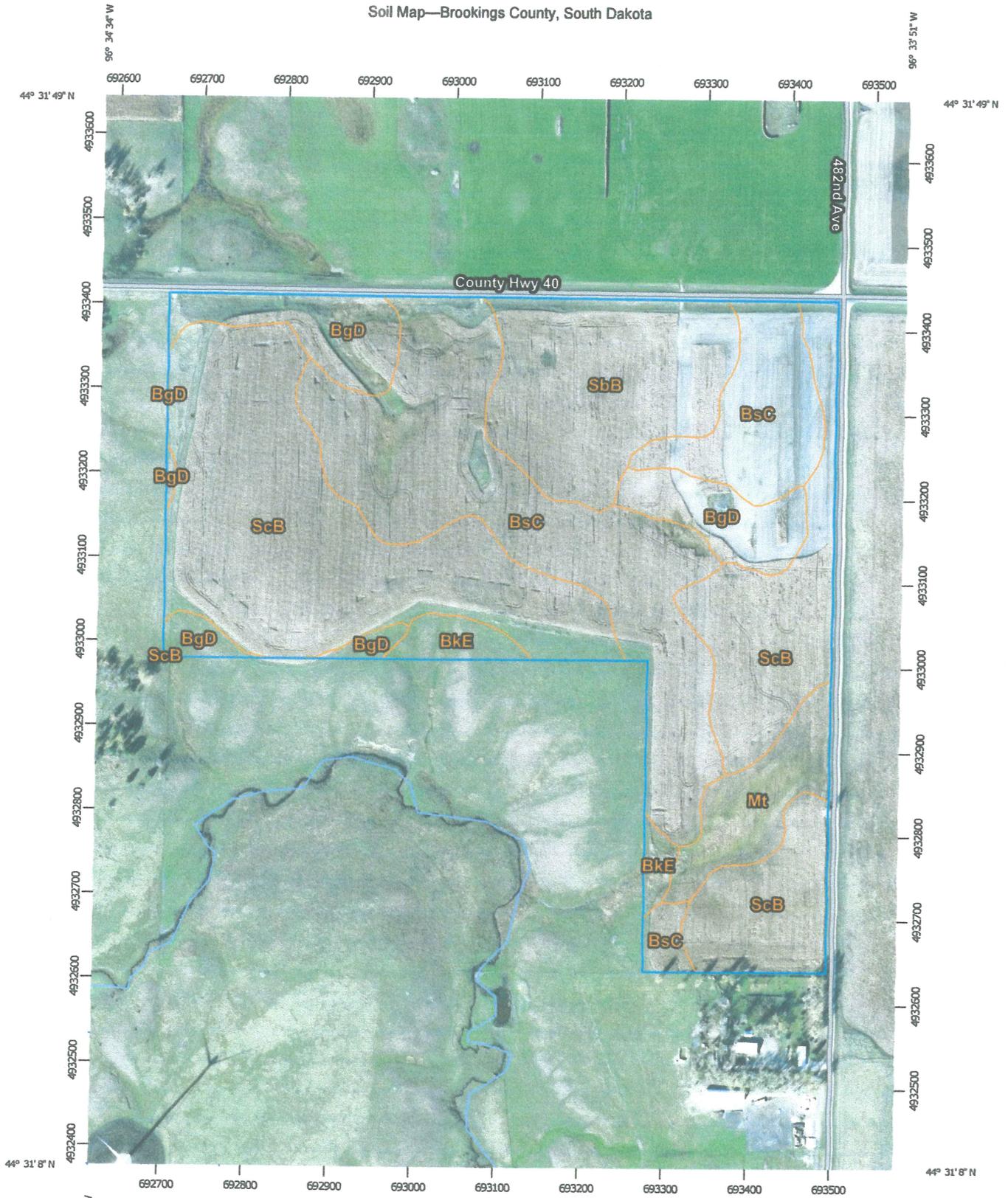


1 inch = 400 feet

***APPENDIX VI***

***SOILS, SHALLOW AQUIFERS, WELLHEAD PROTECTION,  
& FLOODPLAIN INFORMATION***

Soil Map—Brookings County, South Dakota



Map Scale: 1:6,170 if printed on a portrait (8.5" x 11") sheet.

0 50 100 200 300 Meters

0 250 500 1000 1500 Feet

Map projection: Web Mercator Corner coordinates: WGS84 Edge ticks: UTM Zone 14N WGS84



Natural Resources  
Conservation Service

Web Soil Survey  
National Cooperative Soil Survey

9/18/2014  
Page 1 of 3

Soil Map—Brookings County, South Dakota

**MAP LEGEND**

<b>Area of Interest (AOI)</b>	 Area of Interest (AOI)	 Spoil Area
<b>Soils</b>	 Soil Map Unit Polygons	 Stony Spot
	 Soil Map Unit Lines	 Very Stony Spot
	 Soil Map Unit Points	 Wet Spot
<b>Special Point Features</b>		 Other
 Blowout		 Special Line Features
 Borrow Pit	<b>Water Features</b>	 Streams and Canals
 Clay Spot	<b>Transportation</b>	 Rails
 Closed Depression	 Interstate Highways	 US Routes
 Gravel Pit	 Major Roads	 Local Roads
 Gravelly Spot		
 Landfill	<b>Background</b>	 Aerial Photography
 Lava Flow		
 Marsh or swamp		
 Mine or Quarry		
 Miscellaneous Water		
 Perennial Water		
 Rock Outcrop		
 Saline Spot		
 Sandy Spot		
 Severely Eroded Spot		
 Sinkhole		
 Slide or Slip		
 Sodic Spot		

**MAP INFORMATION**

The soil surveys that comprise your AOI were mapped at 1:24,000.

**Warning:** Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service  
 Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>  
 Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Brookings County, South Dakota  
 Survey Area Data: Version 19, Mar 27, 2014

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 6, 2010—Oct 21, 2010

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

## Map Unit Legend

Brookings County, South Dakota (SD011)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BgD	Buse-Barnes loams, 9 to 20 percent slopes	10.0	9.6%
BkE	Buse-Lamoure, channeled, complex, 0 to 40 percent slopes	2.4	2.3%
BsC	Buse-Singsaas complex, 6 to 9 percent slopes	31.7	30.2%
Mt	McIntosh-Badger silty clay loams, 0 to 2 percent slopes	5.0	4.7%
SbB	Singsaas-Buse complex, 2 to 6 percent slopes	13.9	13.3%
ScB	Singsaas-Waubay silty clay loams, 1 to 6 percent slopes	41.9	40.0%
<b>Totals for Area of Interest</b>		<b>104.9</b>	<b>100.0%</b>

# OAK LAKE DAIRY

## SOIL BORING

### LOCATIONS MAP



1 inch = 400 feet



SOIL BORING LOG

Dakota Environmental Consultants, Inc. P.O. Box 636 Huron, SD 57350 (605) 352-5610

Boring #

**SB1**

Soil Description	WL	Depth	Geo.	Elevation	Sample ID	USCS
Topsoil		0.0		1937.0		
		0.5	Topsoil	1936.5	SB1 0'-1.5'	OL
		1.0		1936.0		
		1.5		1935.5		
Sandy clay brown/olive, moist, very stiff		2.0		1935.0	SB1 1.5'-6'	
		2.5		1934.5		
		3.0		1934.0		
		3.5		1933.5		
		4.0		1933.0		
		4.5		1932.5		
		5.0		1932.0		
		5.5		1931.5		
		6.0		1931.0		
		6.5		1930.5		
Sandy clay, brown/olive, moist, stiff to very stiff		7.0		1930.0	SB1 6'-42'	CL
		7.5		1929.5		
		8.0		1929.0		
		8.5		1928.5		
		9.0		1928.0		
		9.5		1927.5		
		10.0		1927.0		
		10.5		1926.5		
		11.0		1926.0		
		11.5		1925.5		
		12.0	Weathered Till	1925.0		
		12.5		1924.5		
		13.0		1924.0		
		13.5		1923.5		
		14.0		1923.0		
		14.5		1922.5		
		15.0		1922.0		
		15.5		1921.5		
		16.0		1921.0		
	16.5		1920.5			
	17.0		1920.0			
	17.5		1919.5			
	18.0		1919.0			
	18.5		1918.5			
	19.0		1918.0			
	19.5		1917.5			
	20.0		1917.0			
	20.5		1916.5			
	21.0		1916.0			
	21.5		1915.5			
	22.0		1915.0			
	22.5		1914.5			
	23.0		1914.0			
	23.5		1913.5			
	24.0		1913.0			
	24.5		1912.5			
	25.0		1912.0			
	25.5		1911.5			

Water level at time of boring: None	Water Level: None	DEC #	Date of Boring: 9/17/2014
	Method: Split Spoon	<b>1419</b>	Page: 1 of 2
	Driller: RR	Chkd by: BF	Elevation: 1937
	Sampler: JB	Project:	
	Recorded By: RR	<b>Oak Lake Dairy AWMS</b>	
	Entered By/Date: TB 9/22/14		



SOIL BORING LOG

Dakota Environmental Consultants, Inc. P.O. Box 636 Huron, SD 57350 (605) 352-5610

Boring #

**SB1**

Soil Description	WL	Depth	Geo.	Elevation	Sample ID	USCS	
Sandy clay, brown/olive, moist, stiff to very stiff		26.0		1911.0	SB1 6'-42'	CL	
		26.5		1910.5			
		27.0		1910.0			
		27.5		1909.5			
		28.0		1909.0			
		28.5		1908.5			
		29.0		1908.0			
		29.5		1907.5			
		30.0		1907.0			
		30.5		1906.5			
		31.0		1906.0			
		31.5		1905.5			
		32.0		1905.0			
		32.5		1904.5			
		33.0		1904.0			
		33.5		1903.5			
		34.0		1903.0			
		34.5		1902.5			
		35.0		1902.0			
	Sandy clay, olive/gray, moist, stiff		35.5				1901.5
		36.0		1901.0			
		36.5		1900.5			
		37.0		1900.0			
		37.5		1899.5			
		38.0		1899.0			
		38.5		1898.5			
		39.0		1898.0			
		39.5		1897.5			
		40.0		1897.0			
		40.5		1896.5			
		41.0		1896.0			
		41.5		1895.5			
		42.0		1895.0			
		42.5		1894.5			
END OF BORING		43.0		1894.0			
		43.5		1893.5			
		44.0		1893.0			
		44.5		1892.5			
		45.0		1892.0			
		45.5		1891.5			
		46.0		1891.0			
		46.5		1890.5			
		47.0		1890.0			
		47.5		1889.5			
		48.0		1889.0			
		48.5		1888.5			
		49.0		1888.0			
		49.5		1887.5			
		50.0		1887.0			
		50.5		1886.5			
		51.0		1886.0			
		51.5		1885.5			
Water level at time of boring: None	Water Level:	None		DEC #	Date of Boring: 9/17/2014		
	Method:	Split Spoon		<b>1419</b>	Page: 2 of 2		
	Driller:	RR		Chkd by: BF	Elevation: 1937		
	Sampler:	JB		Project:			
	Recorded By:	RR		<b>Oak Lake Dairy AWMS</b>			
	Entered By/Date:	TB 9/22/14					



SOIL BORING LOG

Dakota Environmental Consultants, Inc. P.O. Box 636 Huron, SD 57350 (605) 352-5610

Boring #

SB2

Soil Description	WL	Depth	Geo.	Elevation	Sample ID	USCS
Topsoil		0.0	Topsoil	1940.0	SB2 0'-0.5'	OL
Sandy clay, brown, moist, stiff to very stiff		0.5		1939.5	SB2 0.5'-15'	CL
		1.0		1939.0		
		1.5		1938.5		
		2.0		1938.0		
		2.5		1937.5		
		3.0		1937.0		
		3.5		1936.5		
		4.0		1936.0		
		4.5		1935.5		
		5.0		1935.0		
		5.5		1934.5		
		6.0		1934.0		
		6.5		1933.5		
		7.0		1933.0		
		7.5		1932.5		
		8.0		1932.0		
		8.5		1931.5		
		9.0		1931.0		
		9.5		1930.5		
		10.0		1930.0		
Well graded sand, light brown, dry		10.5	Weathered Till	1929.5	SB2 15'-16'	SW
		11.0		1929.0		
		11.5		1928.5		
		12.0		1928.0		
		12.5		1927.5		
		13.0		1927.0		
		13.5		1926.5		
		14.0		1926.0		
		14.5		1925.5		
		15.0		1925.0		
Sandy clay, brown, moist, stiff		15.5		1924.5	SB2 16'-22.5'	CL
		16.0		1924.0		
		16.5		1923.5		
		17.0		1923.0		
		17.5		1922.5		
		18.0		1922.0		
		18.5		1921.5		
		19.0		1921.0		
		19.5		1920.5		
		20.0		1920.0		
Sandy clay, brown/olive, moist, medium stiff to stiff		20.5		1919.5	SB2 22.5'-24'	
		21.0		1919.0		
		21.5		1918.5		
Sandy clay, gray, very slight weathering, moist, stiff		22.0		1918.0	SB2 24'-30'	
		22.5		1917.5		
		23.0		1917.0		
		23.5		1916.5		
Water level at time of boring: None		24.0		1916.0		
		24.5		1915.5		
		25.0		1915.0		
		25.5		1914.5		
Water Level: None		DEC #		Date of Boring: 9/17/2014		
Method: Split Spoon		1419		Page: 1 of 2		
Driller: RR		Chkd by: BF		Elevation: 1940		
Sampler: JB		Project: Oak Lake Dairy AWMS				
Recorded By: RR						
Entered By/Date: TB 9/22/14						



SOIL BORING LOG

Dakota Environmental Consultants, Inc. P.O. Box 636 Huron, SD 57350 (605) 352-5610

Boring #

**SB2**

Soil Description	WL	Depth	Geo.	Elevation	Sample ID	USCS
Sandy clay, gray, very slight weathering, moist,		26.0		1914.0	SB2 24'-30'	
		26.5		1913.5		
		27.0		1913.0		
		27.5		1912.5		
		28.0		1912.0		
		28.5		1911.5		
		29.0		1911.0		
		29.5		1910.5		
		30.0		1910.0		
		30.5		1909.5		
Sandy clay, gray, unweathered, moist, stiff to very stiff		31.0		1909.0	SB2 30'- 45'	CL
		31.5		1908.5		
		32.0		1908.0		
		32.5		1907.5		
		33.0		1907.0		
		33.5		1906.5		
		34.0		1906.0		
		34.5	Weathered Till	1905.5		
		35.0		1905.0		
		35.5		1904.5		
		36.0		1904.0		
		36.5		1903.5		
		37.0		1903.0		
		37.5		1902.5		
		38.0		1902.0		
	38.5		1901.5			
	39.0		1901.0			
	39.5		1900.5			
	40.0		1900.0			
	40.5		1899.5			
	41.0		1899.0			
	41.5		1898.5			
	42.0		1898.0			
	42.5		1897.5			
	43.0		1897.0			
	43.5		1896.5			
	44.0		1896.0			
	44.5		1895.5			
END OF BORING		45.0		1895.0		
		45.5		1894.5		
		46.0		1894.0		
		46.5		1893.5		
		47.0		1893.0		
		47.5		1892.5		
		48.0		1892.0		
		48.5		1891.5		
		49.0		1891.0		
		49.5		1890.5		
	50.0		1890.0			
	50.5		1889.5			
	51.0		1889.0			
	51.5		1888.5			

Water level at time of boring: None	Water Level: None	DEC #	Date of Boring: 9/17/2014
	Method: Split Spoon	<b>1419</b>	Page: 2 of 2
	Driller: RR	Chkd by: BF	Elevation: 1940
	Sampler: JB	Project:	
	Recorded By: RR	<b>Oak Lake Dairy AWMS</b>	
	Entered By/Date: TB 9/22/14		



SOIL BORING LOG

Dakota Environmental Consultants, Inc. P.O. Box 636 Huron, SD 57350 (605) 352-5610

Boring #

**SB3**

Soil Description	WL	Depth	Geo.	Elevation	Sample ID	USCS	
Topsoil		0.0		1937.0			
		0.5	Topsoil	1936.5	SB1 0'-1'	OL	
		1.0		1936.0			
		1.5		1935.5			
		2.0		1935.0			
		2.5		1934.5			
		3.0		1934.0			
		3.5		1933.5			
		4.0		1933.0			
		4.5		1932.5			
		5.0		1932.0			
Sandy clay, brown, moist, stiff to very stiff		5.5		1931.5	SB3 1'-11'	CL	
		6.0		1931.0			
		6.5		1930.5			
		7.0		1930.0			
		7.5		1929.5			
		8.0		1929.0			
		8.5		1928.5			
		9.0		1928.0			
		9.5		1927.5			
		10.0		1927.0			
		10.5		1926.5			
Well graded gravel, brown, wet	(TOB)	11.0	Weathered Till	1926.0	SB3 11'-12'	GW	
		11.5		1925.5			
		12.0		1925.0			
Clayey gravel, brown, wet		12.5		1924.5	SB3 12'-14'	GC	
		13.0		1924.0			
		13.5		1923.5			
		14.0		1923.0			
		14.5		1922.5			
		15.0		1922.0			
		15.5		1921.5			
Sandy clay, brown/olive, moist, soft to medium stiff		16.0		1921.0	SB3 14'-18'		
		16.5		1920.5			
		17.0		1920.0			
		17.5		1919.5			
		18.0		1919.0			
Sandy clay, gray/olive, moist, medium stiff		18.5		1918.5	SB3 18'-20'		
		19.0		1918.0			
		19.5		1917.5			
		20.0		1917.0			
		20.5		1916.5			
		21.0		1916.0			
		21.5		1915.5			
Sandy clay, gray, slight weathering, moist, medium stiff		22.0		1915.0	SB3 20'-25'		
		22.5		1914.5			
		23.0		1914.0			
		23.5		1913.5			
		24.0		1913.0			
		24.5		1912.5			
		25.0	Unweathered Till	1912.0			
Sandy clay, dark gray, moist, unweathered, stiff		25.5		1911.5	SB3 25'-40'		
Water level at time of boring: 11'	Water Level: None	DEC #	Date of Boring: 9/18/2014				
	Method: Split Spoon	<b>1419</b>	Page: 1 of 2				
	Driller: RR	Chkd by: BF	Elevation: 1937				
	Sampler: JB	Project:					
	Recorded By: RR	<b>Oak Lake Dairy AWMS</b>					
	Entered By/Date: TB 9/22/14						



SOIL BORING LOG

Dakota Environmental Consultants, Inc. P.O. Box 636 Huron, SD 57350 (605) 352-5610

Boring #

**SB3**

Soil Description	WL	Depth	Geo.	Elevation	Sample ID	USCS
Sandy clay, dark gray, moist, unweathered, stiff		26.0		1911.0	SB3 25'-40'	CL
		26.5		1910.5		
		27.0		1910.0		
		27.5		1909.5		
		28.0		1909.0		
		28.5		1908.5		
		29.0		1908.0		
		29.5		1907.5		
		30.0		1907.0		
		30.5		1906.5		
		31.0		1906.0		
		31.5		1905.5		
		32.0	Unweathered	1905.0		
		32.5	Till	1904.5		
		33.0		1904.0		
		33.5		1903.5		
		34.0		1903.0		
		34.5		1902.5		
		35.0		1902.0		
		35.5		1901.5		
	36.0		1901.0			
	36.5		1900.5			
	37.0		1900.0			
	37.5		1899.5			
	38.0		1899.0			
	38.5		1898.5			
	39.0		1898.0			
	39.5		1897.5			
END OF BORING		40.0		1897.0		
		40.5		1896.5		
		41.0		1896.0		
		41.5		1895.5		
		42.0		1895.0		
		42.5		1894.5		
		43.0		1894.0		
		43.5		1893.5		
		44.0		1893.0		
		44.5		1892.5		
		45.0		1892.0		
		45.5		1891.5		
		46.0		1891.0		
		46.5		1890.5		
		47.0		1890.0		
		47.5		1889.5		
		48.0		1889.0		
	48.5		1888.5			
	49.0		1888.0			
	49.5		1887.5			
	50.0		1887.0			
	50.5		1886.5			
	51.0		1886.0			
	51.5		1885.5			

Water level at time of boring: 11'	Water Level:	None	DEC #	Date of Boring:	9/18/2014	
	Method:	Split Spoon	<b>1419</b>	Page:	2 of 2	
	Driller:	RR	Chkd by:	BF	Elevation:	1937
	Sampler:	JB	Project:			
	Recorded By:	RR	<b>Oak Lake Dairy AWMS</b>			
	Entered By/Date:	TB 9/22/14				



SOIL BORING LOG

Dakota Environmental Consultants, Inc. P.O. Box 636 Huron, SD 57350 (605) 352-5610

Boring #

**SB4**

Soil Description	WL	Depth	Geo.	Elevation	Sample ID	USCS
Topsoil		0.0	Topsoil	1938.0	SB4 0'-0.5'	OL
Sandy clay, brown/olive, dry, hard		0.5		1937.5	SB4 0.5'-4'	
		1.0		1937.0		
		1.5		1936.5		
		2.0		1936.0		
		2.5		1935.5		
		3.0		1935.0		
		3.5		1934.5		
		4.0		1934.0		
		4.5		1933.5		
		5.0		1933.0		
		5.5		1932.5		
		6.0		1932.0		
		6.5		1931.5		
		7.0		1931.0		
		7.5		1930.5		
	8.0		1930.0			
	8.5		1929.5			
	9.0		1929.0			
	9.5		1928.5			
	10.0		1928.0			
	10.5		1927.5			
	11.0	Weathered	1927.0			
	11.5	Till	1926.5			
	12.0		1926.0			
Sandy clay, brown/olive, moist, very stiff		12.5		1925.5	SB4 4'-23'	CL
		13.0		1925.0		
		13.5		1924.5		
		14.0		1924.0		
		14.5		1923.5		
		15.0		1923.0		
		15.5		1922.5		
		16.0		1922.0		
		16.5		1921.5		
		17.0		1921.0		
		17.5		1920.5		
		18.0		1920.0		
		18.5		1919.5		
		19.0		1919.0		
		19.5		1918.5		
	20.0		1918.0			
	20.5		1917.5			
	21.0		1917.0			
	21.5		1916.5			
	22.0		1916.0			
	22.5		1915.5			
	23.0		1915.0			
	23.5		1914.5			
	24.0		1914.0			
	24.5		1913.5			
	25.0		1913.0			
	25.5		1912.5			
Sandy clay, olive/gray, moist, stiff					SB4 23'-25'	
Sandy clay, brown, moist, stiff					SB4 25'-30'	

Water level at time of boring: None	Water Level: None	DEC #	Date of Boring: 9/18/2014
	Method: Split Spoon	<b>1419</b>	Page: 1 of 2
	Driller: RR	Chkd by: BF	Elevation: 1938
	Sampler: JB	Project:	
	Recorded By: RR	<b>Oak Lake Dairy AWMS</b>	
Entered By/Date: TB 9/22/14			



SOIL BORING LOG

Dakota Environmental Consultants, Inc. P.O. Box 636 Huron, SD 57350 (605) 352-5610

Boring #

**SB4**

Soil Description	WL	Depth	Geo.	Elevation	Sample ID	USCS
Sandy clay, brown, moist, stiff		26.0		1912.0	SB4 25'-30'	
		26.5		1911.5		
		27.0		1911.0		
		27.5		1910.5		
		28.0		1910.0		
		28.5		1909.5		
		29.0		1909.0		
		29.5		1908.5		
		30.0	Weathered Till	1908.0		
		30.5		1907.5		
Sandy clay, olive/gray, moist, stiff		31.0		1907.0	SB4 30'-36'	
		31.5		1906.5		
		32.0		1906.0		
		32.5		1905.5		
		33.0		1905.0		
		33.5		1904.5		
		34.0		1904.0		
		34.5		1903.5		
		35.0		1903.0		
		35.5		1902.5		
Sandy clay, gray, unweathered, moist, stiff		36.0		1902.0	SB4 36'-50'	CL
		36.5		1901.5		
		37.0		1901.0		
		37.5		1900.5		
		38.0		1900.0		
		38.5		1899.5		
		39.0		1899.0		
		39.5		1898.5		
		40.0		1898.0		
		40.5		1897.5		
		41.0		1897.0		
		41.5		1896.5		
		42.0	Unweathered Till	1896.0		
		42.5		1895.5		
		43.0		1895.0		
	43.5		1894.5			
	44.0		1894.0			
	44.5		1893.5			
	45.0		1893.0			
	45.5		1892.5			
	46.0		1892.0			
	46.5		1891.5			
	47.0		1891.0			
	47.5		1890.5			
	48.0		1890.0			
	48.5		1889.5			
	49.0		1889.0			
	49.5		1888.5			
<b>END OF BORING</b>		50.0		1888.0		
		50.5		1887.5		
		51.0		1887.0		
		51.5		1886.5		

Water level at time of boring: None .	Water Level:	None	DEC #	Date of Boring:	9/18/2014	
	Method:	Split Spoon	<b>1419</b>	Page:	2 of 2	
	Driller:	RR	Chkd by:	BF	Elevation:	1938
	Sampler:	JB	Project:			
	Recorded By:	RR	<b>Oak Lake Dairy AWMS</b>			
	Entered By/Date:	TB 9/22/14				



### ATTERBERG LIMITS

Dakota Environmental Inc. P.O. Box 636 Huron, SD 57350 (605) 352-5610

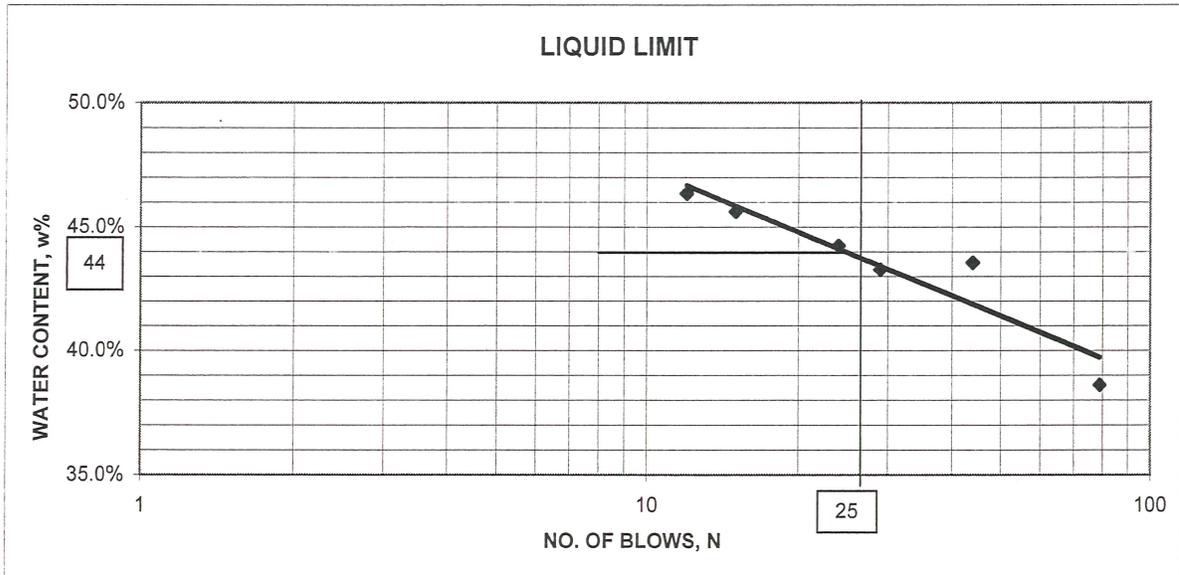
Project Oak Lake Dairy AWMS Job No. 1419

Location of Project S 1/2 Section 29, T121N R52W, Grant Coun Test No. 1419-PL-1

Description of Soil Sandy clay, brown (CL), SB4 16-18' Test Method ASTM: D4318, Multipoint

Tested By RR Test Date 9/23/2014 Reviewed by BF

Can no.	X	Q	D	U	Y	JJ
Mass of wet soil + can	21.21	20.72	21.74	21.22	20.46	21.92
Mass of dry soil + can	19.55	19.03	19.81	19.42	18.85	19.76
Mass of can	15.25	15.15	15.35	15.35	15.32	15.10
Mass of dry soil	4.30	3.88	4.46	4.07	3.53	4.66
Mass of moisture	1.66	1.69	1.93	1.80	1.61	2.16
Water Content, w%	38.6%	43.6%	43.3%	44.2%	45.6%	46.4%
No of Blows, N	79	44	29	24	15	12



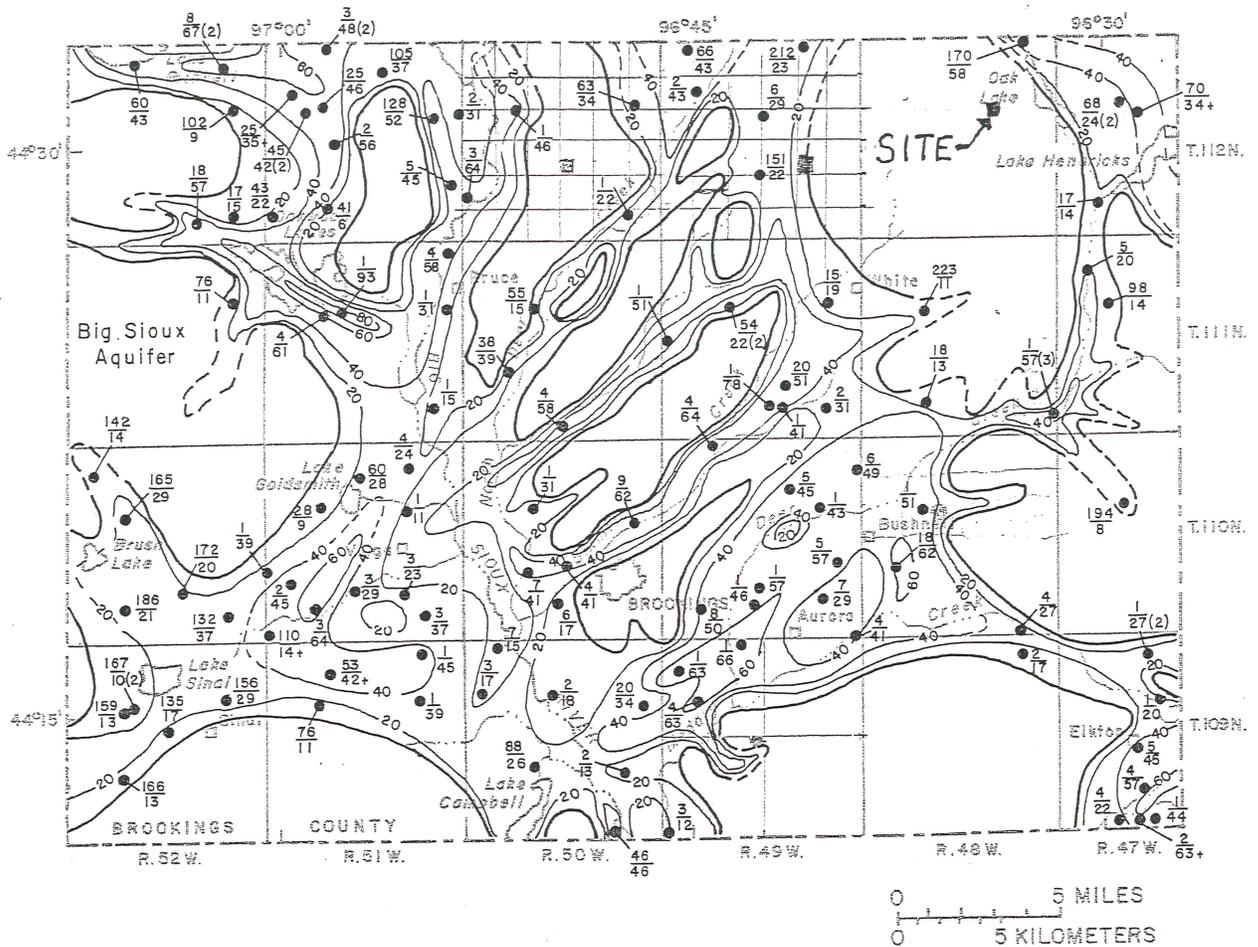
#### Plastic Limit Data

Can no.	C	E	Average
Mass of wet soil & can	18.63	18.86	
Mass of dry soil & can	17.99	18.24	
Mass of can	15.42	15.82	
Mass of dry soil	2.57	2.42	
Mass of Moisture	0.64	0.62	
Water Content, w% = wp	24.9%	25.6%	25.3%

Liquid limit 44  
 Plastic limit 25  
 Plasticity Index 19

% retained on #200 sieve (est.) 34%

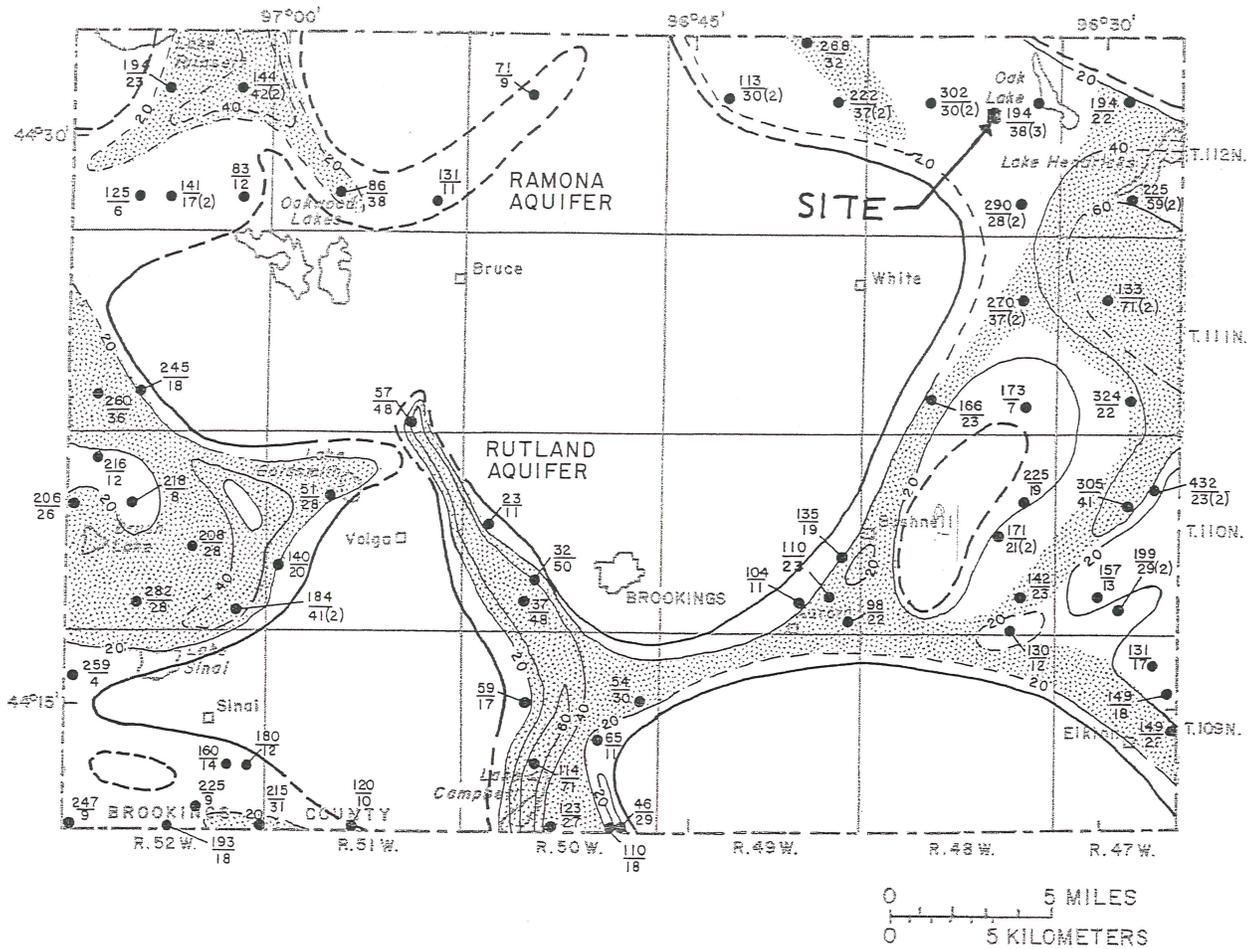




### EXPLANATION

- WELL OR TEST HOLE - Upper number is depth, in feet, to top of sand and gravel including the unsaturated zone. Lower number is thickness, in feet, of sand and gravel, including the unsaturated zone. A plus (+) indicates greater than shown. Number in parenthesis is number of aquifer units penetrated, where greater than one
- 40 — LINE OF EQUAL THICKNESS OF SAND AND GRAVEL - Dashed where inferred. Interval 20 feet
- - - - - INTERMITTENT STREAM
- - - - - AQUIFER BOUNDARY - Dashed where inferred. Based on test holes and private domestic and farm wells

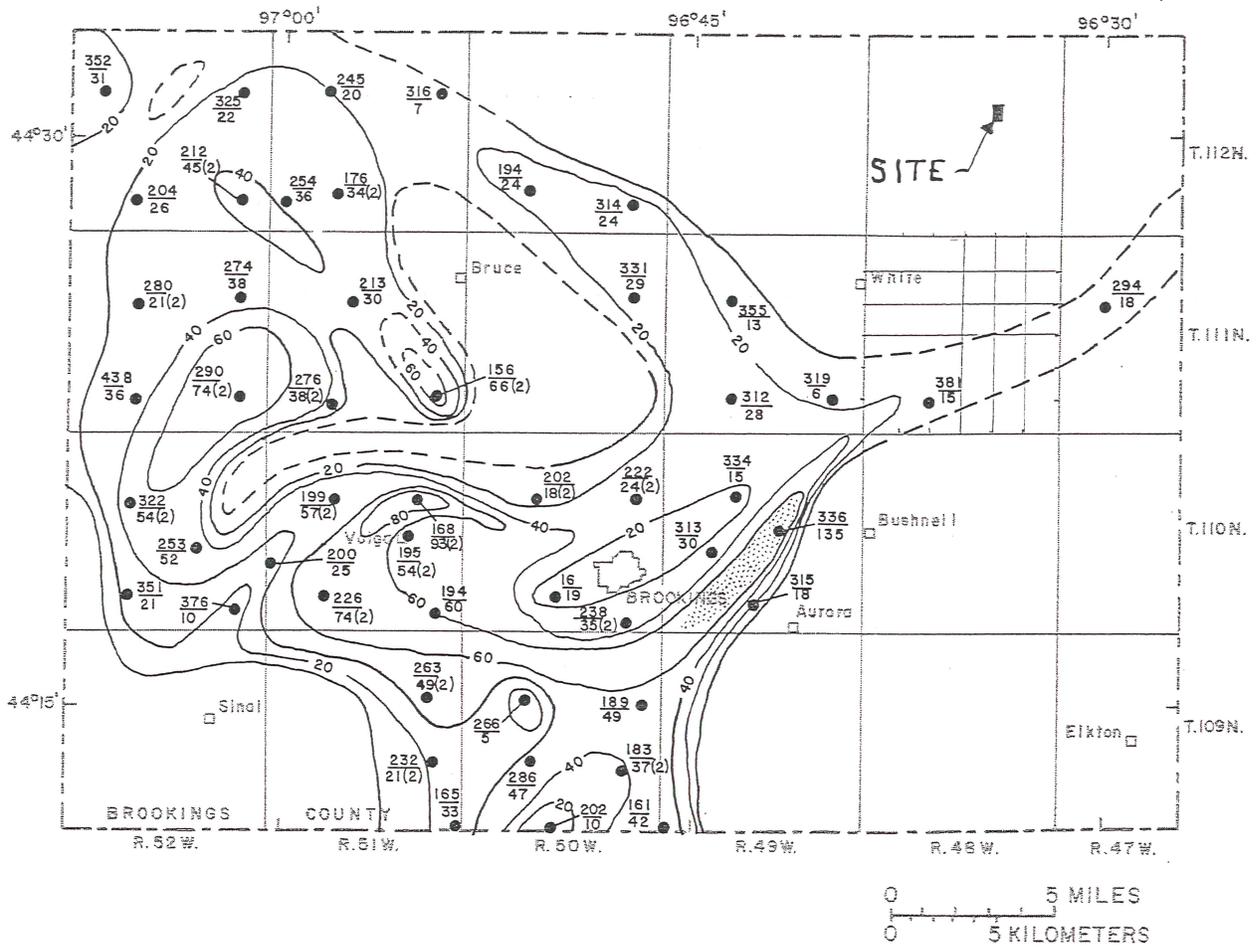
Figure 9.--Extent, depth, and thickness of the Big Sioux and Vermillion East Fork aquifers.--Continued



### EXPLANATION

- $\frac{70}{34+}$ 
 WELL OR TEST HOLE - Upper number is depth, in feet, to top of sand and gravel including the unsaturated zone. Lower number is thickness, in feet, of sand and gravel, including the unsaturated zone. A plus (+) indicates greater than shown. Number in parenthesis is number of aquifer units penetrated, where greater than one
- 40 —
 LINE OF EQUAL THICKNESS OF SAND AND GRAVEL - Dashed where inferred. Interval 20 feet
- · · · —
 INTERMITTENT STREAM
- - - -
 AQUIFER BOUNDARY - Dashed where inferred. Based on test holes and private domestic and farm wells

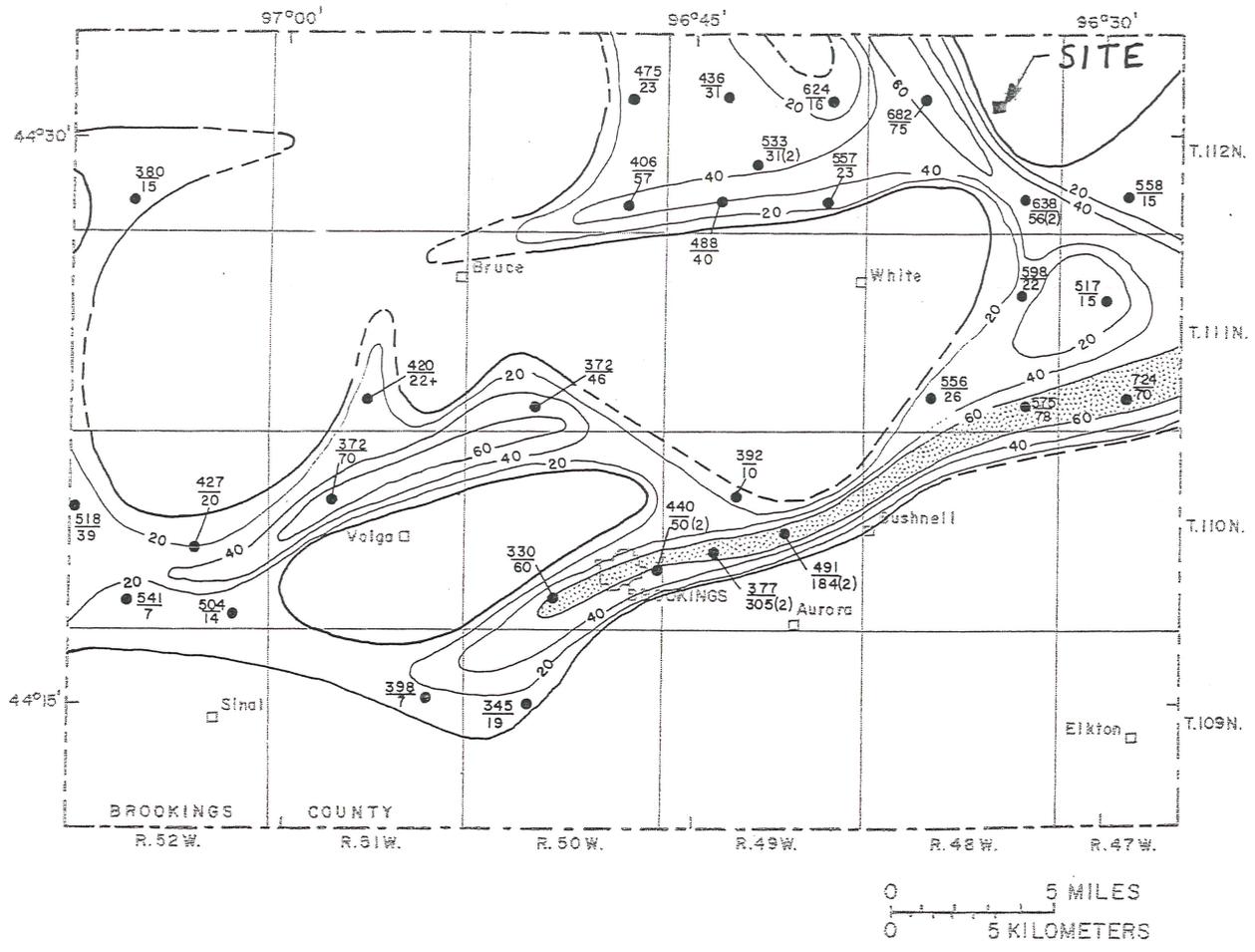
Figure 14.--Extent, depth, and thickness of the Ramona and Rutland aquifers.--Continued



### EXPLANATION

- $\bullet \frac{70}{34+}$ 
 WELL OR TEST HOLE - Upper number is depth, in feet, to top of sand and gravel including the unsaturated zone. Lower number is thickness, in feet, of sand and gravel, including the unsaturated zone. A plus (+) indicates greater than shown. Number in parenthesis is number of aquifer units penetrated, where greater than one
  
- 40 ---
 
 LINE OF EQUAL THICKNESS OF SAND AND GRAVEL - Dashed where inferred. Interval 20 feet
  
- - - - -
 
 INTERMITTENT STREAM
  
- - - - -
 
 AQUIFER BOUNDARY - Dashed where inferred. Based on test holes and private domestic and farm wells

Figure 16.--Extent, depth, and thickness of the Howard aquifer.--Continued



### EXPLANATION

- WELL OR TEST HOLE - Upper number is depth, in feet, to top of sand and gravel including the unsaturated zone. Lower number is thickness, in feet, of sand and gravel, including the unsaturated zone. A plus (+) indicates greater than shown. Number in parenthesis is number of aquifer units penetrated, where greater than one
  
- LINE OF EQUAL THICKNESS OF SAND AND GRAVEL - Dashed where inferred. Interval 20 feet
  
- INTERMITTENT STREAM
  
- AQUIFER BOUNDARY - Dashed where inferred. Based on test holes and private domestic and farm wells

Figure 18.--Extent, depth, and thickness of the Altamont aquifer.--Continued

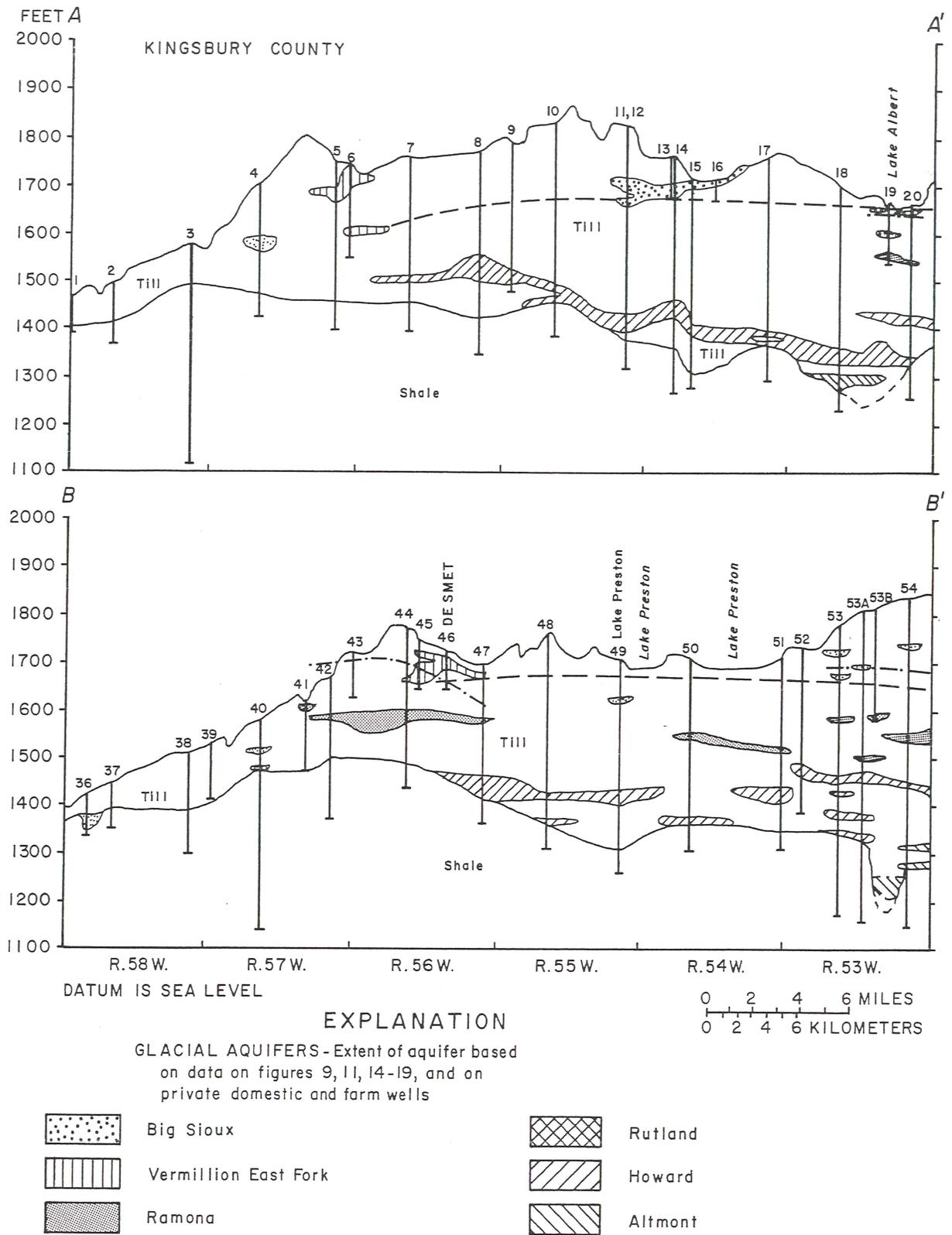
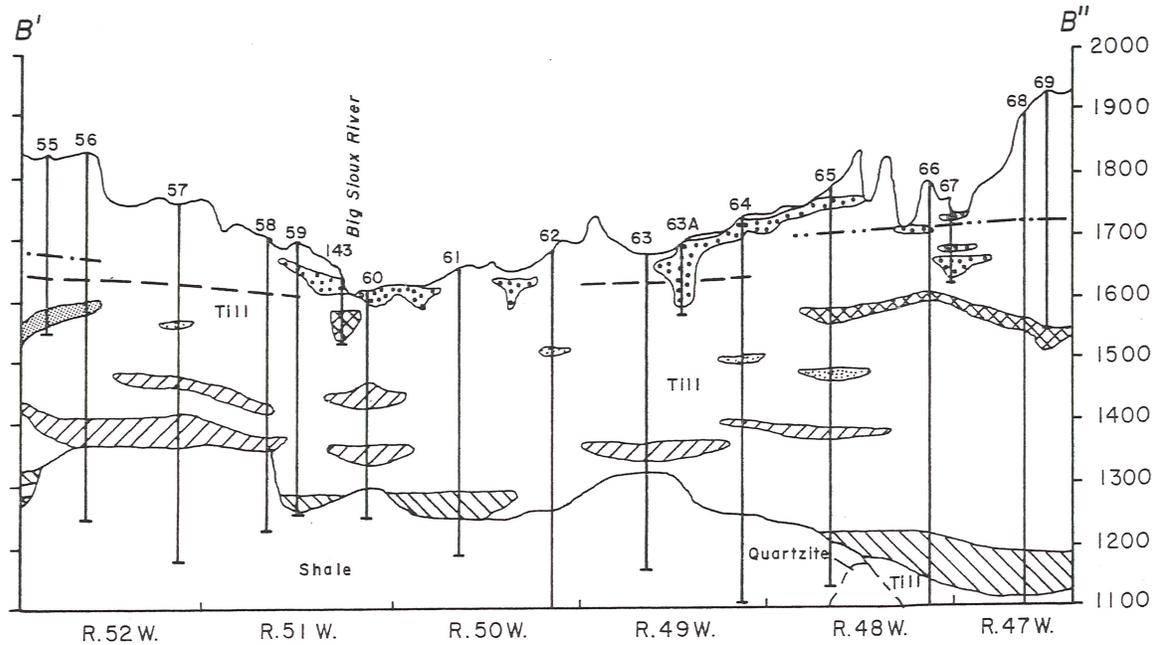
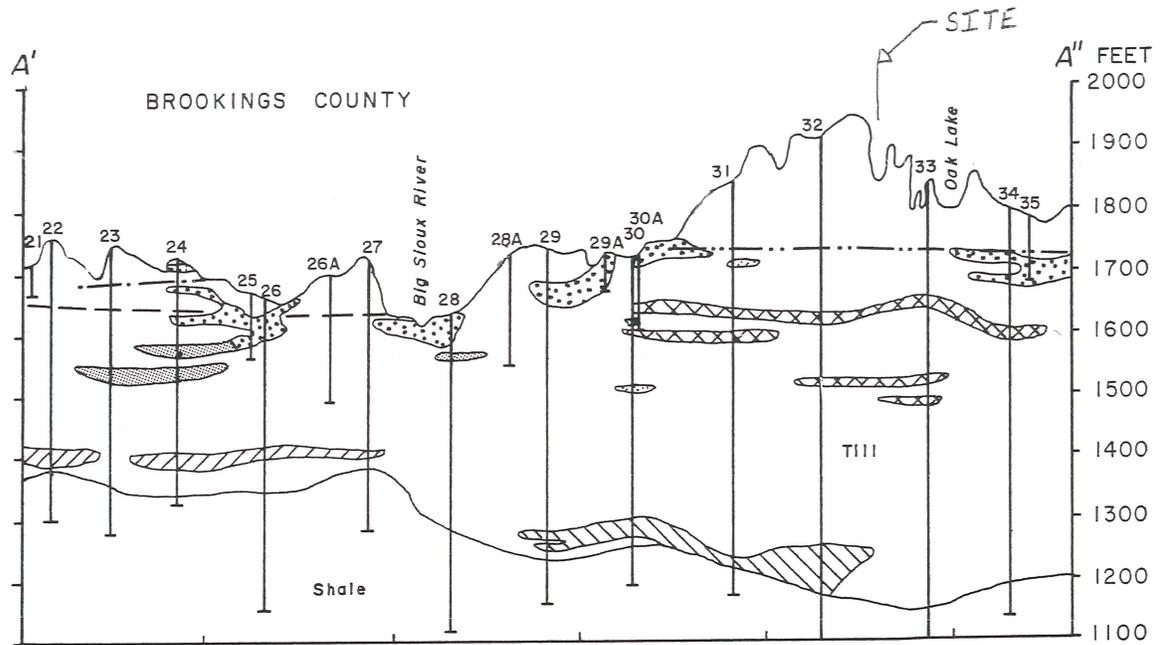
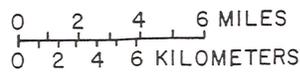


Figure 7.--Aquifers and potentiometric surfaces in glacial deposits.  
(Location of sections shown in fig. 6.)



VERTICAL SCALE IS GREATLY EXAGGERATED

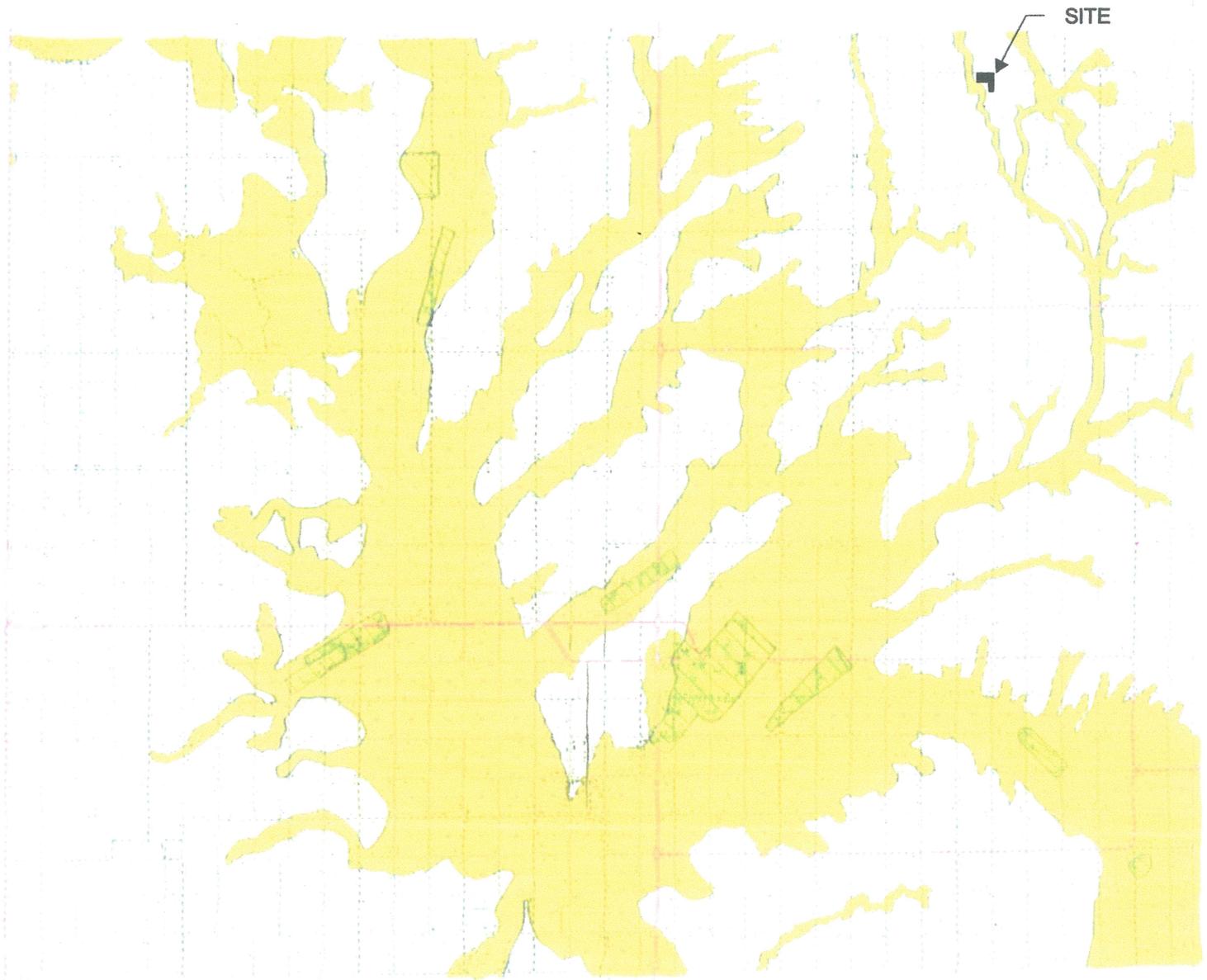


- GLACIAL AQUIFERS - cont.
- Minor
  - CONTACT - Dashed where inferred
  - WELL OR TEST HOLE - Number is hole number shown in figure 6
  - Ramona aquifer
  - Rutland aquifer
  - Howard aquifer

Figure 7.--Aquifers and potentiometric surfaces in glacial deposits.--Continued



# Brookings County Groundwater Protection Zones

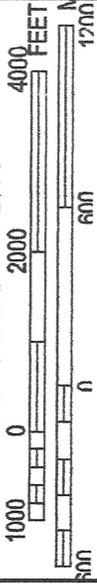


- Zone A - Wellhead Protection Area
- Area Contributing Drainage to Zone A
- Zone B - Shallow Aquifer Boundaries

- Shallow Aquifer Boundaries
- 300 ft accuracy
- 1600 ft accuracy
- Area Contributing Drainage to Zone A



MAP SCALE 1" = 2000'



PANEL 0150C

**FIRM**  
FLOOD INSURANCE RATE MAP  
BROOKINGS COUNTY,  
SOUTH DAKOTA  
AND INCORPORATED AREAS

PANEL 150 OF 700

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY: BROOKINGS COUNTY  
NUMBER: 460283  
PANEL SUFFIX: 0150 C

Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.



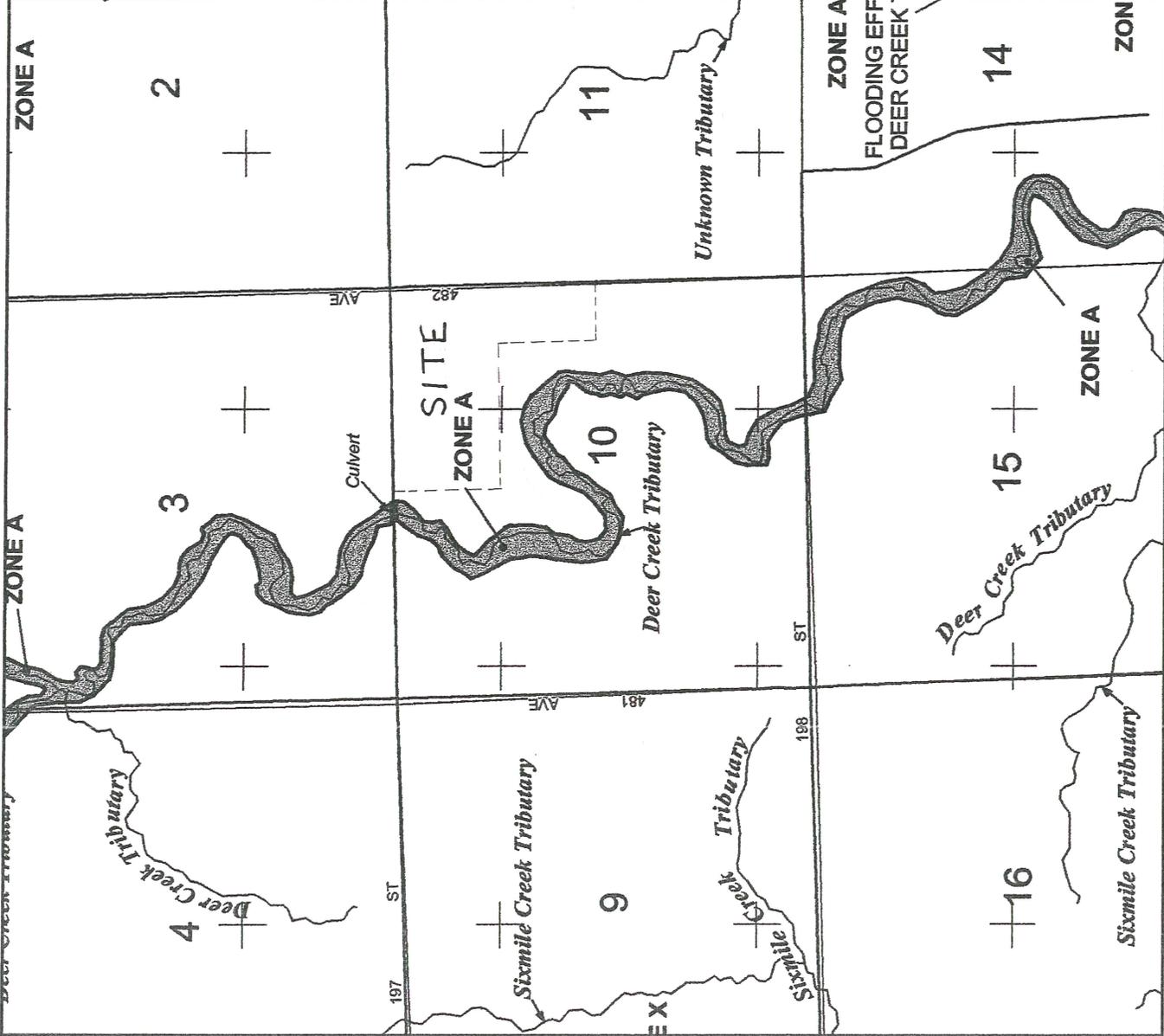
MAP NUMBER  
46011C0150C

EFFECTIVE DATE  
JULY 16, 2008

Federal Emergency Management Agency

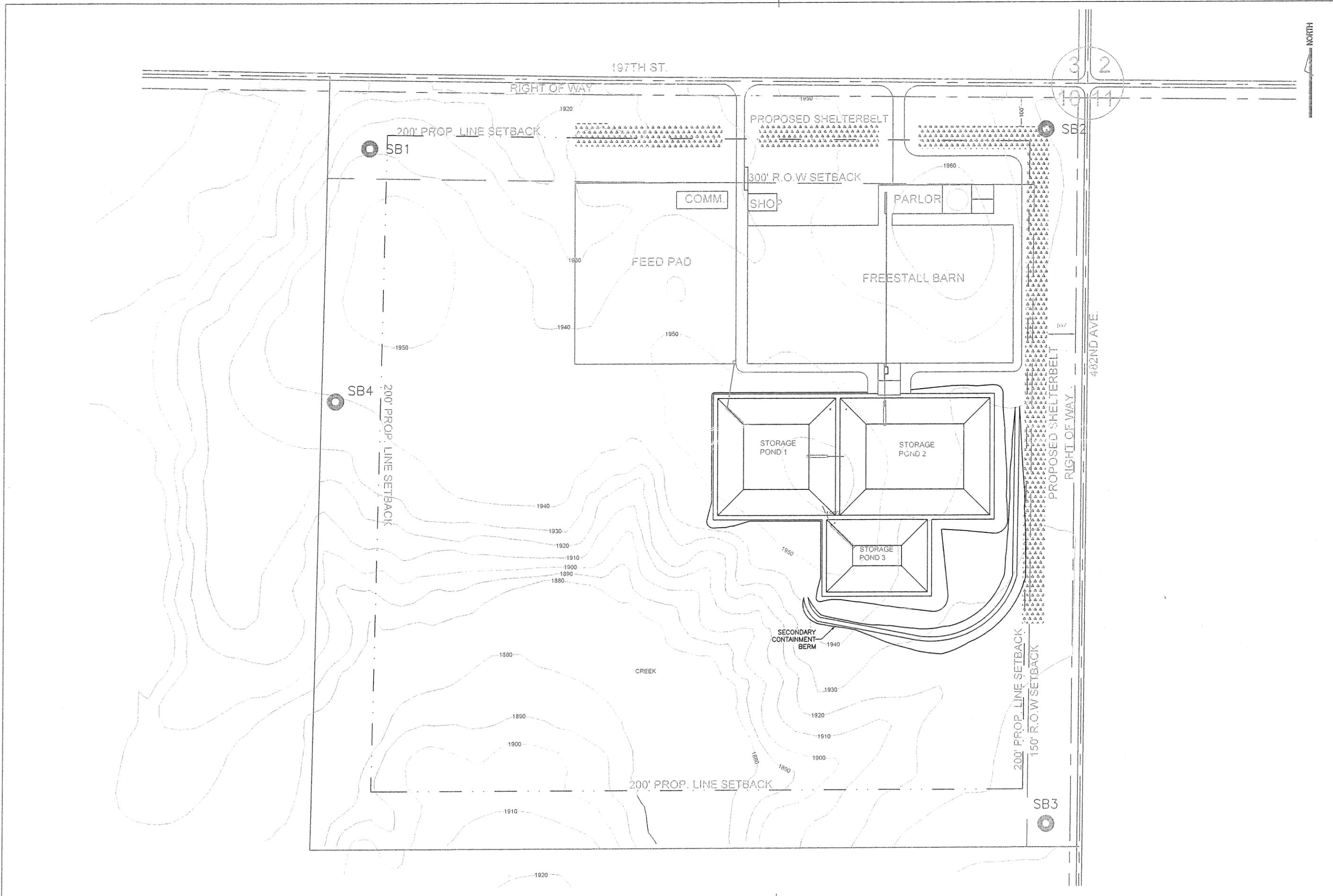
NATIONAL FLOOD INSURANCE PROGRAM

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at [www.msc.fema.gov](http://www.msc.fema.gov)



***APPENDIX VII***

***SITE PLAN / PLANS AND SPECIFICATIONS***



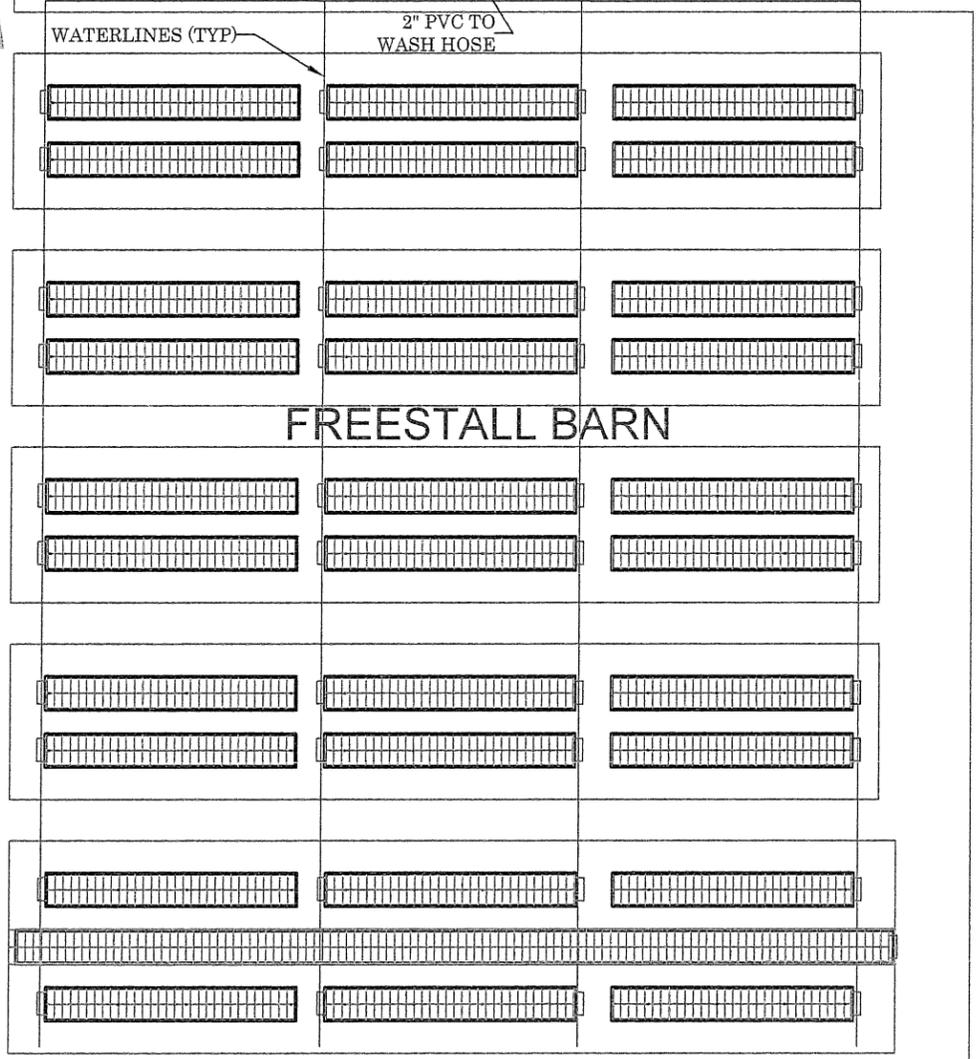
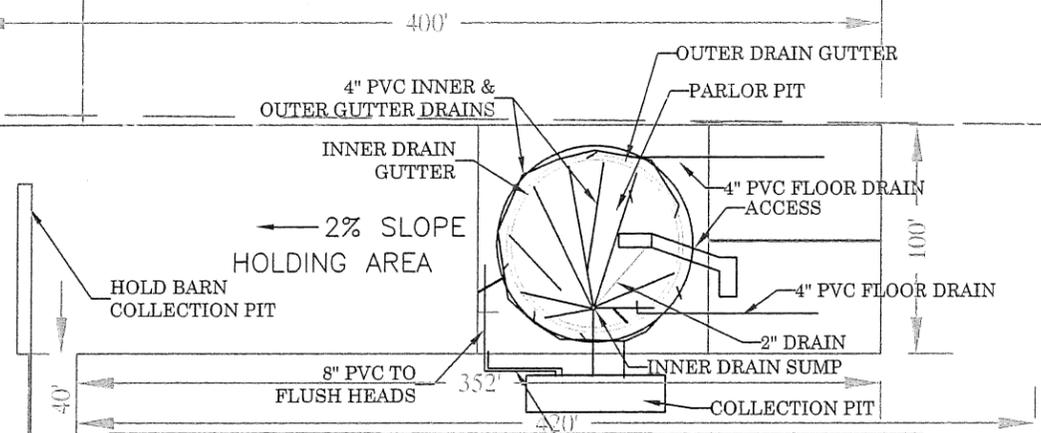
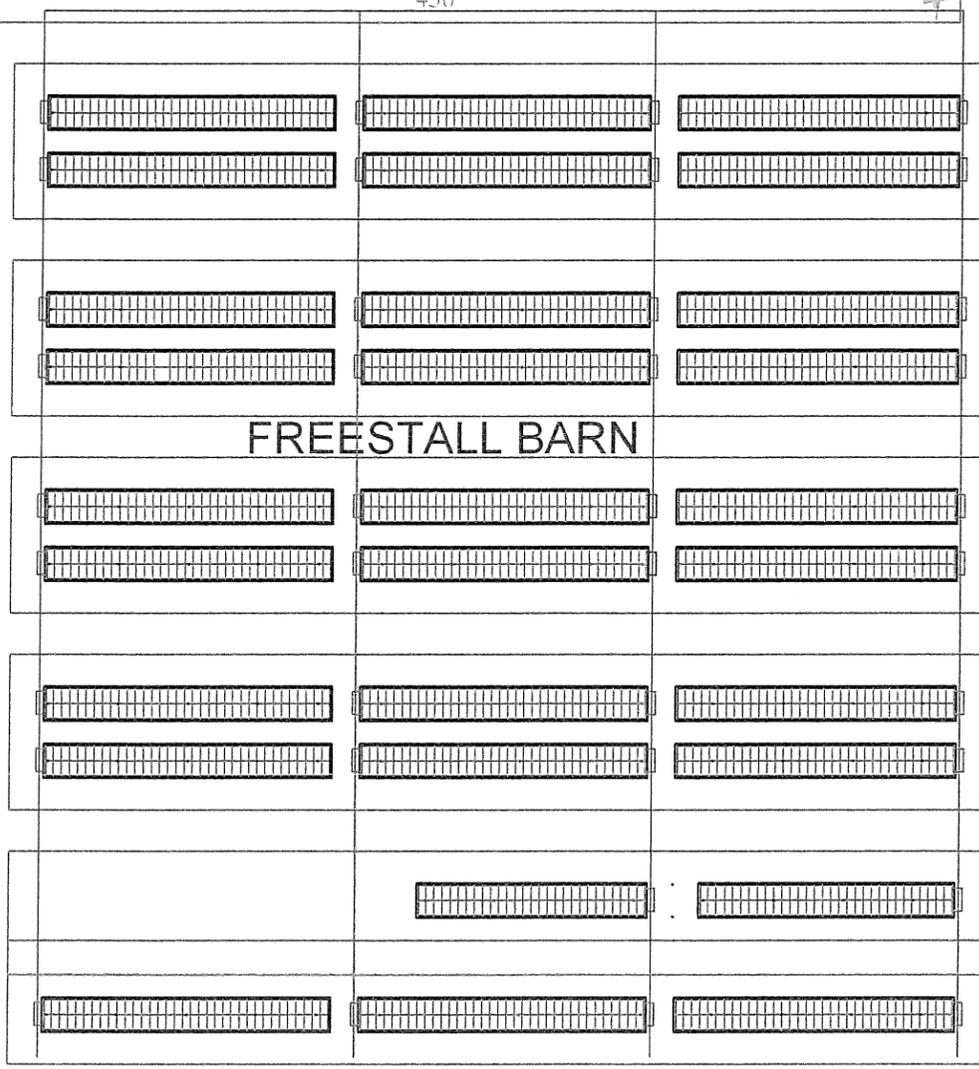
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DATE: 11/14/16	DRAWN: TB	CHECKED: BF	
JOB NO:		1419	
SCALE:		1" = 300'	
DWG:		1	
P.O. BOX 636 HURON, SD 57350 605-352-5610			

COMMODITY BARN

SCALE

100'  
SHOP

300' R.O.W SETBACK



FEED PAD

RUNOFF CATCH PIT

DRAINAGE PIPE TO POND 1 FROM FEED PAD

SEPARATOR BARN

SEPARATOR PIT

TEMPORARY SOLIDS STORAGE

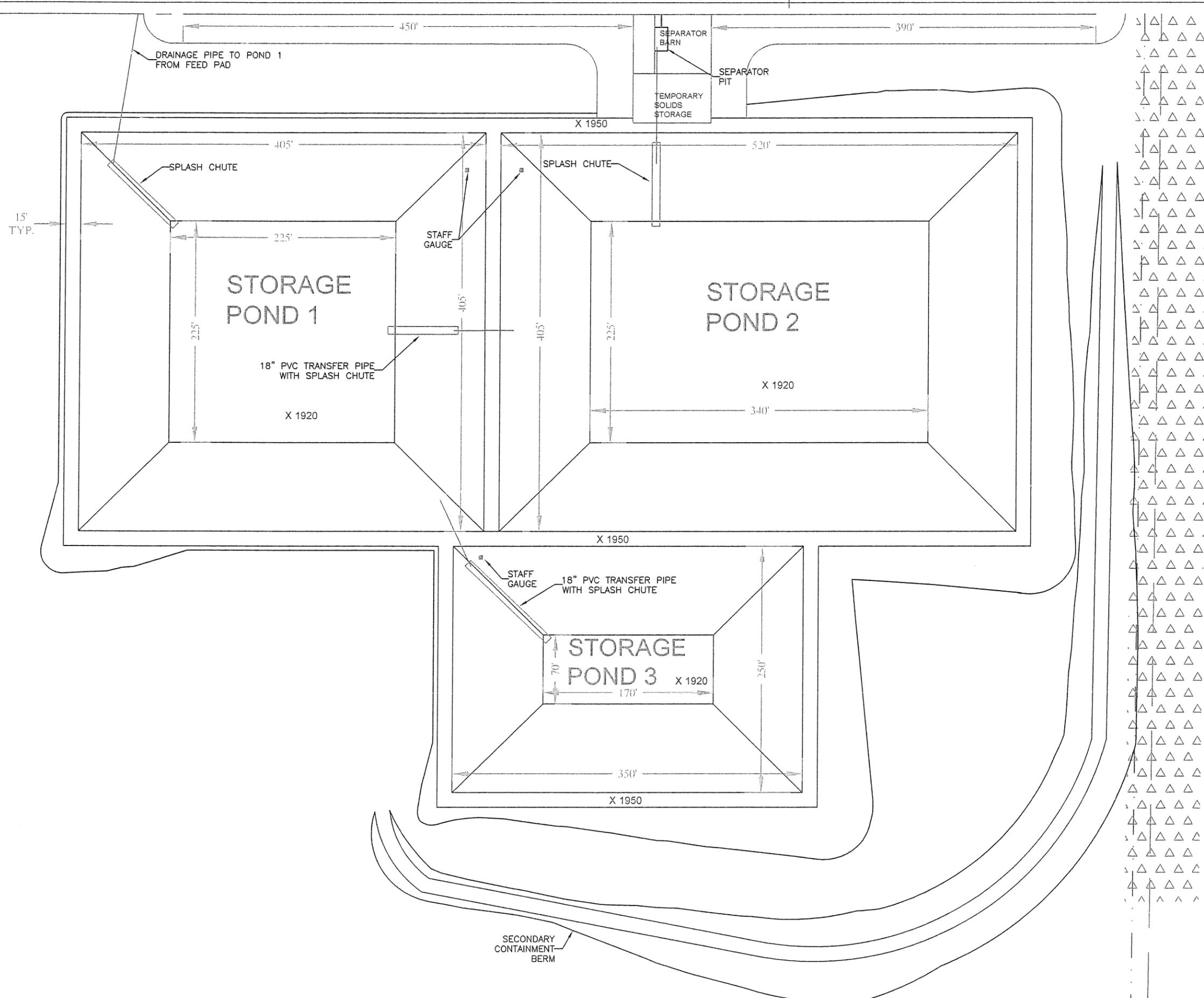
X 1/8" = 1"

200' PROPERTY LINE SETBACK

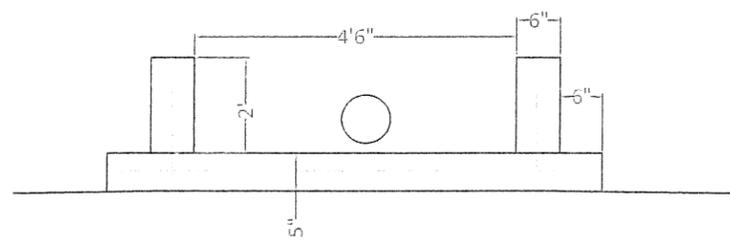
150' R.O.W SETBACK

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BUILDING PLAN				
OAK LAKE DAIRY AWMS				
DAKOTA ENVIRONMENTAL CONSULTANTS INCORPORATED				
P.O. BOX 636 HURON, SD 57350 605-352-5610				
JOB NO: 1419				
SCALE: 1" = 80'				
DWG: 2				

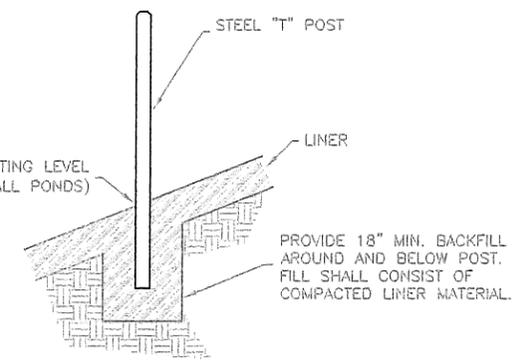




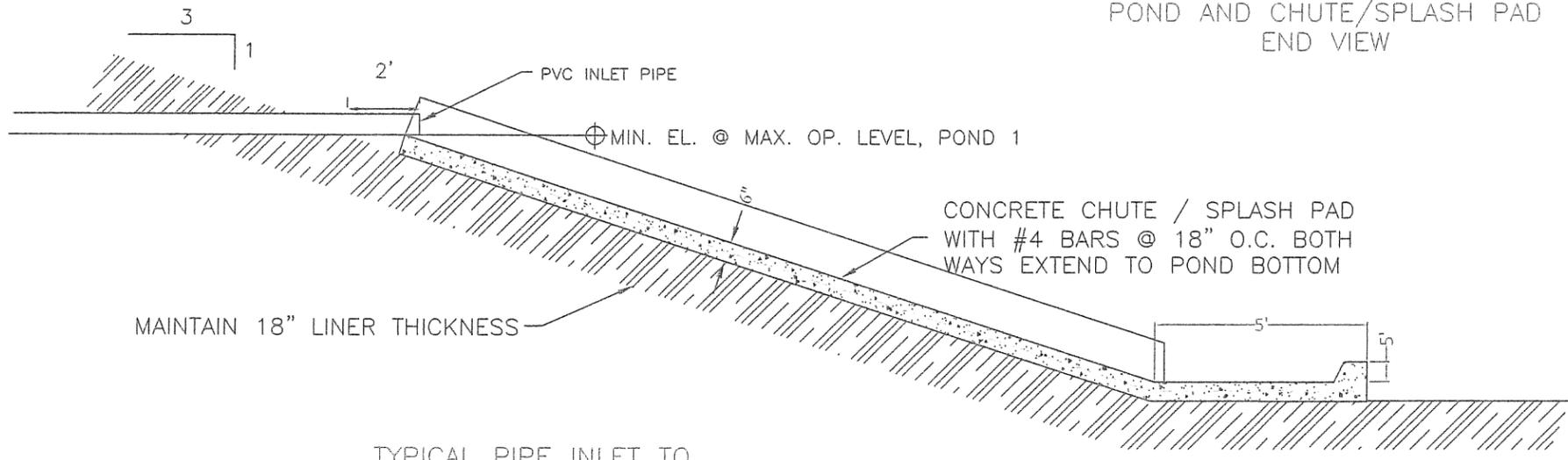
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OAK LAKE DAIRY AWMS		DATE: 11/14/16	DRAWN: TB	CHECKED: BF	
DAKOTA ENVIRONMENTAL CONSULTANTS INCORPORATED		P.O. BOX 636 HURON, SD 57350 605-352-5610			
		JOB NO: 1419			
		SCALE: 1"=100'			
		DWG: 3			



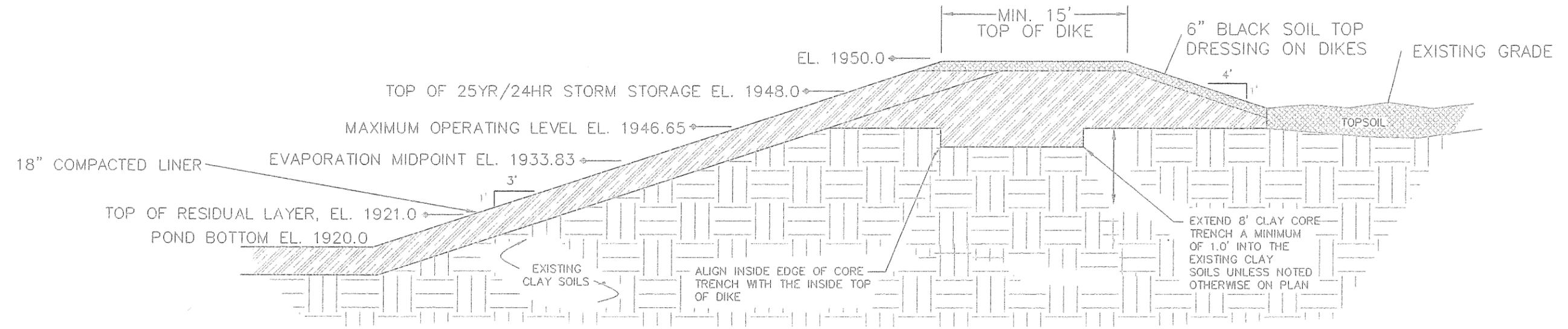
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END VIEW



POND STAFF GAUGE  
NTS

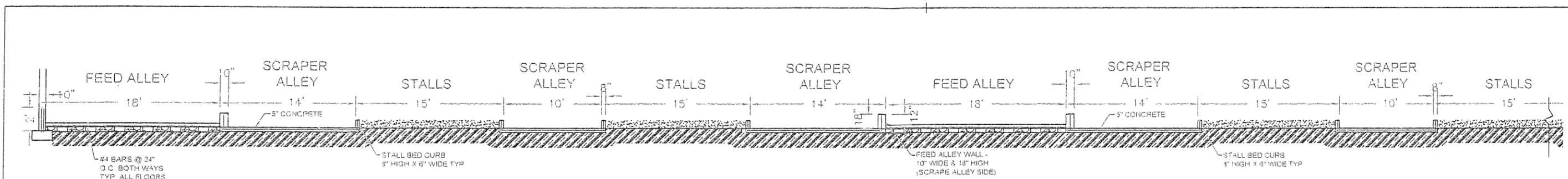


TYPICAL PIPE INLET TO POND AND CHUTE/SPLASH PAD  
SIDE VIEW

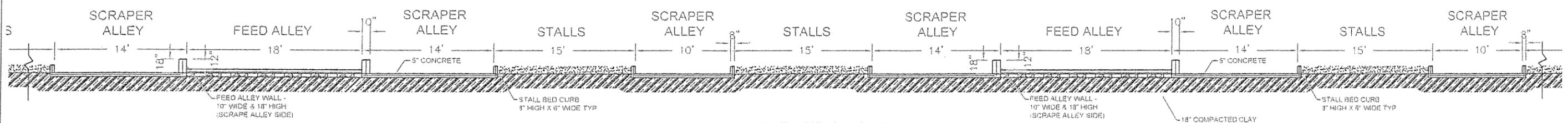


TYPICAL POND DIKE CROSS SECTION  
POND 1 ELEVATIONS SHOWN  
NTS

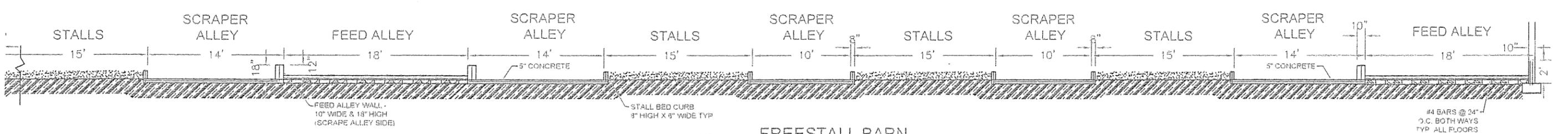
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POND DETAILS				
OAK LAKE DAIRY AWMS				
DAKOTA ENVIRONMENTAL CONSULTANTS INCORPORATED				
P.O. BOX 636 HURON, SD 57350 605-352-5610				
				
JOB NO:				
1419				
SCALE:				
NTS				
DWG:				
4				



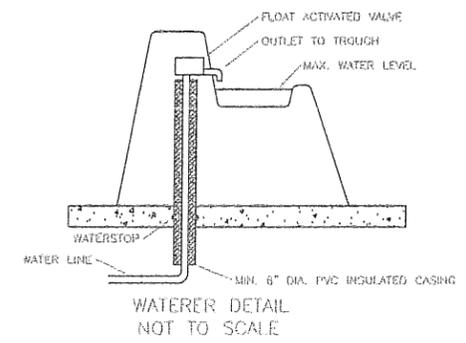
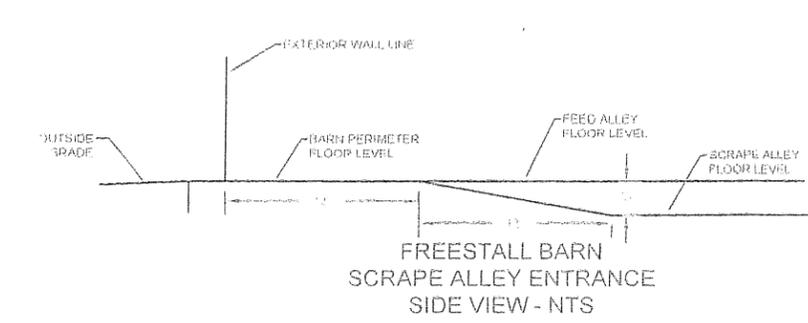
(A4/8)  
**FREESTALL BARN  
 TRANSVERSE SECTION  
 SOUTH SEGMENT**



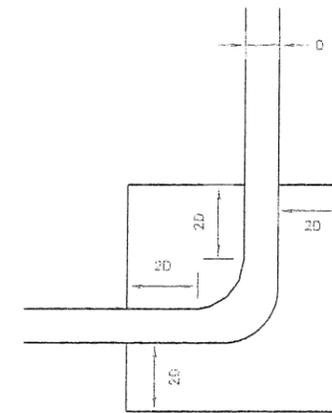
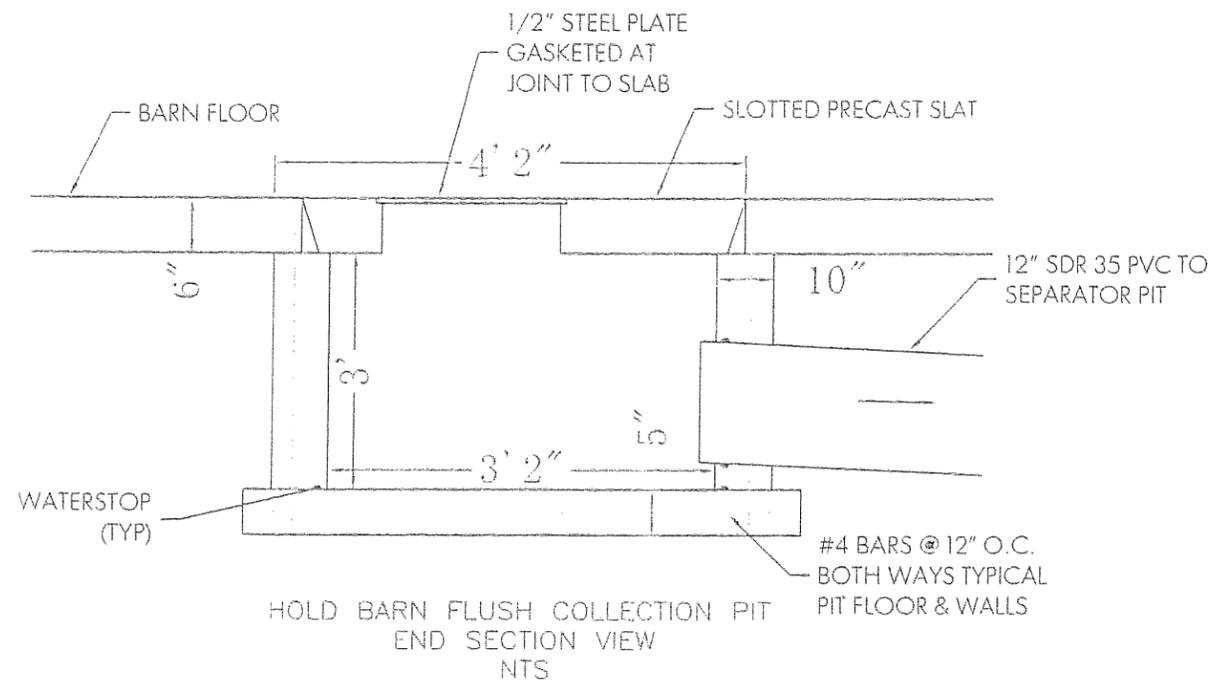
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**FREESTALL BARN  
 TRANSVERSE SECTION  
 MIDDLE SEGMENT**



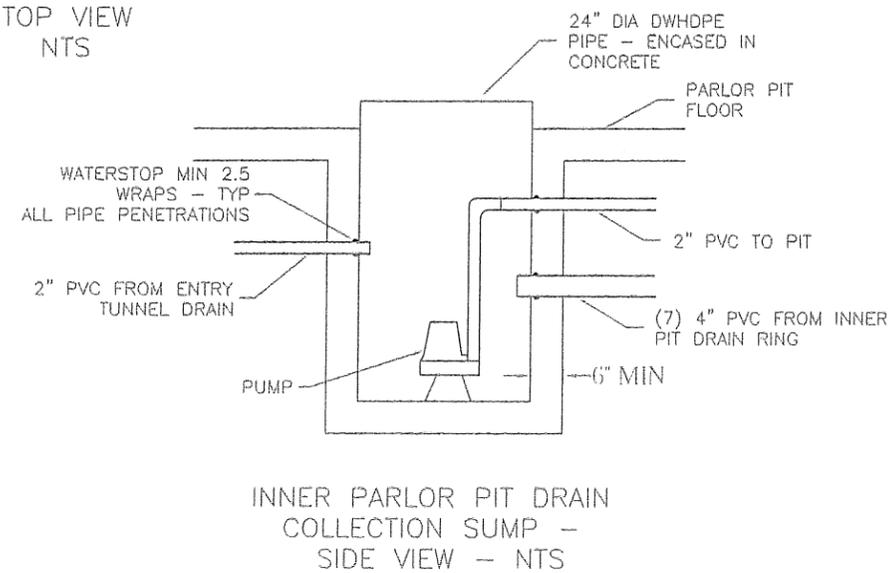
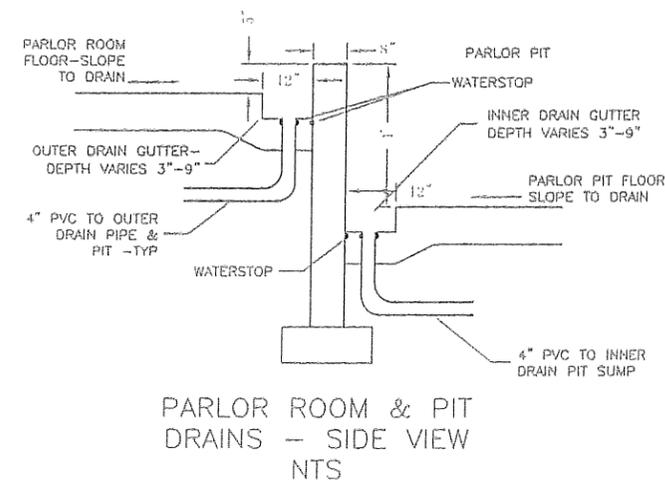
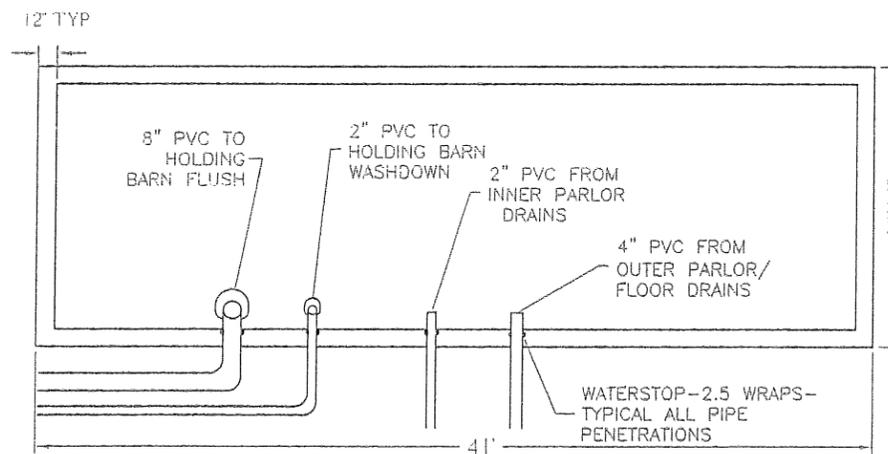
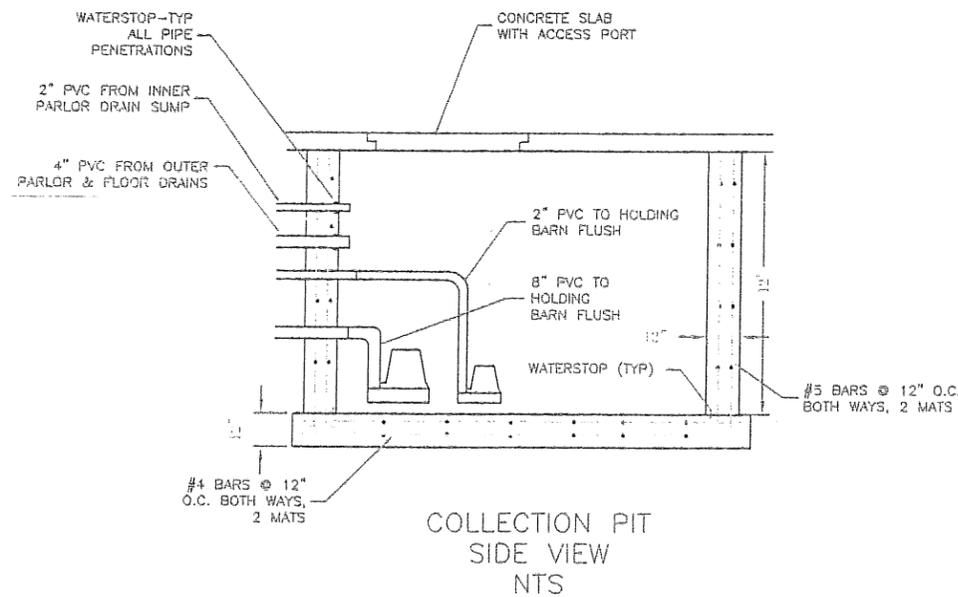
(A4/8)  
**FREESTALL BARN  
 TRANSVERSE SECTION  
 NORTH SEGMENT**



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						BF
	DESCRIPTION	DATE	DRAWN:	RR		
					11/14/16	
FREESTALL BARN SECTION						
OAK LAKE DAIRY AWMS						
JOB NO:						
1419						
SCALE:						
NTS						
DWG:						
5						



- NOTES:
1. PROVIDE ENCASEMENT MIN 2 PIPE DIAMETERS BEFORE TO AFTER ANY BEND IN FORCEMAIN
  2. PROVIDE ENCASEMENT MIN 2 PIPE DIAMETERS AROUND PERIMETER OF FORCEMAIN AT ANY BEND.

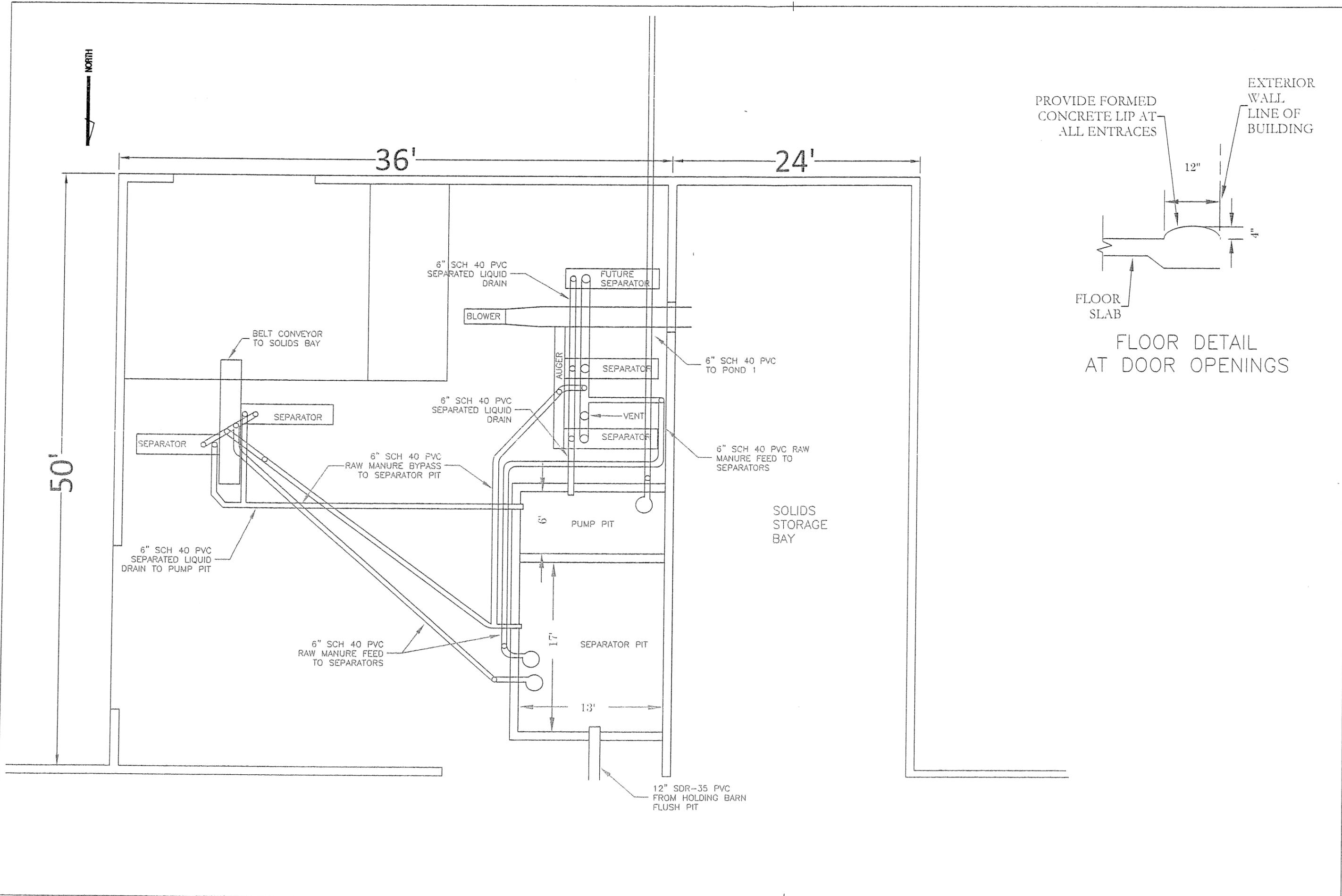


COLLECTION PIT DETAILS  
OAK LAKE DAIRY AWMS

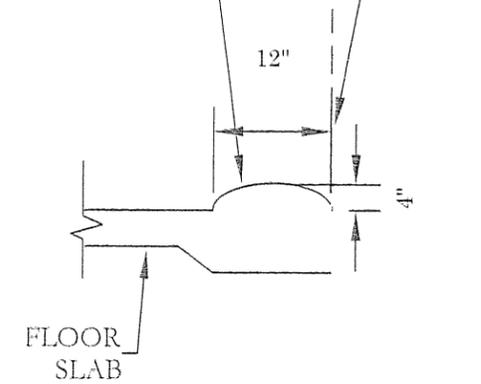


JOB NO:  
1419  
SCALE:  
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DWG:  
6

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BY	CHKD	BY	CHKD
RR	RR	11/14/16	BF

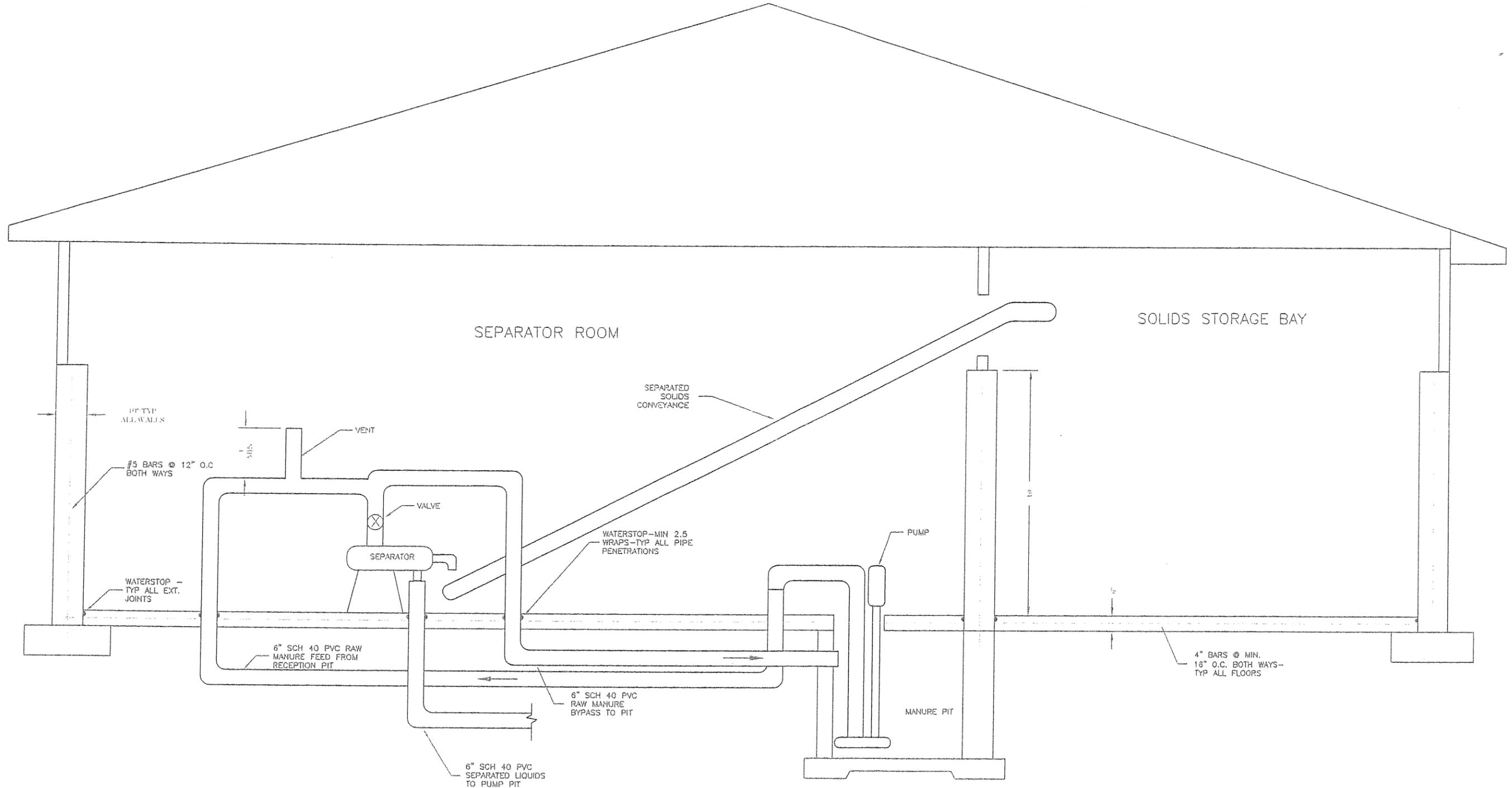


PROVIDE FORMED CONCRETE LIP AT ALL ENTRANCES  
 EXTERIOR WALL LINE OF BUILDING



FLOOR DETAIL AT DOOR OPENINGS

REV.	DATE	DESCRIPTION	DRAWN:	CHECKED:
	11/14/16		RR	BF
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JOB NO:				
1419				
SCALE:				
NTS				
DWG:				
7				



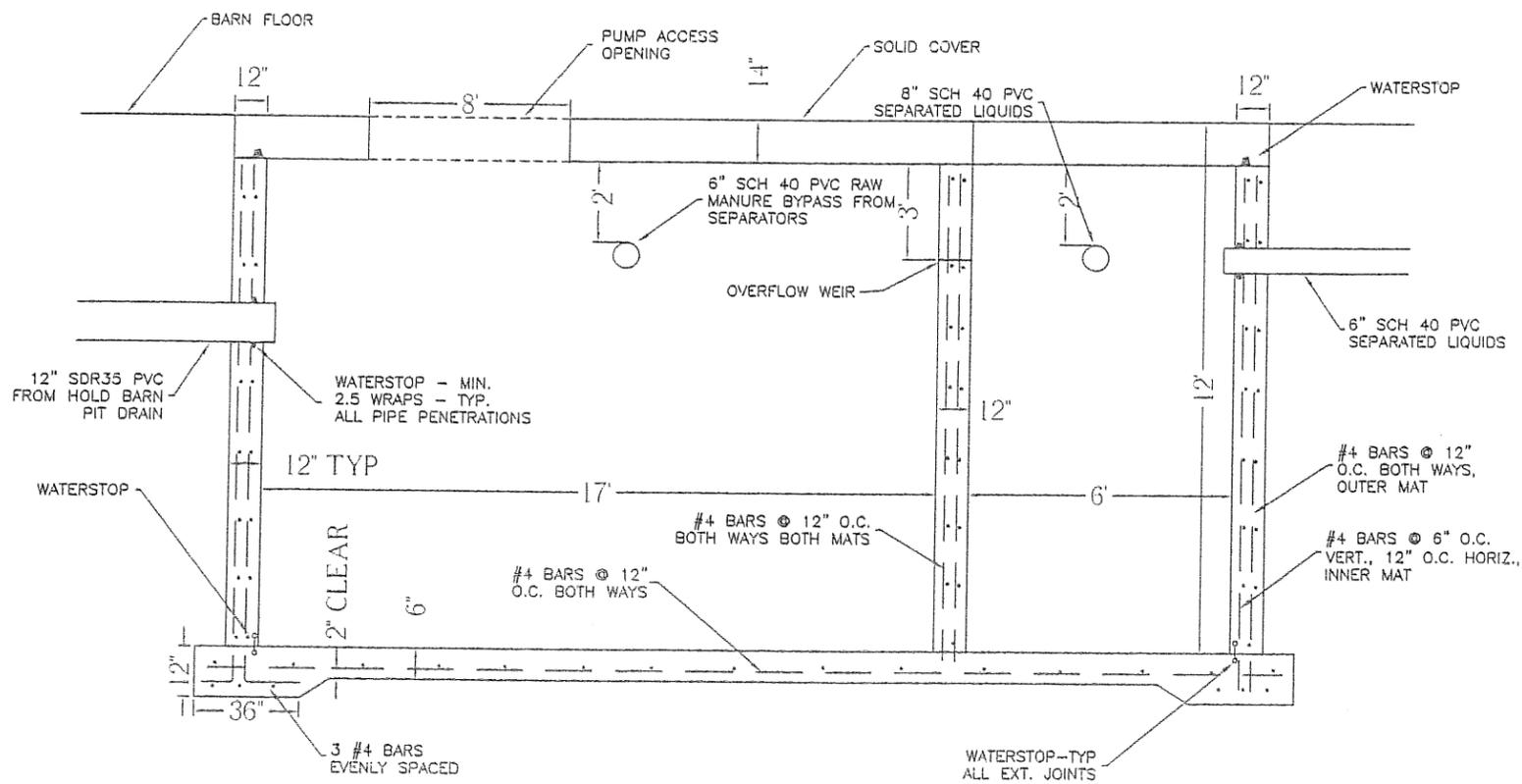
SEPARATOR BARN &  
GENERAL SEPARATOR  
SCHEMATIC-NTS

REV.	DATE	DESCRIPTION	BY	CHKD
	11/14/16	RR		BF

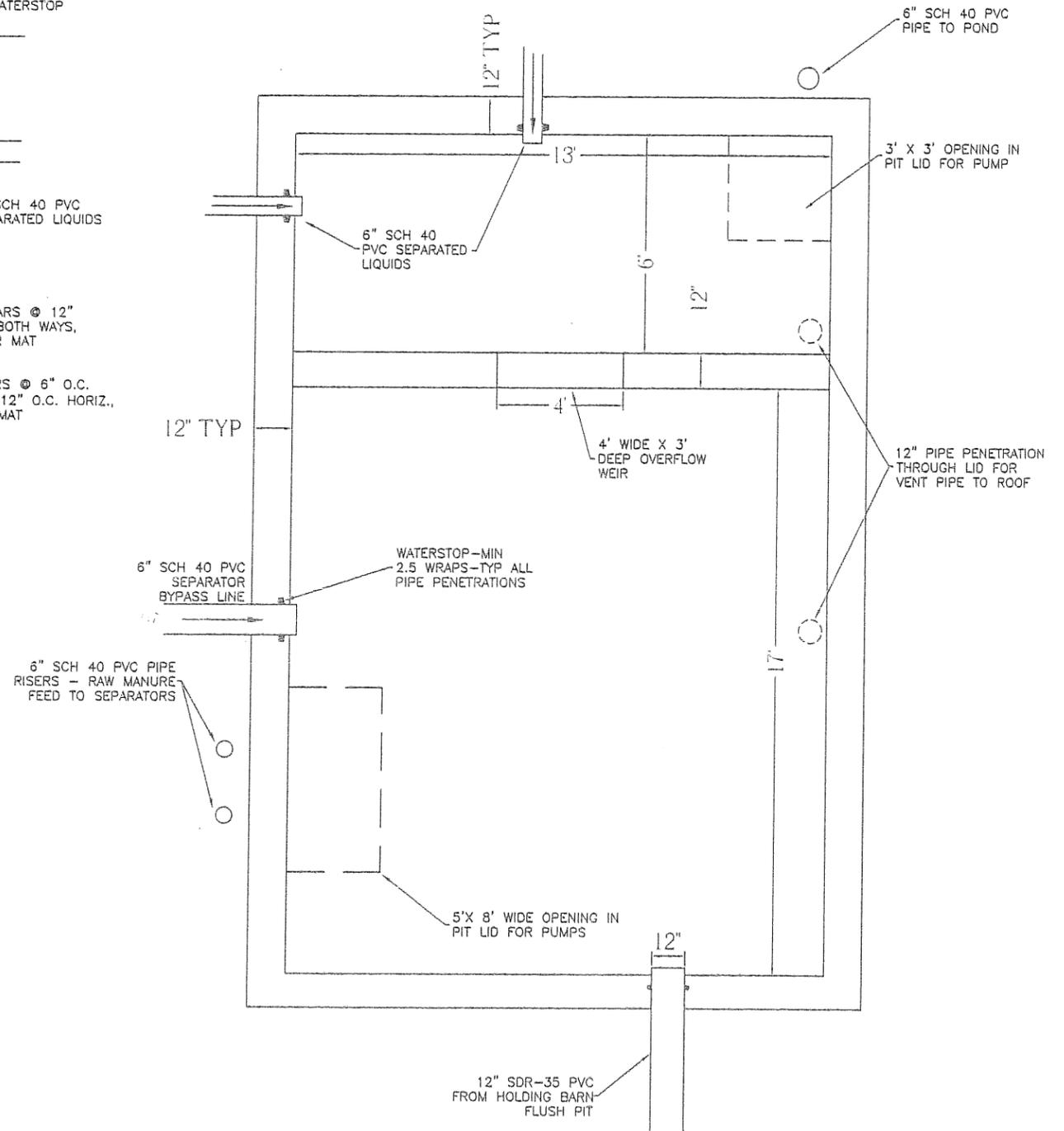
SEPARATOR BUILDING SECTION  
OAK LAKE DAIRY AWMS



JOB NO:	1419
SCALE:	NTS
DWG:	8



SEPARATOR PIT  
SIDE VIEW



SEPARATOR PIT  
PLAN VIEW

REV.	DATE	DESCRIPTION	BY	CHKD
	11/14/16			
		DATE	RR	BF
		DATE	RR	BF
SEPARATOR DETAILS				
OAK LAKE DAIRY AWMS				
				
JOB NO:				
1419				
SCALE:				
NTS				
DWG:				
9				

**GENERAL NOTES/SPECIFICATIONS**

1. **NO VARIATION FROM THESE PLANS IS AUTHORIZED WITHOUT PRIOR APPROVAL OF ENGINEER. THE BUILDER IS TO ADVISE ENGINEER IMMEDIATELY UPON DISCOVERY OF ANY INCONSISTENCY OR DISCREPANCY IN THESE PLANS WITH FIELD CONDITIONS OR PLANS PROVIDED BY OTHERS.**
2. Any new water supply wells placed on the site must be a minimum of 150 feet from the closest point of any waste holding structure including manure pits. Any new well must be a minimum of 50 feet from the closest point of a sewer line.
3. Strip topsoil and vegetation from all areas under structures and embankments. Stripping excavation shall extend to a depth sufficient to expose subsoil reasonably free of roots and other perishable material. Excavated earth material determined to be satisfactory by the Engineer shall be used for earth fill or topsoil. Stripped material suitable for topsoil shall be stockpiled and spread, as specified in these specifications.
4. Stripping excavation for foundations shall extend to consolidated subsoil and shall be left as reasonably smooth surfaces free of unconsolidated or loose soil. Because of the fact that imposed structural loads are distributed laterally with depth, when replacing poor soils with compacted fill it is necessary to oversize the excavation to a certain extent. In most soils we recommend that at least a 1:1 lateral oversize be maintained in excavating below footing grade. In soft clay and swamp deposits we generally recommend a 2:1 or even 3:1 lateral oversize.
5. Excavated soils consisting of loams and clay shall be deemed satisfactory for earth fill to the extent needed. Sandy soil shall be blended to provide for earth fills, or be wasted as directed by the Engineer. The selection, blending, routing, and disposition of material shall be the responsibility of the Builder and subject to approval by the Engineer. Fill materials shall contain no frozen material, ice, snow, sod, brush, roots or other perishable materials, or rocks larger than four inches in diameter. No fill shall be placed on a frozen surface.
6. Prior to placement of fill, the entire area to receive fill shall be rolled with heavy equipment (such as a loaded end-dump) and inspected to identify any unsuitable soils that require removal. Unsuitable materials shall be overexcavated to a depth of 2 feet. After stripping or overexcavating, the foundation shall be loosened thoroughly by scarifying or discing to a minimum depth 6 inches. The entire foundation area shall then be compacted to the density and at the moisture specified for the fill.
7. All foundation excavation and/or preparation shall be completed before placing fill. The fill shall be placed such that the distribution of materials is essentially uniform throughout the entire fill and is free from lenses, pockets, streaks, or layers of material differing substantially from surrounding material.
8. Fill shall be placed within specified moisture contents. When material deposited on the fill is too dry, water may be added to the fill material in the borrow area, or after material has been brought onto the fill. If moisture is added to the fill, uniform moisture distribution shall be obtained by discing, blading or other approved methods.
9. Density and moisture content of the fill will be tested during the course of the work following the methods described in ASTM D2216, ASTM D1556, or equivalent. The engineer shall be notified two days prior to the need for performance of compaction tests. Testing shall be performed at the following rates:
  - a) Earthen liners: A minimum of 4 per lift for areas up to two (2) acres. Provide an additional 2 tests per lift for each additional acre.

- b) Earthfill: A minimum of one compaction test for every 5000 cu. yd.  
If a compaction test fails to meet the required level of compaction, the Builder shall be responsible for the cost of re-testing after the area has been recompacted.
10. In lieu of conducting density tests on the completed liner, there shall be a minimum of two permeability tests conducted on the completed liner. For ponds larger than two acres, one permeability test shall be conducted for each acre of liner. The locations of the tests must be random and equally distributed over the liner bottom and inside embankments. All liner tests shall demonstrate an in-place permeability not to exceed  $1.0 \times 10^{-7}$  cm/sec.
11. Builder is responsible to manage the routing and stockpiling of material for the clay liner. It is anticipated the native clay soils below the topsoil will be suitable for use as liner material, though certain soils encountered may contain excessive sand or silt and are not suitable. As early as possible during excavation, field evaluation of the quality of the native clay soil in the vicinity of the bottom liner should be performed with the engineer to verify its adequacy. The contractor shall stockpile choice clay materials during the progress of excavation to ensure the availability of a suitable volume and quality of liner material.
12. When in-place native soils are used as for compacted liner, excavate beyond the design bottom an additional twelve inches. The next six inch layer shall be scarified and recompacted. Additional six inch lifts of select material will be placed and compacted to reach the specified liner thickness. When imported clay material is used for a liner, overexcavate beyond the design bottom by the liner thickness. The entire liner subgrade area shall be rolled to identify any unsuitable soils that require removal. Following overexcavation, six inch lifts of select material will be placed and compacted to reach the specified liner thickness.
13. Pipe trench bottoms shall be uniform so that the pipe will lay on the bottom without bridging. Clods, rocks, and uneven spots which could damage or cause non-uniform support to the pipe shall be removed. Where rocks, boulders or any other material which might damage pipe are encountered, the trench bottom shall be undercut a minimum of 4 inches below final compacted fine-grained soils. Provisions shall be made to insure safe working conditions where unstable soil, trench depth, or other conditions are such as to impose a safety hazard to personnel working in the trench.
14. Pipe shall be installed in accordance with these plans, the manufacturer's recommendations, and ASTM D2321. Pipe shall be fully supported its entire length by hand excavation or other suitable means. Initial pipe backfill shall be of selected material free from sharp edged rocks, stones or clods. Care shall be taken to avoid deformation or displacement of the pipe during initial backfill operation. The remainder of the backfill shall be placed and spread in approximately uniform layers in such a manner as to completely fill the trench so that there will be no unfilled spaces in the backfill. Mound the backfill soil to replace the soil removed from the trench.
15. All piping shall be installed so a minimum of 5 feet of cover is present between the surface and the crown of the pipe if additional insulation is not provided.
16. Gravity sewer and drainage pipes shall be constructed using SDR 35 or heavier PVC pipe laid at the grades shown on the drawings. Pressure pipe (force main) shall be constructed using SDR-26 PVC pipe or heavier. On pressure pipe systems, provide concrete thrust blocks, with at least 4 square feet of bearing on undisturbed, firm soil, at all bends, valves, tees, fittings or reducers. Where water supply pipes cross under or within 18 inches of any sewer piping, encase the water line in concrete (minimum of 6" surrounding the pipe) for at least 10 feet either side of the crossing.
18. All sewer pipes shall be pressure tested. Contractor shall provide written certification of pressure testing results to the engineer prior to application for payment. The contractor shall provide all labor and materials for pressure testing.

19. Pressure tests of gravity sewers shall be performed as follows: A test plug shall be inserted at the point of discharge into the pond. The sewer shall then be filled with water to the top of the inlet pipe. The water level at the top of the inlet shall not drop for at least fifteen minutes.
20. Pressure tests of pressurized sewers shall be performed as follows:
  - a) Fill the service line and bleed to remove all air.
  - b) Isolate service line from main and raise pressure to 50% above the design operating pressure.
  - c) Maintain pressure within 1 psi for a minimum of 30 minutes.
  - d) Line will pass the test if leakage is no more than the following:  
 $L = (N \times D \times P) / 1850$   
Where:  
L = Allowable leakage, in gallons per hour.  
N = Number of pipe joints.  
D = Nominal pipe diameter, in inches  
P = Average test pressure during test, in psig.
21. Unless otherwise specified on the plans, the fill shall be compacted to the following specifications. Maximum density shall be determined by ATSM-D-698, Standard Proctor Test.
 

	% maximum dry density	% moisture range about optimum	max. lift thickness	total liner thickness
Embankment	90%	-2 to +2	12"	-
Structural fill beneath slabs and pipe	97%	-3 to +3	8"	-
Pond liner	95%	-2 to +2	6"	18"
22. In locations where existing embankments or liners are disturbed to install, remove, or modify piping or appurtenances, the disturbed embankments shall be recompacted to the above specified densities using the procedure described above. The disturbed liner shall be replaced and recompacted to the above specifications. Rammer or plate compactors are considered to be acceptable if larger compacting equipment is not practical for these locations.
23. Seed disturbed and topsoiled areas using Fairway Crested Wheatgrass at 15#/acre, or Smooth Bromegrass at 20#/acre. Apply seed when soil is not wet, using a grass drill at a depth of 1/4 to 3/4 inch, or with other approved types of equipment that will ensure a uniform distribution of the seed. Areas with slopes steeper than 4:1 shall be mulched with straw or hay and anchored by use of a mulching machine or netting.

				CHKD	BY	CHECKED:	BF
				DESCRIPTION		DRAWN:	RR
			DATE			DATE:	11/14/16
			REV.				
GENERAL NOTES & SPECS.							
OAK LAKE DAIRY AWMS							
							
JOB NO:							
1419							
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**CONCRETE CONSTRUCTION NOTES**

1. **BUILDER SHALL NOTIFY THE ENGINEER OF CONSTRUCTION SCHEDULE TO PERMIT SCHEDULING OF PRE-CONSTRUCTION MEETING AND CONSTRUCTION OBSERVATION.**
2. **NO VARIATION FROM THESE PLANS IS AUTHORIZED WITHOUT PRIOR APPROVAL OF THE ENGINEER.**
3. **BUILDER IS RESPONSIBLE TO ADVISE ENGINEER IMMEDIATELY UPON DISCOVERY OF ANY INCONSISTENCY OR DISCREPANCY IN THESE PLANS WITH FIELD CONDITIONS OR PLANS PROVIDED BY OTHERS.**
4. Any required grounding of building components including concrete reinforcement shall be installed in accordance with the provisions of the National Electric Code and regulations.
5. No excavation shall begin without first having locations of all present utilities identified. Builder is responsible for contacting South Dakota One-Call at 1-800-781-7474.
6. All concrete work shall conform to the American Concrete Institute's "Building Code Requirements for Structural Concrete" (ACI 318).
7. Concrete Materials and Testing:
  - a) All concrete shall have 3/4 inch maximum aggregate size. Provide a mix with a slump of 4 inches +/- 1 inch. Do not exceed a water/cementitious materials ratio of 0.45. Water reducing admixtures may be used at the discretion of the contractor.
  - b) Concrete shall use Type II cement and be furnished with proper admixture to obtain 5% +/- 1% air entrainment.
  - c) Concrete shall develop a minimum 28 day strength of 4000 psi.
  - d) Provide quality assurance testing in accordance with the following requirements. Submit the results of all tests to the Engineer. **Testing will be wholly the contractor's responsibility.**
  - e) Collect concrete test cylinders in accordance with ASTM C31. Test cylinders may be taken either at the batch plant (assure materials are thoroughly mixed, at least 1 1/2 minutes after all water and cementitious materials have been introduced), or in the field. Test cylinders shall be made in sets of two. At least one set of two cylinders shall be taken each day concrete may be placed, however, procurement of test cylinders may be waived with the concurrence of the engineer or when less than 40 cubic yards is placed in a given day.  
 Obtain at least the following numbers of test cylinders:  
 One set of 2 cylinders for each 3000 square feet of flatwork;  
 one set of 2 cylinders for each 500 linear feet of exterior walls;  
 and one set of 2 cylinders each for floors and walls of any individual pit.  
 Test all cylinders in accordance with ASTM C39 at 28 days.
8. During hot weather (80° F and above), comply with ACI 305 "Hot Weather Concreting". During cold weather (40° F and below), comply with ACI 306 "Cold Weather Concreting."
9. Calcium Chloride accelerators will not be allowed.
10. Steel reinforcing shall comply with the following:
  - a) Steel for walls shall be ASTM A615, Grade 60.

- b) Reinforcing steel for floors shall be ASTM A615, Grade 40 or Grade 60.
11. All steel shall be lapped 36 bar diameters at splices unless noted otherwise. Splices shall be staggered at least 3 feet. Splices occurring at the same location shall be at least 6 bars apart.
12. Standard concrete cover of bars shall be as follows, unless noted otherwise:
  - a) Where earth formed 3 inches
  - b) Where exposed to earth or weather 2 inches
13. Walls and slabs shall bear on soil capable of safely supporting 2400 psf. Pier bearing elevations are to be at least 4.5 feet below finished grade.
14. For backfill provide granular or low plasticity soil such as silt and clay mixtures, sandy clay, or clean sand and gravel. All backfill materials are subject to approval of the engineer. Compact all fill and backfill in maximum 12-inch layers (loose thickness) to at least 95% of the maximum density as determined by Standard Proctor test (ASTM D698).
15. Excavate the area to the required lines and grades. The entire area shall be rolled as needed to compact any loosened materials. The subgrade shall be trimmed and compacted to provide a uniform surface that does not vary in depth more than 2" in 10 feet from the grades shown on the plan. Fill below footings and slabs, if needed due to unsuitable soils or uneven surface grading, shall consist of clean granular material (sand with less than 12% passing a #200 US sieve) compacted as specified for backfill in note #14, above. Constructed thickness of slabs shall not be less than the dimension given on the drawings.
16. If necessary, wall penetrations shall avoid interruption of steel reinforcement, where possible. Where interruption by piping is required, additional reinforcement around the openings shall be as shown on plans.
17. If groundwater conditions or any soft or potentially unstable materials are encountered during excavation, the Engineer shall be notified immediately.
18. Provide suitable chairs, spacers, or bolsters to support all reinforcing. Accessories shall be as specified in the latest edition of "Concrete Reinforcing Steel Institute Handbook." Maximum spacing of accessories shall be 5'-0". All accessories shall have galvanized or plastic feet. For slabs on grade, use supports with sand plates or horizontal runners if needed. No aluminum items shall be embedded.
19. Install all construction or control (contraction) joints as called for on the drawings or as approved by the floor engineer.
20. Concrete construction shall be planned to minimize the number of construction joints. Except at corners, the location of all construction joints in walls and floor slabs, and the layout of slab control (contraction) joints, shall be reviewed with and approved by the engineer prior to construction.
21. All construction joints in and between floor slabs and exterior walls shall be provided with waterstop. Provide Waterstop RX 102, as manufactured by American Colloid Corp., or polyvinyl chloride waterstop, style #703 as manufactured by Greenstreak or approved equal. Install waterstop in accordance with manufacturer's recommendations on the manure side of reinforcing steel, near the middle of the of the wall or slab section, and as shown on the detail

- drawings. Maintain specified concrete cover over waterstop and reinforcing steel.
22. All pipe penetrations shall be provided with suitable waterstops.
  23. Contractor/builder shall notify the Engineer approximately 48 hours prior to the following activities to permit inspections:
    - a) after subbase preparation, including compaction of granular cushion, and prior to drilling of piers.
    - b) during installation of wall forms and reinforcement, prior to casting concrete.
    - c) after form removal and prior to backfill to permit visual inspection of finished work.
  24. Any imperfections or damage to concrete surfaces below the waterline shall be repaired as approved by the Engineer.
  25. Compaction of fill adjacent to new concrete shall not be started until at least seven days after placement of the concrete and after all walls are laterally braced.
  26. These plans are intended to provide details relevant to the animal waste management system and are a supplement to the building plans supplied by others. The builder is responsible for confirmation of all work to be coordinated with others. Anchorage requirements, embedded items, dimensions of slats, openings for doors or fans, etc. shall be confirmed prior to erection of forms and concrete placement.
  27. Any new water supply wells placed on the site must be a minimum of 150 feet from the closest point of any waste holding structure including manure pits (1,000 feet if the well will be used for human consumption). Any new well must be a minimum of 50 feet from the closest point of a sewer line.
  28. All buried water service lines shall be installed to maintain a minimum of 3 feet of separation from any manure containment or storage structure.
  29. Seed disturbed and topsoiled areas as directed by the project engineer.

CONCRETE NOTES  
OAK LAKE COLONY AWMS



JOB NO:	1419
SCALE:	NTS
DWG:	11

REV.	DATE	DESCRIPTION	BY	CHKD
	11/14/16			
			CHECKED:	BF
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