RECEIVED

APR 06 2015

AP20957

MISSOURI DEPARTMENT OF NATURAL RESOURCES
WATER PROTECTION PROGRAM

FORM W - CONCENTRATED ANIMAL FEEDING OPERATION (CAFO) OPERATING PERMIT APPLICATION

WATER PROTECTION PROGRAM

FOR OFFICE USE ONLY	
CHECK NUMBER	46481
DATE RECEIVED	FEE SUBMITTED
4/6/15	$150.00 SB

Complete all applicable sections. Instructions for completing the form are located at the end of the form. Sign, date and return the form and all requested documents along with a check for the appropriate permit fee to the Missouri Department of Natural Resources. Make a copy of this completed form and keep it with your nutrient management plan.

PART 1 – PERMIT OWNERSHIP AND CONTACT INFORMATION

1.1 OPERATION NAME	CURRENT PERMIT NUMBER	COUNTY
Trenton Farms RE, LLC	MO-	Grundy
PHYSICAL ADDRESS	LEGAL DESCRIPTION	TELEPHONE NUMBER WITH AREA CODE
State Highway W	Sec.: 19 Twn.: 60N Rng.: 24W	(507) 825-7032
CITY	STATE	ZIP CODE
Trenton	MO	64683
1.2 OWNER (PROVIDE LEGAL NAME)	EMAIL ADDRESS	
Trenton Farms RE, LLC		
MAILING ADDRESS		TELEPHONE NUMBER WITH AREA CODE
1300 S. Hwy 75		(507) 825-7032
CITY	STATE	ZIP CODE
Pipestone	MN	65164
1.3 CONTINUING AUTHORITY (IF DIFFERENT THAN THE OWNER)		
MAILING ADDRESS		TELEPHONE NUMBER WITH AREA CODE
CITY	STATE	ZIP CODE

PART 2 – PERMIT TYPE AND PERMIT ACTION

2.1 PERMIT TYPE

☐ NPDES Site Specific Permit
Request review of draft permit prior to public notice. ☐ Yes ☐ No

☐ NPDES General Permit (MOG01)

☑ State No-Discharge General Permit (MOGS1)

2.2 PERMIT ACTION*

☑ New Permit MOGS10500 ☐ Renewal
☐ Modification ☐ Ownership Transfer

PREVIOUS OWNERS NAME

ADRESS

CITY STATE ZIP CODE

SIGNATURE DATE

*See instructions for additional requirements and documents for the request permit action.

PART 3 – DESIGN CAPACITY FOR MANURE STORAGE AND ANIMALS OF EACH CAFO FEATURE

3.1 STORAGE STRUCTURE TYPES, AMOUNT OF STORAGE, AND AMOUNT OF MANURE GENERATED PER YEAR.

List All Manure Storage Structures at each CAFO Feature		Dry Manure Handling System		Wet Manure Handling System			
CAFO Feature	Storage Structure Type(s)	Design Dry Process Waste (tons/yr.)	Days of Storage	Total Storage Capacity (gal)	Design Wastewater per Year (gal./yr.)	Days of Storage	Design Flow MGD
001	C - Farrowing Barn, drains into Gestation Barn				1238688	365+	
002	C - Gestation Barn			5581913	2745908	365+	
003	C - GDU Barn			659168	530332	365+	
004	G - Composter	92.7	365+				
005							

3.2 LIST EACH TYPE OF ANIMAL IN CONFINEMENT AND THE NUMBER OF EACH ANIMAL TYPE.

CAFO Feature	Animal Category #1	Animal Numbers	Animal Category #2	Animal Numbers	Animal Category #3	Animal Numbers
001	5 - Farrowing	936				
002	5 - Gestation	5120				
003	5 - GDU	960	4 - GDU	320		
004						
005						

ART 4 – OPERATIONAL INFORMATION

4.1 OPERATIONAL INFORMATION (SEE INSTRUCTIONS)
SIC Code(s) 0213 CAFO Class Size 1C

4.2 Is this an export-only operation? ☑ Yes ☐ No

NE Grundy

Completing PARTS 5 - 11 will meet the requirements of a Nutrient Management Plan (NMP) for an export only operation.

PART 5 – MANURE STORAGE

5.1 Do all manure storage structures have adequate storage, and operated and maintained as no discharge? ☑ Yes ☐ No

PART 6 – ANIMAL MORTALITY

6.1 PEMANENT METHOD OF DISPOSING OF ROUTINE ANIMAL MORTALITIES.

☑ Composting ☐ Rendering ☐ Send to a Landfill ☐ Incineration ☐ Other (Describe)

6.2 DESCRIBE METHOD OF MORTALITY HANDLING AND STORAGE THROUGH ALL PHASES TO FINAL DISPOSAL. (EXAMPLE: MORTALITIES ARE COMPOSTED WITHIN 24 HOURS OF DEATH AND FINISHED COMPOST PRODUCT IS STORED UNDER ROOF UNTIL LAND APPLIED). ALSO DESCRIBE THE TYPE OF COMPOST STRUCTURE USED, IF APPLICABLE.

Mortalities will be composted within 24 hours of death. Compost material will be land applied to fields in the Nutrient Management Plan.

PART 7 – DIVERSION OF CLEAN WATER

7.1 Is clean stormwater diverted from the production area? ☑ Yes ☐ No

7.2 IF YES, DESCRIBE CONTROLS AND MEASURES USED TO DIVERT STORMWATER.

Production area is under roof, site is graded to direct stormwater away from structures.

7.3 IF NO, DESCRIBE HOW CONTAMINATED STORMWATER IS CONTAINED AND INCLUDE THE STORAGE CAPACITY OF THE CONTAINMENT IF NOT PREVIOUSLY PROVIDED.

PART 8 – PREVENT DIRECT CONTACT OF ANIMALS WITH SURFACE WATERS

8.1 Do the animals have access to waters of the state within the production area? ☐ Yes ☑ No

8.2 LIST MEASURES USED TO PREVENT CONFINED ANIMAL FORM HAVING DIRECT CONTACT WITH WATERS OF THE STATE.

Animals are confined to barns.

PART 9 – CHEMICAL HANDLING

9.1 Check the appropriate boxed below to indicate method for handling and disposal of chemicals used by the operation:

☐ Chemicals are stored, handled, and disposed of according to manufacturer labels.

☐ Chemical storage and handling areas are protected from precipitation and runoff, and any spillage is contained within these areas.

☐ Emergency procedures and equipment are in place to contain and clean up chemical spills.

☐ Equipment wash areas are designed and constructed to prevent contamination of surface waters.

☑ No chemicals are stored or handled in the production area.

PART 10 – MANURE ANALYSIS TESTING

10.1 LIST EACH TYPE OF MANURE SOURCE. (I. e. MANURE, LITTER, COMPOST, WASTE WATER.)

Manure, compost, waste water

10.2 DESCRIBE PROCEDURES FOR ENSURING EACH MANURE SOURCE IS TESTED ANNUALLY.

Manure will be sampled annually and sent to a lab for analysis.

PART 11 – RECORD KEEPING

11.1 Are records of all inspections, manure transfers, discharges and land application maintained? ☑ Yes ☐ No

PART 12 – SIGNATURE

NAME	TITLE
Dr. Luke, Minier	Manager
SIGNATURE	DATE
	3-25-15

Part 13 - Engineer Certification

House Bill 28, which became effective Aug 28, 2013, contained provisions that changed construction permitting requirements. Construction permits are required for the construction of an earthen storage structure to hold, convey, contain, store, or treat domestic, agricultural, or industrial process wastewater. Construction of all other point source systems designed to hold, convey, contain, store, or treat domestic, agricultural, or industrial process waste must be designed by a professional engineer registered in Missouri in accordance with design regulations.

Operation Name Address City	Engineer Firm Address City State Zip Code
I, Project Engineer, certify that above described systems have been designed in accordance with Missouri CAFO design regulations in 10 CSR 20-8.300 PROJECT ENGINEER SIGNATURE	ENGINEER SEAL

pinnacle
Environmental Compliance
...for agriculture
620 Country Club Road Iowa Falls, Iowa 50126 Office: (641) 648-7300 Fax: (641) 648-7310
www.pinnacleiowa.com

March 20, 2015

Dear Landowners,

Trenton Farms RE, LLC would like to inform you of their intentions to build and operate a sow complex in Grundy County.

The site will consist of three buildings, all of which will have below building manure storage pits. The site's total capacity will be 6056 sows, 320 nursery pigs and 960 swine over 55 pounds. This site will have a manure management plan filed with the Missouri Department of Natural Resources. Nutrients from the pits will be land applied on approximately 784 acres using an injected hose applicator system and will be incorporated within 24 hours of applications. The nutrients will be applied on cropland in Grundy County at an application rate based on a manure sample pulled from the pits yearly, and the nutrient uptake of the crops. If you have any questions or comments contact the Environmental Water Protection Program at the Missouri Department of Natural Resources. They will accept comments 30 days from the date of this letter. Their contact information is:

Environmental Water Protection Program
Missouri Department of Natural Resources
.O. Box 176
Jefferson City, MO 65102
(573) 751-1300

The site will be located in the Southwest Quarter of Section 19, Township 60-N Range 24-W, Grundy County, Missouri.

The CAFO site owner's contact information is:

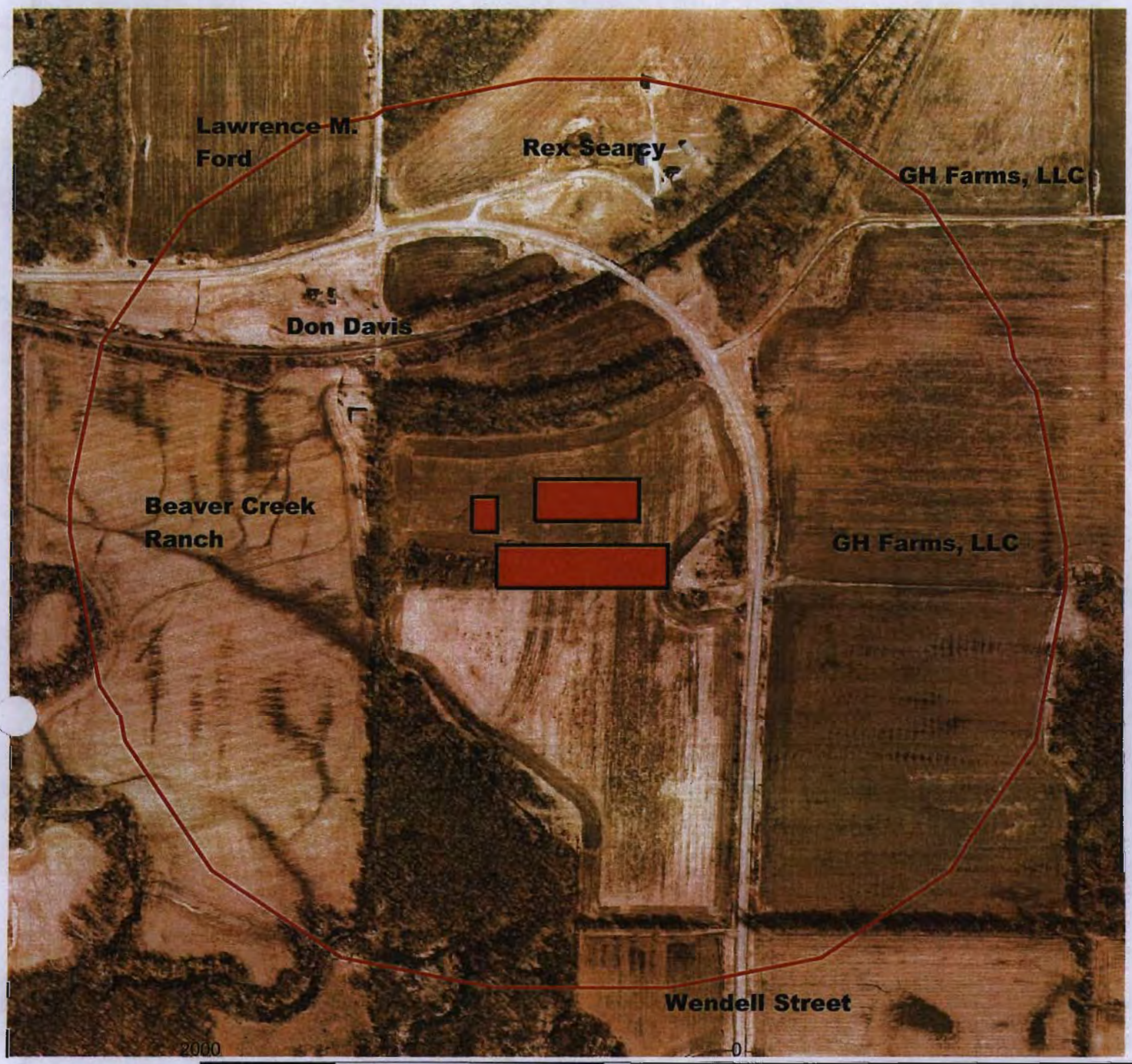
Trenton Farms RE, LLC
1300 S. Hwy 75
Pipestone, MN 56164
(507) 825-7032

If you require additional information please contact the following:

The Pinnacle Group
620 Country Club Road
Iowa Falls, IA 50126
(641) 648-7300

Thank you,
ıe Pinnacle Group

Trenton Farms RE, LLC Site; 15 (4.05 ac.)



LANDOWNER NOTIFICATION
Lawrence M. Ford
Rex Searcy
Beaver Creek Ranch
GH Farms, LLC
Wendell Street
Don Davis

Date: Mar 21, 2015
Field Name: Site; 15
Location: Grundy Co., Missouri, U.S.
Farm Name: Trenton Farms RE LLC
Client Name: P-Index
Total Acres: 4.05
Field Boundary Start Location:
Latitude: 39.99494968
Longitude: -93.64942149

pinnacle
520 Country Club Road
Iowa Falls, Iowa 50126
Office: 641.648.7310
Fax: 641.648.7310

1500 ft Landowner Notification Zone
(4.0ac.)Field Boundary

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Don Davis
501 East Prospect
Red Oak, IA 51566

COMPLETE THIS SECTION ON DELIVERY

A. Signature

X [signature] ☐ Agent ☐ Addressee

B. Received by (Printed Name) | C. Date of Delivery

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

RED OAK IA 51566 MAR 30 2015 USPS

3. Service Type
☑ Certified Mail® ☐ Priority Mail Express™
☐ Registered ☑ Return Receipt for Merchandise
☐ Insured Mail ☐ Collect on Delivery

4. Restricted Delivery? (Extra Fee) ☐ Yes

2. Article Number (Transfer from service label) 7013 2250 0001 7426 8244

PS Form 3811, July 2013 Domestic Return Receipt

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

GH Farms, LLC
220 Garr Field Ave
Chillicothe, MO 64601

COMPLETE THIS SECTION ON DELIVERY

A. Signature

X [signature] ☐ Agent ☐ Addressee

B. Received by (Printed Name) Tim Humphreys | C. Date of Delivery 3/31/15

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☑ Certified Mail® ☐ Priority Mail Express™
☐ Registered ☑ Return Receipt for Merchandise
☐ Insured Mail ☐ Collect on Delivery

4. Restricted Delivery? (Extra Fee) ☐ Yes

2. Article Number (Transfer from service lab 7013 2250 0001 7426 8152

PS Form 3811 July 2013

7013 2250 0001 7426 8114

U.S. Postal Service™
CERTIFIED MAIL™ RECEIPT
(Domestic Mail Only; No Insurance Coverage Provided)
For delivery information, visit our website at www.usps.com®

OFFICIAL USE

Postage	$ .49
Certified Fee	3.30
Return Receipt Fee (Endorsement Required)	2.70
Restricted Delivery Fee (Endorsement Required)	–
Total Postage & Fees	$ 6.49

Postmark Here
IOWA FALLS, IA
MAR 27

Sent To: Lawrence M. Ford
Street, Apt. No.; or PO Box No.: 2737 Casa Del Norte Ct NE
City, State, ZIP+4: Albuquerque, NM 87112

PS Form 3800, August 2006 — See Reverse for Instructions

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Lawrence M. Ford
2737 Casa Del Norte Ct. NE
Albuquerque, NM 87112

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X Lawrence M. Ford ☐ Agent ☒ Address

B. Received by (Printed Name): Lawrence M. Ford
C. Date of Delivery: 4/7

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☒ Certified Mail® ☐ Priority Mail Express™
☐ Registered ☒ Return Receipt for Merchandi
☐ Insured Mail ☐ Collect on Delivery

4. Restricted Delivery? (Extra Fee) ☐ Yes

2. Article Number (Transfer from service label): 7013 2250 0001 7426 8114

PS Form 3811, July 2013 — Domestic Return Receipt

7013 2250 0001 7426 8107

U.S. Postal Service™
CERTIFIED MAIL™ RECEIPT
(Domestic Mail Only; No Insurance Coverage Provided)
For delivery information visit our website at www.usps.com®

OFFICIAL USE

Postage	$ .49
Certified Fee	3.30
Return Receipt Fee (Endorsement Required)	2.70
Restricted Delivery Fee (Endorsement Required)	–
Total Postage & Fees	$ 6.49

Postmark Here

Sent To: Grundy County Commission
Street, Apt. No.; or PO Box No.: 700 Main
City, State, ZIP+4: Trenton, MO 64683

PS Form 3800, August 2006 — See Reverse for Instructions

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Grundy County Commission
700 Main
Trenton, MO 64683

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X Betty Spickard ☐ Agent ☐ Address

B. Received by (Printed Name): Betty Spickard
C. Date of Delivery: 3-25

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☒ Certified Mail® ☐ Priority Mail Express™
☐ Registered ☒ Return Receipt for Merchand
☐ Insured Mail ☐ Collect on Delivery

4. Restricted Delivery? (Extra Fee) ☐ Yes

2. Article Number (Transfer from service label): 7013 2250 0001 7426 8107

PS Form 3811, July 2013 — Domestic Return Receipt

7013 2250 0001 7426 8121

U.S. Postal Service™
CERTIFIED MAIL™ RECEIPT
(Domestic Mail Only; No Insurance Coverage Provided)

For delivery information visit our website at www.usps.com®

OFFICIAL USE

Postage	$ .49
Certified Fee	3.30
Return Receipt Fee (Endorsement Required)	2.70
Restricted Delivery Fee (Endorsement Required)	–
Total Postage & Fees	$ 6.49

Sent To: Wendell Street
Street, Apt. No.; or PO Box No.: 641 SW Highway W
City, State, ZIP+4®: Trenton, MO 64683

Postmark Here: IOWA FALLS, IA MAR 23 2015

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Wendell Street
641 SW Highway W
Trenton, MO 64683

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X [signature] ☐ Agent ☐ Addressee

B. Received by (Printed Name): W Street — C. Date of Delivery: 3/25/15

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☑ Certified Mail® ☐ Priority Mail Express™
☐ Registered ☑ Return Receipt for Merchandise
☐ Insured Mail ☐ Collect on Delivery

4. Restricted Delivery? (Extra Fee) ☐ Yes

2. Article Number (Transfer from service label): 7013 2250 0001 7426 8121

PS Form 3811, July 2013 — Domestic Return Receipt

7013 2250 0001 7426 8145

U.S. Postal Service™
CERTIFIED MAIL™ RECEIPT
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For delivery information visit our website at www.usps.com®

OFFICIAL USE

Postage	$ .49
Certified Fee	3.30
Return Receipt Fee (Endorsement Required)	2.70
Restricted Delivery Fee (Endorsement Required)	–
Total Postage & Fees	$ 6.49

Sent To: Rex Searcy
Street, Apt. No.; or PO Box No.: 565 SW Highway W
City, State, ZIP+4®: Trenton, MO 64683-8534

Postmark Here: IOWA FALLS, IA MAR 2 2015

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Rex Searcy
565 SW Highway W
Trenton, MO 64683-8534

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X [signature] ☑ Agent ☐ Addressee

B. Received by (Printed Name): Jim Williams — C. Date of Delivery: 3/26/15

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☒ No

3. Service Type
☑ Certified Mail® ☐ Priority Mail Express™
☐ Registered ☑ Return Receipt for Merchandise
☐ Insured Mail ☐ Collect on Delivery

4. Restricted Delivery? (Extra Fee) ☐ Yes

2. Article Number (Transfer from service label): 7013 2250 0001 7426 8145

PS Form 3811, July 2013 — Domestic Return Receipt

7013 2250 0001 7426 8138

U.S. Postal Service™
CERTIFIED MAIL™ RECEIPT
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For delivery information visit our website at www.usps.com®

OFFICIAL USE

Postage	$ .49
Certified Fee	3.30
Return Receipt Fee (Endorsement Required)	2.70
Restricted Delivery Fee (Endorsement Required)	–
Total Postage & Fees	$ 6.49

Sent To: Beaver Creek Ranch
Street, Apt. No.; or PO Box No.: 215 S. 10th St.
City, State, ZIP+4®: Sac City, IA 50583

Postmark Here: IOWA FALLS, IA MAR 23 2015

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Beaver Creek Ranch
215 S. 10th St.
Sac City, IA 50583

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X [signature] ☐ Agent ☐ Addressee

B. Received by (Printed Name): David R. Stanley — C. Date of Delivery: 27 Mar 15

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☑ Certified Mail® ☐ Priority Mail Express™
☐ Registered ☑ Return Receipt for Merchandise
☐ Insured Mail ☐ Collect on Delivery

4. Restricted Delivery? (Extra Fee) ☐ Yes

2. Article Number (Transfer from service label): 7013 2250 0001 7426 8138

PS Form 3811, July 2013 — Domestic Return Receipt

TRENTON FARMS RE, LLC
SWINE FACILITY

State Highway W
Trenton, MO 64683

GESTATION FACILITY MANURE PRODUCTIONS & STORAGE CALCULATIONS

FARROWING FACILITY MANURE PRODUCTION & STORAGE CALCULATIONS

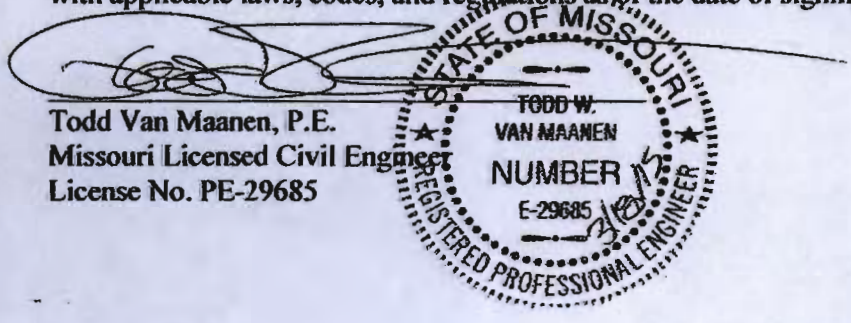
GILT DEVELOPMENT FACILITY MANURE PRODUCTION & STORAGE CALCULATIONS

Prepared by

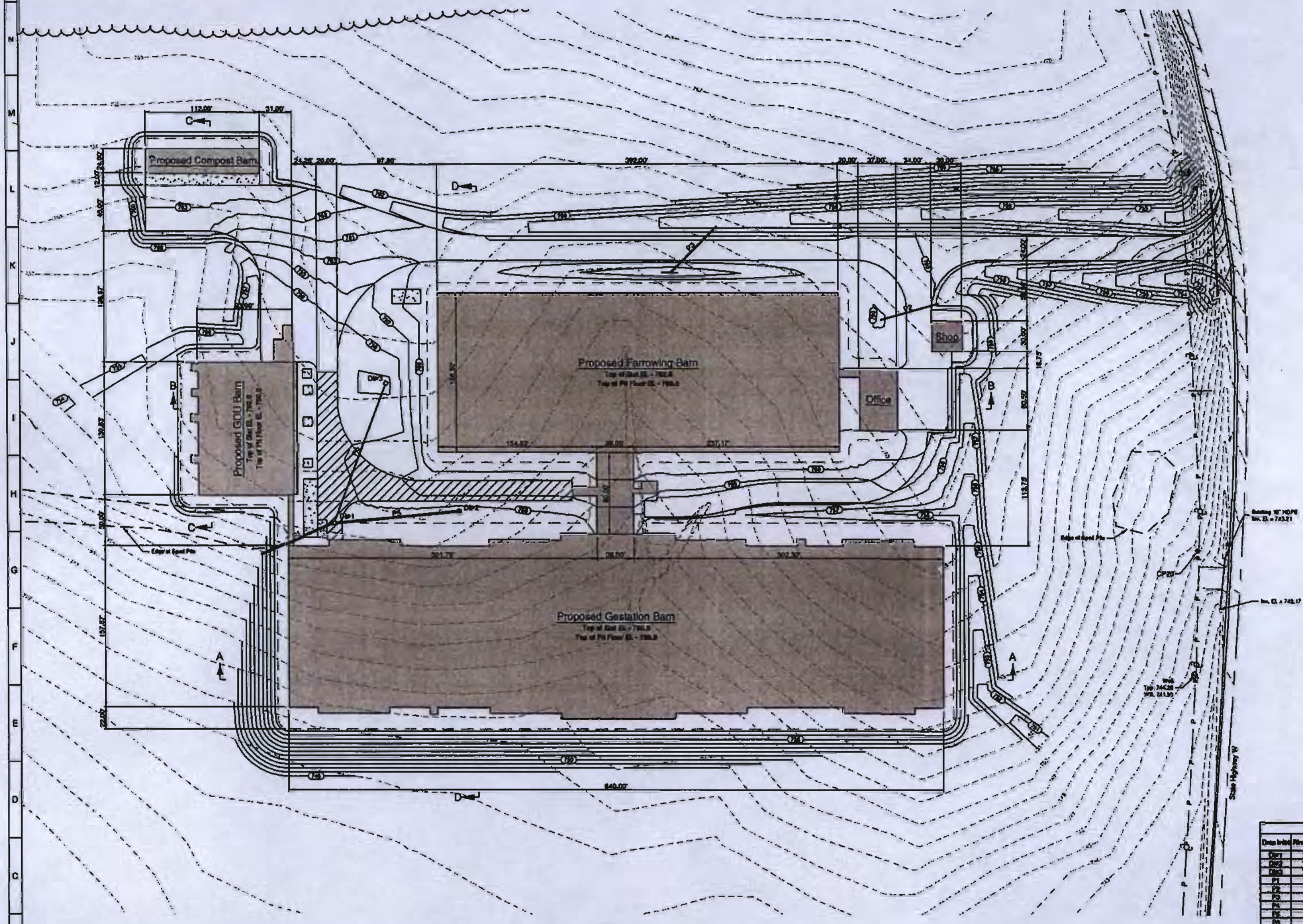
Eisenbraun & Associates
Professional Engineers & Surveyors
216 Walnut
Yankton, SD 57078

March 18, 2015

I hereby certify that I am a licensed professional in the State of Missouri. To the best of my knowledge, information and belief, the manure management and containment system is designed in general conformance with applicable laws, codes, and regulations as of the date of signing.



Todd Van Maanen, P.E.
Missouri Licensed Civil Engineer
License No. PE-29685



GRAPHIC SCALE

100 50 0 50 100 200

1 INCH = 100 FEET

Control Table			
Description	Northing	Easting	Elevation
CP #20	[illegible]	[illegible]	[illegible]
CP #21	[illegible]	[illegible]	[illegible]

LEGEND

Existing Contour

Existing Tree Line

Existing Barbwire Fence

Existing Overhead Power

Telephone Pedestal

Power Pole

Well

Sign

Guy Wire

Control Point

Existing Asphalt Surface

Existing Gravel Surface

Proposed Heavy Duty Gravel

Proposed Medium Duty Gravel

Proposed Concrete Surfacing

Estimate of Quantities

Description	Quantity	Units
Unclassified Excavation	31,882	CY
Unclassified Embankment*	27,131	CY
Heavy Duty Gravel Surfacing	6,468	SY
Medium Duty Gravel Surfacing	1,033	SY
3' x 3' Concrete Drop Inlet w/Frame & Grate	3	EA
12" HDPE Storm Sewer	89	LF
15" HDPE Storm Sewer	144	LF
18" HDPE Storm Sewer	312	LF
24" HDPE Storm Sewer	77	LF
Concrete Surfacing	334	SY

[illegible]

Storm Sewer Drop Inlets & Pipe Elevations

Drop Inlet	Rim Elevation	Upstream Pipe Invert	Downstream Pipe Invert	Pipe Length	Units	Type
DI-1	757.41	[illegible]	[illegible]	-	EA	3' X 3' Concrete Drop Inlet w/Frame & Grate
DI-2	[illegible]	-	[illegible]	-	EA	3' X 3' Concrete Drop Inlet w/Frame & Grate
DI-3	[illegible]	-	[illegible]	-	EA	3' X 3' Concrete Drop Inlet w/Frame & Grate
P1	-	[illegible]	[illegible]	[illegible]	LF	[illegible] HDPE Storm Sewer
P2	-	[illegible]	[illegible]	[illegible]	LF	[illegible] HDPE Storm Sewer
P3	-	[illegible]	[illegible]	[illegible]	LF	[illegible] HDPE Storm Sewer
P4	-	754.19	[illegible]	77.00	LF	[illegible] HDPE Storm Sewer
P5	-	[illegible]	[illegible]	[illegible]	LF	[illegible] HDPE Storm Sewer
P6	-	[illegible]	[illegible]	[illegible]	LF	[illegible] HDPE Storm Sewer

Prepared By

Eisenbraun & Associates

Innovative Solutions - Long Term Value

LICENSED PROFESSIONAL ENGINEER

VAN MAANEN

SOUTH DAKOTA

3/19/2015

REV. NO.	DATE	REVISIONS DESCRIPTION

Trenton Family Farms RE, LLC

SW 1/4, Sec. 19, T60N, R24W, Grundy County, Missouri

PROJECT NO:	Y15118
CAD DWG FILE:	C-SP01-15118
DRAWN BY:	BRIANB
REVIEWED BY:	TVM
DATE:	Mar. 19, 2015
COPYRIGHT:	2015 EISENBRAUN & ASSOCIATES
SHEET TITLE	

Topographic Map

C-101

SHEET 1 OF 11

AWMS Computations For
Deep Pit Swine Production Operations - Farrowing Barn

Producer:	Trenton Farms RE, LLC	County:	Grundy County, MO
Address:	State Highway W Trenton, MO 64683	Location:	SW 1/4, Section 19, T60N, R24W
Phone:	641-682-0222		

E/A Project No. Y15118 Date: 18-Mar-15

Manure Production For Animal Operations

Manure Characteristics, MWPS-18, Section 1, Second Edition
Table 6

Animal Type	Size, lb	Manure Production ft^3 / day	No. of Animals	Waste Volume ft^3 / day
Nursery Pig	25	0.04	0	0
Nursery Pig	40	0.05	0	0
Finishing	150	0.12	0	0
Finishing	200	0.16	0	0
Gestating	300	0.11	0	0
Gestating	300	0.15	0	0
Lactating	375	0.28	0	0
Lactating**	450	0.334	936	313
Lactating	500	0.37	0	0
Boar	300	0.10	0	0
Boar	400	0.13	0	0

**Production Data Interpolated from Table Values

Total Number of Swine	936	
Total Animal Waste Volume	313	ft^3 / day
Desired Storage Period for AWMS Facility	365	days
Total Waste Storage Volume Required	**114,200**	**ft^3**

Washwater Volume Requirements

Washwater Usage : gal. / animal /day	0.75	Factor of Safety	1.5
Washwater Volume per day		1,053	gallons
Washwater as percent of Waste Volume		45	percent
Washwater storage required		**51,400**	**ft^3**

Total Waste and Washwater Storage Volume Required: 165,600 ft^3

AWMS Computations For
Deep Pit Swine Production Operations - Gestation Barn

Producer:	Trenton Farms RE, LLC	County:	Grundy County, MO
Address:	State Highway W	Location:	SW 1/4, Section 19, T60N, R24W
	Trenton, MO 64683		
Phone:	641-682-0222		

E/A Project No. Y15118 Date: 18-Mar-15

Manure Production For Animal Operations

Manure Characteristics, MWPS-18, Section 1, Second Edition
Table 6

Animal Type	Size, lb	Manure Production ft^3 / day	No. of Animals	Waste Volume ft^3 / day
Nursery Pig	25	0.04	0	0
Nursery Pig	40	0.05	0	0
Finishing	150	0.12	640	77
Finishing	200	0.16	0	0
Gestating	400	0.15	4,480	672
Gestating**	450	0.165	0	0
Gestating	500	0.18	0	0
Lactating	375	0.28	0	0
Lactating	500	0.37	0	0
Boar	300	0.10	0	0
Boar	400	0.13	0	0

**Production Data Interpolated from Table Values

Total Number of Swine	5,120	
Total Animal Waste Volume	749	ft^3 / day
Desired Storage Period for AWMS Facility	365	days
Total Waste Storage Volume Required	**273,400**	**ft^3**

Washwater Volume Requirements

Washwater Usage : gal. / animal /day	0.25	Factor of Safety	1.5
Washwater Volume per day		1,920	gallons
Washwater as percent of Waste Volume		34	percent
Washwater storage required		**93,700**	**ft^3**

Total Waste and Washwater Production (Farrowing):	**165,600**	**ft^3**
Total Waste and Washwater Production (Gestation):	**367,100**	**ft^3**
Total Waste & Washwater Storage Available:	**746,245**	**ft^3**

Producer:	Trenton Farms RE, LLC	County:	Grundy County, MO
Address:	State Highway W	Location:	SW 1/4, Section 19, T60N, R24W
	Trenton, MO 64683		Gestation Barn

E/A Project No: Y12129 Date: 26-Jun-12

Deep Pit Volumes

Total Interior Length	638.33	ft.
Total Interior Width	156.00	ft.
Total Wall Height	10.00	ft.
	0.00	ft.
Top of Wall to Bottom of Vent Opening	1.42	ft.
Freeboard	1.00	ft.
Total Air Circulation Space	2.42	ft.
Max. Depth of Waste	7.58	ft.
	754,812	ft^3

Column Volumes

Number		742	
Rectangular	Length	0.00	ft.
	Width	0.00	ft.
Circular	Diameter	1.00	ft.
Base Volume		0.00	ft^3
Max. Depth of Waste		7.58	ft.
Volume per Column at Max. Depth		5.95	ft^3
		4,417	ft^3

Pumpout Pits

Number	2	
Interior Length	6.00	ft.
Interior Width	6.00	ft.
Maximum Depth of Waste	7.58	ft.
	546	c.f.

Openings

Width	4.33	ft.
Thickness	0.83	ft.
Max. Depth of Waste	7.58	ft.
	54.48	ft^3

Divider Wall

Total Interior Length		638.33	ft.
	Width	1.00	ft.
Openings	Length	4.00	ft.
	Height	2.00	ft.
	Number	11	
Max. Depth of Waste		7.58	ft.
Volume at Max. Depth		4,750.54	ft^3

Total Volume / Pit	746,245	ft^3
Total Number of Buildings	1	
Total Capacity	746,245	ft^3

AWMS Computations For GDU Barn

Producer: Trenton Farms RE, LLC
Address: State Highway W
Trenton, MO 64683
Phone: 641-682-0222

County: Grundy County, MO
Location: SW 1/4, Section 19, T60N, R24W

E/A Project No. Y15118 Date: March 18, 2015

Manure Production For Animal Operations

Manure Characteristics, MWPS-18, Section 1, Second Edition
Table 6

Animal Type	Size, lb	Manure Production ft^3 / day	No. of Animals	Waste Volume ft^3 / day
Nursery Pig	25	0.04	160	6
Nursery Pig	40	0.05	160	8
Finishing	150	0.12	960	115
Finishing**	170	0.1360	0	0
Finishing	200	0.16	0	0
Gestating	400	0.15	0	0
Gestating	500	0.18	0	0
Lactating	500	0.37	0	0
Lactating	600	0.45	0	0
Boar	300	0.10	0	0
Boar	400	0.13	0	0

**Production Data Interpolated from Table Values

Total Number of Swine	1,280	
Total Animal Waste Volume	130	ft^3 / day
Desired Storage Period for AWMS Facility	365	days
Total Waste Storage Volume Required	**47,400**	**ft^3**

Washwater Volume Requirements

Washwater Usage : gal. / animal /day	0.25	Factor of Safety	1.5
Washwater Volume per day		480	gallons
Washwater as percent of Waste Volume		49	percent
Washwater storage required		**23,500**	**ft^3**

Total Waste and Washwater Storage Volume Required: 70,900 ft^3

Producer:	Trenton Farms RE, LLC	County:	Grundy County, MO
Address:	State Highway W Trenton, MO 64683	Location:	SW 1/4, Section 19, T60N, R24W GDU Barn

E/A Project No: Y15118 Date: 18-Mar-15

Approximate Deep Pit Volumes

Total Interior Length		129.17 ft.
Total Interior Width		91.33 ft.
Total Wall Height		10.00 ft.
		0.00 ft.
Top of Wall to Bottom of Vent Opening		1.42 ft.
Freeboard		1.00 ft.
Total Air Circulation Space		2.42 ft.
Max. Depth of Waste		7.58 ft.
		89,422 ft^3

Column Volumes

Number		90
Rectangular	Length	0.00 ft.
	Width	0.00 ft.
Circular	Diameter	1.00 ft.
Base Volume		0.00 ft^3
Max. Depth of Waste		7.58 ft.
Volume per Column at Max. Depth		5.95 ft^3
		536 ft^3

Pumpout Pits

Number	4
Interior Length	6.00 ft.
Interior Width	6.00 ft.
Maximum Depth of Waste	7.58 ft.
	1,092 c.f.

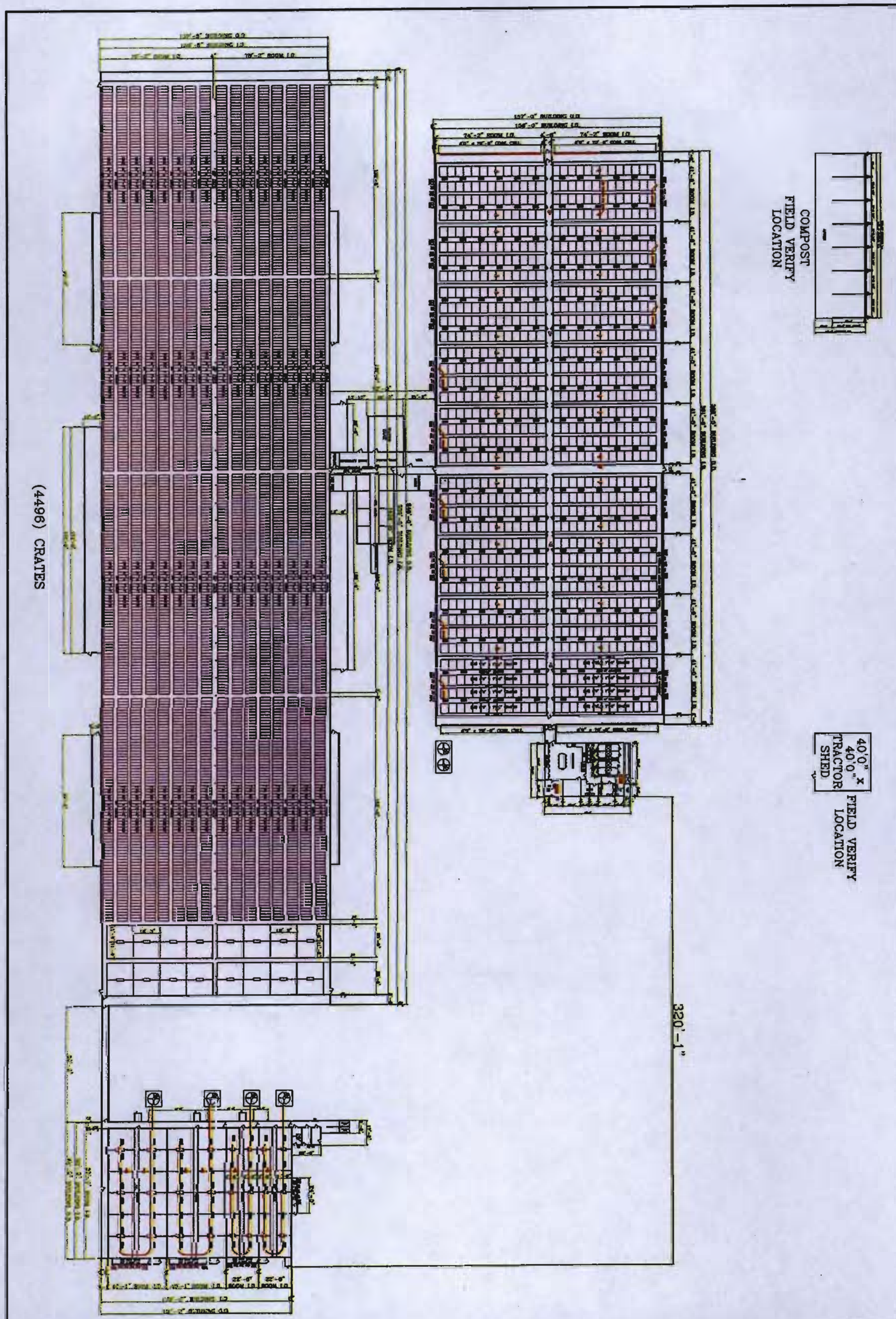
Openings

Width	6.00 ft.
Thickness	0.83 ft.
Max. Depth of Waste	7.58 ft.
	150.99 ft^3

Divider Walls

Number of Walls		3
Length		91.33 ft.
Wall Thickness		1.00 ft.
Height of Wall		10.00 ft.
Max. Depth of Waste		7.58 ft.
		2,076.84 ft^3
Openings (per wall)		
	Number	3
Rectangular	Width	4.00 ft.
	Height	2.00 ft.
Round	Diameter	0.00 ft.
	Thickness	1.00 ft.
		24.00 ft^3

Total Volume / Building	88,124 ft^3
Total Number of Buildings	1
Total Capacity	88,124 ft^3



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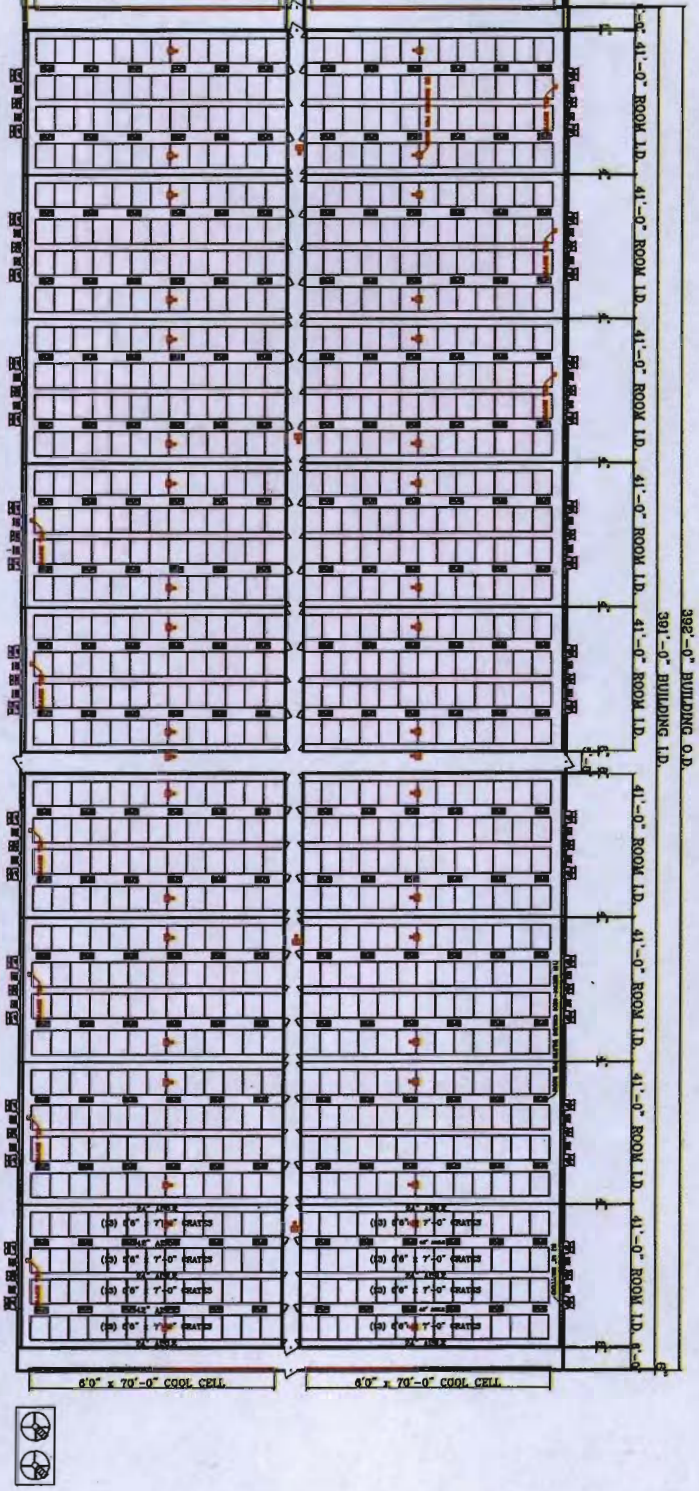
		DRAWN BY: F BENJAMIN	
	DESCRIPTION: SITE PLAN	FILE NAME: MO-3	
		SCALE: NONE / PROGRAM: AUTOCAD	APPROVED BY:

HOG SLAT
MIDWEST DIVISION
1112 20TH STREET NORTH
HUMBOLDT, IA 50548
PHONE: 1-515-332-4014
TOLL FREE: 1-888-294-4014
FAX: 515-332-1675



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FARM NAME: MO-3

DESCRIPTION: FARROWING FLOOR PLAN

DATE: 06/20/16

DRAWN BY: F BENJAMIN

FILE NAME: MO-2

SCALE: NONE

PROGRAM: AUTOCAD

REVISIONS & DESCRIPTION:

APPROVED BY:

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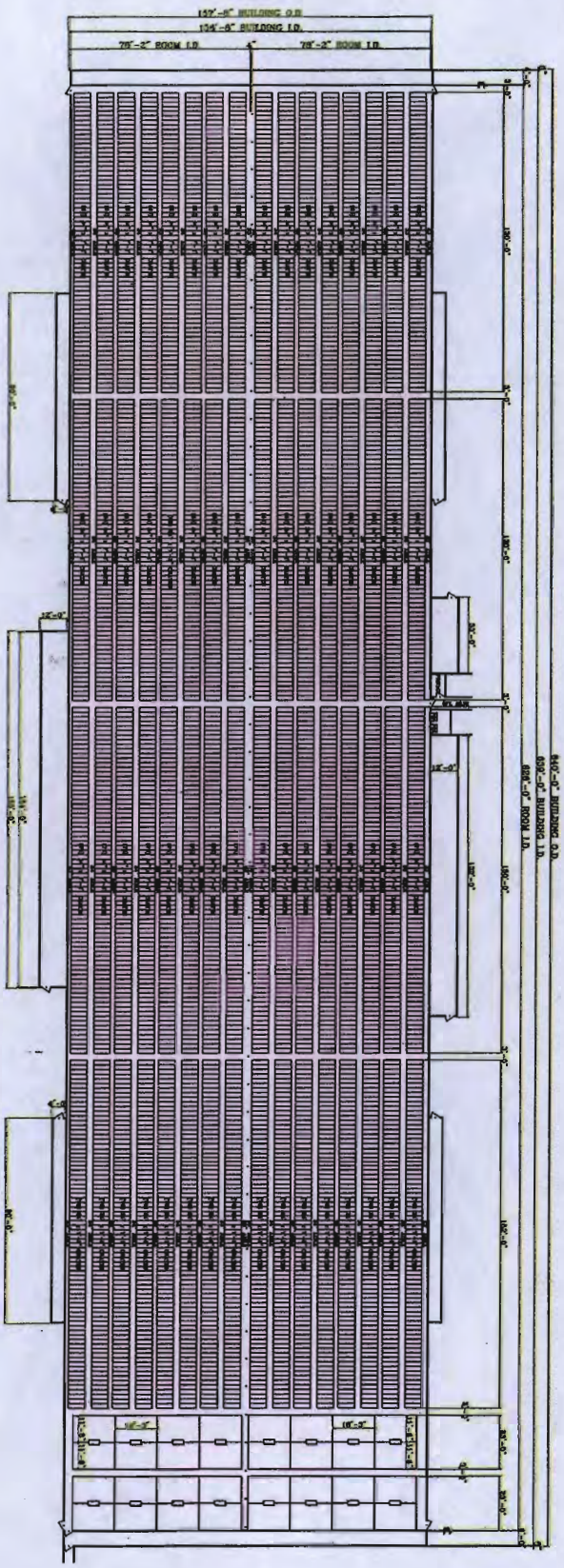
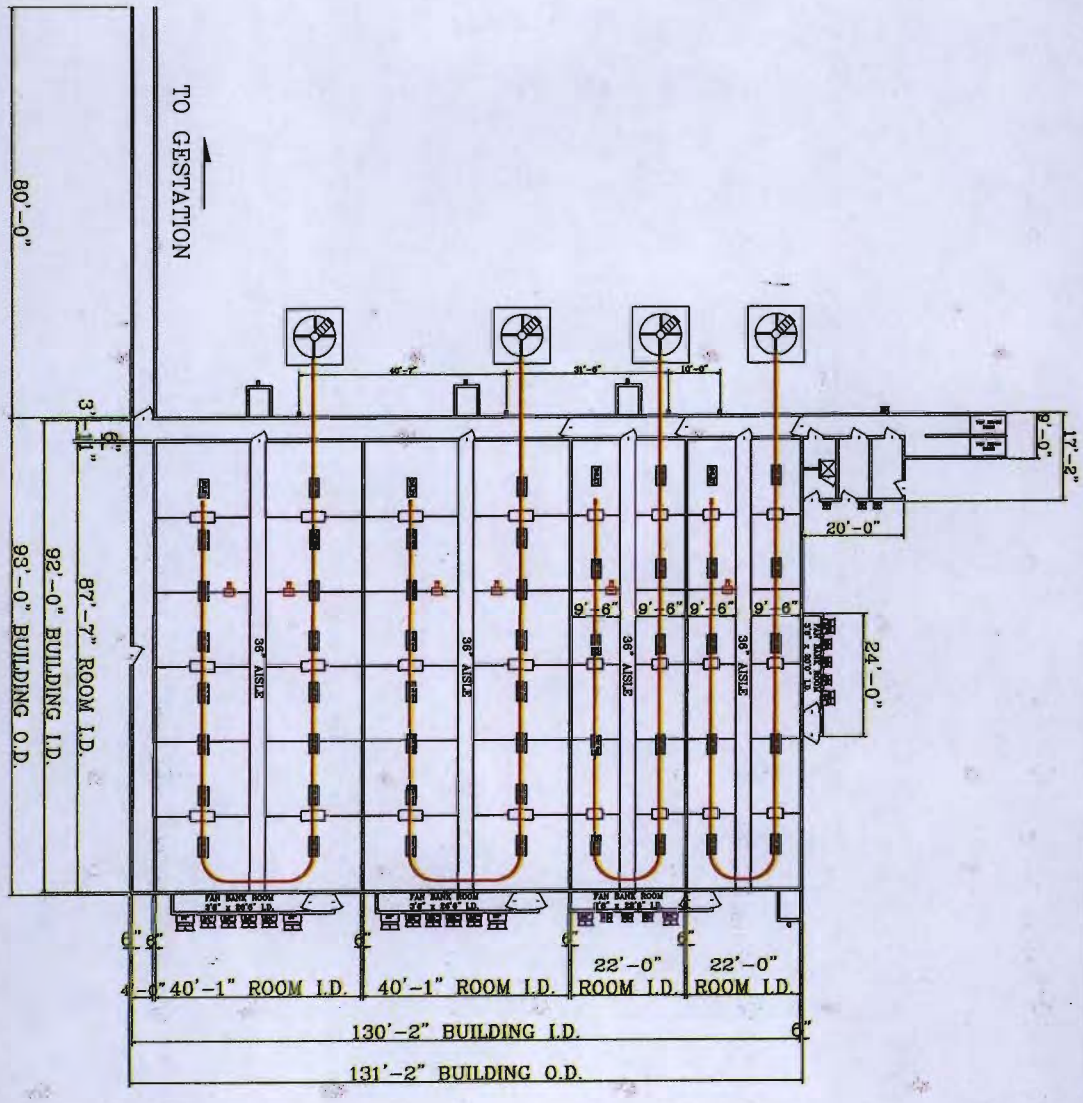
HUMBOLDT, IA 50548
PHONE: 1-515-332-4014
TOLL FREE: 1-580-294-4014
FAX: 515-332-1876



(4496) CRATES

PAGE: 3	FARM NAME: MO-3	DATE: 02/03/16	REVISIONS & DESCRIPTION:	THIS DRAWING IS PREPARED FOR THE USE OF HOG SLAT INCORPORATED AND ITS SUB-CONTRACTORS. ANY REPRODUCTION OR OTHER USE OF THE DOCUMENT WITHOUT EXPRESSED WRITTEN CONSENT OF HOG SLAT INCORPORATED IS PROHIBITED.	HOG SLAT MIDWEST DIVISION 1112 HOYT STREET NORTH HUMBOLDT, IA 50548 PHONE: 1-515-332-4014 TOLL FREE: 1-800-264-4014 FAX: 515-332-1075
	DESCRIPTION: GESTATION FLOOR PLAN #1	DRAWN BY: P BENJAMIN FILE NAME: MO-3 SCALE: NONE PROGRAM: AUTOCAD	APPROVED BY:	© 1999, HOG SLAT INCORPORATED	



PAGE 4

FARM NAME: MO-3

DESCRIPTION: GDU FLOOR PLAN

DATE 01/20/16

DRAWN BY P BENJAMIN

FILE NAME MO-3

SCALE NONE

PROGRAM AUTOCAD

REVISIONS & DESCRIPTION:

APPROVED BY:

HOG SLAT
MIDWEST DIVISION
1112 80TH STREET NORTH
HUMBOLDT, IA 50548
PHONE: 1-515-332-4014
TOLL FREE: 1-800-294-4014
FAX: 515-332-1075

March 18, 2015

Attn: Greg Caldwell
Missouri Department of Natural Resources
Water Protection Program
P.O. Box 176
Jefferson City, MO 65102

RE: Trenton Farms RE, LLC, Grundy County, Missouri
E/A Project No. Y15118

Dear Mr. Caldwell:

Enclosed are the plans, specifications and other required submittal information for the Trenton Farms RE, LLC Composting Facility. This information is being submitted to your office for the review and approval of the plans and specifications for a composting project to be utilized by the aforementioned facility. The submittal package has been assembled utilizing the requirements as set forth in the Missouri Department of Natural Resources' regulations. For your ease of review, these requirements have been paraphrased and answered in the following order.

1) Responsible Party for entire project: Trenton Farms RE, LLC, Luke Minion, 1300 S HWY 75, PO Box 188, Pipestone, MN 56164
   - Legal Description: SW 1/4, Section 19, T60N, R24W, Grundy County, Missouri
   - Site Information: 7,216 head Swine Production Operation. The compost facility will be located northwest portion of the swine site.
   Enclosed is a Site Map of the Trenton Farms RE, LLC Composting facility.

2) Site Preparation: The composter should be built on an impervious weight-bearing pad that is large enough to allow equipment to maneuver, covered with a roof to prevent excessive moisture on composting material and built of rot resistant material that is strong enough to with stand the force exerted by equipment. Included are a Site Layout Map of the facility and the Compost Building Details.

3) Type of Carcass: Swine

4) Disposition of Finished Compost: The compost will be utilized for land application in conjunction with their Missouri Department of Natural Resources approved Nutrient Management Plan or recycled back into the composting facility as a bulking agent.

5) Estimated Quantity: The average daily death loss is calculated at 334.5 pounds per day, which can also be translated as total death loss per year at 122,093 pounds. Please refer to the Compost Bin Sizing Spreadsheet that illustrates this data.

6) Type of Composting Materials: The bulking agents that will be utilized are wood chips, sawdust, and/or shredded cornstalks. An estimated 452 cubic yards (185,400 pounds, assuming sawdust bulk density) of bulking material will be required annually. Please refer to the Compost Bin Sizing Spreadsheet for this data.

7) Composting Procedure: **As taken from* Composting Animal Mortalities, *Minnesota Department of Agriculture, May 2009.*
   - Place at least 12 inches of bulking agent on the floor of the composting bin. This layer will insulate the composting material from the outside environment, provide carbon to fuel the composting process, and absorb liquids.
   - Place the carcasses in a single layer on top of the bulking agent one foot from the wall of the bin and at least six inches apart. This allows air to circulate around the carcasses and insulates them from the environment. Depending on the size of the bin and of the loader, one may not want to build a whole single layer first, because the loader may not be able to reach the back of the bin when more carcasses are added later. This can be avoided by building the pile from the back, building it up and forward simultaneously.
   - Cover the carcasses with about 12 inches of bulking agent. Add water as needed to maintain the proper moisture level. Because it is difficult to add water evenly, consider adding it to the bulking agent before it goes on the pile. *Caution:* If the pile dries out (25% to 45% moisture) and if piles are too large, spontaneous combustion can occur, just as with hay or silage. Attention to moisture, temperature, and pile size is the best protection. An accessible water supply is a good safety precaution. If manure will be used, add it either beneath the bulking agent or incorporated with the bulking agent. The pile is now ready for the next layer.
   - Record the species, class, and weight of the carcasses, and the amount and type of bulking agent and into the compost log.
   - Place additional carcasses as they become available on the pile in layers following these same steps, allowing 6 to 12 inches of bulking agent between layers. More than one species can be composted in the same bin (if applicable). It may be necessary to use the loader bucket to dig a depression to hold the fresh carcass in place before covering it with bulking agent, especially if it is a large animal. Continue adding carcasses until the pile is close to the top of the bin. Cover the top of the pile with 12 inches of bulking agent to reduce odor and protect against pests. SD Animal Industry Board regulations require that flies, rodents, and vermin

be controlled so as not to be a health hazard to human or animal populations.

- After the bin is full, start a second bin following these same steps. Leave the first bin to compost. This first bin has carcasses at various stages of decomposition from largely decomposed (first one in) to just beginning (last one in).
- Monitor the pile daily to make sure that all carcass parts stay completely covered by bulking agent. The pile will settle, so you may need to add additional bulking agent over the top.
- Check the temperature daily and record it in the compost log. The temperature should be taken at multiple locations in the pile, especially near the last animal that was added. Temperatures should be increasing and should soon be between 130° and 150° F.
- If it seems that the pile is not composting correctly because of the temperature or because there are odors, some troubleshooting will need to be done and make adjustments accordingly.
- Once the pile reaches at least 130°F, it should stay above that temperature for at least one week. Do not start counting the days until the area that was added to the pile last reaches this temperature. When the temperature drops, the pile is ready to be turned.
- The typical primary composting time is approximately 45 days for carcasses weighing from 25 to 300 lbs. See the table of estimates for primary composting times by carcass weight.

Primary Composting Times

Primary Carcass Size (lb)	*Estimated Composting Days*
0-10	15
10-25	22
25-300	45

8) Plan for Turning the Pile and Finishing the Compost: **As taken from* Composting Animal Mortalities, *Minnesota Department of Agriculture, May 2009.*

- Layer the bottom of an empty bin with 12 inches of bulking agent.
- Use a front-end or skid loader to move the material from the primary bin to the secondary bin, one bucket at a time. This aerates the pile. Minimal flesh or soft bones should be present, but long bones, skulls, teeth, and pelvis, and some hide, feathers, and fleece may remain. There may be some odor while turning due to disturbance of the anaerobic zones. Look to see whether water needs to be added. If so, add it to the existing pile as needed before or while it is being turned, so that it gets evenly incorporated.

- Cover the fresh pile with another 12 inches of bulking agent to prevent odor and visits by scavenging animals.
- Record the date turned and bulking agent type and volume used in the compost log.
- Monitor and record the temperature of the turned pile daily. Since the composting materials are more consistent now, one doesn't need to be as careful about taking the temperature in multiple locations.
- Once the pile maintains a temperature in excess of 130° F for seven days and then drops, the compost may be finished.
- Secondary composting times will be similar to the number of days in the primary cycle.
- Inspect the pile. If flesh is no longer visible, the compost can be termed "finished." It should be dark, humus-like material with very little odor. At this stage, any bones should be so brittle that they can be easily crushed. It is required that the finished product contain no visible pieces of soft tissue. If there is still some flesh visible, you need to turn the pile again and let it go through another heat cycle. With larger animals such as cattle and sheep, more time is needed to completely compost their larger and denser bones. If the compost is finished other than the bones, remove them and place in a new pile for further decomposition.

9) Plan for Monitoring Temperature: A probe-type thermometer with a minimum 36-inch stainless steel stem will be used to monitor the temperature of the pile.

10) Plan for Moisture Testing and Monitoring: For optimum performance, the moisture content should be between 40% and 60%. Proper moisture judgment can be made by simply feeling the compost. The compost should be moist and leave the hand feeling moist, but should not be able to squeeze water out of it. A water hydrant or other water source will be installed next to the composting facility in the event that water needs to be added to the compost.

11) Plan for Monitoring and Inspection for Complete Decomposition Prior to Distribution: The finished product should be a dark, humus-like material with minimal odor. Any bones should be brittle and easily crushed. If the compost is finished other than the bones, they shall be removed and placed in a new pile for further decomposition. The finished compost should not contain any visible pieces of soft tissue. If soft tissue is present, the pile should be turned and allowed to go through another heat cycle.

12) Frequency of Activities: A logbook will be kept to record dates and weights of carcasses placed in the composter, temperature readings, moisture content, amounts of bulking agents used, dates when compost is turned and dates and amounts of finished compost.

13) Seasonal or Year Round: Year Round

14) Distance from Natural Surface Water, Wells, and Property Lines:

-Natural Surface water: An unnamed tributary of Hickory Creek is approximately 1,600 feet south of the proposed location of the compost building.

-Well: The compost building will be located at least 300 feet from any on site wells.

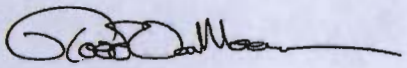
- Property Lines: The north property line is approximately 500 feet from the north side of the proposed building location, the east property line is approximately 1,000 feet from the east side of the proposed building location, the west property line is 400 feet from the west side of the proposed building location, and the south property line is approximately 800 feet from the south side of the proposed building location.

15) Records for Review Upon Request: Records for review will be available upon request at the swine operation main office.

It is our belief that all of the required information for your review of the Trenton Farms RE, LLC Composting Proposal has been provided. This facility is taking the necessary steps to protect the environment and continue to provide needed livestock production in Grundy County and the State of Missouri.

We welcome your favorable review of the information. If you have any questions or need any additional information, please do not hesitate to contact us. Thank you.

Sincerely,
Eisenbraun & Associates, Inc.



Todd Van Maanen, PE
Project Engineer

AWMS Computations for Composting

Producer: Trenton Farms RE, LLC

County: Grundy County, MO
Location: SW 1/4, Section 19, T60N, R24W

E/A Project No. Y15118 Date: 18-Mar-15

Daily Mortalities

Carcass Size (lb)	Multiplier for Death Loss*	Loss per Day (lb)
0-10	3 ft^3/day	0
10-25	5 ft^3/day	0
25-300	10 ft^3/day	31.3
300-750	14 ft^3/day	303.2
750-1400	20 ft^3/day	0

Total Death Loss per Day: 334.5 lbs

Primary bin volume required: 4557.8 ft^3

*Information taken from Minnesota Department of Agriculture, *Composting Animal Mortalities*, pg. 19

Bins Required

Bin Sizes	Height	8 ft
	Width	16 ft
	Depth	24 ft

Number of Bins Required**: 5 Bins Required

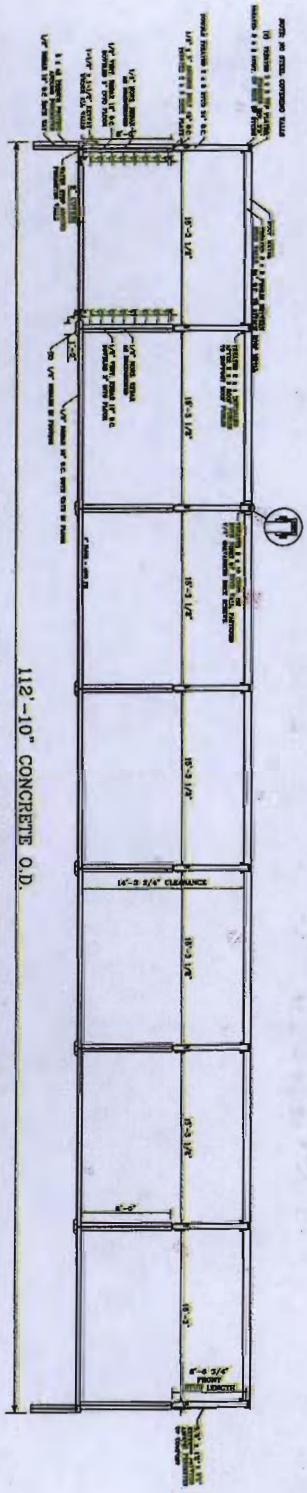
**Assuming equal number of primary and secondary bins, plus one storage bin

Composting Material Required

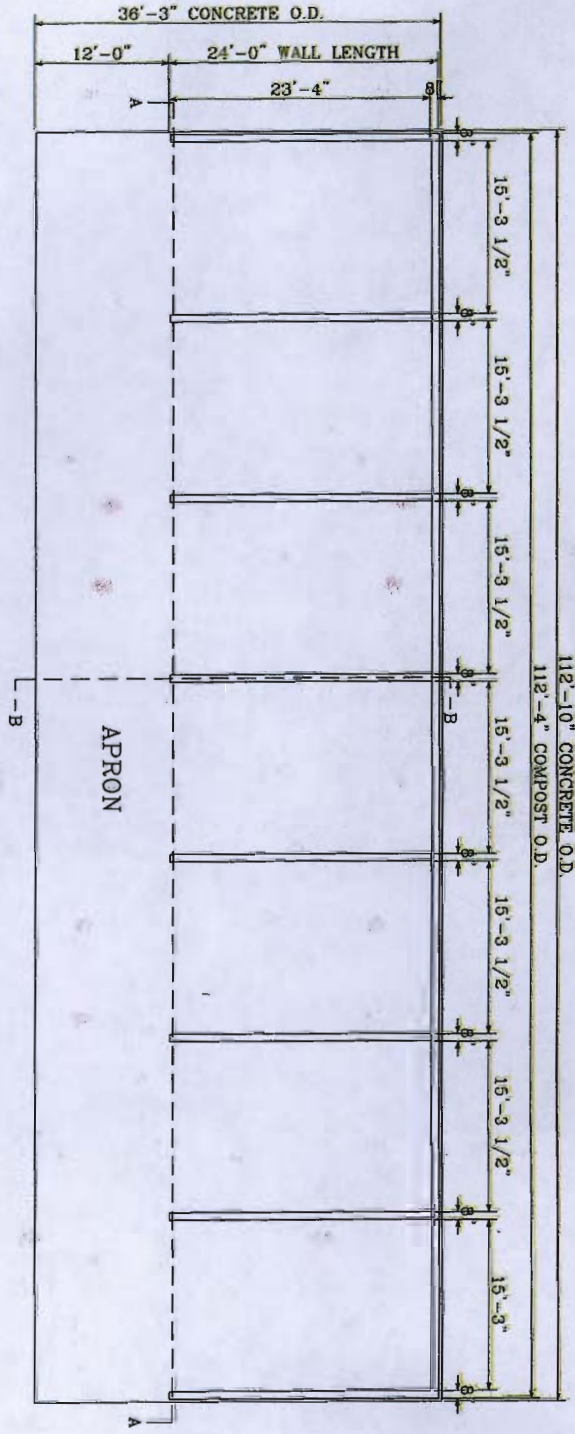
Total Death Loss per Day (lb)	334.5 lb
Total Death Loss per Year (lb)	122,093 lb

Total Composting Material Required***: 452 yd^3/yr
185,400 lb/yr

***Assuming 100 ft^3 of sawdust of equivalent compost material per 1,000 lb of mortality & 410 lb/yd^3 of sawdust



CONCRETE CROSS SECTION A – A



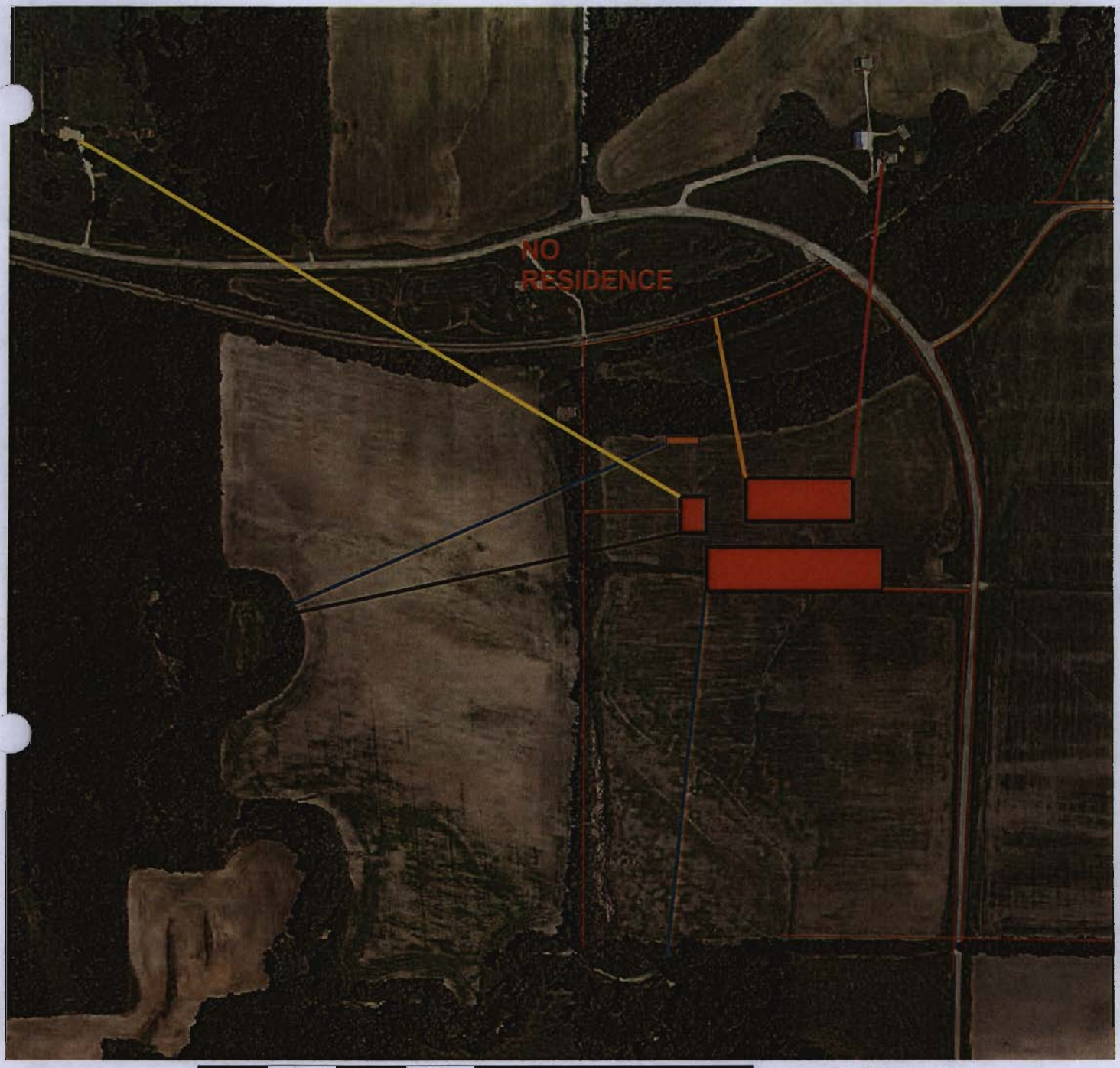
PAGE 8	FARM NAME: MO-3	DATE: 01/25/16	REVISIONS & DESCRIPTION:	THIS DRAWING IS PREPARED FOR THE USE OF HOG SLAT INCORPORATED AND ITS SUB-CONTRACTORS. ANY REPRODUCTION OR OTHER USE OF THE DOCUMENT WITHOUT EXPRESSED WRITTEN CONSENT OF HOG SLAT INCORPORATED IS PROHIBITED.	HOG SLAT MIDWEST DIVISION 1112 80TH STREET NORTH HUMBOLDT, IA 50548 PHONE: 1-515-332-4014 TOLL FREE: 1-800-294-4014 FAX: 515-332-1075
	DESCRIPTION: COMPOST	DRAWN BY: F HOLLMAN			
		FILE NAME: MO-3			
		SCALE: NONE	DRAWING: AUTOCAD	APPROVED BY:	

Trenton Farms RE, LLC
Grundy County, Missouri
Composting Records

Date	Bin #	Outside Temperature (°F)	Compost Temperature (°F)	Mortality Added (lb)	Bulk Material Added (lb)	Turn Pile? (Y/N)	Primary or Secondary Composting (P/S)	Material Removed for Land Application (lb)	Material Removed for Recycling (lb)

Page _____

Site; 15 (4.05 ac.)

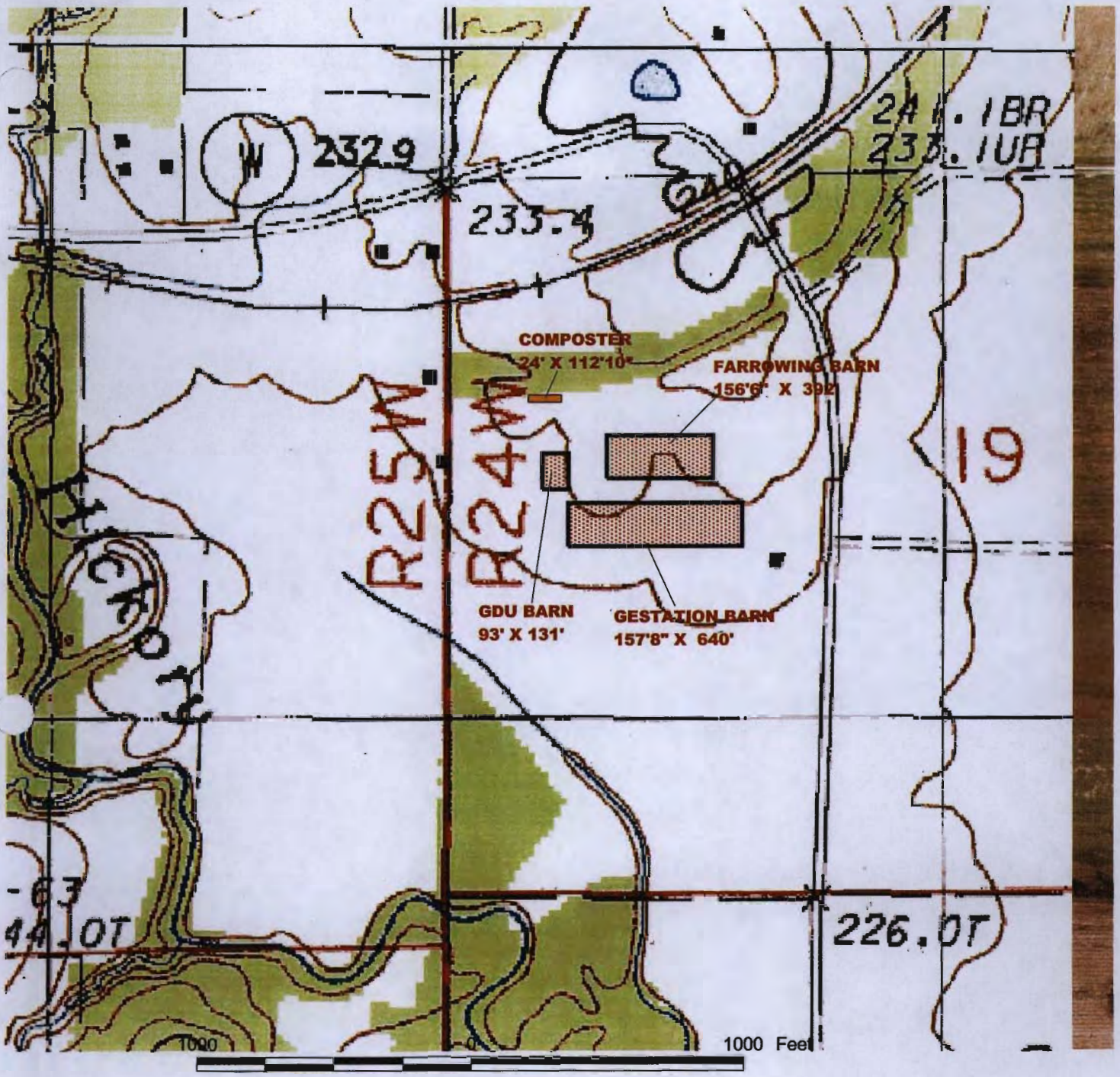


Distance To Property Line
344.197
582.343
Distance To Road
326.759
Distance To Residences
1125.409
2516.475
Distance To Water
1313.838
1426.455
1469.554
Composter
Property lines.shp
(4.0ac.)Field Boundary

Date: Mar 31, 2015
Field Name: Site; 15
Location: Grundy Co., Missouri, U.S.
Farm Name: Trenton Farms RE LLC
Client Name: P-Index
Total Acres: 4.05
Field Boundary Start Location:
Latitude: 39.99494968
Longitude: -93.64942149

pinnacle
620 Country Club Road
Iowa Falls, Iowa 50126
Office: 641.648.7300
Fax: 641.648.7310
www.pinnacleiowa.com

Site; 15 (4.05 ac.)



Date: Mar 31, 2015
Field Name: Site; 15
Location: Grundy Co., Missouri, U.S.
Farm Name: Trenton Farms RE LLC
Client Name: P-Index
Total Acres: 4.05
Field Boundary Start Location:
Latitude: 39.99494968
Longitude: -93.64942149

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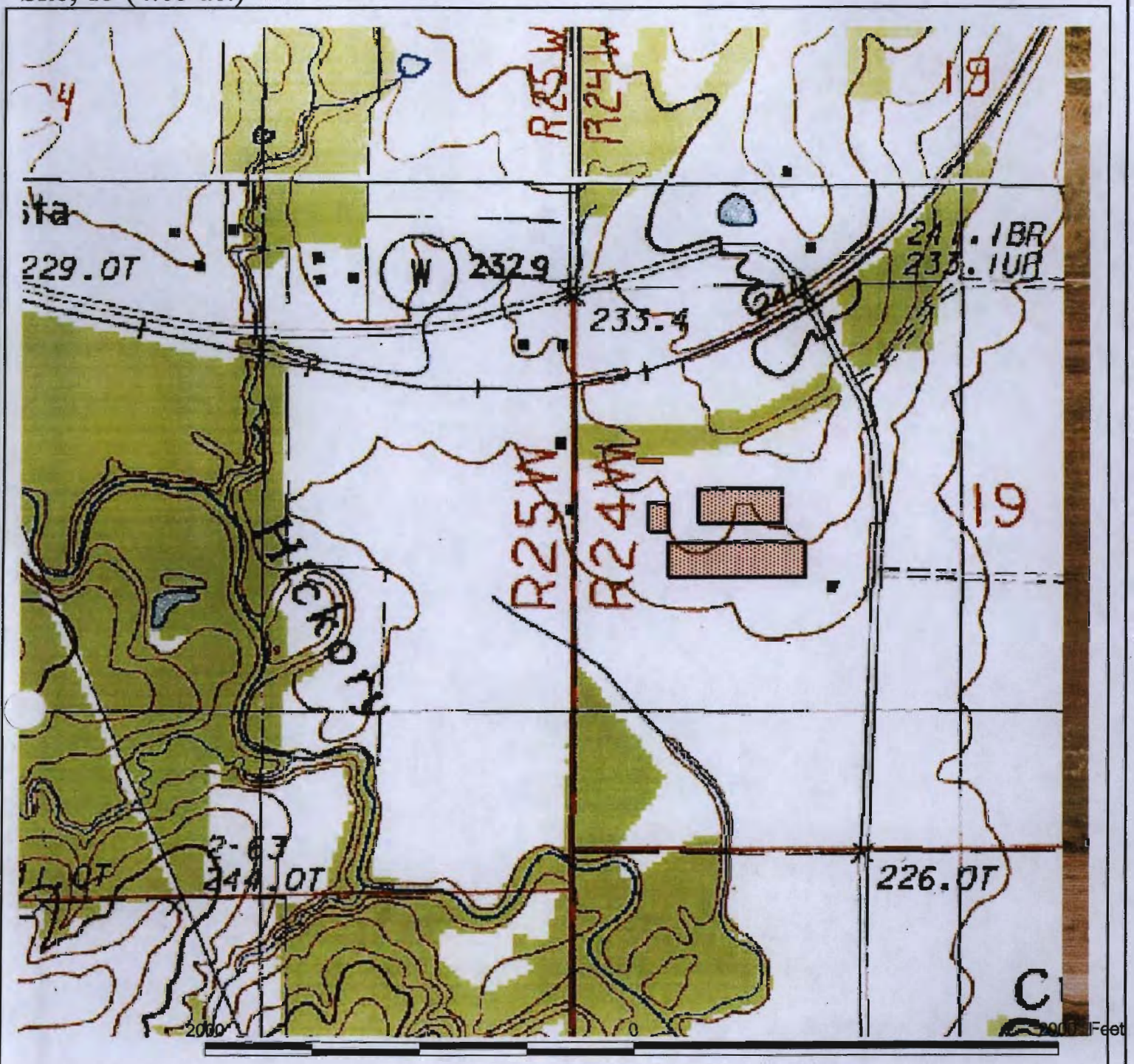
620 Country Club Road
Iowa Falls, Iowa 50126
Office: 641.648.7300
Fax: 641.648.7310
www.pinnacleiowa.com

Composter
(4.0ac.)Field Boundary

Site; 15 (4.05 ac.)



Date: Mar 31, 2015
Field Name: Site; 15
Location: Grundy Co., Missouri, U.S.
Farm Name: Trenton Farms RE LLC
Client Name: P-Index
Total Acres: 4.05
Field Boundary Start Location:
Latitude: 39.99494968
Longitude: -93.64942149

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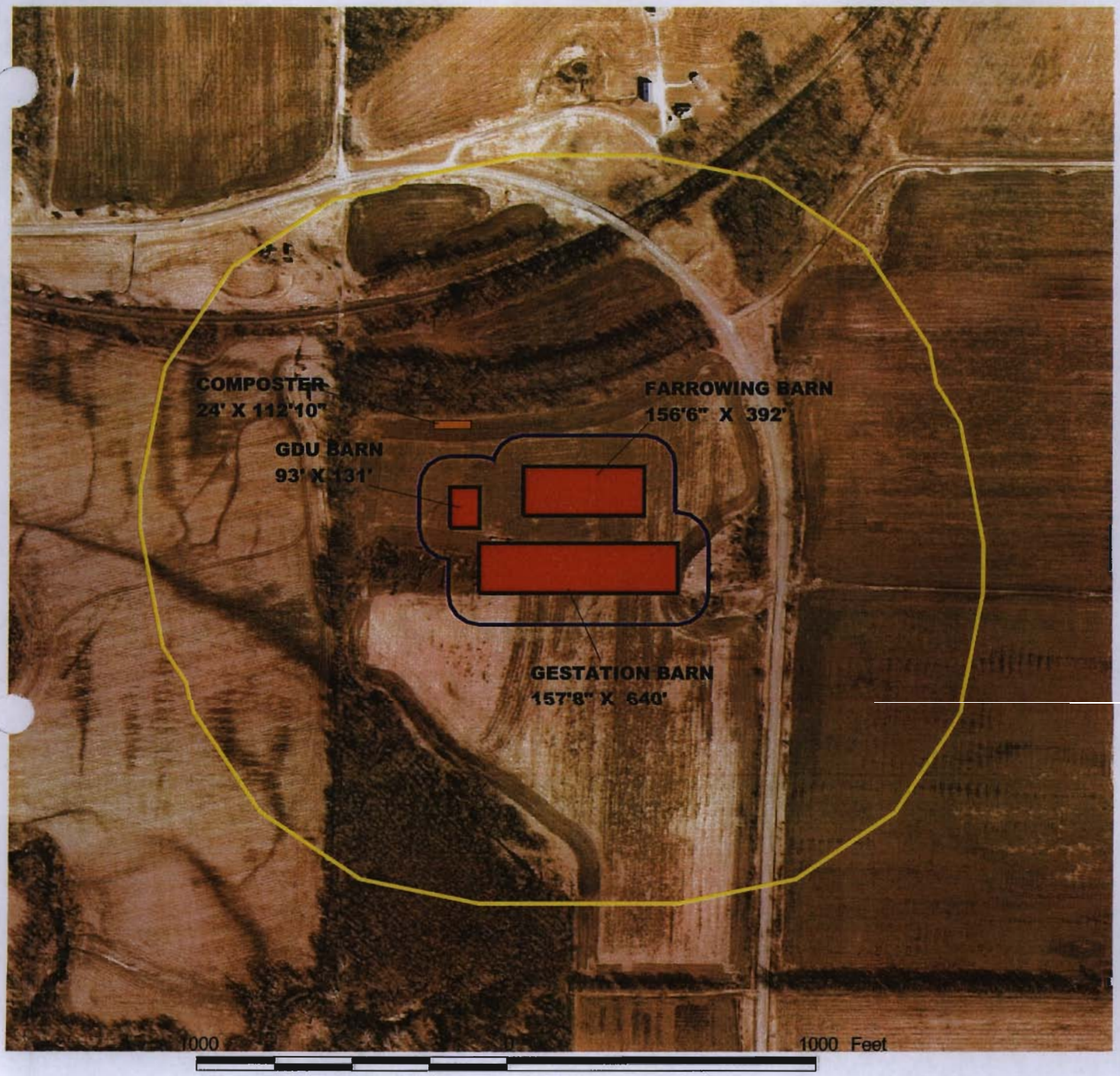
620 Country Club Road
Iowa Falls, Iowa 50126
Office: 641.648.7300
Fax: 641.648.7310
www.pinnacleiowa.com

Composter
(4.0ac.)Field Boundary

Site; 15 (4.05 ac.)



Date: Mar 31, 2015
Field Name: Site; 15
Location: Grundy Co., Missouri, U.S.
Farm Name: Trenton Farms RE LLC
Client Name: P-Index
Total Acres: 4.05
Field Boundary Start Location:
Latitude: 39.99494968
Longitude: -93.64942149

pinnacle
620 Country Club Road
Iowa Falls, Iowa 50126
Office: 641.648.7300
Fax: 641.648.7310
www.pinnacleiowa.com

- Composter
- 1000 ft Residence Buffer
- 100 ft Water Buffer
- (4.0ac.)Field Boundary

T60N,R24W,Sec.19

Legend

Public Land Survey Lines

- Section Boundary
- Land Grant Boundary
- Township Boundary
- State Boundary
- Artificial Boundary

100/500-Year Floodplain (Q3)

- 100-Year Flood Zone
- 500-Year Flood Zone
- Excluded Areas
- No Flood Zone Data Available

2007-2009 (Spring) High Resolution Aerial Photos

Locator Map

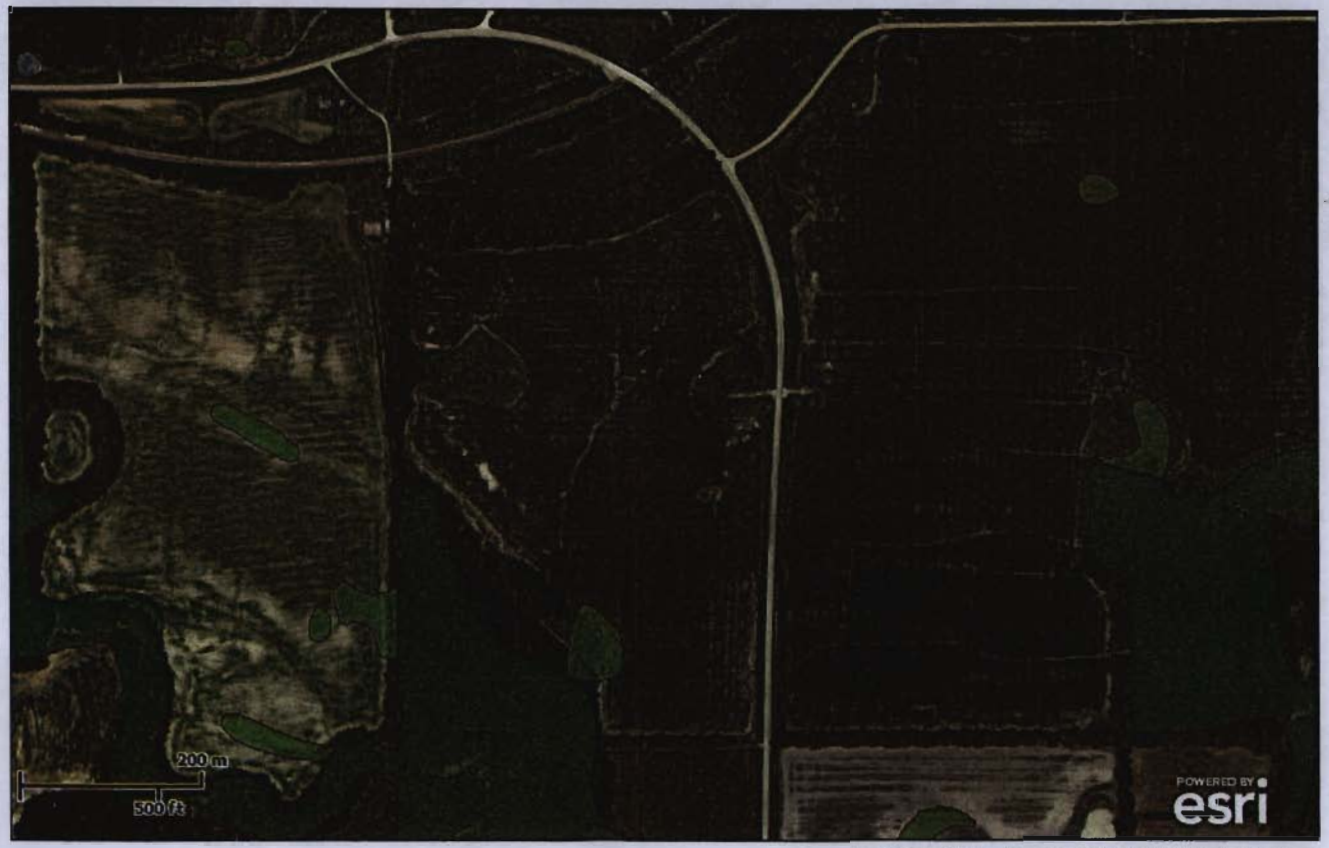
Map prepared by:
http://cares.missouri.edu,
2/26/2015

U.S. Fish and Wildlife Service

National Wetlands Inventory

Trenton Site

Feb 26, 2015



Wetlands

- Freshwater Emergent
- Freshwater Forested/Shrub
- Estuarine and Marine Deepwater
- Estuarine and Marine
- Freshwater Pond
- Lake
- Riverine
- Other

User Remarks:

Overview Map
Grundy County

Farm Name: Trenton Farms RE,LLC
Location: Grundy County,
[illegible]souri, United States
[illegible]ent Name: Overview Map
Number of Fields: 13
Total Acres: 728.7

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620 Country Club Road
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Fax: 641.648.7310
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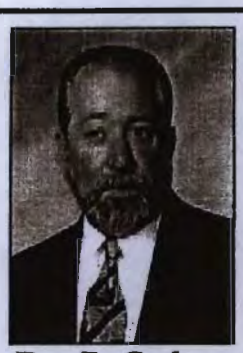
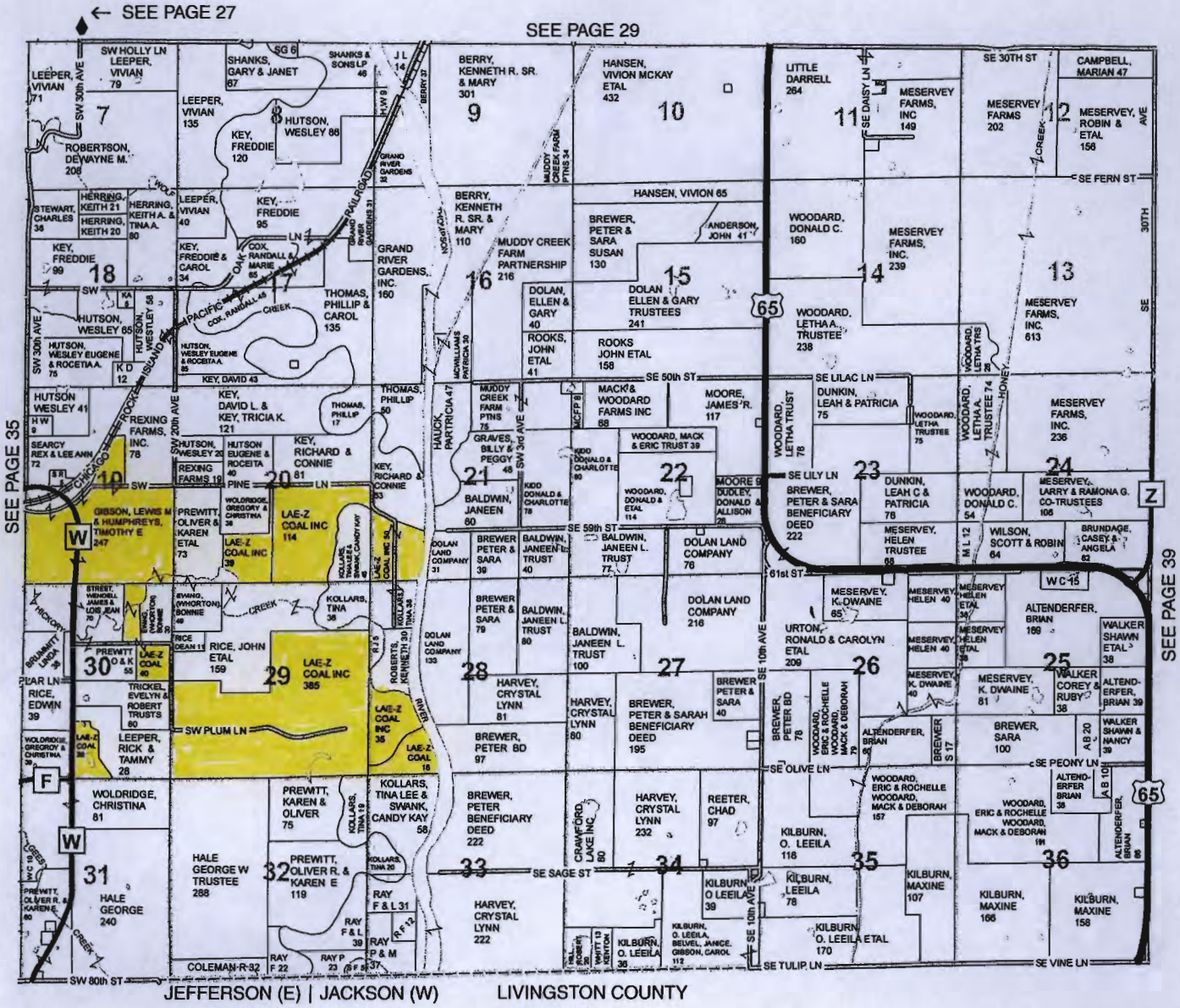
Trenton Farms RE LLC; 15
Nitrogen Rate Ap (728.7 ac. - 100%)



Jackson (W) & Jefferson (E) — Township 60N - Range 24W



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...for agriculture
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TRENTON FARMS RE, LLC PROJECT SUMMARY

Trenton Farms RE, LLC, proposes to construct three hog confinement buildings in Grundy County, Section 19, Township 60 North Range 24 West. The site will consist of a gestation barn housing 5120 sows, a farrowing barn housing 936 sows and a Gilt Development Unit for 960 swine over 55 pounds. A composter will also be built on site. The site will have an animal unit capacity of 2806.4, making it a Class 1C Confined Animal Feeding Operation.

Manure will be stored in formed concrete structures below the Gestation Barn and GDU. Manure from the Farrowing Barn will drain into the Gestation Barn. Dimensions for the storage structures are as follows:

Gestation Barn - 157'6" x 640'
GDU Barn – 93' x 131'

Total storage capacity for the Gestation Barn will be 746,245 cubic feet, in excess of the Gestation Barn and Farrowing Barn's combined estimated annual manure production of 532,700 cubic feet. The GDU Barn will have 88,124 cubic feet of storage capacity, in excess of its estimated annual manure production of 70,900 cubic feet. The entire facility, therefore, has projected storage capacity in excess of 365 days.
Manure from Trenton Farms RE, LLC will be applied to fields listed in the site's Nutrient Management Plan at agronomic rates based on the crop uptake of nutrients and the nutrient analysis of the manure. Manure will be injected, not surface applied. Manure will be tested annually for nutrient content. Mortalities will be composted and the compost material land applied.

Enclosed is a nutrient management plan prepared by The Pinnacle Group on behalf of Wildcat Family Farms RE, LLC.

Overview Map
Grundy County

Farm Name: Trenton Farms RE,LLC
Location: Grundy County, Missouri, United States
Client Name: Overview Map
Number of Fields: 13
Total Acres: 728.7

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Trenton Farms RE LLC; 15
Nitrogen Rate Ap (728.7 ac. - 100%)

Manure Management Plan Form
Animal Feeding Operation Information

Name of operation: Trenton Farms RE, LLC **Permit No.** N/A

Location of the operation: SW State Hwy W
(911 address)

Trenton (Town) MO (State) 64683 (Zip)

NW (1/4 1/4) 1/4 of the SW (1/4) 1/4 of Sec 19 (Section) T 60N R 24W (Tier & Range) _____ (Township Name) Grundy (County)

Owner and contacts of the animal feeding operation:

Owner Trenton Farms RE, LLC Phone 507-825-7032
Address 1300 S. Hwy 75, Pipestone, MN 56164

Contact person (if different than owner) Brian Ritland Phone 641-648-7300
Address 620 Country Club Rd Iowa Falls, IA 50126
E-mail address (optional) britland@pinnacleiowa.com Cell phone (optional) _____

Contract company (if applicable) _____ Phone _____
Address _____

Table 1. Information about livestock production and manure management system

1	2	3	4	5	6	7	8
Animal type/ Production phase[a]	Max # of animals confined	Manure Storage Structure [b]	N[c]	P_2O_5[c]	gal/space/dy[d]	Days/yr Facility occupied	Annual Manure Produced[e]
Gestation	5120	Below Building Pit	25	25	3.0	365	2,745,908
Farrow-Nursery	936	Below Building Pit	15	12	2.2	365	1,238,688
Grow/finish (wet/dry)	1280	GDU Below Building Pit	50	42	0.9	365	530,332
						Total Gallons	**4,514,928**

Animal Unit Capacity 2838.4

Source of Manure Nutrient Content Data

Tables, MWPS-18 *Manure Management Systems*

MO602419P1300; 15 (14.37 ac.)

Date: Mar 13, 2015
Field Name: MO602419P1300; 15
Location: Grundy Co., Missouri, U.S.
Farm Name: Trenton Farms RE LLC
Client Name: P-Index
Total Acres: 14.37
Field Boundary Start Location:
Latitude: 39.99883201
Longitude: -93.64171449

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(12.2ac.)Field Boundary
50 ft Property LIneRoad Buffer

MO602419P4000; 15 (112.19 ac.)

Date: Mar 27, 2015
Field Name: MO602419P4000; 15
Location: Grundy Co., Missouri, U.S.
Farm Name: Trenton Farms RE LLC
Client Name: P-Index
Total Acres: 112.19
Field Boundary Start Location:
Latitude: 39.99160819
Longitude: -93.64565825

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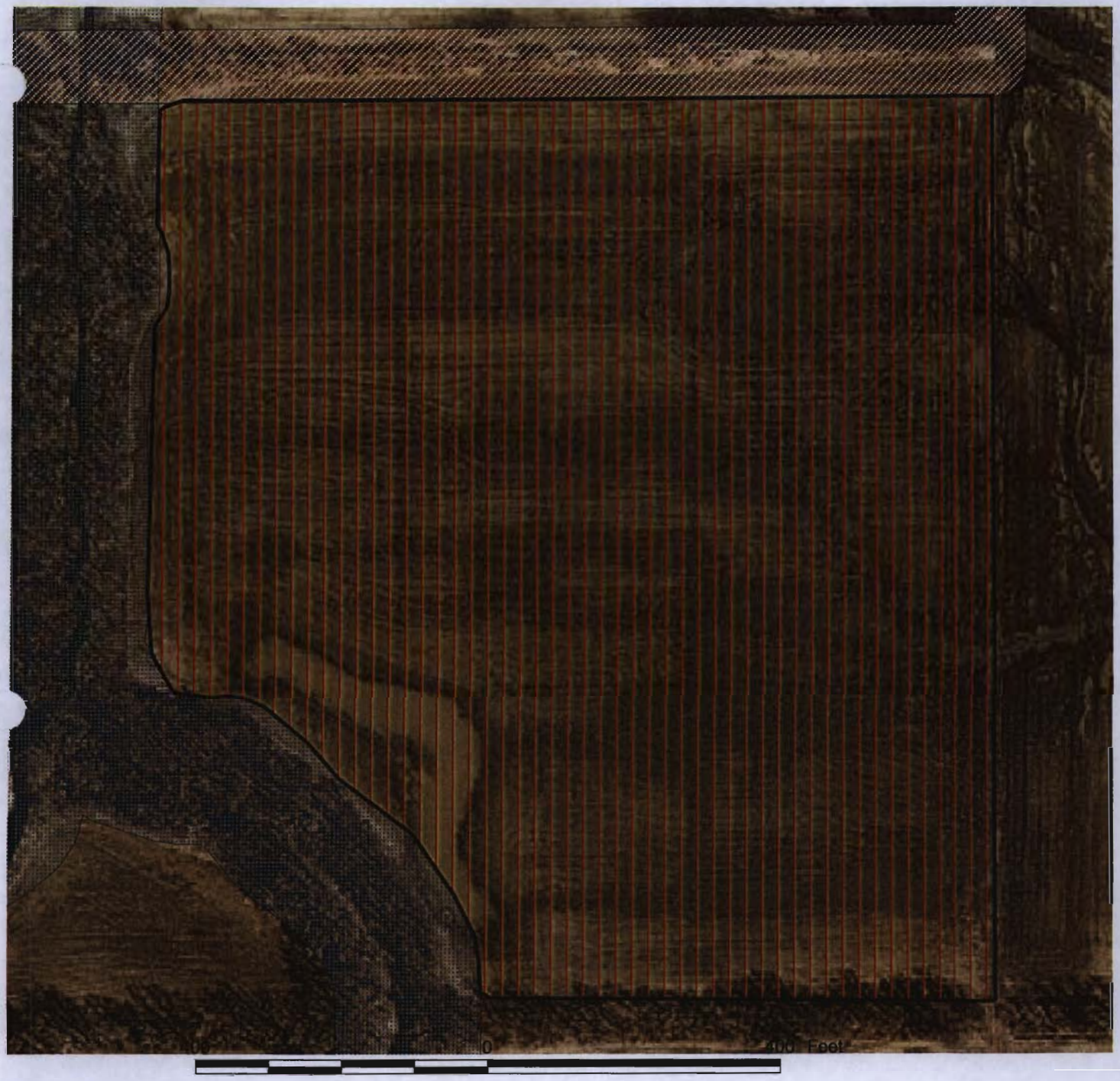
(102.2ac.)Field Boundary
1000 ft Residence Buffer
50 ft Property LIneRoad Buffer
100 ft Water Buffer

MO602420P3400; 15 (30.89 ac.)



Date: Mar 27, 2015
Field Name: MO602420P3400; 15
Location: Grundy Co., Missouri, U.S.
Farm Name: Trenton Farms RE LLC
Client Name: P-Index
Total Acres: 30.89
Field Boundary Start Location:
Latitude: 39.99184468
Longitude: -93.62743864

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(29.3ac.)Field Boundary
50 ft Property LIneRoad Buffer
100 ft Water Buffer

MO602420P4000; 15 (108.82 ac.)

Date: Mar 27, 2015
Field Name: MO602420P4000; 15
Location: Grundy Co., Missouri, U.S.
Farm Name: Trenton Farms RE LLC
Client Name: P-Index
Total Acres: 108.82
Field Boundary Start Location:
Latitude: 39.99183956
Longitude: -93.62742110

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(104.6ac.)Field Boundary
50 ft Property LIneRoad Buffer
100 ft Water Buffer

MO602421P3500B; 15 (25.17 ac.)

Date: Mar 27, 2015
Field Name: MO602421P3500B; 15
Location: Grundy Co., Missouri, U.S.
Farm Name: Trenton Farms RE LLC
Client Name: P-Index
Total Acres: 25.17
Field Boundary Start Location:
Latitude: 39.99199832
Longitude: -93.61531524

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(21.6ac.)Field Boundary
50 ft Property LIneRoad Buffer
100 ft Water Buffer

MO602421P3500C; 15 (19.83 ac.)

Date: Mar 27, 2015
Field Name: MO602421P3500C; 15
Location: Grundy Co., Missouri, U.S.
Farm Name: Trenton Farms RE LLC
Client Name: P-Index
Total Acres: 19.83
Field Boundary Start Location:
Latitude: 39.99200571
Longitude: -93.61522544

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(18.7ac.)Field Boundary
50 ft Property LIneRoad Buffer
100 ft Water Buffer

MO602429P8000B; 15 (98.70 ac.)

Date: Mar 27, 2015
Field Name: MO602429P8000B; 15
Location: Grundy Co., Missouri, U.S.
Farm Name: Trenton Farms RE LLC
Client Name: P-Index
Total Acres: 98.70
Field Boundary Start Location:
Latitude: 39.98054447
Longitude: -93.63628233

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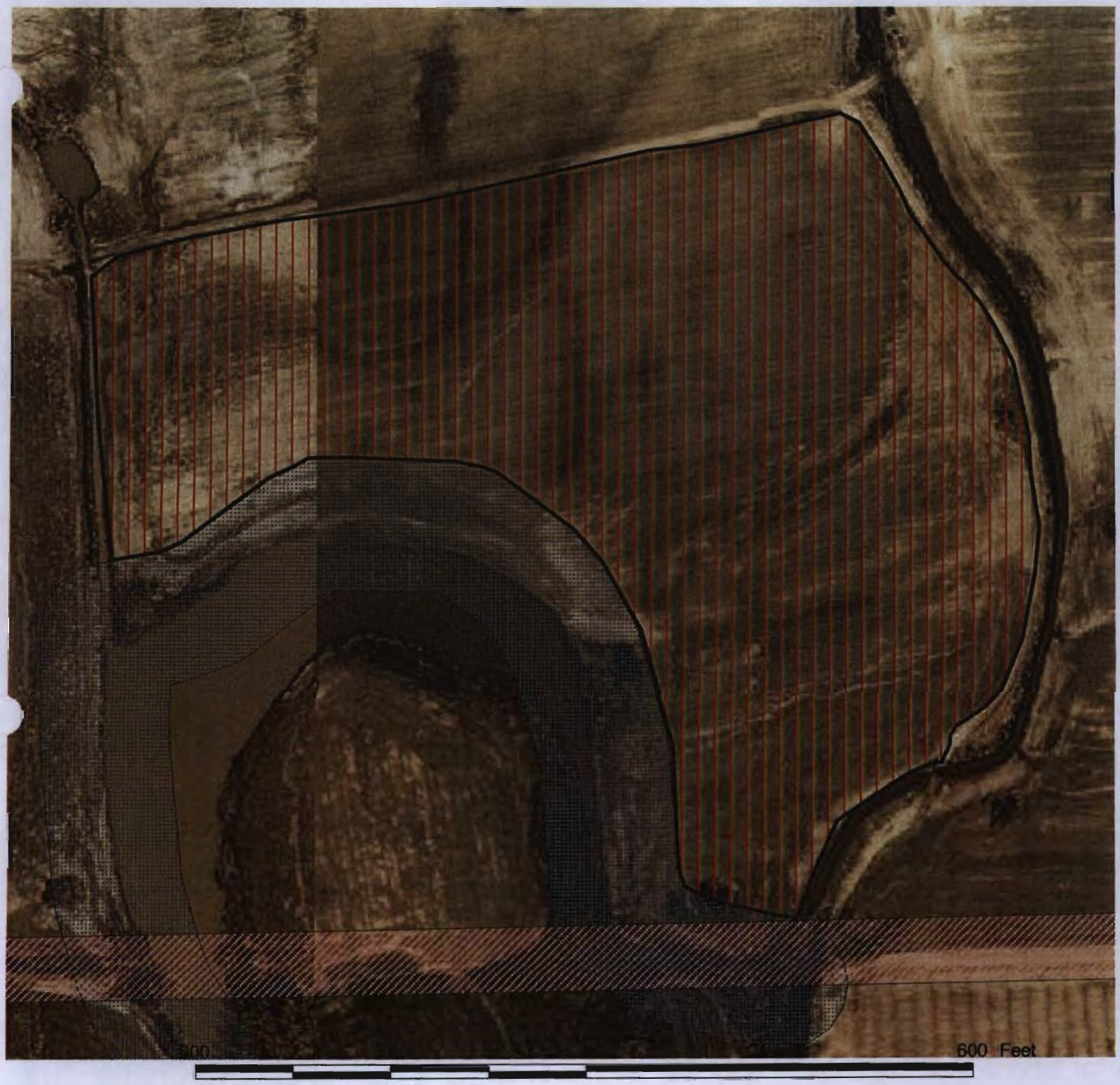
(94.7ac.)Field Boundary
50 ft Property LIneRoad Buffer
100 ft Water Buffer

MO602429P8000C; 15 (24.07 ac.)



Date: Mar 27, 2015
Field Name: MO602429P8000C; 15
Location: Grundy Co., Missouri, U.S.
Farm Name: Trenton Farms RE LLC
Client Name: P-Index
Total Acres: 24.07
Field Boundary Start Location:
Latitude: 39.98016906
Longitude: -93.62372197

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(21.7ac.)Field Boundary
50 ft Property LIneRoad Buffer
100 ft Water Buffer

MO602429P8000D; 15 (297.48 ac.)

Date: Mar 27, 2015
Field Name: MO602429P8000D; 15
Location: Grundy Co., Missouri, U.S.
Farm Name: Trenton Farms RE LLC
Client Name: P-Index
Total Acres: 297.48
Field Boundary Start Location:
Latitude: 39.98798974
Longitude: -93.62515936

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(284.0ac.)Field Boundary
50 ft Property LIneRoad Buffer
100 ft Water Buffer

MO602430P1150B; 15 (5.97 ac.)

Date: Mar 27, 2015
Field Name: MO602430P1150B; 15
Location: Grundy Co., Missouri, U.S.
Farm Name: Trenton Farms RE LLC
Client Name: P-Index
Total Acres: 5.97
Field Boundary Start Location:
Latitude: 39.99137845
Longitude: -93.64136127

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(4.9ac.)Field Boundary
50 ft Property LIneRoad Buffer
100 ft Water Buffer

MO602430P1150C; 15 (6.92 ac.)

Date: Mar 27, 2015
Field Name: MO602430P1150C; 15
Location: Grundy Co., Missouri, U.S.
Farm Name: Trenton Farms RE LLC
Client Name: P-Index
Total Acres: 6.92
Field Boundary Start Location:
Latitude: 39.98712251
Longitude: -93.63980063

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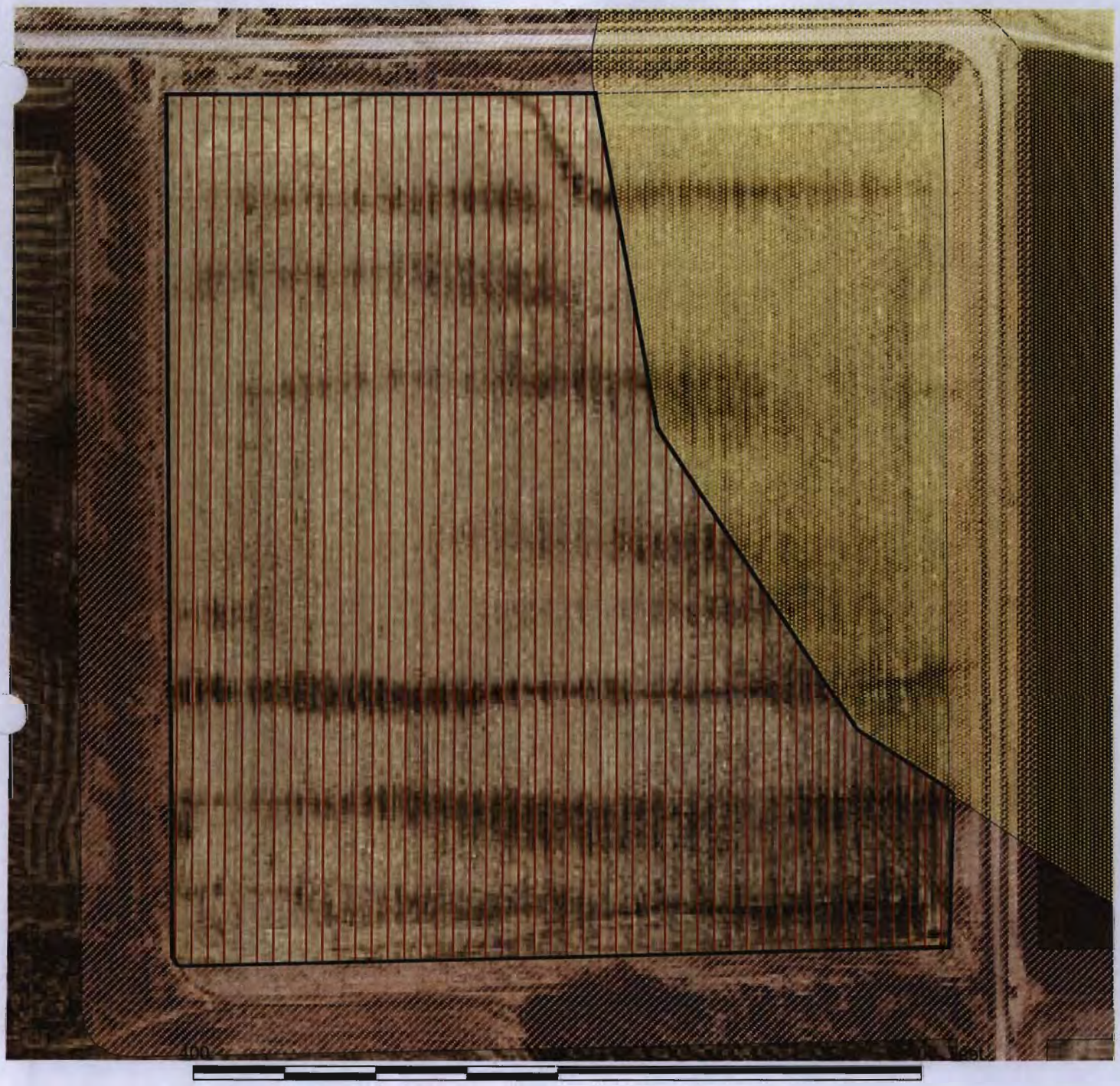
(6.0ac.)Field Boundary
50 ft Property LIneRoad Buffer
100 ft Water Buffer

MO602430P1400; 15 (21.02 ac.)



Date: Mar 27, 2015
Field Name: MO602430P1400; 15
Location: Grundy Co., Missouri, U.S.
Farm Name: Trenton Farms RE LLC
Client Name: P-Index
Total Acres: 21.02
Field Boundary Start Location:
Latitude: 39.98428175
Longitude: -93.63663616

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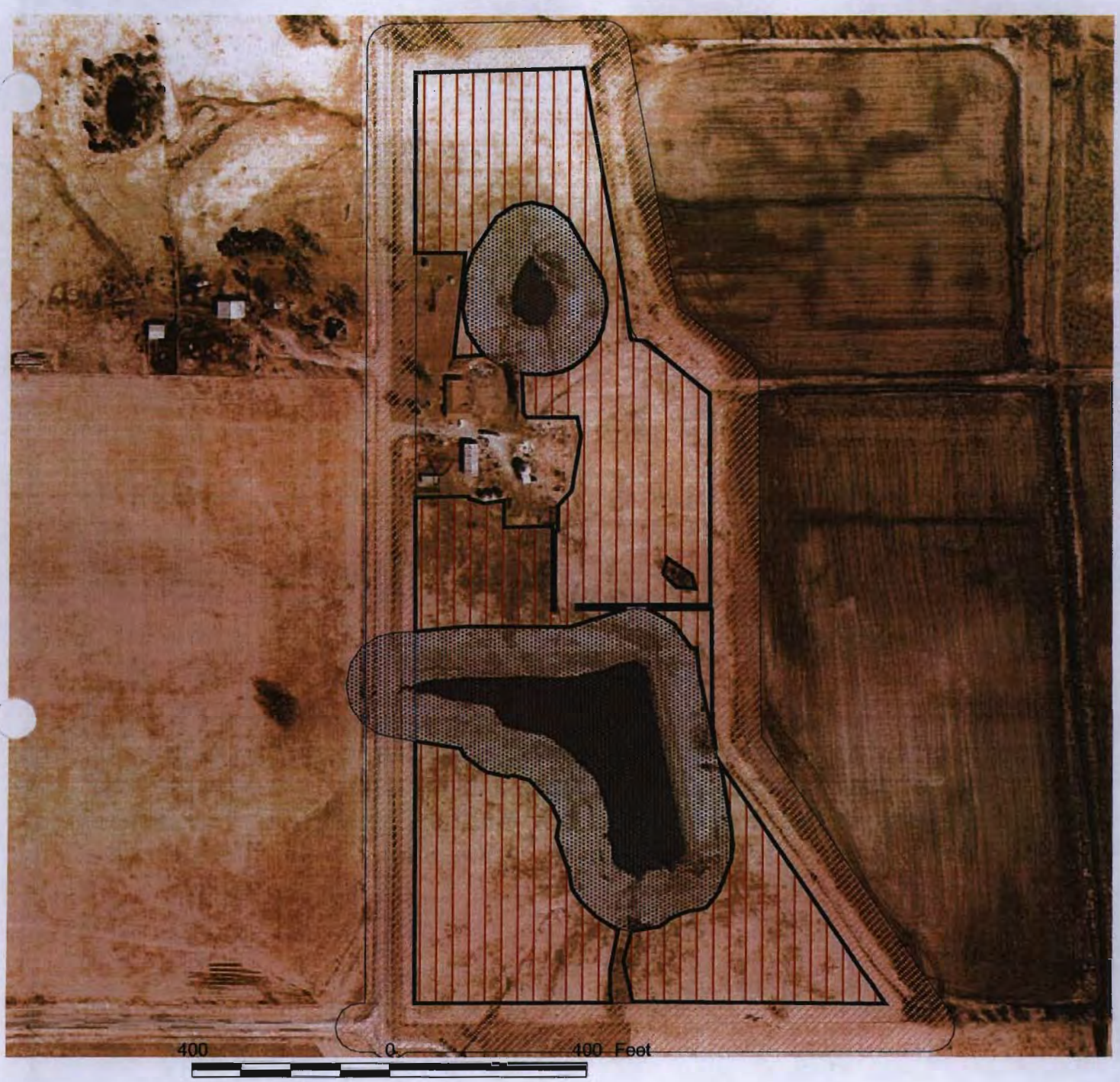
(13.9ac.)Field Boundary
1000 ft Residence Buffer
50 ft Property LIneRoad Buffer
100 ft Water Buffer

MO602430P3400; 15 (20.78 ac.)



Date: Mar 31, 2015
Field Name: MO602430P3400; 15
Location: Grundy Co., Missouri, U.S.
Farm Name: Trenton Farms RE LLC
Client Name: P-Index
Total Acres: 20.78
Field Boundary Start Location:
Latitude: 39.97765096
Longitude: -93.64402174

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(14.8ac.)Field Boundary
100ft Water Buffer
50 ft Property LIneRoad Buffer

USDA NRCS

RUSLE2 Profile Erosion Calculation Record

Info: MO602419P1300

File: profiles\default

Inputs:
Location: USA\Missouri\Grundy County
Soil: Grundy County, Missouri\30214 Vigar loam, 2 to 5 percent slopes, rarely flooded\Vigar loam 95%
Slope length (horiz): 130 ft
Avg. slope steepness: 4.0 %

Management	*Vegetation*	*Yield units*	*# yield units, #/ac*
managements\CMZ 04\c.Other Local Mgt Records*CB South	vegetations\Corn, grain	bushels	122.14
managements\CMZ 04\c.Other Local Mgt Records*CB South	vegetations\Soybean, mw 30 in rows	bu	43.800

Contouring: a. rows up-and-down hill
Strips/barriers: (none)
Diversion/terrace, sediment basin: (none)
Subsurface drainage: (none)
Adjust res. burial level: Normal res. burial

Outputs:
T value: 5.0 t/ac/yr
Soil loss erod. portion: 3.6 t/ac/yr
Detachment on slope: 3.6 t/ac/yr
Soil loss for cons. plan: 3.6 t/ac/yr
Sediment delivery: 3.6 t/ac/yr

Crit. slope length: 130 ft
Surf. cover after planting: -- %
Avg. ann. forage harvest: 0 lb/ac

Date	*Operation*	*Vegetation*	*Surf. res. cov. after op, %*
10/25/0	Manure injector, liquid low disturb.30 inch		72
4/10/1	Cultivator, field 6-12 in sweeps		40
4/15/1	Planter, double disk opnr w/fluted coulter	Corn, grain	38
10/25/1	Harvest, killing crop 50pct standing stubble		73
4/28/2	Chisel, st. pt.		43
4/28/2	Cultivator, field 6-12 in sweeps		43
5/1/2	Planter, double disk opnr w/fluted coulter	Soybean, mw 30 in rows	45
10/20/2	Harvest, killing crop 30pct standing stubble		73

USDA NRCS

RUSLE2 Profile Erosion Calculation Record

Info: MO602419P4000

File: profiles\default

Inputs:
Location: USA\Missouri\Grundy County
Soil: Grundy County, Missouri\36042 Vesser silt loam, 0 to 2 percent slopes, occasionally flooded\Vesser silt loam 90%
Slope length (horiz): 120 ft
Avg. slope steepness: 1.0 %

Management	*Vegetation*	*Yield units*	*# yield units, #/ac*
managements\CMZ 04\c.Other Local Mgt Records*CB South	vegetations\Corn, grain	bushels	122.14
managements\CMZ 04\c.Other Local Mgt Records*CB South	vegetations\Soybean, mw 30 in rows	bu	43.800

Contouring: a. rows up-and-down hill
Strips/barriers: (none)
Diversion/terrace, sediment basin: (none)
Subsurface drainage: (none)
Ijust res. burial level: Normal res. burial

Outputs:
T value: 5.0 t/ac/yr
Soil loss erod. portion: 1.3 t/ac/yr
Detachment on slope: 1.3 t/ac/yr
Soil loss for cons. plan: 1.3 t/ac/yr
Sediment delivery: 1.3 t/ac/yr

Crit. slope length: 120 ft
Surf. cover after planting: -- %
Avg. ann. forage harvest: 0 lb/ac

Date	*Operation*	*Vegetation*	*Surf. res. cov. after op, %*
10/25/0	Manure injector, liquid low disturb.30 inch		72
4/10/1	Cultivator, field 6-12 in sweeps		40
4/15/1	Planter, double disk opnr w/fluted coulter	Corn, grain	38
10/25/1	Harvest, killing crop 50pct standing stubble		73
4/28/2	Chisel, st. pt.		43
4/28/2	Cultivator, field 6-12 in sweeps		43
5/1/2	Planter, double disk opnr w/fluted coulter	Soybean, mw 30 in rows	45
10/20/2	Harvest, killing crop 30pct standing stubble		73

USDA NRCS

RUSLE2 Profile Erosion Calculation Record

Info: MO602420P3400

File: profiles\default

Inputs:
Location: USA\Missouri\Grundy County
Soil: Grundy County, Missouri\36042 Vesser silt loam, 0 to 2 percent slopes, occasionally flooded\Vesser silt loam 90%
Slope length (horiz): 120 ft
Avg. slope steepness: 1.0 %

Management	*Vegetation*	*Yield units*	*# yield units, #/ac*
managements\CMZ 04\c.Other Local Mgt Records*CB South	vegetations\Corn, grain	bushels	122.14
managements\CMZ 04\c.Other Local Mgt Records*CB South	vegetations\Soybean, mw 30 in rows	bu	43.800

Contouring: a. rows up-and-down hill
Strips/barriers: (none)
Diversion/terrace, sediment basin: (none)
Subsurface drainage: (none)
djust res. burial level: Normal res. burial

Outputs:
T value: 5.0 t/ac/yr
Soil loss erod. portion: 1.3 t/ac/yr
Detachment on slope: 1.3 t/ac/yr
Soil loss for cons. plan: 1.3 t/ac/yr
Sediment delivery: 1.3 t/ac/yr

Crit. slope length: 120 ft
Surf. cover after planting: -- %
Avg. ann. forage harvest: 0 lb/ac

Date	*Operation*	*Vegetation*	*Surf. res. cov. after op, %*
10/25/0	Manure injector, liquid low disturb.30 inch		72
4/10/1	Cultivator, field 6-12 in sweeps		40
4/15/1	Planter, double disk opnr w/fluted coulter	Corn, grain	38
10/25/1	Harvest, killing crop 50pct standing stubble		73
4/28/2	Chisel, st. pt.		43
4/28/2	Cultivator, field 6-12 in sweeps		43
5/1/2	Planter, double disk opnr w/fluted coulter	Soybean, mw 30 in rows	45
10/20/2	Harvest, killing crop 30pct standing stubble		73

USDA NRCS

RUSLE2 Profile Erosion Calculation Record

Info: MO602420P4000

File: profiles\default

Inputs:
Location: USA\Missouri\Grundy County
Soil: Grundy County, Missouri\36042 Vesser silt loam, 0 to 2 percent slopes, occasionally flooded\Vesser silt loam 90%
Slope length (horiz): 120 ft
Avg. slope steepness: 1.0 %

Management	*Vegetation*	*Yield units*	*# yield units, #/ac*
managements\CMZ 04\c.Other Local Mgt Records*CB South	vegetations\Corn, grain	bushels	122.14
managements\CMZ 04\c.Other Local Mgt Records*CB South	vegetations\Soybean, mw 30 in rows	bu	43.800

Contouring: a. rows up-and-down hill
Strips/barriers: (none)
Diversion/terrace, sediment basin: (none)
Subsurface drainage: (none)
Adjust res. burial level: Normal res. burial

Outputs:
T value: 5.0 t/ac/yr
Soil loss erod. portion: 1.3 t/ac/yr
Detachment on slope: 1.3 t/ac/yr
Soil loss for cons. plan: 1.3 t/ac/yr
Sediment delivery: 1.3 t/ac/yr

Crit. slope length: 120 ft
Surf. cover after planting: -- %
Avg. ann. forage harvest: 0 lb/ac

Date	*Operation*	*Vegetation*	*Surf. res. cov. after op, %*
10/25/0	Manure injector, liquid low disturb.30 inch		72
4/10/1	Cultivator, field 6-12 in sweeps		40
4/15/1	Planter, double disk opnr w/fluted coulter	Corn, grain	38
10/25/1	Harvest, killing crop 50pct standing stubble		73
4/28/2	Chisel, st. pt.		43
4/28/2	Cultivator, field 6-12 in sweeps		43
5/1/2	Planter, double disk opnr w/fluted coulter	Soybean, mw 30 in rows	45
10/20/2	Harvest, killing crop 30pct standing stubble		73

Phosphorus Index Worksheet
Version 0.2 April 20, 2005

	MO602419P1300	MO602419P4000	MO602420P3400	MO602420P4000
County	Grundy	Grundy	Grundy	Grundy
Soil test P level	13	10.1	18	12.5
Units	ppm	ppm	ppm	ppm
Extraction Procedure	Bray-I	Bray-I	Bray-I	Bray-I
Sampling depth	6 to 8 inches	6 to 8 inches	6 to 8 inches	6 to 8 inches
Tillage	Tilled	Tilled	Tilled	Tilled
RUSLE value - average annual (tons/ac)	3.6	1.3	1.3	1.3
Land cover	Row crop - straight row	Row crop - straight row	Row crop - straight row	Row crop - straight row
Hydrologic soil group	C	C	C	C
Hydrologic condition	Good	Good	Good	Good
Distance from center of field to water feature	2370	1330.6	558.6	959.9
Particulate P value	2.0	0.9	1.1	1.0
Soluble P value	0.2	0.2	0.3	0.2
Total P value	2.2	1.1	1.4	1.2
P index rating	LOW	LOW	LOW	LOW
Agronomic P rating (Opt.= 45 lbs/a)	MEDIUM	LOW	MEDIUM	MEDIUM
Sensitivity value	2.6	2.2	2.2	2.2

USDA NRCS

RUSLE2 Profile Erosion Calculation Record

Info: MO602421P3500B

File: profiles\default

Inputs:
Location: USA\Missouri\Grundy County
Soil: Grundy County, Missouri\66004 Dockery silt loam, 0 to 2 percent slopes, frequently flooded\Dockery silt loam 90%
Slope length (horiz): 98 ft
Avg. slope steepness: 1.0 %

Management	*Vegetation*	*Yield units*	*# yield units, #/ac*
managements\CMZ 04\c.Other Local Mgt Records*CB South	vegetations\Corn, grain	bushels	122.14
managements\CMZ 04\c.Other Local Mgt Records*CB South	vegetations\Soybean, mw 30 in rows	bu	43.800

Contouring: a. rows up-and-down hill
Strips/barriers: (none)
Diversion/terrace, sediment basin: (none)
Subsurface drainage: (none)
Adjust res. burial level: Normal res. burial

Outputs:
T value: 5.0 t/ac/yr
Soil loss erod. portion: 1.9 t/ac/yr
Detachment on slope: 1.9 t/ac/yr
Soil loss for cons. plan: 1.9 t/ac/yr
Sediment delivery: 1.9 t/ac/yr

Crit. slope length: 98 ft
Surf. cover after planting: -- %
Avg. ann. forage harvest: 0 lb/ac

Date	*Operation*	*Vegetation*	*Surf. res. cov. after op, %*
10/25/0	Manure injector, liquid low disturb.30 inch		72
4/10/1	Cultivator, field 6-12 in sweeps		40
4/15/1	Planter, double disk opnr w/fluted coulter	Corn, grain	38
10/25/1	Harvest, killing crop 50pct standing stubble		73
4/28/2	Chisel, st. pt.		43
4/28/2	Cultivator, field 6-12 in sweeps		43
5/1/2	Planter, double disk opnr w/fluted coulter	Soybean, mw 30 in rows	45
10/20/2	Harvest, killing crop 30pct standing stubble		73

USDA NRCS

RUSLE2 Profile Erosion Calculation Record

Info: MO602421P3500C

File: profiles\default

Inputs:
Location: USA\Missouri\Grundy County
Soil: Grundy County, Missouri\66004 Dockery silt loam, 0 to 2 percent slopes, frequently flooded\Dockery silt loam 90%
Slope length (horiz): 98 ft
Avg. slope steepness: 1.0 %

Management	*Vegetation*	*Yield units*	*# yield units, #/ac*
managements\CMZ 04\c.Other Local Mgt Records*CB South	vegetations\Corn, grain	bushels	122.14
managements\CMZ 04\c.Other Local Mgt Records*CB South	vegetations\Soybean, mw 30 in rows	bu	43.800

Contouring: a. rows up-and-down hill
Strips/barriers: (none)
Diversion/terrace, sediment basin: (none)
Subsurface drainage: (none)
Adjust res. burial level: Normal res. burial

Outputs:
T value: 5.0 t/ac/yr
Soil loss erod. portion: 1.9 t/ac/yr
Detachment on slope: 1.9 t/ac/yr
Soil loss for cons. plan: 1.9 t/ac/yr
Sediment delivery: 1.9 t/ac/yr

Crit. slope length: 98 ft
Surf. cover after planting: -- %
Avg. ann. forage harvest: 0 lb/ac

Date	*Operation*	*Vegetation*	*Surf. res. cov. after op, %*
10/25/0	Manure injector, liquid low disturb.30 inch		72
4/10/1	Cultivator, field 6-12 in sweeps		40
4/15/1	Planter, double disk opnr w/fluted coulter	Corn, grain	38
10/25/1	Harvest, killing crop 50pct standing stubble		73
4/28/2	Chisel, st. pt.		43
4/28/2	Cultivator, field 6-12 in sweeps		43
5/1/2	Planter, double disk opnr w/fluted coulter	Soybean, mw 30 in rows	45
10/20/2	Harvest, killing crop 30pct standing stubble		73

Phosphorus Index Worksheet
Version 0.2 April 20, 2005

	MO602421P3500B	MO602421P3500C		
County	Grundy	Grundy	Scotland	Scotland
Soil test P level	11	11	0	0
Units	ppm	ppm	ppm	ppm
Extraction Procedure	Bray-I	Bray-I	Mehlich-III	Mehlich-III
Sampling depth	6 to 8 inches	6 to 8 inches	6 to 8 inches	6 to 8 inches
Tillage	Tilled	Tilled	Tilled	Tilled
RUSLE value - average annual (tons/ac)	1.9	1.9	0	0
Land cover	Row crop - straight row	Row crop - straight row	Row crop - contoured and terraced with residue	Row crop - contoured with residue
Hydrologic soil group	C	C	C	C
Hydrologic condition	Good	Good	Good	Good
Distance from center of field to water feature	918	457.8	0	0
Particulate P value	1.4	1.6	0.0	0.0
Soluble P value	0.2	0.2	0.0	0.0
Total P value	1.6	1.8	0.0	0.0
P index rating	LOW	LOW	LOW	LOW
Agronomic P rating (Opt.= 45 lbs/a)	LOW	LOW	Non-agronomic test for MO	Non-agronomic test for MO
Sensitivity value	2.4	2.4	1.3	1.6

USDA NRCS

RUSLE2 Profile Erosion Calculation Record

Info: MO602429P8000B

File: profiles\default

Inputs:
Location: USA\Missouri\Grundy County
Soil: Grundy County, Missouri\36046 Wabash silty clay, 0 to 2 percent slopes, occasionally flooded\Wabash silty clay 85%
Slope length (horiz): 160 ft
Avg. slope steepness: 1.0 %

Management	*Vegetation*	*Yield units*	*# yield units, #/ac*
managements\CMZ 04\c.Other Local Mgt Records*CB South	vegetations\Corn, grain	bushels	122.14
managements\CMZ 04\c.Other Local Mgt Records*CB South	vegetations\Soybean, mw 30 in rows	bu	43.800

Contouring: a. rows up-and-down hill
Strips/barriers: (none)
Diversion/terrace, sediment basin: (none)
Subsurface drainage: (none)
Adjust res. burial level: Normal res. burial

Outputs:
T value: 5.0 t/ac/yr
Soil loss erod. portion: 0.60 t/ac/yr
Detachment on slope: 0.60 t/ac/yr
Soil loss for cons. plan: 0.60 t/ac/yr
Sediment delivery: 0.60 t/ac/yr

Crit. slope length: 160 ft
Surf. cover after planting: -- %
Avg. ann. forage harvest: 0 lb/ac

Date	*Operation*	*Vegetation*	*Surf. res. cov. after op, %*
10/25/0	Manure injector, liquid low disturb.30 inch		72
4/10/1	Cultivator, field 6-12 in sweeps		40
4/15/1	Planter, double disk opnr w/fluted coulter	Corn, grain	38
10/25/1	Harvest, killing crop 50pct standing stubble		73
4/28/2	Chisel, st. pt.		43
4/28/2	Cultivator, field 6-12 in sweeps		43
5/1/2	Planter, double disk opnr w/fluted coulter	Soybean, mw 30 in rows	45
10/20/2	Harvest, killing crop 30pct standing stubble		73

USDA NRCS

RUSLE2 Profile Erosion Calculation Record

Info: MO602429P8000C

File: profiles\default

Inputs:
Location: USA\Missouri\Grundy County
Soil: Grundy County, Missouri\66004 Dockery silt loam, 0 to 2 percent slopes, frequently flooded\Dockery silt loam 90%
Slope length (horiz): 98 ft
Avg. slope steepness: 1.0 %

Management	*Vegetation*	*Yield units*	*# yield units, #/ac*
managements\CMZ 04\c.Other Local Mgt Records*CB South	vegetations\Corn, grain	bushels	122.14
managements\CMZ 04\c.Other Local Mgt Records*CB South	vegetations\Soybean, mw 30 in rows	bu	43.800

Contouring: a. rows up-and-down hill
Strips/barriers: (none)
Diversion/terrace, sediment basin: (none)
Subsurface drainage: (none)
Ijust res. burial level: Normal res. burial

Outputs:
T value: 5.0 t/ac/yr
Soil loss erod. portion: 1.9 t/ac/yr
Detachment on slope: 1.9 t/ac/yr
Soil loss for cons. plan: 1.9 t/ac/yr
Sediment delivery: 1.9 t/ac/yr

Crit. slope length: 98 ft
Surf. cover after planting: -- %
Avg. ann. forage harvest: 0 lb/ac

Date	*Operation*	*Vegetation*	*Surf. res. cov. after op, %*
10/25/0	Manure injector, liquid low disturb.30 inch		72
4/10/1	Cultivator, field 6-12 in sweeps		40
4/15/1	Planter, double disk opnr w/fluted coulter	Corn, grain	38
10/25/1	Harvest, killing crop 50pct standing stubble		73
4/28/2	Chisel, st. pt.		43
4/28/2	Cultivator, field 6-12 in sweeps		43
5/1/2	Planter, double disk opnr w/fluted coulter	Soybean, mw 30 in rows	45
10/20/2	Harvest, killing crop 30pct standing stubble		73

USDA NRCS

RUSLE2 Profile Erosion Calculation Record

Info: MO602429P8000D

File: profiles\default

Inputs:
Location: USA\Missouri\Grundy County
Soil: Grundy County, Missouri\36042 Vesser silt loam, 0 to 2 percent slopes, occasionally flooded\Vesser silt loam 90%
Slope length (horiz): 120 ft
Avg. slope steepness: 1.0 %

Management	*Vegetation*	*Yield units*	*# yield units, #/ac*
managements\CMZ 04\c.Other Local Mgt Records*CB South	vegetations\Corn, grain	bushels	122.14
managements\CMZ 04\c.Other Local Mgt Records*CB South	vegetations\Soybean, mw 30 in rows	bu	43.800

Contouring: a. rows up-and-down hill
Strips/barriers: (none)
Diversion/terrace, sediment basin: (none)
Subsurface drainage: (none)
Ijust res. burial level: Normal res. burial

Outputs:
T value: 5.0 t/ac/yr
Soil loss erod. portion: 1.3 t/ac/yr
Detachment on slope: 1.3 t/ac/yr
Soil loss for cons. plan: 1.3 t/ac/yr
Sediment delivery: 1.3 t/ac/yr

Crit. slope length: 120 ft
Surf. cover after planting: -- %
Avg. ann. forage harvest: 0 lb/ac

Date	*Operation*	*Vegetation*	*Surf. res. cov. after op, %*
10/25/0	Manure injector, liquid low disturb.30 inch		72
4/10/1	Cultivator, field 6-12 in sweeps		40
4/15/1	Planter, double disk opnr w/fluted coulter	Corn, grain	38
10/25/1	Harvest, killing crop 50pct standing stubble		73
4/28/2	Chisel, st. pt.		43
4/28/2	Cultivator, field 6-12 in sweeps		43
5/1/2	Planter, double disk opnr w/fluted coulter	Soybean, mw 30 in rows	45
10/20/2	Harvest, killing crop 30pct standing stubble		73

USDA NRCS

RUSLE2 Profile Erosion Calculation Record

Info: MO602430P1150B

File: profiles\default

Inputs:
Location: USA\Missouri\Grundy County
Soil: Grundy County, Missouri\36013 Fatima silt loam, 0 to 2 percent slopes, occasionally flooded\Fatima silt loam 90%
Slope length (horiz): 160 ft
Avg. slope steepness: 1.0 %

Management	*Vegetation*	*Yield units*	*# yield units, #/ac*
managements\CMZ 04\c.Other Local Mgt Records*CB South	vegetations\Corn, grain	bushels	122.14
managements\CMZ 04\c.Other Local Mgt Records*CB South	vegetations\Soybean, mw 30 in rows	bu	43.800

Contouring: a. rows up-and-down hill
Strips/barriers: (none)
Diversion/terrace, sediment basin: (none)
Subsurface drainage: (none)
ljust res. burial level: Normal res. burial

Outputs:
T value: 5.0 t/ac/yr
Soil loss erod. portion: 1.4 t/ac/yr
Detachment on slope: 1.4 t/ac/yr
Soil loss for cons. plan: 1.4 t/ac/yr
Sediment delivery: 1.4 t/ac/yr

Crit. slope length: 160 ft
Surf. cover after planting: -- %
Avg. ann. forage harvest: 0 lb/ac

Date	*Operation*	*Vegetation*	*Surf. res. cov. after op, %*
10/25/0	Manure injector, liquid low disturb.30 inch		72
4/10/1	Cultivator, field 6-12 in sweeps		40
4/15/1	Planter, double disk opnr w/fluted coulter	Corn, grain	38
10/25/1	Harvest, killing crop 50pct standing stubble		73
4/28/2	Chisel, st. pt.		43
4/28/2	Cultivator, field 6-12 in sweeps		43
5/1/2	Planter, double disk opnr w/fluted coulter	Soybean, mw 30 in rows	45
10/20/2	Harvest, killing crop 30pct standing stubble		73

Phosphorus Index Worksheet
Version 0.2 April 20, 2005

	MO602429P8000B	MO6024129PO8000C	MO602429P8000D	MO602430P1150B
County	Grundy	Grundy	Grundy	Grundy
Soil test P level	**18.4**	**18.4**	**18.4**	**12.5**
Units	ppm	ppm	ppm	ppm
Extraction Procedure	Bray-I	Bray-I	Bray-I	Bray-I
Sampling depth	6 to 8 inches	6 to 8 inches	6 to 8 inches	6 to 8 inches
Tillage	Tilled	Tilled	Tilled	Tilled
RUSLE value - average annual (tons/ac)	**0.6**	**1.9**	**1.3**	**1.4**
Land cover	Row crop - straight row	Row crop - straight row	Row crop - straight row	Row crop - straight row
Hydrologic soil group	D	C	C	B
Hydrologic condition	Good	Good	Good	Good
Distance from center of field to water feature	1790.3	285.1	1481.3	311.2
Particulate P value	0.4	1.7	0.9	0.9
Soluble P value	0.4	0.3	0.3	0.2
Total P value	0.8	2.1	1.2	1.0
P index rating	LOW	LOW	LOW	LOW
Agronomic P rating (Opt.= 45 lbs/a)	MEDIUM	MEDIUM	MEDIUM	MEDIUM
Sensitivity value	2.3	2.5	2.2	1.7

USDA NRCS

RUSLE2 Profile Erosion Calculation Record

Info: MO602430P1150C

File: profiles\default

Inputs:
Location: USA\Missouri\Grundy County
Soil: Grundy County, Missouri\36050 Zook silty clay loam, 0 to 2 percent slopes, occasionally flooded\Zook silty clay loam 90%
Slope length (horiz): 120 ft
Avg. slope steepness: 1.0 %

Management	*Vegetation*	*Yield units*	*# yield units, #/ac*
managements\CMZ 04\c.Other Local Mgt Records*CB South	vegetations\Corn, grain	bushels	122.14
managements\CMZ 04\c.Other Local Mgt Records*CB South	vegetations\Soybean, mw 30 in rows	bu	43.800

Contouring: a. rows up-and-down hill
Strips/barriers: (none)
Diversion/terrace, sediment basin: (none)
Subsurface drainage: (none)
Adjust res. burial level: Normal res. burial

Outputs:
T value: 5.0 t/ac/yr
Soil loss erod. portion: 1.1 t/ac/yr
Detachment on slope: 1.1 t/ac/yr
Soil loss for cons. plan: 1.1 t/ac/yr
Sediment delivery: 1.1 t/ac/yr

Crit. slope length: 120 ft
Surf. cover after planting: -- %
Avg. ann. forage harvest: 0 lb/ac

Date	*Operation*	*Vegetation*	*Surf. res. cov. after op, %*
10/25/0	Manure injector, liquid low disturb.30 inch		72
4/10/1	Cultivator, field 6-12 in sweeps		40
4/15/1	Planter, double disk opnr w/fluted coulter	Corn, grain	38
10/25/1	Harvest, killing crop 50pct standing stubble		73
4/28/2	Chisel, st. pt.		43
4/28/2	Cultivator, field 6-12 in sweeps		43
5/1/2	Planter, double disk opnr w/fluted coulter	Soybean, mw 30 in rows	45
10/20/2	Harvest, killing crop 30pct standing stubble		73

USDA NRCS

RUSLE2 Profile Erosion Calculation Record

Info: MO602430P1400

File: profiles\default

Inputs:
Location: USA\Missouri\Grundy County
Soil: Grundy County, Missouri\36042 Vesser silt loam, 0 to 2 percent slopes, occasionally flooded\Vesser silt loam 90%
Slope length (horiz): 120 ft
Avg. slope steepness: 1.0 %

Management	*Vegetation*	*Yield units*	*# yield units, #/ac*
managements\CMZ 04\c.Other Local Mgt Records*CB South	vegetations\Corn, grain	bushels	122.14
managements\CMZ 04\c.Other Local Mgt Records*CB South	vegetations\Soybean, mw 30 in rows	bu	43.800

Contouring: a. rows up-and-down hill
Strips/barriers: (none)
Diversion/terrace, sediment basin: (none)
Subsurface drainage: (none)
ljust res. burial level: Normal res. burial

Outputs:
T value: 5.0 t/ac/yr
Soil loss erod. portion: 1.3 t/ac/yr
Detachment on slope: 1.3 t/ac/yr
Soil loss for cons. plan: 1.3 t/ac/yr
Sediment delivery: 1.3 t/ac/yr

Crit. slope length: 120 ft
Surf. cover after planting: -- %
Avg. ann. forage harvest: 0 lb/ac

Date	*Operation*	*Vegetation*	*Surf. res. cov. after op, %*
10/25/0	Manure injector, liquid low disturb.30 inch		72
4/10/1	Cultivator, field 6-12 in sweeps		40
4/15/1	Planter, double disk opnr w/fluted coulter	Corn, grain	38
10/25/1	Harvest, killing crop 50pct standing stubble		73
4/28/2	Chisel, st. pt.		43
4/28/2	Cultivator, field 6-12 in sweeps		43
5/1/2	Planter, double disk opnr w/fluted coulter	Soybean, mw 30 in rows	45
10/20/2	Harvest, killing crop 30pct standing stubble		73

Phosphorus Index Worksheet
Version 0.2 April 20, 2005

	MO602430P1150C	MO602430P1400		
County	Grundy	Grundy	Grundy	Grundy
Soil test P level	**12.5**	**12.5**	**0**	**0**
Units	ppm	ppm	ppm	ppm
Extraction Procedure	Bray-I	Bray-I	Bray-I	Bray-I
Sampling depth	6 to 8 inches	6 to 8 inches	6 to 8 inches	6 to 8 inches
Tillage	Tilled	Tilled	Tilled	Tilled
RUSLE value - average annual (tons/ac)	**1.1**	**1.3**	**0**	**0**
Land cover	Row crop - straight row	Row crop - straight row	Row crop - straight row	Row crop - straight row
Hydrologic soil group	C	C	C	B
Hydrologic condition	Good	Good	Good	Good
Distance from center of field to water feature	182.9	1286.5	0	0
Particulate P value	1.0	1.0	0.0	0.0
Soluble P value	0.2	0.2	0.0	0.0
Total P value	1.2	1.2	0.0	0.0
P index rating	LOW	LOW	LOW	LOW
Agronomic P rating (Opt.= 45 lbs/a)	MEDIUM	MEDIUM	LOW	LOW
Sensitivity value	2.2	2.2	1.9	1.4

NRCS Natural Resources Conservation Service

RUSLE2 Profile Erosion Calculation Record

Info: MO602430P3400

File: profiles\default

Inputs:
Location: USA\Missouri\Grundy County
Soil: Grundy County, Missouri\30194 Shelby clay loam, 14 to 20 percent slopes, eroded\Shelby clay loam 95%
Slope length (horiz): 200 ft
Avg. slope steepness: 17 %

Management	*Vegetation*	*Yield units*	*# yield units, #/ac*
managements\CMZ 04\c.Other Local Mgt Records*Pasture	vegetations\Grass, cool season pasture, regrowth after grazing	ton	1.0000
managements\CMZ 04\c.Other Local Mgt Records*Pasture	vegetations\Grass, cool season pasture, regrowth after grazing	ton	1.0000
managements\CMZ 04\c.Other Local Mgt Records*Pasture	vegetations\Grass, cool season pasture, regrowth after grazing	ton	1.0000
managements\CMZ 04\c.Other Local Mgt Records*Pasture	vegetations\Grass, cool season pasture, regrowth after grazing	ton	1.0000
managements\CMZ 04\c.Other Local Mgt Records*Pasture	vegetations\Grass, cool season pasture, regrowth after grazing	ton	1.0000

Contouring: a. rows up-and-down hill
Strips/barriers: (none)
Diversion/terrace, sediment basin: (none)
Subsurface drainage: (none)
Adjust res. burial level: Normal res. burial

Outputs:
T value: 5.0 t/ac/yr
Soil loss erod. portion: 0.14 t/ac/yr
Detachment on slope: 0.14 t/ac/yr
Soil loss for cons. plan: 0.14 t/ac/yr
Sediment delivery: 0.14 t/ac/yr

Crit. slope length: 200 ft
Surf. cover after planting: -- %
Avg. ann. forage harvest: 5000 lb/ac

. .	Operation	. egetation	Surf. res. cov. after op, %
5/1/0	Graze, rotational	Grass, cool season pasture, regrowth after grazing	49
6/15/0	Manure injector, liquid low disturb.30 inch		60
6/20/0	Graze, rotational	Grass, cool season pasture, regrowth after grazing	53
8/1/0	Graze, rotational	Grass, cool season pasture, regrowth after grazing	46
9/15/0	Graze, rotational	Grass, cool season pasture, regrowth after grazing	46
11/1/0	Graze, rotational	Grass, cool season pasture, regrowth after grazing	46

Phosphorus Index Worksheet
Version 0.2 April 20, 2005

MO602430P3400

County	Grundy	Scotland	Scotland	Scotland
Soil test P level	8	0	0	0
Units	ppm	ppm	ppm	ppm
Extraction Procedure	Bray-I	Mehlich-III	Mehlich-III	Mehlich-III
Sampling depth	6 to 8 inches	6 to 8 inches	6 to 8 inches	6 to 8 inches
Tillage	Notill or Forage	Tilled	Tilled	Tilled
RUSLE value - average annual (tons/ac)	0.14	0	0	0
Land cover	Pasture	Row crop - contoured with residue	Row crop - contoured and terraced with residue	Row crop - contoured with residue
Hydrologic soil group	C	C	C	C
Hydrologic condition	Good	Good	Good	Good
Distance from center of field to water feature	285.1	0	0	0
Particulate P value	0.1	0.0	0.0	0.0
Soluble P value	0.3	0.0	0.0	0.0
Total P value	0.4	0.0	0.0	0.0
P index rating	LOW	LOW	LOW	LOW
Agronomic P rating (Opt = 45 lbs/a)	LOW	Non-agronomic test for MO	Non-agronomic test for MO	Non-agronomic test for MO
Sensitivity value	1.2	1.6	1.3	1.6

USDA United States Department of Agriculture
National Agricultural Statistics Service

2007

Quick Stats

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Program	Year	Period	Week Ending	Geo Level	State	State ANSI	Ag District	Ag District Code	County	County ANSI	Zip Code	Region	watershed_code	Watershed	Commodity	Data Item	Domain	Domain Category	Value	CV (%)
SURVEY	2012	YEAR		COUNTY	MISSOURI	29	NORTH CENTRAL	20	GRUNDY	079			00000000		CORN	CORN, GRAIN - YIELD, MEASURED IN BU / ACRE	TOTAL	NOT SPECIFIED	60.5	
SURVEY	2011	YEAR		COUNTY	MISSOURI	29	NORTH CENTRAL	20	GRUNDY	079			00000000		CORN	CORN, GRAIN - YIELD, MEASURED IN BU / ACRE	TOTAL	NOT SPECIFIED	131.6	
SURVEY	2010	YEAR		COUNTY	MISSOURI	29	NORTH CENTRAL	20	GRUNDY	079			00000000		CORN	CORN, GRAIN - YIELD, MEASURED IN BU / ACRE	TOTAL	NOT SPECIFIED	109.1	
SURVEY	2009	YEAR		COUNTY	MISSOURI	29	NORTH CENTRAL	20	GRUNDY	079			00000000		CORN	CORN, GRAIN - YIELD, MEASURED IN BU / ACRE	TOTAL	NOT SPECIFIED	137	
SURVEY	2008	YEAR		COUNTY	MISSOURI	29	NORTH CENTRAL	20	GRUNDY	079			00000000		CORN	CORN, GRAIN - YIELD, MEASURED IN BU / ACRE	TOTAL	NOT SPECIFIED	117	

Avg. = 111

Avg. +10% = 122.14

USDA United States Department of Agriculture
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2007

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Program	Year	Period	Week Ending	Geo Level	State	State ANSI	Ag District	Ag District Code	County	County ANSI	Zip Code	Region	watershed_code	Watershed	Commodity	Data Item	Domain	Domain Category	Value	CV (%)
SURVEY	2014	YEAR		COUNTY	MISSOURI	29	NORTH CENTRAL	20	GRUNDY	079			00000000		SOYBEANS	SOYBEANS - YIELD, MEASURED IN BU / ACRE	TOTAL	NOT SPECIFIED	44.4	
SURVEY	2012	YEAR		COUNTY	MISSOURI	29	NORTH CENTRAL	20	GRUNDY	079			00000000		SOYBEANS	SOYBEANS - YIELD, MEASURED IN BU / ACRE	TOTAL	NOT SPECIFIED	27.7	
SURVEY	2011	YEAR		COUNTY	MISSOURI	29	NORTH CENTRAL	20	GRUNDY	079			00000000		SOYBEANS	SOYBEANS - YIELD, MEASURED IN BU / ACRE	TOTAL	NOT SPECIFIED	44.3	
SURVEY	2010	YEAR		COUNTY	MISSOURI	29	NORTH CENTRAL	20	GRUNDY	079			00000000		SOYBEANS	SOYBEANS - YIELD, MEASURED IN BU / ACRE	TOTAL	NOT SPECIFIED	40.2	
SURVEY	2009	YEAR		COUNTY	MISSOURI	29	NORTH CENTRAL	20	GRUNDY	079			00000000		SOYBEANS	SOYBEANS - YIELD, MEASURED IN BU / ACRE	TOTAL	NOT SPECIFIED	42.5	

Avg. = 39.8

Avg. +10% = 43.8

USDA United States Department of Agriculture
National Agricultural Statistics Service

2007 CENSUS AGRICULTURE

Quick Stats

Program	Year	Period	Week Ending	Geo Level	State	State ANSI	Ag District	Ag District Code	County	County ANSI	Zip Code	Region	watershed_code	Watershed	Commodity	Data Item	Domain	Domain Category	Value	CV (%)
SURVEY	2008	YEAR		COUNTY	MISSOURI	29	NORTH CENTRAL	20	GRUNDY	079			00000000		HAY	HAY - YIELD, MEASURED IN TONS / ACRE	TOTAL	NOT SPECIFIED	1.95	
SURVEY	2007	YEAR		COUNTY	MISSOURI	29	NORTH CENTRAL	20	GRUNDY	079			00000000		HAY	HAY - YIELD, MEASURED IN TONS / ACRE	TOTAL	NOT SPECIFIED	1.68	
SURVEY	2006	YEAR		COUNTY	MISSOURI	29	NORTH CENTRAL	20	GRUNDY	079			00000000		HAY	HAY - YIELD, MEASURED IN TONS / ACRE	TOTAL	NOT SPECIFIED	1.67	
SURVEY	2005	YEAR		COUNTY	MISSOURI	29	NORTH CENTRAL	20	GRUNDY	079			00000000		HAY	HAY - YIELD, MEASURED IN TONS / ACRE	TOTAL	NOT SPECIFIED	1.73	
SURVEY	2004	YEAR		COUNTY	MISSOURI	29	NORTH CENTRAL	20	GRUNDY	079			00000000		HAY	HAY - YIELD, MEASURED IN TONS / ACRE	TOTAL	NOT SPECIFIED	2.04	

Avg. = 1.81

Avg +10% - ~~1.99~~

2.00

Missouri
Comprehensive Nutrient Management Plan
FARMER PLAN DOCUMENT

Operation Name: Trenton Farms RE, LLC

This plan is a summary of the key activities for one year of the nutrient management plan. The period of time covered by this plan is:
6/2015 - 5/2016

The objective of this document is to provide a concise list of the nutrient management activities on this operation for the year indicated. Activities covered by this plan include:

- Planned manure transfers and sales.
- Planned manure application dates and rates.
- Planned fertilizer application dates and rates.

Record keeping is an important part of nutrient management. Please use the space in this plan to record what actually occurred on each field.

Farm contact information: Trenton Farms RE, LLC
SW State Highway W
Trenton, MO 64683
507-825-7032 (office)

Whole Plan Period: June 2015 - May 2020

Contents

A. Manure Transfers - 6/2015 - 5/2016

Exports off the Farm: *(blank rows are for recording exports as they occur)*

Export Month	Export Year	Source of Manure	Target Export Amount	Units	Receiving Operation	Notes

Imports onto the Farm: *(blank rows are for recording imports as they occur)*

Import Month	Import Year	Source of Manure	Animal Type	Target Import Amount	Units	Notes

Internal Transfers of Manure: *(blank rows are for recording transfers as they occur)*

Transfer Month	Transfer Year	Source of Manure	Manure Destination	Target Transfer Amount	Units	Notes

B. Planned Manure Applications - 6/2015 - 5/2016

Month and Year	Field ID	Field SubID	Planned Crop(s)	Source	Application Equipment	Acres Covered	Application Rate	Units per acre	Total Applied
Oct 2015	MO602419P 4000		Corn grain	GDU	Injector Tank	61.8	4,000	Gal	247,000
Oct 2015	MO602429P 8000B		Soybeans	Gestation	Injector Tank	94.8	5,800	Gal	549,900
Oct 2015	MO602429P 8000C		Soybeans	Gestation	Injector Tank	21.7	5,800	Gal	126,100
Oct 2015	MO602429P 8000D		Soybeans	Gestation	Injector Tank	225.0	5,800	Gal	1,305,200
Nov 2015	MO602429P 8000D		Soybeans	Gestation	Injector Tank	59.1	5,800	Gal	342,550

Manure Application Records - 6/2015 - 5/2016

App #	Date	Field ID	Field SubID	Manure Source	Application Equipment	Actual Rate	Actual Loads	Total Applied	Acres Covered
1									
2									
3									
4									
5									
6									
7									

Manure Application Records - 6/2015 - 5/2016 (continued)

App #	Applicator's Name	[1]Soil Condition	[2]Ground Cover	[3]Days to Incorporate	Air Temp	Wind Speed	Wind Direction	[4]Rain Before	[5]Rain After	[6]Weather
1										
2										
3										
4										
5										
6										
7										

1. Soil condition at time of operations: Dry, Firm, Wet, Muddy, Snow-Covered, Frozen.
2. Percent residue or ground cover at time of application.
3. Number of days to incorporate manure after application: Use "N1" for no incorporation.
4. Amount of rainfall during the 24 hours prior to application.
5. Amount of rainfall during the 24 hours after application.
6. Weather condition at time of application: Sunny, Partly Cloudy, Cloudy, Rain, Snow.

C. Planned Commercial Fertilizer Applications - 6/2015 - 5/2016

No planned commercial fertilizer applications for the period.

Commercial Fertilizer Application Records - 6/2015 - 5/2016

Month and Year	Field ID	Field SubID	Field Size (acres)	Planned Crop(s)	Fertilizer Analysis	Application Method	Material rate/acre	Total Material Applied	N (lbs/a)	P_2O_5 (lbs/a)	K_2O (lbs/a)

D. Recommended Manure Management Practices

Every time you apply manure you should review the following checklist to be sure conditions are favorable for manure applications. **These practices are required on permitted operations and operations that receive cost-share support through EQIP.**

- Know the proper manure source and application rate for each field.
- Keep good records, write down such things as operations performed, dates and times, actual rates, and weather conditions. This document provides record keeping forms.
- No surface application of manure if precipitation, likely to create runoff, is forecasted to occur within 24 hours of the planned application.
- No manure application on land with a slope greater than 20 percent.
- No surface application of manure to frozen, snow-covered or saturated soils.
- Manure applications shall comply with all manure application setbacks defined in the table below:

Manure application setback distances where manure should not be applied. For streams, lakes and wetlands the setback distance is measured from the defined edge of the water feature.

Setback Feature	Application Conditions	Setback Distance (feet)
Public or private drinking water well, drinking water lake or impoundment, or drinking water intake structure.	All applications	300
Other wells including un-plugged abandon wells	All applications	300
Public and privately owned lakes and impoundments not used as a water supply including impoundments with no outlet. Perennial streams, intermittent streams, canals, drainage ditches and wetlands. Tile line inlet (un-plugged during application).	Permanently vegetated setback	35
	Up-gradient, no or insufficient vegetated setback	100
	Down-gradient, no or insufficient vegetated setback	35
Losing streams, cave entrance, spring, or active sinkhole.	All applications	300
Non-owned occupied residence.	All applications	150
Public use area including non-owned businesses.	All applications	150
Public roads and property boundaries.	All applications	50

The following practices are recommended:

- Apply nutrients close to crop use to maximize nutrient uptake and reduce potential losses.
- Calibrate and maintain application equipment to apply accurate and uniform rates; all land application equipment should be calibrated at least annually.
- Avoid application when wind is blowing in the direction of neighbors or on weekends and holidays when people are more likely to be outdoors.

For liquid applications:

- Adjusting surface application rates to meet infiltration rate and water holding capacity of the soil.
- Irrigation systems should have automatic shut-off devices in case of pressure loss and/or an operator on-site at all times during operation to monitor application equipment.
- The perimeter of all fields receiving manure should be checked regularly during operation of land application equipment to confirm manure is not running off the field or entering waters of the state.

6/2015 - 5/2016 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602419P1300

Field Information

Total Acres:	14.4	Spreadable Acres:	12.2
Non-Spreadable Acres:	2.2	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Corn grain	122.099998474121 bu	100	75	80

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

No planned manure application.

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

6/2015 - 5/2016 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602419P4000

Field Information

Total Acres:	112.2	Spreadable Acres:	102.2
Non-Spreadable Acres:	10.0	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Corn grain	122.099998474121 bu	100	75	80

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Oct 2015			
Manure Source	GDU			
Application Rate	4,000 gal/a			
Acres Covered	61.8			
Total Applied	247,000 gal			
Loads per Field	38.0			
Placement	Injected			
N (lbs/acres)	154			
P_2O_5 (lbs/acre)	168			
K_2O (lbs/acre)	106			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

6/2015 - 5/2016 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602420P3400

Field Information

Total Acres:	30.9	Spreadable Acres:	29.3
Non-Spreadable Acres:	1.6	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Corn grain	122.099998474121 bu	100	65	85

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

No planned manure application.

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

6/2015 - 5/2016 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602420P4000

Field Information

Total Acres:	108.8	Spreadable Acres:	104.6
Non-Spreadable Acres:	4.2	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Soybeans	43.7999992370605 bu	0	45	110

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

No planned manure application.

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

6/2015 - 5/2016 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602421P3500B

Field Information

Total Acres:	25.2	Spreadable Acres:	21.6
Non-Spreadable Acres:	3.6	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Corn grain	122.099998474121 bu	100	85	85

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

No planned manure application.

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

6/2015 - 5/2016 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602421P3500C

Field Information

Total Acres:	19.8	Spreadable Acres:	18.7
Non-Spreadable Acres:	1.1	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Corn grain	122.099998474121 bu	100	85	85

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

No planned manure application.

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

6/2015 - 5/2016 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602429P8000B

Field Information

Total Acres:	98.7	Spreadable Acres:	94.7
Non-Spreadable Acres:	4.0	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Soybeans	43.7999992370605 bu	0	45	75

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Oct 2015			
Manure Source	Gestation			
Application Rate	5,800 gal/a			
Acres Covered	94.8			
Total Applied	549,900 gal			
Loads per Field	84.6			
Placement	Injected			
N (lbs/acres)	96			
P_2O_5 (lbs/acre)	145			
K_2O (lbs/acre)	206			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

6/2015 - 5/2016 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602429P8000C

Field Information

Total Acres:	24.1	Spreadable Acres:	21.7
Non-Spreadable Acres:	2.4	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Soybeans	43.7999992370605 bu	0	45	75

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Oct 2015			
Manure Source	Gestation			
Application Rate	5,800 gal/a			
Acres Covered	21.7			
Total Applied	126,100 gal			
Loads per Field	19.4			
Placement	Injected			
N (lbs/acres)	96			
P_2O_5 (lbs/acre)	145			
K_2O (lbs/acre)	206			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

6/2015 - 5/2016 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602429P8000D

Field Information

Total Acres:	297.5	Spreadable Acres:	284.0
Non-Spreadable Acres:	13.5	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Soybeans	43.7999992370605 bu	0	45	75

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1	Application 2		
Application Time	Oct 2015	Nov 2015		
Manure Source	Gestation	Gestation		
Application Rate	5,800 gal/a	5,800 gal/a		
Acres Covered	225.0	59.1		
Total Applied	1,305,200 gal	342,550 gal		
Loads per Field	200.8	52.7		
Placement	Injected	Injected		
N (lbs/acres)	96	96		
P_2O_5 (lbs/acre)	145	145		
K_2O (lbs/acre)	206	206		

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

6/2015 - 5/2016 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602430P1150B

Field Information

Total Acres:	6.0	Spreadable Acres:	4.9
Non-Spreadable Acres:	1.1	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Corn grain	122.099998474121 bu	100	80	0

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

No planned manure application.

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

6/2015 - 5/2016 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602430P1150C

Field Information

Total Acres:	6.9	Spreadable Acres:	6.0
Non-Spreadable Acres:	0.9	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Corn grain	122.099998474121 bu	100	80	0

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

No planned manure application.

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

6/2015 - 5/2016 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602430P1400

Field Information

Total Acres:	21.0	Spreadable Acres:	13.9
Non-Spreadable Acres:	7.1	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Corn grain	122.099998474121 bu	100	80	0

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

No planned manure application.

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

6/2015 - 5/2016 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602430P3400

Field Information

Total Acres:	20.8	Spreadable Acres:	14.8
Non-Spreadable Acres:	6.0	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Cool season grass pasture	2 ton	80	40	30

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

No planned manure application.

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

Crop Management

* Cool season grass pasture - For cool season grass pasture and bluegrass pasture split nitrogen applications between late spring after first grazing and mid August, applying 60% before the season of greatest need.

Summary Tables - 6/2015 - 5/2016

F. Manure Summary: 6/2015 - 5/2016

	Source 1	Source 2		
Source	Gestation	GDU		
Units	gals	gals		
Beginning of Year Inventory	0	0		
Inputs				
Production	4,558,000	502,000		
Imports - off farm	0	0		
Transfers - on farm	0	0		
Total Inputs	4,558,000	502,000		
Outputs				
Land Applied	2,323,750	247,000		
Exports - off farm	0	0		
Transfers - on farm	0	0		
Total Outputs	2,323,750	247,000		
End of Year Inventory	2,234,250	255,000		

G. Land Applied Nutrient Summary: 6/2015 - 5/2016

	Total Applied		PAN[1]	P_2O_5	K_2O
Manure Source	(tons or gals)		----------lbs----------		
Gestation	2,323,750	gals	38,458	58,087	82,524
GDU	247,000	gals	9,517	10,382	6,551
Manure Total			47,975	68,469	89,075
	Total Applied		**N**	**P_2O_5**	**K_2O**
Fertilizer Source	(lbs or gals)		----------lbs----------		
Fertilizer Total			0	0	0
Total			47,975	68,469	89,075

H. Lime Recommendations

These lime recommendations are one-time applications meant to be applied only once to adjust soil pH to its desired level. If you have already applied the recommended lime rate in a previous year of this plan please disregard these recommendations.

Lime Recommendations[1]

Field ID	Field SubID	Field Size	Test Year	NA[2]	pH	pH Rating	Mg (lbs/a)	Mg Rating	Lime Rec. lbs ENM/acre[3]	Mg Rec. lbs EMg/acre[4]
MO602419P1300		14.4	2012	6.9	5.8	Medium	302	High	1,780	0 [D]
MO602419P4000		112.2	2012	6.9	5.8	Medium	302	High	1,780	0 [D]
MO602420P3400		30.9	2012	7.0	6.1	High	384	High	1,370	0 [D]
MO602420P4000		108.8	2012	7.0	6.1	High	384	High	1,370	0 [D]
MO602421P3500B		25.2	2012	7.1	6.2	High	400	High	1,170	0 [D]
MO602421P3500C		19.8	2012	7.1	6.2	High	400	High	1,170	0 [D]
MO602429P8000B		98.7	2012	7.2	6.3	High	566	High	905	0 [D]
MO602429P8000C		24.1	2012	7.2	6.3	High	566	High	905	0 [D]
MO602429P8000D		297.5	2012	7.2	6.3	High	566	High	905	0 [D]
MO602430P1150B		6.0	2012	7.1	6.5	High	566	High	0	0
MO602430P1150C		6.9	2012	7.1	6.5	High	566	High	0	0
MO602430P1400		21.0	2012	7.1	6.5	High	566	High	0	0
MO602430P3400		20.8	2012	6.6	5.7	Medium	652	High	740	0 [D]

[1]These lime recommendations assume you used the University of Missouri soil testing laboratory, or comparable lab.
[2]NA = Neutralizable Acidity, units in meq/100g soil.
[3]ENM = Effective Neutralizing Material.
[4]EMg = Effective Magnesium.

[D] To determine limestone needed in tons/acre, divide your ENM requirement by the guarantee of your limestone dealer.

I. Crop Record Keeping Table: 6/2015 - 5/2016

Field ID	Field SubID	Crop	Planting Date	Hybrid or Variety	Seeding Rate	Harvest date(s)	Yield/A
MO602419P 1300		Corn grain					
MO602419P 4000		Corn grain					
MO602420P 3400		Corn grain					
MO602420P 4000		Soybeans					
MO602421P 3500B		Corn grain					
MO602421P 3500C		Corn grain					
MO602429P 8000B		Soybeans					
MO602429P 8000C		Soybeans					
MO602429P 8000D		Soybeans					
MO602430P 1150B		Corn grain					
MO602430P 1150C		Corn grain					
MO602430P 1400		Corn grain					
MO602430P 3400		Cool season grass pasture					

Document Source Information

Report based on information from Manure Management Planer (MMP 0.3.3.2)

Plan:

File:	S:\Manure ground\MMP P Index Plans\Trenton Farms RE, LLC\Original MMP 2015.mmp
Initialized:	11/6/2008
Last Saved:	3/31/2015 12:49:31 PM
Exported:	3/31/2015 12:58:54 PM
Title:	
Years in Plan:	5
Plan Start Year:	2015
Plan Start Month:	6

Operation:

Name:	Trenton Farms RE, LLC

Operation Contact:

Trenton Farms RE, LLC
SW State Highway W
Trenton MO 64683
507-825-7032 (office)
(home)

Missouri
Comprehensive Nutrient Management Plan
FARMER PLAN DOCUMENT

Operation Name: Trenton Farms RE, LLC

This plan is a summary of the key activities for one year of the nutrient management plan. The period of time covered by this plan is:
6/2016 - 5/2017

The objective of this document is to provide a concise list of the nutrient management activities on this operation for the year indicated. Activities covered by this plan include:

- Planned manure transfers and sales.
- Planned manure application dates and rates.
- Planned fertilizer application dates and rates.

Record keeping is an important part of nutrient management. Please use the space in this plan to record what actually occurred on each field.

Farm contact information: Trenton Farms RE, LLC
SW State Highway W
Trenton, MO 64683
507-825-7032 (office)

Whole Plan Period: June 2015 - May 2020

Contents

A. Manure Transfers - 6/2016 - 5/2017

Exports off the Farm: *(blank rows are for recording exports as they occur)*

Export Month	Export Year	Source of Manure	Target Export Amount	Units	Receiving Operation	Notes

Imports onto the Farm: *(blank rows are for recording imports as they occur)*

Import Month	Import Year	Source of Manure	Animal Type	Target Import Amount	Units	Notes

Internal Transfers of Manure: *(blank rows are for recording transfers as they occur)*

Transfer Month	Transfer Year	Source of Manure	Manure Destination	Target Transfer Amount	Units	Notes

B. Planned Manure Applications - 6/2016 - 5/2017

Month and Year	Field ID	Field SubID	Planned Crop(s)	Source	Application Equipment	Acres Covered	Application Rate	Units per acre	Total Applied
Jun 2016	MO602430P 3400		Cool season grass pasture	Gestation	Injector Tank	14.9	4,900	Gal	72,800
Oct 2016	MO602419P 1300		Soybeans	GDU	Injector Tank	12.3	2,600	Gal	31,850
Oct 2016	MO602419P 4000		Soybeans	GDU	Injector Tank	102.4	2,400	Gal	245,700
Oct 2016	MO602420P 3400		Soybeans	GDU	Injector Tank	29.5	2,600	Gal	76,700
Oct 2016	MO602420P 4000		Corn grain	Gestation	Injector Tank	75.6	9,300	Gal	703,300
Oct 2016	MO602421P 3500C		Soybeans	Gestation	Injector Tank	18.8	6,100	Gal	114,400
Oct 2016	MO602429P 8000B		Corn grain	Gestation	Injector Tank	94.8	8,300	Gal	786,500
Oct 2016	MO602429P 8000C		Corn grain	Gestation	Injector Tank	21.8	8,300	Gal	180,700
Oct 2016	MO602429P 8000D		Corn grain	Gestation	Injector Tank	284.0	8,300	Gal	2,357,550
Oct 2016	MO602430P 1150B		Soybeans	GDU	Injector Tank	5.0	2,600	Gal	13,000
Oct 2016	MO602430P 1150C		Soybeans	GDU	Injector Tank	6.0	2,600	Gal	15,600
Oct 2016	MO602430P 1400		Soybeans	GDU	Injector Tank	14.0	2,600	Gal	36,400
Nov 2016	MO602420P 4000		Corn grain	Gestation	Injector Tank	29.0	9,300	Gal	269,750
Nov 2016	MO602421P 3500B		Soybeans	Gestation	Injector Tank	20.7	6,100	Gal	126,100

Manure Application Records - 6/2016 - 5/2017

App #	Date	Field ID	Field SubID	Manure Source	Application Equipment	Actual Rate	Actual Loads	Total Applied	Acres Covered
1									
2									
3									
4									
5									
6									
7									

Manure Application Records - 6/2016 - 5/2017 (continued)

App #	Applicator's Name	[1]Soil Condition	[2]Ground Cover	[3]Days to Incorporate	Air Temp	Wind Speed	Wind Direction	[4]Rain Before	[5]Rain After	[6]Weather
1										
2										
3										
4										
5										
6										
7										

1. Soil condition at time of operations: Dry, Firm, Wet, Muddy, Snow-Covered, Frozen.
2. Percent residue or ground cover at time of application.
3. Number of days to incorporate manure after application: Use "N1" for no incorporation.
4. Amount of rainfall during the 24 hours prior to application.
5. Amount of rainfall during the 24 hours after application.
6. Weather condition at time of application: Sunny, Partly Cloudy, Cloudy, Rain, Snow.

Manure Application Records - 6/2016 - 5/2017

App #	Date	Field ID	Field SubID	Manure Source	Application Equipment	Actual Rate	Actual Loads	Total Applied	Acres Covered
8									
9									
10									
11									
12									
13									
14									

Manure Application Records - 6/2016 - 5/2017 (continued)

App #	Applicator's Name	[1]Soil Condition	[2]Ground Cover	[3]Days to Incorporate	Air Temp	Wind Speed	Wind Direction	[4]Rain Before	[5]Rain After	[6]Weather
8										
9										
10										
11										
12										
13										
14										

1. Soil condition at time of operations: Dry, Firm, Wet, Muddy, Snow-Covered, Frozen.
2. Percent residue or ground cover at time of application.
3. Number of days to incorporate manure after application: Use "N1" for no incorporation.
4. Amount of rainfall during the 24 hours prior to application.
5. Amount of rainfall during the 24 hours after application.
6. Weather condition at time of application: Sunny, Partly Cloudy, Cloudy, Rain, Snow.

C. Planned Commercial Fertilizer Applications - 6/2016 - 5/2017

No planned commercial fertilizer applications for the period.

Commercial Fertilizer Application Records - 6/2016 - 5/2017

Month and Year	Field ID	Field SubID	Field Size (acres)	Planned Crop(s)	Fertilizer Analysis	Application Method	Material rate/acre	Total Material Applied	N (lbs/a)	P_2O_5 (lbs/a)	K_2O (lbs/a)

D. Recommended Manure Management Practices

Every time you apply manure you should review the following checklist to be sure conditions are favorable for manure applications. **These practices are required on permitted operations and operations that receive cost-share support through EQIP.**

- Know the proper manure source and application rate for each field.
- Keep good records, write down such things as operations performed, dates and times, actual rates, and weather conditions. This document provides record keeping forms.
- No surface application of manure if precipitation, likely to create runoff, is forecasted to occur within 24 hours of the planned application.
- No manure application on land with a slope greater than 20 percent.
- No surface application of manure to frozen, snow-covered or saturated soils.
- Manure applications shall comply with all manure application setbacks defined in the table below:

Manure application setback distances where manure should not be applied. For streams, lakes and wetlands the setback distance is measured from the defined edge of the water feature.

Setback Feature	Application Conditions	Setback Distance (feet)
Public or private drinking water well, drinking water lake or impoundment, or drinking water intake structure.	All applications	300
Other wells including un-plugged abandon wells	All applications	300
Public and privately owned lakes and impoundments not used as a water supply including impoundments with no outlet. Perennial streams, intermittent streams, canals, drainage ditches and wetlands. Tile line inlet (un-plugged during application).	Permanently vegetated setback	35
	Up-gradient, no or insufficient vegetated setback	100
	Down-gradient, no or insufficient vegetated setback	35
Losing streams, cave entrance, spring, or active sinkhole.	All applications	300
Non-owned occupied residence.	All applications	150
Public use area including non-owned businesses.	All applications	150
Public roads and property boundaries.	All applications	50

The following practices are recommended:

- Apply nutrients close to crop use to maximize nutrient uptake and reduce potential losses.
- Calibrate and maintain application equipment to apply accurate and uniform rates; all land application equipment should be calibrated at least annually.
- Avoid application when wind is blowing in the direction of neighbors or on weekends and holidays when people are more likely to be outdoors.

For liquid applications:

- Adjusting surface application rates to meet infiltration rate and water holding capacity of the soil.
- Irrigation systems should have automatic shut-off devices in case of pressure loss and/or an operator on-site at all times during operation to monitor application equipment.
- The perimeter of all fields receiving manure should be checked regularly during operation of land application equipment to confirm manure is not running off the field or entering waters of the state.

6/2016 - 5/2017 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602419P1300

Field Information

Total Acres:	14.4	Spreadable Acres:	12.2
Non-Spreadable Acres:	2.2	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Soybeans	43.7999992370605 bu	0	60	105

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Oct 2016			
Manure Source	GDU			
Application Rate	2,600 gal/a			
Acres Covered	12.3			
Total Applied	31,850 gal			
Loads per Field	4.9			
Placement	Injected			
N (lbs/acres)	100			
P_2O_5 (lbs/acre)	109			
K_2O (lbs/acre)	69			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

6/2016 - 5/2017 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602419P4000

Field Information

Total Acres:	112.2	Spreadable Acres:	102.2
Non-Spreadable Acres:	10.0	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Soybeans	43.7999992370605 bu	0	60	105

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Oct 2016			
Manure Source	GDU			
Application Rate	2,400 gal/a			
Acres Covered	102.4			
Total Applied	245,700 gal			
Loads per Field	37.8			
Placement	Injected			
N (lbs/acres)	92			
P_2O_5 (lbs/acre)	101			
K_2O (lbs/acre)	63			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

6/2016 - 5/2017 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602420P3400

Field Information

Total Acres:	30.9	Spreadable Acres:	29.3
Non-Spreadable Acres:	1.6	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Soybeans	43.7999992370605 bu	0	45	110

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Oct 2016			
Manure Source	GDU			
Application Rate	2,600 gal/a			
Acres Covered	29.5			
Total Applied	76,700 gal			
Loads per Field	11.8			
Placement	Injected			
N (lbs/acres)	100			
P_2O_5 (lbs/acre)	109			
K_2O (lbs/acre)	69			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

6/2016 - 5/2017 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602420P4000

Field Information

Total Acres:	108.8	Spreadable Acres:	104.6
Non-Spreadable Acres:	4.2	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Corn grain	122.099998474121 bu	100	65	85

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1	Application 2		
Application Time	Oct 2016	Nov 2016		
Manure Source	Gestation	Gestation		
Application Rate	9,300 gal/a	9,300 gal/a		
Acres Covered	75.6	29.0		
Total Applied	703,300 gal	269,750 gal		
Loads per Field	108.2	41.5		
Placement	Injected	Injected		
N (lbs/acres)	153	153		
P_2O_5 (lbs/acre)	233	233		
K_2O (lbs/acre)	330	330		

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

Crop Management

* Nitrogen Credit: Nitrogen requirements have been reduced by 30 pounds per acre for this corn crop as it follows soybeans.

6/2016 - 5/2017 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602421P3500B

Field Information

Total Acres:	25.2	Spreadable Acres:	21.6
Non-Spreadable Acres:	3.6	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Soybeans	43.7999992370605 bu	0	65	115

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Nov 2016			
Manure Source	Gestation			
Application Rate	6,100 gal/a			
Acres Covered	20.7			
Total Applied	126,100 gal			
Loads per Field	19.4			
Placement	Injected			
N (lbs/acres)	101			
P_2O_5 (lbs/acre)	153			
K_2O (lbs/acre)	217			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

6/2016 - 5/2017 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602421P3500C

Field Information

Total Acres:	19.8	Spreadable Acres:	18.7
Non-Spreadable Acres:	1.1	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Soybeans	43.7999992370605 bu	0	65	115

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Oct 2016			
Manure Source	Gestation			
Application Rate	6,100 gal/a			
Acres Covered	18.8			
Total Applied	114,400 gal			
Loads per Field	17.6			
Placement	Injected			
N (lbs/acres)	101			
P_2O_5 (lbs/acre)	153			
K_2O (lbs/acre)	217			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

6/2016 - 5/2017 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602429P8000B

Field Information

Total Acres:	98.7	Spreadable Acres:	94.7
Non-Spreadable Acres:	4.0	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Corn grain	122.099998474121 bu	95	65	45

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Oct 2016			
Manure Source	Gestation			
Application Rate	8,300 gal/a			
Acres Covered	94.8			
Total Applied	786,500 gal			
Loads per Field	121.0			
Placement	Injected			
N (lbs/acres)	137			
P_2O_5 (lbs/acre)	208			
K_2O (lbs/acre)	295			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

Crop Management

* Nitrogen Credit: Nitrogen requirements have been reduced by 30 pounds per acre for this corn crop as it follows soybeans.

6/2016 - 5/2017 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602429P8000C

Field Information

Total Acres:	24.1	Spreadable Acres:	21.7
Non-Spreadable Acres:	2.4	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Corn grain	122.099998474121 bu	95	65	45

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Oct 2016			
Manure Source	Gestation			
Application Rate	8,300 gal/a			
Acres Covered	21.8			
Total Applied	180,700 gal			
Loads per Field	27.8			
Placement	Injected			
N (lbs/acres)	137			
P_2O_5 (lbs/acre)	208			
K_2O (lbs/acre)	295			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

Crop Management

* Nitrogen Credit: Nitrogen requirements have been reduced by 30 pounds per acre for this corn crop as it follows soybeans.

6/2016 - 5/2017 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602429P8000D

Field Information

Total Acres:	297.5	Spreadable Acres:	284.0
Non-Spreadable Acres:	13.5	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Corn grain	122.099998474121 bu	95	65	45

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Oct 2016			
Manure Source	Gestation			
Application Rate	8,300 gal/a			
Acres Covered	284.0			
Total Applied	2,357,550 gal			
Loads per Field	362.7			
Placement	Injected			
N (lbs/acres)	137			
P_2O_5 (lbs/acre)	208			
K_2O (lbs/acre)	295			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

Crop Management

* Nitrogen Credit: Nitrogen requirements have been reduced by 30 pounds per acre for this corn crop as it follows soybeans.

6/2016 - 5/2017 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602430P1150B

Field Information

Total Acres:	6.0	Spreadable Acres:	4.9
Non-Spreadable Acres:	1.1	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Soybeans	43.7999992370605 bu	0	60	0

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Oct 2016			
Manure Source	GDU			
Application Rate	2,600 gal/a			
Acres Covered	5.0			
Total Applied	13,000 gal			
Loads per Field	2.0			
Placement	Injected			
N (lbs/acres)	100			
P_2O_5 (lbs/acre)	109			
K_2O (lbs/acre)	69			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

6/2016 - 5/2017 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602430P1150C

Field Information

Total Acres:	6.9	Spreadable Acres:	6.0
Non-Spreadable Acres:	0.9	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Soybeans	43.7999992370605 bu	0	60	0

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Oct 2016			
Manure Source	GDU			
Application Rate	2,600 gal/a			
Acres Covered	6.0			
Total Applied	15,600 gal			
Loads per Field	2.4			
Placement	Injected			
N (lbs/acres)	100			
P_2O_5 (lbs/acre)	109			
K_2O (lbs/acre)	69			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

6/2016 - 5/2017 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602430P1400

Field Information

Total Acres:	21.0	Spreadable Acres:	13.9
Non-Spreadable Acres:	7.1	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Soybeans	43.7999992370605 bu	0	60	0

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Oct 2016			
Manure Source	GDU			
Application Rate	2,600 gal/a			
Acres Covered	14.0			
Total Applied	36,400 gal			
Loads per Field	5.6			
Placement	Injected			
N (lbs/acres)	100			
P_2O_5 (lbs/acre)	109			
K_2O (lbs/acre)	69			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

6/2016 - 5/2017 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602430P3400

Field Information

Total Acres:	20.8	Spreadable Acres:	14.8
Non-Spreadable Acres:	6.0	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Cool season grass pasture	2 ton	80	40	30

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Jun 2016			
Manure Source	Gestation			
Application Rate	4,900 gal/a			
Acres Covered	14.9			
Total Applied	72,800 gal			
Loads per Field	11.2			
Placement	Injected			
N (lbs/acres)	81			
P_2O_5 (lbs/acre)	123			
K_2O (lbs/acre)	174			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

Crop Management

* Cool season grass pasture - For cool season grass pasture and bluegrass pasture split nitrogen applications between late spring after first grazing and mid August, applying 60% before the season of greatest need.

Summary Tables - 6/2016 - 5/2017

F. Manure Summary: 6/2016 - 5/2017

	Source 1	Source 2		
Source	Gestation	GDU		
Units	gals	gals		
Beginning of Year Inventory	2,234,250	255,000		
Inputs				
Production	4,558,000	502,000		
Imports - off farm	0	0		
Transfers - on farm	0	0		
Total Inputs	4,558,000	502,000		
Outputs				
Land Applied	4,611,100	419,250		
Exports - off farm	0	0		
Transfers - on farm	0	0		
Total Outputs	4,611,100	419,250		
End of Year Inventory	2,181,150	337,750		

G. Land Applied Nutrient Summary: 6/2016 - 5/2017

	Total Applied		PAN[1]	P_2O_5	K_2O
Manure Source	(tons or gals)		----------lbs----------		
Gestation	4,611,100	gals	76,084	115,572	163,860
GDU	419,250	gals	16,101	17,624	11,061
Manure Total			92,185	133,196	174,921
	Total Applied		**N**	**P_2O_5**	**K_2O**
Fertilizer Source	(lbs or gals)		----------lbs----------		
Fertilizer Total			0	0	0
Total			92,185	133,196	174,921

H. Lime Recommendations

These lime recommendations are one-time applications meant to be applied only once to adjust soil pH to its desired level. If you have already applied the recommended lime rate in a previous year of this plan please disregard these recommendations.

Lime Recommendations[1]

Field ID	Field SubID	Field Size	Test Year	NA[2]	pH	pH Rating	Mg (lbs/a)	Mg Rating	Lime Rec. lbs ENM/acre[3]	Mg Rec. lbs EMg/acre[4]
MO602419P1300		14.4	2012	6.9	5.8	Medium	302	High	1,780	0 [D]
MO602419P4000		112.2	2012	6.9	5.8	Medium	302	High	1,780	0 [D]
MO602420P3400		30.9	2012	7.0	6.1	High	384	High	1,370	0 [D]
MO602420P4000		108.8	2012	7.0	6.1	High	384	High	1,370	0 [D]
MO602421P3500B		25.2	2012	7.1	6.2	High	400	High	1,170	0 [D]
MO602421P3500C		19.8	2012	7.1	6.2	High	400	High	1,170	0 [D]
MO602429P8000B		98.7	2012	7.2	6.3	High	566	High	905	0 [D]
MO602429P8000C		24.1	2012	7.2	6.3	High	566	High	905	0 [D]
MO602429P8000D		297.5	2012	7.2	6.3	High	566	High	905	0 [D]
MO602430P1150B		6.0	2012	7.1	6.5	High	566	High	0	0
MO602430P1150C		6.9	2012	7.1	6.5	High	566	High	0	0
MO602430P1400		21.0	2012	7.1	6.5	High	566	High	0	0
MO602430P3400		20.8	2012	6.6	5.7	Medium	652	High	740	0 [D]

[1]These lime recommendations assume you used the University of Missouri soil testing laboratory, or comparable lab.
[2]NA = Neutralizable Acidity, units in meq/100g soil.
[3]ENM = Effective Neutralizing Material.
[4]EMg = Effective Magnesium.

[D] To determine limestone needed in tons/acre, divide your ENM requirement by the guarantee of your limestone dealer.

I. Crop Record Keeping Table: 6/2016 - 5/2017

Field ID	Field SubID	Crop	Planting Date	Hybrid or Variety	Seeding Rate	Harvest date(s)	Yield/A
MO602419P 1300		Soybeans					
MO602419P 4000		Soybeans					
MO602420P 3400		Soybeans					
MO602420P 4000		Corn grain					
MO602421P 3500B		Soybeans					
MO602421P 3500C		Soybeans					
MO602429P 8000B		Corn grain					
MO602429P 8000C		Corn grain					
MO602429P 8000D		Corn grain					
MO602430P 1150B		Soybeans					
MO602430P 1150C		Soybeans					
MO602430P 1400		Soybeans					
MO602430P 3400		Cool season grass pasture					

Document Source Information

Report based on information from Manure Management Planer (MMP 0.3.3.2)

Plan:

File:	S:\Manure ground\MMP P Index Plans\Trenton Farms RE, LLC\Original MMP 2015.mmp
Initialized:	11/6/2008
Last Saved:	3/31/2015 12:49:31 PM
Exported:	3/31/2015 12:58:54 PM
Title:	
Years in Plan:	5
Plan Start Year:	2015
Plan Start Month:	6

Operation:

Name:	Trenton Farms RE, LLC

Operation Contact:

Trenton Farms RE, LLC
SW State Highway W
Trenton MO 64683
507-825-7032 (office)
(home)

Missouri
Comprehensive Nutrient Management Plan
FARMER PLAN DOCUMENT

Operation Name: Trenton Farms RE, LLC

This plan is a summary of the key activities for one year of the nutrient management plan. The period of time covered by this plan is:
6/2017 - 5/2018

The objective of this document is to provide a concise list of the nutrient management activities on this operation for the year indicated. Activities covered by this plan include:

- Planned manure transfers and sales.
- Planned manure application dates and rates.
- Planned fertilizer application dates and rates.

Record keeping is an important part of nutrient management. Please use the space in this plan to record what actually occurred on each field.

Farm contact information: Trenton Farms RE, LLC
SW State Highway W
Trenton, MO 64683
507-825-7032 (office)

Whole Plan Period: June 2015 - May 2020

Contents

A. Manure Transfers - 6/2017 - 5/2018

Exports off the Farm: *(blank rows are for recording exports as they occur)*

Export Month	Export Year	Source of Manure	Target Export Amount	Units	Receiving Operation	Notes

Imports onto the Farm: *(blank rows are for recording imports as they occur)*

Import Month	Import Year	Source of Manure	Animal Type	Target Import Amount	Units	Notes

Internal Transfers of Manure: *(blank rows are for recording transfers as they occur)*

Transfer Month	Transfer Year	Source of Manure	Manure Destination	Target Transfer Amount	Units	Notes

B. Planned Manure Applications - 6/2017 - 5/2018

Month and Year	Field ID	Field SubID	Planned Crop(s)	Source	Application Equipment	Acres Covered	Application Rate	Units per acre	Total Applied
Sep 2017	MO602430P 1150B		Corn grain	GDU	Injector Tank	5.0	3,800	Gal	18,850
Oct 2017	MO602419P 1300		Corn grain	GDU	Injector Tank	12.3	3,800	Gal	46,800
Oct 2017	MO602419P 4000		Corn grain	GDU	Injector Tank	102.3	3,800	Gal	388,700
Oct 2017	MO602420P 3400		Corn grain	Gestation	Injector Tank	29.4	9,300	Gal	273,000
Oct 2017	MO602420P 4000		Soybeans	Gestation	Injector Tank	104.6	6,100	Gal	638,300
Oct 2017	MO602421P 3500B		Corn grain	Gestation	Injector Tank	21.7	9,300	Gal	201,500
Oct 2017	MO602421P 3500C		Corn grain	Gestation	Injector Tank	18.7	9,300	Gal	174,200
Oct 2017	MO602429P 8000B		Soybeans	Gestation	Injector Tank	94.8	4,300	Gal	407,550
Oct 2017	MO602429P 8000C		Soybeans	Gestation	Injector Tank	21.8	4,300	Gal	93,600
Oct 2017	MO602429P 8000D		Soybeans	Gestation	Injector Tank	284.0	4,300	Gal	1,221,350
Oct 2017	MO602430P 1150C		Corn grain	GDU	Injector Tank	6.2	3,800	Gal	23,400
Oct 2017	MO602430P 1400		Corn grain	GDU	Injector Tank	14.0	3,800	Gal	53,300

Manure Application Records - 6/2017 - 5/2018

App #	Date	Field ID	Field SubID	Manure Source	Application Equipment	Actual Rate	Actual Loads	Total Applied	Acres Covered
1									
2									
3									
4									
5									
6									
7									

Manure Application Records - 6/2017 - 5/2018 (continued)

App #	Applicator's Name	[1]Soil Condition	[2]Ground Cover	[3]Days to Incorporate	Air Temp	Wind Speed	Wind Direction	[4]Rain Before	[5]Rain After	[6]Weather
1										
2										
3										
4										
5										
6										
7										

1. Soil condition at time of operations: Dry, Firm, Wet, Muddy, Snow-Covered, Frozen.
2. Percent residue or ground cover at time of application.
3. Number of days to incorporate manure after application: Use "N1" for no incorporation.
4. Amount of rainfall during the 24 hours prior to application.
5. Amount of rainfall during the 24 hours after application.
6. Weather condition at time of application: Sunny, Partly Cloudy, Cloudy, Rain, Snow.

Manure Application Records - 6/2017 - 5/2018

App #	Date	Field ID	Field SubID	Manure Source	Application Equipment	Actual Rate	Actual Loads	Total Applied	Acres Covered
8									
9									
10									
11									
12									
13									
14									

Manure Application Records - 6/2017 - 5/2018 (continued)

App #	Applicator's Name	[1]Soil Condition	[2]Ground Cover	[3]Days to Incorporate	Air Temp	Wind Speed	Wind Direction	[4]Rain Before	[5]Rain After	[6]Weather
8										
9										
10										
11										
12										
13										
14										

1. Soil condition at time of operations: Dry, Firm, Wet, Muddy, Snow-Covered, Frozen.
2. Percent residue or ground cover at time of application.
3. Number of days to incorporate manure after application: Use "N1" for no incorporation.
4. Amount of rainfall during the 24 hours prior to application.
5. Amount of rainfall during the 24 hours after application.
6. Weather condition at time of application: Sunny, Partly Cloudy, Cloudy, Rain, Snow.

C. Planned Commercial Fertilizer Applications - 6/2017 - 5/2018

No planned commercial fertilizer applications for the period.

Commercial Fertilizer Application Records - 6/2017 - 5/2018

Month and Year	Field ID	Field SubID	Field Size (acres)	Planned Crop(s)	Fertilizer Analysis	Application Method	Material rate/acre	Total Material Applied	N (lbs/a)	P_2O_5 (lbs/a)	K_2O (lbs/a)

D. Recommended Manure Management Practices

Every time you apply manure you should review the following checklist to be sure conditions are favorable for manure applications. **These practices are required on permitted operations and operations that receive cost-share support through EQIP.**

- Know the proper manure source and application rate for each field.
- Keep good records, write down such things as operations performed, dates and times, actual rates, and weather conditions. This document provides record keeping forms.
- No surface application of manure if precipitation, likely to create runoff, is forecasted to occur within 24 hours of the planned application.
- No manure application on land with a slope greater than 20 percent.
- No surface application of manure to frozen, snow-covered or saturated soils.
- Manure applications shall comply with all manure application setbacks defined in the table below:

Manure application setback distances where manure should not be applied. For streams, lakes and wetlands the setback distance is measured from the defined edge of the water feature.

Setback Feature	Application Conditions	Setback Distance (feet)
Public or private drinking water well, drinking water lake or impoundment, or drinking water intake structure.	All applications	300
Other wells including un-plugged abandon wells	All applications	300
Public and privately owned lakes and impoundments not used as a water supply including impoundments with no outlet. Perennial streams, intermittent streams, canals, drainage ditches and wetlands. Tile line inlet (un-plugged during application).	Permanently vegetated setback	35
	Up-gradient, no or insufficient vegetated setback	100
	Down-gradient, no or insufficient vegetated setback	35
Losing streams, cave entrance, spring, or active sinkhole.	All applications	300
Non-owned occupied residence.	All applications	150
Public use area including non-owned businesses.	All applications	150
Public roads and property boundaries.	All applications	50

The following practices are recommended:

- Apply nutrients close to crop use to maximize nutrient uptake and reduce potential losses.
- Calibrate and maintain application equipment to apply accurate and uniform rates; all land application equipment should be calibrated at least annually.
- Avoid application when wind is blowing in the direction of neighbors or on weekends and holidays when people are more likely to be outdoors.

For liquid applications:

- Adjusting surface application rates to meet infiltration rate and water holding capacity of the soil.
- Irrigation systems should have automatic shut-off devices in case of pressure loss and/or an operator on-site at all times during operation to monitor application equipment.
- The perimeter of all fields receiving manure should be checked regularly during operation of land application equipment to confirm manure is not running off the field or entering waters of the state.

6/2017 - 5/2018 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602419P1300

Field Information

Total Acres:	14.4	Spreadable Acres:	12.2
Non-Spreadable Acres:	2.2	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Corn grain	122.099998474121 bu	100	75	80

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Oct 2017			
Manure Source	GDU			
Application Rate	3,800 gal/a			
Acres Covered	12.3			
Total Applied	46,800 gal			
Loads per Field	7.2			
Placement	Injected			
N (lbs/acres)	146			
P_2O_5 (lbs/acre)	160			
K_2O (lbs/acre)	100			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

Crop Management

* Nitrogen Credit: Nitrogen requirements have been reduced by 30 pounds per acre for this corn crop as it follows soybeans.

6/2017 - 5/2018 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602419P4000

Field Information

Total Acres:	112.2	Spreadable Acres:	102.2
Non-Spreadable Acres:	10.0	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_20
Corn grain	122.099998474121 bu	100	75	80

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Oct 2017			
Manure Source	GDU			
Application Rate	3,800 gal/a			
Acres Covered	102.3			
Total Applied	388,700 gal			
Loads per Field	59.8			
Placement	Injected			
N (lbs/acres)	146			
P_2O_5 (lbs/acre)	160			
K_2O (lbs/acre)	100			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

Crop Management

* Nitrogen Credit: Nitrogen requirements have been reduced by 30 pounds per acre for this corn crop as it follows soybeans.

6/2017 - 5/2018 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602420P3400

Field Information

Total Acres:	30.9	Spreadable Acres:	29.3
Non-Spreadable Acres:	1.6	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_20
Corn grain	122.099998474121 bu	100	65	85

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Oct 2017			
Manure Source	Gestation			
Application Rate	9,300 gal/a			
Acres Covered	29.4			
Total Applied	273,000 gal			
Loads per Field	42.0			
Placement	Injected			
N (lbs/acres)	153			
P_2O_5 (lbs/acre)	233			
K_2O (lbs/acre)	330			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

Crop Management

* Nitrogen Credit: Nitrogen requirements have been reduced by 30 pounds per acre for this corn crop as it follows soybeans.

6/2017 - 5/2018 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602420P4000

Field Information

Total Acres:	108.8	Spreadable Acres:	104.6
Non-Spreadable Acres:	4.2	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Soybeans	43.7999992370605 bu	0	45	110

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Oct 2017			
Manure Source	Gestation			
Application Rate	6,100 gal/a			
Acres Covered	104.6			
Total Applied	638,300 gal			
Loads per Field	98.2			
Placement	Injected			
N (lbs/acres)	101			
P_2O_5 (lbs/acre)	153			
K_2O (lbs/acre)	217			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

6/2017 - 5/2018 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602421P3500B

Field Information

Total Acres:	25.2	Spreadable Acres:	21.6
Non-Spreadable Acres:	3.6	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_20
Corn grain	122.099998474121 bu	100	85	85

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Oct 2017			
Manure Source	Gestation			
Application Rate	9,300 gal/a			
Acres Covered	21.7			
Total Applied	201,500 gal			
Loads per Field	31.0			
Placement	Injected			
N (lbs/acres)	153			
P_2O_5 (lbs/acre)	233			
K_2O (lbs/acre)	330			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

Crop Management

* Nitrogen Credit: Nitrogen requirements have been reduced by 30 pounds per acre for this corn crop as it follows soybeans.

6/2017 - 5/2018 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602421P3500C

Field Information

Total Acres:	19.8	Spreadable Acres:	18.7
Non-Spreadable Acres:	1.1	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_20
Corn grain	122.099998474121 bu	100	85	85

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Oct 2017			
Manure Source	Gestation			
Application Rate	9,300 gal/a			
Acres Covered	18.7			
Total Applied	174,200 gal			
Loads per Field	26.8			
Placement	Injected			
N (lbs/acres)	153			
P_2O_5 (lbs/acre)	233			
K_2O (lbs/acre)	330			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

Crop Management

* Nitrogen Credit: Nitrogen requirements have been reduced by 30 pounds per acre for this corn crop as it follows soybeans.

6/2017 - 5/2018 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602429P8000B

Field Information

Total Acres:	98.7	Spreadable Acres:	94.7
Non-Spreadable Acres:	4.0	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Soybeans	43.7999992370605 bu	0	45	75

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Oct 2017			
Manure Source	Gestation			
Application Rate	4,300 gal/a			
Acres Covered	94.8			
Total Applied	407,550 gal			
Loads per Field	62.7			
Placement	Injected			
N (lbs/acres)	71			
P_2O_5 (lbs/acre)	108			
K_2O (lbs/acre)	153			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

6/2017 - 5/2018 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602429P8000C

Field Information

Total Acres:	24.1	Spreadable Acres:	21.7
Non-Spreadable Acres:	2.4	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_20
Soybeans	43.7999992370605 bu	0	45	75

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Oct 2017			
Manure Source	Gestation			
Application Rate	4,300 gal/a			
Acres Covered	21.8			
Total Applied	93,600 gal			
Loads per Field	14.4			
Placement	Injected			
N (lbs/acres)	71			
P_2O_5 (lbs/acre)	108			
K_2O (lbs/acre)	153			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

6/2017 - 5/2018 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602429P8000D

Field Information

Total Acres:	297.5	Spreadable Acres:	284.0
Non-Spreadable Acres:	13.5	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_20
Soybeans	43.7999992370605 bu	0	45	75

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Oct 2017			
Manure Source	Gestation			
Application Rate	4,300 gal/a			
Acres Covered	284.0			
Total Applied	1,221,350 gal			
Loads per Field	187.9			
Placement	Injected			
N (lbs/acres)	71			
P_2O_5 (lbs/acre)	108			
K_2O (lbs/acre)	153			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

6/2017 - 5/2018 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602430P1150B

Field Information

Total Acres:	6.0	Spreadable Acres:	4.9
Non-Spreadable Acres:	1.1	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Corn grain	122.099998474121 bu	100	80	0

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Sep 2017			
Manure Source	GDU			
Application Rate	3,800 gal/a			
Acres Covered	5.0			
Total Applied	18,850 gal			
Loads per Field	2.9			
Placement	Injected			
N (lbs/acres)	146			
P_2O_5 (lbs/acre)	160			
K_2O (lbs/acre)	100			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

Crop Management

* Nitrogen Credit: Nitrogen requirements have been reduced by 30 pounds per acre for this corn crop as it follows soybeans.

6/2017 - 5/2018 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602430P1150C

Field Information

Total Acres:	6.9	Spreadable Acres:	6.0
Non-Spreadable Acres:	0.9	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Corn grain	122.099998474121 bu	100	80	0

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Oct 2017			
Manure Source	GDU			
Application Rate	3,800 gal/a			
Acres Covered	6.2			
Total Applied	23,400 gal			
Loads per Field	3.6			
Placement	Injected			
N (lbs/acres)	146			
P_2O_5 (lbs/acre)	160			
K_2O (lbs/acre)	100			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

Crop Management

* Nitrogen Credit: Nitrogen requirements have been reduced by 30 pounds per acre for this corn crop as it follows soybeans.

6/2017 - 5/2018 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602430P1400

Field Information

Total Acres:	21.0	Spreadable Acres:	13.9
Non-Spreadable Acres:	7.1	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_20
Corn grain	122.099998474121 bu	100	80	0

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Oct 2017			
Manure Source	GDU			
Application Rate	3,800 gal/a			
Acres Covered	14.0			
Total Applied	53,300 gal			
Loads per Field	8.2			
Placement	Injected			
N (lbs/acres)	146			
P_2O_5 (lbs/acre)	160			
K_2O (lbs/acre)	100			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

Crop Management

* Nitrogen Credit: Nitrogen requirements have been reduced by 30 pounds per acre for this corn crop as it follows soybeans.

6/2017 - 5/2018 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602430P3400

Field Information

Total Acres:	20.8	Spreadable Acres:	14.8
Non-Spreadable Acres:	6.0	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_20
Cool season grass pasture	2 ton	80	40	30

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

No planned manure application.

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

Crop Management

* Cool season grass pasture - For cool season grass pasture and bluegrass pasture split nitrogen applications between late spring after first grazing and mid August, applying 60% before the season of greatest need.

Summary Tables - 6/2017 - 5/2018

F. Manure Summary: 6/2017 - 5/2018

	Source 1	Source 2		
Source	Gestation	GDU		
Units	gals	gals		
Beginning of Year Inventory	2,181,150	337,750		
Inputs				
Production	4,558,000	502,000		
Imports - off farm	0	0		
Transfers - on farm	0	0		
Total Inputs	4,558,000	502,000		
Outputs				
Land Applied	3,009,500	531,050		
Exports - off farm	0	0		
Transfers - on farm	0	0		
Total Outputs	3,009,500	531,050		
End of Year Inventory	3,729,650	308,700		

G. Land Applied Nutrient Summary: 6/2017 - 5/2018

	Total Applied		PAN[1]	P_2O_5	K_2O
Manure Source	(tons or gals)		----------lbs----------		
Gestation	3,009,500	gals	49,687	75,531	107,023
GDU	531,050	gals	20,411	22,368	13,980
Manure Total			70,098	97,899	121,003
	Total Applied		**N**	**P_2O_5**	**K_2O**
Fertilizer Source	(lbs or gals)		----------lbs----------		
Fertilizer Total			0	0	0
Total			70,098	97,899	121,003

H. Lime Recommendations

These lime recommendations are one-time applications meant to be applied only once to adjust soil pH to its desired level. If you have already applied the recommended lime rate in a previous year of this plan please disregard these recommendations.

Lime Recommendations[1]

Field ID	Field SubID	Field Size	Test Year	NA[2]	pH	pH Rating	Mg (lbs/a)	Mg Rating	Lime Rec. lbs ENM/acre[3]	Mg Rec. lbs EMg/acre[4]
MO602419P1300		14.4	2012	6.9	5.8	Medium	302	High	1,780	0 [D]
MO602419P4000		112.2	2012	6.9	5.8	Medium	302	High	1,780	0 [D]
MO602420P3400		30.9	2012	7.0	6.1	High	384	High	1,370	0 [D]
MO602420P4000		108.8	2012	7.0	6.1	High	384	High	1,370	0 [D]
MO602421P3500B		25.2	2012	7.1	6.2	High	400	High	1,170	0 [D]
MO602421P3500C		19.8	2012	7.1	6.2	High	400	High	1,170	0 [D]
MO602429P8000B		98.7	2012	7.2	6.3	High	566	High	905	0 [D]
MO602429P8000C		24.1	2012	7.2	6.3	High	566	High	905	0 [D]
MO602429P8000D		297.5	2012	7.2	6.3	High	566	High	905	0 [D]
MO602430P1150B		6.0	2012	7.1	6.5	High	566	High	0	0
MO602430P1150C		6.9	2012	7.1	6.5	High	566	High	0	0
MO602430P1400		21.0	2012	7.1	6.5	High	566	High	0	0
MO602430P3400		20.8	2012	6.6	5.7	Medium	652	High	740	0 [D]

[1]These lime recommendations assume you used the University of Missouri soil testing laboratory, or comparable lab.
[2]NA = Neutralizable Acidity, units in meq/100g soil.
[3]ENM = Effective Neutralizing Material.
[4]EMg = Effective Magnesium.

[D] To determine limestone needed in tons/acre, divide your ENM requirement by the guarantee of your limestone dealer.

I. Crop Record Keeping Table: 6/2017 - 5/2018

Field ID	Field SubID	Crop	Planting Date	Hybrid or Variety	Seeding Rate	Harvest date(s)	Yield/A
MO602419P 1300		Corn grain					
MO602419P 4000		Corn grain					
MO602420P 3400		Corn grain					
MO602420P 4000		Soybeans					
MO602421P 3500B		Corn grain					
MO602421P 3500C		Corn grain					
MO602429P 8000B		Soybeans					
MO602429P 8000C		Soybeans					
MO602429P 8000D		Soybeans					
MO602430P 1150B		Corn grain					
MO602430P 1150C		Corn grain					
MO602430P 1400		Corn grain					
MO602430P 3400		Cool season grass pasture					

Document Source Information

Report based on information from Manure Management Planer (MMP 0.3.3.2)

Plan:

File:	S:\Manure ground\MMP P Index Plans\Trenton Farms RE, LLC\Original MMP 2015.mmp
Initialized:	11/6/2008
Last Saved:	3/31/2015 12:49:31 PM
Exported:	3/31/2015 12:58:54 PM
Title:	
Years in Plan:	5
Plan Start Year:	2015
Plan Start Month:	6

Operation:

Name:	Trenton Farms RE, LLC

Operation Contact:

Trenton Farms RE, LLC
SW State Highway W
Trenton MO 64683
507-825-7032 (office)
(home)

Missouri
Comprehensive Nutrient Management Plan
FARMER PLAN DOCUMENT

Operation Name: Trenton Farms RE, LLC

This plan is a summary of the key activities for one year of the nutrient management plan. The period of time covered by this plan is:
6/2018 - 5/2019

The objective of this document is to provide a concise list of the nutrient management activities on this operation for the year indicated. Activities covered by this plan include:

- Planned manure transfers and sales.
- Planned manure application dates and rates.
- Planned fertilizer application dates and rates.

Record keeping is an important part of nutrient management. Please use the space in this plan to record what actually occurred on each field.

Farm contact information: Trenton Farms RE, LLC
SW State Highway W
Trenton, MO 64683
507-825-7032 (office)

Whole Plan Period: June 2015 - May 2020

Contents

A. Manure Transfers - 6/2018 - 5/2019

Exports off the Farm: *(blank rows are for recording exports as they occur)*

Export Month	Export Year	Source of Manure	Target Export Amount	Units	Receiving Operation	Notes

Imports onto the Farm: *(blank rows are for recording imports as they occur)*

Import Month	Import Year	Source of Manure	Animal Type	Target Import Amount	Units	Notes

Internal Transfers of Manure: *(blank rows are for recording transfers as they occur)*

Transfer Month	Transfer Year	Source of Manure	Manure Destination	Target Transfer Amount	Units	Notes

B. Planned Manure Applications - 6/2018 - 5/2019

Month and Year	Field ID	Field SubID	Planned Crop(s)	Source	Application Equipment	Acres Covered	Application Rate	Units per acre	Total Applied
Jul 2018	MO602430P 3400		Cool season grass pasture	Gestation	Injector Tank	14.9	4,900	Gal	72,800
Sep 2018	MO602419P 4000		Soybeans	GDU	Injector Tank	102.3	2,300	Gal	235,300
Oct 2018	MO602419P 1300		Soybeans	GDU	Injector Tank	12.4	2,300	Gal	28,600
Oct 2018	MO602420P 3400		Soybeans	Gestation	Injector Tank	29.4	4,400	Gal	129,350
Oct 2018	MO602420P 4000		Corn grain	Gestation	Injector Tank	104.6	8,200	Gal	858,000
Oct 2018	MO602421P 3500B		Soybeans	Gestation	Injector Tank	21.7	4,400	Gal	95,550
Oct 2018	MO602421P 3500C		Soybeans	Gestation	Injector Tank	18.8	4,400	Gal	82,550
Oct 2018	MO602429P 8000B		Corn grain	Gestation	Injector Tank	94.7	8,500	Gal	805,350
Oct 2018	MO602429P 8000C		Corn grain	Gestation	Injector Tank	21.7	8,500	Gal	184,600
Oct 2018	MO602429P 8000D		Corn grain	Gestation	Injector Tank	284.0	8,500	Gal	2,414,100
Nov 2018	MO602430P 1150B		Soybeans	GDU	Injector Tank	5.1	2,300	Gal	11,700
Nov 2018	MO602430P 1150C		Soybeans	GDU	Injector Tank	6.2	2,200	Gal	13,650
Nov 2018	MO602430P 1400		Soybeans	GDU	Injector Tank	14.1	2,300	Gal	32,500

Manure Application Records - 6/2018 - 5/2019

App #	Date	Field ID	Field SubID	Manure Source	Application Equipment	Actual Rate	Actual Loads	Total Applied	Acres Covered
1									
2									
3									
4									
5									
6									
7									

Manure Application Records - 6/2018 - 5/2019 (continued)

App #	Applicator's Name	[1]Soil Condition	[2]Ground Cover	[3]Days to Incorporate	Air Temp	Wind Speed	Wind Direction	[4]Rain Before	[5]Rain After	[6]Weather
1										
2										
3										
4										
5										
6										
7										

1. Soil condition at time of operations: Dry, Firm, Wet, Muddy, Snow-Covered, Frozen.
2. Percent residue or ground cover at time of application.
3. Number of days to incorporate manure after application: Use "N1" for no incorporation.
4. Amount of rainfall during the 24 hours prior to application.
5. Amount of rainfall during the 24 hours after application.
6. Weather condition at time of application: Sunny, Partly Cloudy, Cloudy, Rain, Snow.

Manure Application Records - 6/2018 - 5/2019

App #	Date	Field ID	Field SubID	Manure Source	Application Equipment	Actual Rate	Actual Loads	Total Applied	Acres Covered
8									
9									
10									
11									
12									
13									
14									

Manure Application Records - 6/2018 - 5/2019 (continued)

App #	Applicator's Name	[1]Soil Condition	[2]Ground Cover	[3]Days to Incorporate	Air Temp	Wind Speed	Wind Direction	[4]Rain Before	[5]Rain After	[6]Weather
8										
9										
10										
11										
12										
13										
14										

1. Soil condition at time of operations: Dry, Firm, Wet, Muddy, Snow-Covered, Frozen.
2. Percent residue or ground cover at time of application.
3. Number of days to incorporate manure after application: Use "N1" for no incorporation.
4. Amount of rainfall during the 24 hours prior to application.
5. Amount of rainfall during the 24 hours after application.
6. Weather condition at time of application: Sunny, Partly Cloudy, Cloudy, Rain, Snow.

C. Planned Commercial Fertilizer Applications - 6/2018 - 5/2019

No planned commercial fertilizer applications for the period.

Commercial Fertilizer Application Records - 6/2018 - 5/2019

Month and Year	Field ID	Field SubID	Field Size (acres)	Planned Crop(s)	Fertilizer Analysis	Application Method	Material rate/acre	Total Material Applied	N (lbs/a)	P_2O_5 (lbs/a)	K_2O (lbs/a)

D. Recommended Manure Management Practices

Every time you apply manure you should review the following checklist to be sure conditions are favorable for manure applications. **These practices are required on permitted operations and operations that receive cost-share support through EQIP.**

- Know the proper manure source and application rate for each field.
- Keep good records, write down such things as operations performed, dates and times, actual rates, and weather conditions. This document provides record keeping forms.
- No surface application of manure if precipitation, likely to create runoff, is forecasted to occur within 24 hours of the planned application.
- No manure application on land with a slope greater than 20 percent.
- No surface application of manure to frozen, snow-covered or saturated soils.
- Manure applications shall comply with all manure application setbacks defined in the table below:

Manure application setback distances where manure should not be applied. For streams, lakes and wetlands the setback distance is measured from the defined edge of the water feature.

Setback Feature	Application Conditions	Setback Distance (feet)
Public or private drinking water well, drinking water lake or impoundment, or drinking water intake structure.	All applications	300
Other wells including un-plugged abandon wells	All applications	300
Public and privately owned lakes and impoundments not used as a water supply including impoundments with no outlet. Perennial streams, intermittent streams, canals, drainage ditches and wetlands. Tile line inlet (un-plugged during application).	Permanently vegetated setback	35
	Up-gradient, no or insufficient vegetated setback	100
	Down-gradient, no or insufficient vegetated setback	35
Losing streams, cave entrance, spring, or active sinkhole.	All applications	300
Non-owned occupied residence.	All applications	150
Public use area including non-owned businesses.	All applications	150
Public roads and property boundaries.	All applications	50

The following practices are recommended:

- Apply nutrients close to crop use to maximize nutrient uptake and reduce potential losses.
- Calibrate and maintain application equipment to apply accurate and uniform rates; all land application equipment should be calibrated at least annually.
- Avoid application when wind is blowing in the direction of neighbors or on weekends and holidays when people are more likely to be outdoors.

For liquid applications:

- Adjusting surface application rates to meet infiltration rate and water holding capacity of the soil.
- Irrigation systems should have automatic shut-off devices in case of pressure loss and/or an operator on-site at all times during operation to monitor application equipment.
- The perimeter of all fields receiving manure should be checked regularly during operation of land application equipment to confirm manure is not running off the field or entering waters of the state.

6/2018 - 5/2019 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602419P1300

Field Information

Total Acres:	14.4	Spreadable Acres:	12.2
Non-Spreadable Acres:	2.2	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Soybeans	43.7999992370605 bu	0	60	105

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Oct 2018			
Manure Source	GDU			
Application Rate	2,300 gal/a			
Acres Covered	12.4			
Total Applied	28,600 gal			
Loads per Field	4.4			
Placement	Injected			
N (lbs/acres)	89			
P_2O_5 (lbs/acre)	97			
K_2O (lbs/acre)	61			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

6/2018 - 5/2019 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602419P4000

Field Information

Total Acres:	112.2	Spreadable Acres:	102.2
Non-Spreadable Acres:	10.0	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Soybeans	43.7999992370605 bu	0	60	105

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Sep 2018			
Manure Source	GDU			
Application Rate	2,300 gal/a			
Acres Covered	102.3			
Total Applied	235,300 gal			
Loads per Field	36.2			
Placement	Injected			
N (lbs/acres)	89			
P_2O_5 (lbs/acre)	97			
K_2O (lbs/acre)	61			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

6/2018 - 5/2019 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602420P3400

Field Information

Total Acres:	30.9	Spreadable Acres:	29.3
Non-Spreadable Acres:	1.6	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Soybeans	43.7999992370605 bu	0	45	110

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Oct 2018			
Manure Source	Gestation			
Application Rate	4,400 gal/a			
Acres Covered	29.4			
Total Applied	129,350 gal			
Loads per Field	19.9			
Placement	Injected			
N (lbs/acres)	73			
P_2O_5 (lbs/acre)	110			
K_2O (lbs/acre)	156			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

6/2018 - 5/2019 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602420P4000

Field Information

Total Acres:	108.8	Spreadable Acres:	104.6
Non-Spreadable Acres:	4.2	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_20
Corn grain	122.099998474121 bu	100	65	85

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Oct 2018			
Manure Source	Gestation			
Application Rate	8,200 gal/a			
Acres Covered	104.6			
Total Applied	858,000 gal			
Loads per Field	132.0			
Placement	Injected			
N (lbs/acres)	135			
P_2O_5 (lbs/acre)	205			
K_2O (lbs/acre)	291			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

Crop Management

* Nitrogen Credit: Nitrogen requirements have been reduced by 30 pounds per acre for this corn crop as it follows soybeans.

6/2018 - 5/2019 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602421P3500B

Field Information

Total Acres:	25.2	Spreadable Acres:	21.6
Non-Spreadable Acres:	3.6	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Soybeans	43.7999992370605 bu	0	65	115

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Oct 2018			
Manure Source	Gestation			
Application Rate	4,400 gal/a			
Acres Covered	21.7			
Total Applied	95,550 gal			
Loads per Field	14.7			
Placement	Injected			
N (lbs/acres)	73			
P_2O_5 (lbs/acre)	110			
K_2O (lbs/acre)	156			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

6/2018 - 5/2019 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602421P3500C

Field Information

Total Acres:	19.8	Spreadable Acres:	18.7
Non-Spreadable Acres:	1.1	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Soybeans	43.7999992370605 bu	0	65	115

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Oct 2018			
Manure Source	Gestation			
Application Rate	4,400 gal/a			
Acres Covered	18.8			
Total Applied	82,550 gal			
Loads per Field	12.7			
Placement	Injected			
N (lbs/acres)	73			
P_2O_5 (lbs/acre)	110			
K_2O (lbs/acre)	156			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

6/2018 - 5/2019 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602429P8000B

Field Information

Total Acres:	98.7	Spreadable Acres:	94.7
Non-Spreadable Acres:	4.0	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Corn grain	122.099998474121 bu	95	65	45

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Oct 2018			
Manure Source	Gestation			
Application Rate	8,500 gal/a			
Acres Covered	94.7			
Total Applied	805,350 gal			
Loads per Field	123.9			
Placement	Injected			
N (lbs/acres)	140			
P_2O_5 (lbs/acre)	213			
K_2O (lbs/acre)	302			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

Crop Management

* Nitrogen Credit: Nitrogen requirements have been reduced by 30 pounds per acre for this corn crop as it follows soybeans.

6/2018 - 5/2019 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602429P8000C

Field Information

Total Acres:	24.1	Spreadable Acres:	21.7
Non-Spreadable Acres:	2.4	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_20
Corn grain	122.099998474121 bu	95	65	45

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Oct 2018			
Manure Source	Gestation			
Application Rate	8,500 gal/a			
Acres Covered	21.7			
Total Applied	184,600 gal			
Loads per Field	28.4			
Placement	Injected			
N (lbs/acres)	140			
P_2O_5 (lbs/acre)	213			
K_2O (lbs/acre)	302			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

Crop Management

* Nitrogen Credit: Nitrogen requirements have been reduced by 30 pounds per acre for this corn crop as it follows soybeans.

6/2018 - 5/2019 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602429P8000D

Field Information

Total Acres:	297.5	Spreadable Acres:	284.0
Non-Spreadable Acres:	13.5	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Corn grain	122.099998474121 bu	95	65	45

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Oct 2018			
Manure Source	Gestation			
Application Rate	8,500 gal/a			
Acres Covered	284.0			
Total Applied	2,414,100 gal			
Loads per Field	371.4			
Placement	Injected			
N (lbs/acres)	140			
P_2O_5 (lbs/acre)	213			
K_2O (lbs/acre)	302			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

Crop Management

* Nitrogen Credit: Nitrogen requirements have been reduced by 30 pounds per acre for this corn crop as it follows soybeans.

6/2018 - 5/2019 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602430P1150B

Field Information

Total Acres:	6.0	Spreadable Acres:	4.9
Non-Spreadable Acres:	1.1	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Soybeans	43.7999992370605 bu	0	60	0

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Nov 2018			
Manure Source	GDU			
Application Rate	2,300 gal/a			
Acres Covered	5.1			
Total Applied	11,700 gal			
Loads per Field	1.8			
Placement	Injected			
N (lbs/acres)	89			
P_2O_5 (lbs/acre)	97			
K_2O (lbs/acre)	61			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

6/2018 - 5/2019 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602430P1150C

Field Information

Total Acres:	6.9	Spreadable Acres:	6.0
Non-Spreadable Acres:	0.9	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Soybeans	43.7999992370605 bu	0	60	0

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Nov 2018			
Manure Source	GDU			
Application Rate	2,200 gal/a			
Acres Covered	6.2			
Total Applied	13,650 gal			
Loads per Field	2.1			
Placement	Injected			
N (lbs/acres)	85			
P_2O_5 (lbs/acre)	92			
K_2O (lbs/acre)	58			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

6/2018 - 5/2019 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602430P1400

Field Information

Total Acres:	21.0	Spreadable Acres:	13.9
Non-Spreadable Acres:	7.1	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Soybeans	43.7999992370605 bu	0	60	0

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Nov 2018			
Manure Source	GDU			
Application Rate	2,300 gal/a			
Acres Covered	14.1			
Total Applied	32,500 gal			
Loads per Field	5.0			
Placement	Injected			
N (lbs/acres)	89			
P_2O_5 (lbs/acre)	97			
K_2O (lbs/acre)	61			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

6/2018 - 5/2019 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602430P3400

Field Information

Total Acres:	20.8	Spreadable Acres:	14.8
Non-Spreadable Acres:	6.0	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_20
Cool season grass pasture	2 ton	80	40	30

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Jul 2018			
Manure Source	Gestation			
Application Rate	4,900 gal/a			
Acres Covered	14.9			
Total Applied	72,800 gal			
Loads per Field	11.2			
Placement	Injected			
N (lbs/acres)	81			
P_2O_5 (lbs/acre)	123			
K_2O (lbs/acre)	174			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

Crop Management

* Cool season grass pasture - For cool season grass pasture and bluegrass pasture split nitrogen applications between late spring after first grazing and mid August, applying 60% before the season of greatest need.

Summary Tables - 6/2018 - 5/2019

F. Manure Summary: 6/2018 - 5/2019

	Source 1	Source 2		
Source	Gestation	GDU		
Units	gals	gals		
Beginning of Year Inventory	3,729,650	308,700		
Inputs				
Production	4,558,000	502,000		
Imports - off farm	0	0		
Transfers - on farm	0	0		
Total Inputs	4,558,000	502,000		
Outputs				
Land Applied	4,642,300	321,750		
Exports - off farm	0	0		
Transfers - on farm	0	0		
Total Outputs	4,642,300	321,750		
End of Year Inventory	3,645,350	488,950		

G. Land Applied Nutrient Summary: 6/2018 - 5/2019

	Total Applied		PAN[1]	P_2O_5	K_2O
Manure Source	(tons or gals)		----------lbs----------		
Gestation	4,642,300	gals	76,486	116,250	164,856
GDU	321,750	gals	12,445	13,559	8,527
Manure Total			88,931	129,809	173,383
	Total Applied		**N**	**P_2O_5**	**K_2O**
Fertilizer Source	(lbs or gals)		----------lbs----------		
Fertilizer Total			0	0	0
Total			88,931	129,809	173,383

H. Lime Recommendations

These lime recommendations are one-time applications meant to be applied only once to adjust soil pH to its desired level. If you have already applied the recommended lime rate in a previous year of this plan please disregard these recommendations.

Lime Recommendations[1]

Field ID	Field SubID	Field Size	Test Year	NA[2]	pH	pH Rating	Mg (lbs/a)	Mg Rating	Lime Rec. lbs ENM/acre[3]	Mg Rec. lbs EMg/acre[4]
MO602419P1300		14.4	2012	6.9	5.8	Medium	302	High	1,780	0 [D]
MO602419P4000		112.2	2012	6.9	5.8	Medium	302	High	1,780	0 [D]
MO602420P3400		30.9	2012	7.0	6.1	High	384	High	1,370	0 [D]
MO602420P4000		108.8	2012	7.0	6.1	High	384	High	1,370	0 [D]
MO602421P3500B		25.2	2012	7.1	6.2	High	400	High	1,170	0 [D]
MO602421P3500C		19.8	2012	7.1	6.2	High	400	High	1,170	0 [D]
MO602429P8000B		98.7	2012	7.2	6.3	High	566	High	905	0 [D]
MO602429P8000C		24.1	2012	7.2	6.3	High	566	High	905	0 [D]
MO602429P8000D		297.5	2012	7.2	6.3	High	566	High	905	0 [D]
MO602430P1150B		6.0	2012	7.1	6.5	High	566	High	0	0
MO602430P1150C		6.9	2012	7.1	6.5	High	566	High	0	0
MO602430P1400		21.0	2012	7.1	6.5	High	566	High	0	0
MO602430P3400		20.8	2012	6.6	5.7	Medium	652	High	740	0 [D]

[1]These lime recommendations assume you used the University of Missouri soil testing laboratory, or comparable lab.
[2]NA = Neutralizable Acidity, units in meq/100g soil.
[3]ENM = Effective Neutralizing Material.
[4]EMg = Effective Magnesium.

[D] To determine limestone needed in tons/acre, divide your ENM requirement by the guarantee of your limestone dealer.

I. Crop Record Keeping Table: 6/2018 - 5/2019

Field ID	Field SubID	Crop	Planting Date	Hybrid or Variety	Seeding Rate	Harvest date(s)	Yield/A
MO602419P 1300		Soybeans					
MO602419P 4000		Soybeans					
MO602420P 3400		Soybeans					
MO602420P 4000		Corn grain					
MO602421P 3500B		Soybeans					
MO602421P 3500C		Soybeans					
MO602429P 8000B		Corn grain					
MO602429P 8000C		Corn grain					
MO602429P 8000D		Corn grain					
MO602430P 1150B		Soybeans					
MO602430P 1150C		Soybeans					
MO602430P 1400		Soybeans					
MO602430P 3400		Cool season grass pasture					

Document Source Information

Report based on information from Manure Management Planer (MMP 0.3.3.2)

Plan:

File:	S:\Manure ground\MMP P Index Plans\Trenton Farms RE, LLC\Original MMP 2015.mmp
Initialized:	11/6/2008
Last Saved:	3/31/2015 12:49:31 PM
Exported:	3/31/2015 12:58:54 PM
Title:	
Years in Plan:	5
Plan Start Year:	2015
Plan Start Month:	6

Operation:

Name:	Trenton Farms RE, LLC

Operation Contact:

Trenton Farms RE, LLC
SW State Highway W
Trenton MO 64683
507-825-7032 (office)
(home)

United States Department of Agriculture
Natural Resources Conservation Service

University of Missouri Extension
Commercial Agriculture Program

Missouri
Comprehensive Nutrient Management Plan
FARMER PLAN DOCUMENT

Operation Name: Trenton Farms RE, LLC

This plan is a summary of the key activities for one year of the nutrient management plan. The period of time covered by this plan is:
6/2019 - 5/2020

The objective of this document is to provide a concise list of the nutrient management activities on this operation for the year indicated. Activities covered by this plan include:

- Planned manure transfers and sales.
- Planned manure application dates and rates.
- Planned fertilizer application dates and rates.

Record keeping is an important part of nutrient management. Please use the space in this plan to record what actually occurred on each field.

Farm contact information: Trenton Farms RE, LLC
SW State Highway W
Trenton, MO 64683
507-825-7032 (office)

Whole Plan Period: June 2015 - May 2020

Contents

A. Manure Transfers - 6/2019 - 5/2020

Exports off the Farm: *(blank rows are for recording exports as they occur)*

Export Month	Export Year	Source of Manure	Target Export Amount	Units	Receiving Operation	Notes

Imports onto the Farm: *(blank rows are for recording imports as they occur)*

Import Month	Import Year	Source of Manure	Animal Type	Target Import Amount	Units	Notes

Internal Transfers of Manure: *(blank rows are for recording transfers as they occur)*

Transfer Month	Transfer Year	Source of Manure	Manure Destination	Target Transfer Amount	Units	Notes

B. Planned Manure Applications - 6/2019 - 5/2020

Month and Year	Field ID	Field SubID	Planned Crop(s)	Source	Application Equipment	Acres Covered	Application Rate	Units per acre	Total Applied
Sep 2019	MO602419P 1300		Corn grain	GDU	Injector Tank	12.3	3,800	Gal	46,800
Oct 2019	MO602419P 4000		Corn grain	GDU	Injector Tank	102.3	3,800	Gal	388,700
Oct 2019	MO602420P 3400		Corn grain	Gestation	Injector Tank	29.4	8,500	Gal	249,600
Oct 2019	MO602420P 4000		Soybeans	Gestation	Injector Tank	104.7	4,600	Gal	481,650
Oct 2019	MO602421P 3500B		Corn grain	Gestation	Injector Tank	21.6	8,500	Gal	183,950
Oct 2019	MO602421P 3500C		Corn grain	Gestation	Injector Tank	18.7	8,500	Gal	159,250
Oct 2019	MO602429P 8000B		Soybeans	Gestation	Injector Tank	94.7	4,200	Gal	397,800
Oct 2019	MO602429P 8000C		Soybeans	Gestation	Injector Tank	21.8	4,200	Gal	91,650
Oct 2019	MO602429P 8000D		Soybeans	Gestation	Injector Tank	284.1	4,200	Gal	1,193,400
Oct 2019	MO602430P 1150B		Corn grain	GDU	Injector Tank	5.0	3,800	Gal	18,850
Oct 2019	MO602430P 1150C		Corn grain	GDU	Injector Tank	6.2	3,800	Gal	23,400
May 2020	MO602430P 3400		Cool season grass pasture	Gestation	Injector Tank	14.9	4,900	Gal	72,800

Manure Application Records - 6/2019 - 5/2020

App #	Date	Field ID	Field SubID	Manure Source	Application Equipment	Actual Rate	Actual Loads	Total Applied	Acres Covered
1									
2									
3									
4									
5									
6									
7									

Manure Application Records - 6/2019 - 5/2020 (continued)

App #	Applicator's Name	[1]Soil Condition	[2]Ground Cover	[3]Days to Incorporate	Air Temp	Wind Speed	Wind Direction	[4]Rain Before	[5]Rain After	[6]Weather
1										
2										
3										
4										
5										
6										
7										

1. Soil condition at time of operations: Dry, Firm, Wet, Muddy, Snow-Covered, Frozen.
2. Percent residue or ground cover at time of application.
3. Number of days to incorporate manure after application: Use "N1" for no incorporation.
4. Amount of rainfall during the 24 hours prior to application.
5. Amount of rainfall during the 24 hours after application.
6. Weather condition at time of application: Sunny, Partly Cloudy, Cloudy, Rain, Snow.

Manure Application Records - 6/2019 - 5/2020

App #	Date	Field ID	Field SubID	Manure Source	Application Equipment	Actual Rate	Actual Loads	Total Applied	Acres Covered
8									
9									
10									
11									
12									
13									
14									

Manure Application Records - 6/2019 - 5/2020 (continued)

App #	Applicator's Name	[1]Soil Condition	[2]Ground Cover	[3]Days to Incorporate	Air Temp	Wind Speed	Wind Direction	[4]Rain Before	[5]Rain After	[6]Weather
8										
9										
10										
11										
12										
13										
14										

1. Soil condition at time of operations: Dry, Firm, Wet, Muddy, Snow-Covered, Frozen.
2. Percent residue or ground cover at time of application.
3. Number of days to incorporate manure after application: Use "N1" for no incorporation.
4. Amount of rainfall during the 24 hours prior to application.
5. Amount of rainfall during the 24 hours after application.
6. Weather condition at time of application: Sunny, Partly Cloudy, Cloudy, Rain, Snow.

C. Planned Commercial Fertilizer Applications - 6/2019 - 5/2020

No planned commercial fertilizer applications for the period.

Commercial Fertilizer Application Records - 6/2019 - 5/2020

Month and Year	Field ID	Field SubID	Field Size (acres)	Planned Crop(s)	Fertilizer Analysis	Application Method	Material rate/acre	Total Material Applied	N (lbs/a)	P_2O_5 (lbs/a)	K_2O (lbs/a)

D. Recommended Manure Management Practices

Every time you apply manure you should review the following checklist to be sure conditions are favorable for manure applications. **These practices are required on permitted operations and operations that receive cost-share support through EQIP.**

- Know the proper manure source and application rate for each field.
- Keep good records, write down such things as operations performed, dates and times, actual rates, and weather conditions. This document provides record keeping forms.
- No surface application of manure if precipitation, likely to create runoff, is forecasted to occur within 24 hours of the planned application.
- No manure application on land with a slope greater than 20 percent.
- No surface application of manure to frozen, snow-covered or saturated soils.
- Manure applications shall comply with all manure application setbacks defined in the table below:

Manure application setback distances where manure should not be applied. For streams, lakes and wetlands the setback distance is measured from the defined edge of the water feature.

Setback Feature	Application Conditions	Setback Distance (feet)
Public or private drinking water well, drinking water lake or impoundment, or drinking water intake structure.	All applications	300
Other wells including un-plugged abandon wells	All applications	300
Public and privately owned lakes and impoundments not used as a water supply including impoundments with no outlet. Perennial streams, intermittent streams, canals, drainage ditches and wetlands. Tile line inlet (un-plugged during application).	Permanently vegetated setback	35
	Up-gradient, no or insufficient vegetated setback	100
	Down-gradient, no or insufficient vegetated setback	35
Losing streams, cave entrance, spring, or active sinkhole.	All applications	300
Non-owned occupied residence.	All applications	150
Public use area including non-owned businesses.	All applications	150
Public roads and property boundaries.	All applications	50

The following practices are recommended:

- Apply nutrients close to crop use to maximize nutrient uptake and reduce potential losses.
- Calibrate and maintain application equipment to apply accurate and uniform rates; all land application equipment should be calibrated at least annually.
- Avoid application when wind is blowing in the direction of neighbors or on weekends and holidays when people are more likely to be outdoors.

For liquid applications:

- Adjusting surface application rates to meet infiltration rate and water holding capacity of the soil.
- Irrigation systems should have automatic shut-off devices in case of pressure loss and/or an operator on-site at all times during operation to monitor application equipment.
- The perimeter of all fields receiving manure should be checked regularly during operation of land application equipment to confirm manure is not running off the field or entering waters of the state.

6/2019 - 5/2020 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602419P1300

Field Information

Total Acres:	14.4	Spreadable Acres:	12.2
Non-Spreadable Acres:	2.2	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Corn grain	122.099998474121 bu	100	75	80

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Sep 2019			
Manure Source	GDU			
Application Rate	3,800 gal/a			
Acres Covered	12.3			
Total Applied	46,800 gal			
Loads per Field	7.2			
Placement	Injected			
N (lbs/acres)	146			
P_2O_5 (lbs/acre)	160			
K_2O (lbs/acre)	100			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

Crop Management

* Nitrogen Credit: Nitrogen requirements have been reduced by 30 pounds per acre for this corn crop as it follows soybeans.

6/2019 - 5/2020 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602419P4000

Field Information

Total Acres:	112.2	Spreadable Acres:	102.2
Non-Spreadable Acres:	10.0	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Corn grain	122.099998474121 bu	100	75	80

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Oct 2019			
Manure Source	GDU			
Application Rate	3,800 gal/a			
Acres Covered	102.3			
Total Applied	388,700 gal			
Loads per Field	59.8			
Placement	Injected			
N (lbs/acres)	146			
P_2O_5 (lbs/acre)	160			
K_2O (lbs/acre)	100			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

Crop Management

* Nitrogen Credit: Nitrogen requirements have been reduced by 30 pounds per acre for this corn crop as it follows soybeans.

6/2019 - 5/2020 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602420P3400

Field Information

Total Acres:	30.9	Spreadable Acres:	29.3
Non-Spreadable Acres:	1.6	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_20
Corn grain	122.099998474121 bu	100	65	85

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Oct 2019			
Manure Source	Gestation			
Application Rate	8,500 gal/a			
Acres Covered	29.4			
Total Applied	249,600 gal			
Loads per Field	38.4			
Placement	Injected			
N (lbs/acres)	140			
P_2O_5 (lbs/acre)	213			
K_2O (lbs/acre)	302			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

Crop Management

* Nitrogen Credit: Nitrogen requirements have been reduced by 30 pounds per acre for this corn crop as it follows soybeans.

6/2019 - 5/2020 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602420P4000

Field Information

Total Acres:	108.8	Spreadable Acres:	104.6
Non-Spreadable Acres:	4.2	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Soybeans	43.7999992370605 bu	0	45	110

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Oct 2019			
Manure Source	Gestation			
Application Rate	4,600 gal/a			
Acres Covered	104.7			
Total Applied	481,650 gal			
Loads per Field	74.1			
Placement	Injected			
N (lbs/acres)	76			
P_2O_5 (lbs/acre)	115			
K_2O (lbs/acre)	163			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

6/2019 - 5/2020 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602421P3500B

Field Information

Total Acres:	25.2	Spreadable Acres:	21.6
Non-Spreadable Acres:	3.6	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Corn grain	122.099998474121 bu	100	85	85

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Oct 2019			
Manure Source	Gestation			
Application Rate	8,500 gal/a			
Acres Covered	21.6			
Total Applied	183,950 gal			
Loads per Field	28.3			
Placement	Injected			
N (lbs/acres)	140			
P_2O_5 (lbs/acre)	213			
K_2O (lbs/acre)	302			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

Crop Management

* Nitrogen Credit: Nitrogen requirements have been reduced by 30 pounds per acre for this corn crop as it follows soybeans.

6/2019 - 5/2020 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602421P3500C

Field Information

Total Acres:	19.8	Spreadable Acres:	18.7
Non-Spreadable Acres:	1.1	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Corn grain	122.099998474121 bu	100	85	85

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Oct 2019			
Manure Source	Gestation			
Application Rate	8,500 gal/a			
Acres Covered	18.7			
Total Applied	159,250 gal			
Loads per Field	24.5			
Placement	Injected			
N (lbs/acres)	140			
P_2O_5 (lbs/acre)	213			
K_2O (lbs/acre)	302			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

Crop Management

* Nitrogen Credit: Nitrogen requirements have been reduced by 30 pounds per acre for this corn crop as it follows soybeans.

6/2019 - 5/2020 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602429P8000B

Field Information

Total Acres:	98.7	Spreadable Acres:	94.7
Non-Spreadable Acres:	4.0	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Soybeans	43.7999992370605 bu	0	45	75

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Oct 2019			
Manure Source	Gestation			
Application Rate	4,200 gal/a			
Acres Covered	94.7			
Total Applied	397,800 gal			
Loads per Field	61.2			
Placement	Injected			
N (lbs/acres)	69			
P_2O_5 (lbs/acre)	105			
K_2O (lbs/acre)	149			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

6/2019 - 5/2020 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602429P8000C

Field Information

Total Acres:	24.1	Spreadable Acres:	21.7
Non-Spreadable Acres:	2.4	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_20
Soybeans	43.7999992370605 bu	0	45	75

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Oct 2019			
Manure Source	Gestation			
Application Rate	4,200 gal/a			
Acres Covered	21.8			
Total Applied	91,650 gal			
Loads per Field	14.1			
Placement	Injected			
N (lbs/acres)	69			
P_2O_5 (lbs/acre)	105			
K_2O (lbs/acre)	149			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

6/2019 - 5/2020 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602429P8000D

Field Information

Total Acres:	297.5	Spreadable Acres:	284.0
Non-Spreadable Acres:	13.5	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_20
Soybeans	43.7999992370605 bu	0	45	75

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Oct 2019			
Manure Source	Gestation			
Application Rate	4,200 gal/a			
Acres Covered	284.1			
Total Applied	1,193,400 gal			
Loads per Field	183.6			
Placement	Injected	-		
N (lbs/acres)	69			
P_2O_5 (lbs/acre)	105			
K_2O (lbs/acre)	149			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

6/2019 - 5/2020 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602430P1150B

Field Information

Total Acres:	6.0	Spreadable Acres:	4.9
Non-Spreadable Acres:	1.1	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Corn grain	122.099998474121 bu	100	80	0

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Oct 2019			
Manure Source	GDU			
Application Rate	3,800 gal/a			
Acres Covered	5.0			
Total Applied	18,850 gal			
Loads per Field	2.9			
Placement	Injected			
N (lbs/acres)	146			
P_2O_5 (lbs/acre)	160			
K_2O (lbs/acre)	100			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

Crop Management

* Nitrogen Credit: Nitrogen requirements have been reduced by 30 pounds per acre for this corn crop as it follows soybeans.

6/2019 - 5/2020 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602430P1150C

Field Information

Total Acres:	6.9	Spreadable Acres:	6.0
Non-Spreadable Acres:	0.9	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Corn grain	122.099998474121 bu	100	80	0

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	Oct 2019			
Manure Source	GDU			
Application Rate	3,800 gal/a			
Acres Covered	6.2			
Total Applied	23,400 gal			
Loads per Field	3.6			
Placement	Injected			
N (lbs/acres)	146			
P_2O_5 (lbs/acre)	160			
K_2O (lbs/acre)	100			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

Crop Management

* Nitrogen Credit: Nitrogen requirements have been reduced by 30 pounds per acre for this corn crop as it follows soybeans.

6/2019 - 5/2020 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602430P1400

Field Information

Total Acres:	21.0	Spreadable Acres:	13.9
Non-Spreadable Acres:	7.1	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Corn grain	122.099998474121 bu	100	80	0

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

No planned manure application.

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

Crop Management

* Nitrogen Credit: Nitrogen requirements have been reduced by 30 pounds per acre for this corn crop as it follows soybeans.

6/2019 - 5/2020 NUTRIENT MANAGEMENT PLAN

FIELD ID: MO602430P3400

Field Information

Total Acres:	20.8	Spreadable Acres:	14.8
Non-Spreadable Acres:	6.0	Distance to Storage:	0.00 miles

Fertilizer Recommendation (lbs/acre)

Crop	Yield Goal	N	P_2O_5	K_2O
Cool season grass pasture	2 ton	80	40	30

This fertilizer recommendation has not been adjusted for any applications of manure or fertilizer.

Manure Management

	Application 1			
Application Time	May 2020			
Manure Source	Gestation			
Application Rate	4,900 gal/a			
Acres Covered	14.9			
Total Applied	72,800 gal			
Loads per Field	11.2			
Placement	Injected			
N (lbs/acres)	81			
P_2O_5 (lbs/acre)	123			
K_2O (lbs/acre)	174			

Commercial Fertilizer Management

No planned commercial fertilizer application. No records in database.

Crop Management

* Cool season grass pasture - For cool season grass pasture and bluegrass pasture split nitrogen applications between late spring after first grazing and mid August, applying 60% before the season of greatest need.

Summary Tables - 6/2019 - 5/2020

F. Manure Summary: 6/2019 - 5/2020

	Source 1	Source 2		
Source	Gestation	GDU		
Units	gals	gals		
Beginning of Year Inventory	3,645,350	488,950		
Inputs				
Production	4,558,000	502,000		
Imports - off farm	0	0		
Transfers - on farm	0	0		
Total Inputs	4,558,000	502,000		
Outputs				
Land Applied	2,830,100	477,750		
Exports - off farm	0	0		
Transfers - on farm	0	0		
Total Outputs	2,830,100	477,750		
End of Year Inventory	5,373,250	513,200		

G. Land Applied Nutrient Summary: 6/2019 - 5/2020

	Total Applied		PAN[1]	P_2O_5	K_2O
Manure Source	(tons or gals)		----------lbs----------		
Gestation	2,830,100	gals	46,563	70,782	100,397
GDU	477,750	gals	18,367	20,128	12,580
Manure Total			64,930	90,910	112,977
	Total Applied		**N**	**P_2O_5**	**K_2O**
Fertilizer Source	(lbs or gals)		----------lbs----------		
Fertilizer Total			0	0	0
Total			64,930	90,910	112,977

H. Lime Recommendations

These lime recommendations are one-time applications meant to be applied only once to adjust soil pH to its desired level. If you have already applied the recommended lime rate in a previous year of this plan please disregard these recommendations.

Lime Recommendations[1]

Field ID	Field SubID	Field Size	Test Year	NA[2]	pH	pH Rating	Mg (lbs/a)	Mg Rating	Lime Rec. lbs ENM/acre[3]	Mg Rec. lbs EMg/acre[4]
MO602419P1300		14.4	2012	6.9	5.8	Medium	302	High	1,780	0 [D]
MO602419P4000		112.2	2012	6.9	5.8	Medium	302	High	1,780	0 [D]
MO602420P3400		30.9	2012	7.0	6.1	High	384	High	1,370	0 [D]
MO602420P4000		108.8	2012	7.0	6.1	High	384	High	1,370	0 [D]
MO602421P3500B		25.2	2012	7.1	6.2	High	400	High	1,170	0 [D]
MO602421P3500C		19.8	2012	7.1	6.2	High	400	High	1,170	0 [D]
MO602429P8000B		98.7	2012	7.2	6.3	High	566	High	905	0 [D]
MO602429P8000C		24.1	2012	7.2	6.3	High	566	High	905	0 [D]
MO602429P8000D		297.5	2012	7.2	6.3	High	566	High	905	0 [D]
MO602430P1150B		6.0	2012	7.1	6.5	High	566	High	0	0
MO602430P1150C		6.9	2012	7.1	6.5	High	566	High	0	0
MO602430P1400		21.0	2012	7.1	6.5	High	566	High	0	0
MO602430P3400		20.8	2012	6.6	5.7	Medium	652	High	740	0 [D]

[1]These lime recommendations assume you used the University of Missouri soil testing laboratory, or comparable lab.
[2]NA = Neutralizable Acidity, units in meq/100g soil.
[3]ENM = Effective Neutralizing Material.
[4]EMg = Effective Magnesium.

[D] To determine limestone needed in tons/acre, divide your ENM requirement by the guarantee of your limestone dealer.

I. Crop Record Keeping Table: 6/2019 - 5/2020

Field ID	Field SubID	Crop	Planting Date	Hybrid or Variety	Seeding Rate	Harvest date(s)	Yield/A
MO602419P 1300		Corn grain					
MO602419P 4000		Corn grain					
MO602420P 3400		Corn grain					
MO602420P 4000		Soybeans					
MO602421P 3500B		Corn grain					
MO602421P 3500C		Corn grain					
MO602429P 8000B		Soybeans					
MO602429P 8000C		Soybeans					
MO602429P 8000D		Soybeans					
MO602430P 1150B		Corn grain					
MO602430P 1150C		Corn grain					
MO602430P 1400		Corn grain					
MO602430P 3400		Cool season grass pasture					

Document Source Information

Report based on information from Manure Management Planer (MMP 0.3.3.2)

Plan:

File:	S:\Manure ground\MMP P Index Plans\Trenton Farms RE, LLC\Original MMP 2015.mmp
Initialized:	11/6/2008
Last Saved:	3/31/2015 12:49:31 PM
Exported:	3/31/2015 12:58:54 PM
Title:	
Years in Plan:	5
Plan Start Year:	2015
Plan Start Month:	6

Operation:

Name:	Trenton Farms RE, LLC

Operation Contact:

Trenton Farms RE, LLC
SW State Highway W
Trenton MO 64683
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MISSOURI
DEPARTMENT OF
NATURAL RESOURCES

Missouri Concentrated Animal Feeding Operation Nutrient Management Technical Standard

March 4, 2009

Division of Environmental Quality

Water Protection Program

I Introduction

A. Authority and Purpose

Missouri statutory requirements for Concentrated Animal Feeding Operations (CAFOs), located within 640.700 to 640.758 RSMo., grants the Missouri Department of Natural Resources and the Missouri Clean Water Commission authority and jurisdiction to promulgate rules regulating the establishment, permitting, design, construction, operation and management of Class I CAFOs. The department's CAFO regulations require the development and implementation of a field specific Nutrient Management Plan (NMP), meeting the criteria prescribed in 10 CSR 20-6.300(5)(A)-(I), at all Class I CAFOs.

In accordance with 10 CSR 20-6.300(3)(G)3., this Nutrient Management Technical Standard (NMTS) has been developed to provide a framework for the protocol(s) and method(s) that CAFOs should utilize when determining the form, source, amount, timing, and method of application on individual land application fields. Furthermore, this NMTS represents the department's best professional judgment regarding how to satisfy and/or implement the specific NMP criteria G, H and I within 10 CSR 20-6.300(5)(A). This framework seeks to achieve realistic production goals while ensuring appropriate agricultural utilization of the nutrients in the manure, litter, or process wastewater while also minimizing movement of nitrogen, phosphorus, and other potential water contaminants into surface and/or ground water.

This NMTS will be used by the department and partnering federal agencies as a guide for determining when precipitation-related discharges from CAFO land application fields are exempted as "Agriculture Stormwater Discharge" as allowed within 10 CSR 20-6.300(2)(B)7. CAFOs will qualify for the Agriculture Stormwater Discharge exemption when they can demonstrate compliance with this NMTS at the time of a precipitation-related discharge from land application areas.

B. Applicability

In Missouri, all confinement operations with 1,000 animal units or greater are Class I CAFOs and must follow the requirements set forth in this NMTS in accordance with the regulations found in 10 CSR 20-6.300. New and expanding CAFOs that apply for a construction permit after February 26, 2009 must have a nutrient management plan that complies with this NMTS developed prior to issuance of an operating permit. For purposes of this paragraph, an expanding CAFO is a CAFO that is adding a manure storage structure or confinement barn and expanding the total animal capacity of the operation. All other CAFOs must develop nutrient management plans that meet this NMTS prior to renewal of their permit.

NOTE: An operation may choose to use alternative protocols other than those established in this standard, however, it must be able to demonstrate that such alternative protocols provide both a reliable and a technically valid basis for achieving the nutrient management objectives.

II. Definitions

Manure - For the purposes of this document the term "manure" will refer to any form of litter, manure, wastewater, animal mortality byproduct or other organic residuals collected from the production areas of animal feeding operations.

Missouri Phosphorus (P) Index – The Missouri P-index is designed to help identify fields that have a high probability of phosphorus loss from the combined effects of erosion and high soil test phosphorus. The Missouri P-index integrates field information including current soil test phosphorus level, tillage type, anticipated land cover, soil hydrologic category, distance of the field from a receiving body of water along with an estimate of soil loss derived from the NRCS erosion prediction software, RUSLE2 (Revised Universal Soil Loss Equation Version 2). The Missouri P-index may be utilized when the soil test phosphorus level is "High" or "Very High" and must be conducted in accordance with the University of Missouri (MU) Guide G9184. The Missouri P-index is currently distributed as a Microsoft Office Excel spreadsheet available on the Web at *www.nmplanner.missouri.edu*

Missouri Soil Test Phosphorus Rating - The soil test phosphorus rating is found on a Missouri Soil Test laboratory report and indicates the relative level of plant-available phosphorus in the soil for a particular field. The soil test rating will indicate the probability that an application of phosphate on a particular field is likely to result in an increase in crop yield. A soil test phosphorus rating must be obtained from a lab accredited by the Missouri Soil Testing Association (list of accredited labs can be found at *http://soilplantlab.missouri.edu/soil/mstacertified.htm*) using procedures recommended by the University of Missouri Soil Testing Laboratory.

Surface Application – Land application method by which manure is broadcast or sprayed via mechanical equipment onto the ground surface. Surface application does not include manure that is injected into the soil profile.

Vegetated Buffer - A permanent strip of dense perennial vegetation established parallel to the contours of and perpendicular to the dominant slope of the field for the purposes of effectively slowing water runoff, enhancing water infiltration, and minimizing the risk of any potential nutrients or pollutants from leaving the field and reaching surface waters.

III. Nutrient Management Requirements:

Objective A. Land application fields in the nutrient management plan shall use the following protocols to determine the field-specific placement, timing and rate of manure application so that (a) they do not exceed the annual plant available nitrogen need of the crop, and (b) they are in accordance with the results of a field-specific phosphorus assessment.

A1. Soil and manure testing and fertilizer recommendation protocols.

(1) Soil sampling protocols to determine soil test phosphorus, cation exchange capacity (CEC) and soil organic matter should be based on the following criteria:

a. MU Guides G9215 (for pastures) and G9217 (for row and hay crops);
b. The average field area represented by a soil sample should be approximately 20 acres or less;
c. Each soil sample should be comprised of a well-mixed subsample derived from at least 15 representative cores from the sampled field area; more cores are recommended on pastures or where phosphorus has been band applied;
d. As an alternative to the conventional soil sampling approach in A1(1)c., operations may elect to use a geo-referenced grid soil sampling method instead. Grid size should be less than three acres and at least 10 cores should be obtained from within 15 feet of the central grid point;
e. Soil sampling depth should be six to eight inches;
f. Fields should be re-sampled before manure application when:
   i. The soil test is greater than five years old; or
   ii. Phosphate surplus (actual applied phosphate minus actual removed phosphate) for the field has exceeded 500 lbs/acre since the last soil test;
g. Soil samples should be analyzed at soil testing laboratories accredited by the Missouri Soil Testing Association (see a current list of accredited labs at *http://soilplantlab.missouri.edu/soil/mstacertified.htm*) using procedures recommended by the University of Missouri Soil Testing Laboratory.

Note: Soil sample results that meet all of the above criteria shall be considered "current soil test results".

(2) Fertilizer recommendations should be based on the following:

a. Justified field-specific yield goals. Yield goals should be based on crop yield records from multiple years for the field. Good judgment should be used to adjust yield goals to counteract unusually low or high yields. When a field's yield history is not available another referenced source may be used to estimate yield goal;
b. Current soil test results;
c. University of Missouri fertilizer recommendations should be utilized. University of Missouri recommendations can be obtained on-line using current soil sample results at *http://soilplantlab.missouri.edu/soil/scripts/manualentry.aspx*;
d. When necessary, nutrient removal rates should be based on MU Guide G9120 or alternatively can be based on measured plant analysis records from the farm. If nutrient removal rates are based on

plant analysis records, document how the crop is sampled and how plant analysis records are used to estimate nutrient removal for a crop;

e. Published nutrient removal estimates from other land grant universities in adjoining states are also acceptable.

f. Field-Level Fertilizer Applications – Fertilizer recommendations used to develop nutrient budgets shall be based on 20-acre field areas. When fertilizer recommendations are similar (within 10% or 10 pounds per acre, whichever is greater) for adjoining 20-acre field areas, they may be combined for purposes of fertilizer application and nutrient budgeting. Field areas of up to 80 acres may be combined using this guidance. Larger field areas may be combined if justification for this decision in documented in the nutrient management plan.

(3) The following protocols describe how and when sources of manure should be sampled and how manure testing results will be used to estimate nutrient concentration in manure.

a. CAFOs are required to sample each unique source of land-applied manure at least once per year;

b. All manure samples should be tested for total nitrogen, ammonium nitrogen, total phosphorus, and total potassium. When lab results are reported on a dry basis manure samples should also be tested for dry matter or total solids (moisture content). Nitrate nitrogen is typically not present in manure samples but should be tested for if an innovative manure handling system is likely to create aerobic conditions where nitrate will persist in manure;

c. Samples should be collected and handled following the guidelines outlined in MU Guide Publications EQ215 and G9340 (for poultry litter);

d. When possible, sample and analyze manure just prior to the time for land application of manure so current results are available for calculating manure application rates.

A2. All manure applications on land application area(s) shall meet all three of the following criteria:

(1) Annual nitrogen application from all sources should not exceed the recommended nitrogen application rate for non-legume crops and the nitrogen removal capacity of legume crops by more than 10 pounds per acre or 10 percent, whichever is greater.

a. The recommended nitrogen application rate for non-legume crops should be based on University of Missouri nitrogen fertilizer recommendations derived from a current soil test result for the field and a realistic yield goal. The nitrogen fertilizer recommendation must be adjusted using nitrogen credits for a preceding legume crop, residual fertilizer nitrogen value of manure applications from the previous year and, when appropriate, excessive residual inorganic nitrogen in the soil profile as quantified by the preplant soil nitrogen test. If University of Missouri does not provide a specific nitrogen recommendation for a non-legume crop, recommendations from other land grant universities should be used. Information on calculating residual fertilizer value of manure applications is available in MU Guide Publication G9186. Information on the appropriate use of the preplant soil nitrogen test is in MU Guide Publication G9177;

b. The nitrogen removal capacity of legume crops should be based on the estimated nitrogen content of the harvested crop as defined in MU Guide G9120 and a realistic yield goal. The estimated nitrogen content of the crop must be adjusted using nitrogen credits for residual fertilizer nitrogen value of manure applications from the previous year and, when appropriate, excessive residual

inorganic nitrogen in the soil profile as quantified by the preplant soil nitrogen test. If MU Guide G9120 does not provide an estimate of the nitrogen content of legume crop, recommendations from other land grant universities should be used. Information on calculating residual fertilizer value of manure applications is available in MU Guide Publication G9186. Information on the appropriate use of the preplant soil nitrogen test is in MU Guide Publication G9177;

c. The nitrogen contribution of manure should be based on a calculation of plant-available nitrogen (PAN). Plant-available nitrogen is calculated by adjusting the inorganic and organic nitrogen concentrations using procedures outlined in MU Guide Publication G9186, and is available on the Web at *http://nmplanner.missouri.edu/tools/pan_calculator.asp*

(2) Manure application rates must comply with the results of a field-specific phosphorus loss assessment.

a. Manure application rates can be based solely on nitrogen criteria (nitrogen-based management) if:
   i. The Missouri soil test phosphorus rating from a current soil test is very low, low, medium or optimum; or
   ii. The Missouri P-Index rating is low or medium.

b. Manure application rates cannot exceed the annual planned phosphate removal capacity of the crop by more than 10 pounds per acre or 10 percent, whichever is greater (phosphorus-based management) if:
   i. The Missouri P-index rating is high; or
   ii. The Missouri soil test phosphorus rating from a current soil test is high and the field has not been assessed using the Missouri P-index.

c. Multi-year phosphorus application – When phosphorus-based management is necessary, manure applications can exceed the annual planned phosphate removal capacity of the crop. However, application rates must comply with the following conditions:
   i. Rates shall not exceed the recommended nitrogen application rate during the year of application, or estimated nitrogen removal capacity in the harvested crop during the year of application when there is no recommended nitrogen application, and
   ii. the amount of phosphorus banked in the soil will not exceed four years of crop removal for the planned rotation using the criteria found in section A1.(2) above, and
   iii. the actual application rate shall not exceed 10 pounds per acre or 10 percent of the planned multi-year phosphorus application rate, whichever is greater.

d. No manure will be applied on a land application field if:
   i. The Missouri P-index rating for the field is very high; or
   ii. the University of Missouri soil test phosphorus rating from a current soil test is very high or excess and the field has not been assessed using the Missouri P-index.

The Missouri P Index is described in MU Guide Publication G9184 and is available as a Microsoft Office Excel spreadsheet at *http://nmplanner.missouri.edu/tools/pindex.asp*

(3) The timing, soil conditions and placement of all manure applications shall meet the following criteria:

a. Manure applications shall comply with all manure application setbacks defined in Table A1;

b. No surface application of manure is allowed if precipitation, likely to create runoff, is forecasted to occur within 24 hours of the planned application;

c. Manure will not be applied on land with a slope greater than 20 percent;
d. Manure will not be surface applied to frozen, snow-covered or saturated soils;
e. Manure applications must be monitored such that target application rates are met and any malfunction in the operation of the equipment is detected and corrected before any over-application of manure occurs on the land-application site;
   i. Wastewater and liquid manure applications must be conducted so as to prevent surface runoff of wastewater and liquid manure beyond the edge of the field during land application. Steps to insure no runoff of manure during land application include:
      1. Adjusting surface application rates to meet infiltration rate and water holding capacity of the soil;
      2. Irrigation systems must have automatic shut-off devices in case of pressure loss and/or an operator on-site at all times during operation to monitor application equipment.
   ii. All land application equipment should be calibrated at least annually;
   iii. The perimeter of all fields receiving manure should be checked regularly during operation of land application equipment to confirm manure is not running off the field or entering waters of the state.

Table A1. Manure application setback distances. For streams, lakes and wetlands the setback distance is measured from the defined edge of the water feature.

Setback Feature	Application Conditions	Setback Distance (feet)
Public or private drinking water well or other wells including un-plugged abandon wells	All applications methods	300
Public or private drinking water lake or impoundment	All applications methods	300
Public or private drinking water intake structure	All applications methods	300
Classified waters of the state not used as a water supply as defined in 10 CSR 20-7.031(1)F	Permanently vegetated buffer[1]	35
	No or insufficient vegetated buffer	100
Other public and privately owned lakes and impoundments not used as a water supply including impoundments with no outlet	Permanently vegetated buffer[1]	35
	Up-gradient, no or insufficient vegetated buffer	100
	Down-gradient, no or insufficient vegetated buffer	35
Other perennial streams, other intermittent streams, canals, drainage ditches and wetlands	Permanently vegetated buffer[1]	35
	Up-gradient, no or insufficient vegetated buffer	100
	Down-gradient, no or insufficient vegetated buffer	35
Tile line inlet (if left un-plugged during manure application)	Up-gradient, permanently vegetated buffer[1]	35
	Up-gradient, no or insufficient vegetated buffer	100
	Down-gradient	0
Losing stream	All applications methods	300
Cave entrance	All applications methods	300
Spring	All applications methods	300
Active sinkhole	All applications methods	300
Non-owned occupied residence	Spray irrigation only	150
Public use area including non-owned businesses	Spray irrigation only	150
Public road	All applications methods	50
Property boundary	All applications methods	50

[1] See definition of vegetative buffer in the definitions section of this document.

Objective B. Operations shall maintain the following records to document implementation of appropriate nutrient management plan protocols.

B1. Annual nutrient management monitoring and record keeping requirements.

(1) **Manure Storage Operational Monitoring**– Record the following information for each manure storage structure:

a. Weekly records of the depth of manure and process wastewater in liquid storage structure(s).
b. The date, time, and estimated volume (gallons) of any overflow(s) from the storage structure.
c. Record the following information for every manure application event from a manure storage structure:
   i. Date of manure application
   ii. Source of manure (indentify the storage structure)
   iii. Weather and soil condition at time of application
   iv. Field ID receiving manure
   v. Rate of manure application per acre (tons/acre, gallons/acre, or acre-inch).
   vi. Plant Available Nitrogen (PAN) and phosphate in manure applied to field (pounds/acre).
   vii. Method of application (injection, surface applied, etc)
   viii. Acres receiving manure
   ix. Total tonnage or volume of manure applied (tons or gallons)

d. For all manure transfers (sales or giveaway) off the farm record the following:
   i. Date of transfer
   ii. Name and address of recipient
   iii. Storage source of manure transferred
   iv. Amount of manure transferred (tons or gallons)

(2) **Manure Nutrient Monitoring** - For each unique source of manure.

a. Date(s) for manure sampling
b. For each sampling date report total nitrogen, ammonium nitrogen, total phosphate (P_2O_5), total potash (K_2O); report percent moisture or dry matter and nitrate nitrogen when appropriate and relevant
c. Report or identify the actual manure nutrient concentration used for calculating manure application rates. If different manure sampling results were used for different parts of the year then provide the range of dates when each sample result was used. If estimates are used, provide information as needed to justify the use of estimate(s) of manure nutrient concentrations

(3) **Field Soil Test Monitoring** - For each individual field in the land application area that receives manure record the following:

a. Year of the last soil test
b. Current soil test results reporting at a minimum soil test phosphorus, cation exchange capacity (CEC) and soil organic matter (%)

c. Fertilizer nitrogen and phosphate recommendations (pounds/acre)

(4) **Land Application Operational Monitoring** - For each individual field in the land application area that receives manure record the following:

a. Field ID receiving manure
b. Total acres in each field receiving manure
c. Planned crop(s) (corn, soybeans, fescue, pasture,...etc)
d. Projected yield
e. Actual yield
f. For each field complete an annual nitrogen inventory including:
   i. Total Planned Fertilizer Nitrogen Requirement for the crop in pounds/acre (fertilizer nitrogen for non-legumes or the nitrogen removal capacity for legumes as described in section A2 (1) of this standard)
   ii. Plant Available Nitrogen (PAN) from manure applied to field (lbs N/acre)
   iii. Nitrogen applied from other sources (lbs N/acre)
   iv. Total applied plant available nitrogen from all sources (lbs N/acre)
   v. Difference between total applied plant available nitrogen from all sources and planned crop nitrogen requirement (lbs N/acre)

g) For each field complete an annual phosphate inventory including:
   i. The soil test phosphorus rating for the field
   ii. The Missouri Phosphorus Index (P-index) rating, if applicable
   iii. Actual phosphate applied as manure (lbs phosphate/acre)
   iv. Actual phosphate applied from other sources (lbs phosphate/acre)
   v. Planned phosphate removal from crops harvested this year (lbs phosphate /acre)
   vi. Actual phosphate removal from crops harvested this year (lbs phosphate /acre)
   vii. Phosphate balance for the year (actual applied minus planned removal; lbs phosphate /acre)
   viii. On fields where "multi-year phosphorus application" is utilized, report the cumulative phosphate balance for the multi-year planning period. (the cumulative balance equals the actual phosphate applied minus planned phosphate removed in lbs phosphate /acre)

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The Missouri Phosphorus Index

Division of Plant Sciences and Commercial Agriculture Program

Phosphorus (P) is the nutrient limiting algal production in many Missouri streams and lakes. Water quality deteriorates when too much phosphorus enters a stream or lake, a process called eutrophication. Excess phosphorus also can reduce water clarity, cause fish kills, increase drinking water treatment costs and reduce the quality of drinking water.

Phosphorus loss from an agricultural field is determined by the interaction of many different characteristics of the field.

- Soil characteristics such as soil texture and soil depth affect the quantity of runoff from a field; more runoff can carry more phosphorus to a stream or lake.
- Soil type, soil cover and cropping practices affect the amount of soil loss from a field; more erosion carries more phosphorus to a stream or lake.
- Soil test phosphorus levels and the time elapsed between a surface application of manure or other phosphorus fertilizer and a runoff event affect the concentration of phosphorus in runoff; higher phosphorus concentrations in runoff carry more phosphorus to a stream or lake.

MU Extension publications G9181, *Agricultural Phosphorus and Water Quality,* and G9182, *Managing Manure Phosphorus to Protect Water Quality,* have additional information on the impact of excess phosphorus on stream and lake water quality and the factors affecting phosphorus loss from agricultural fields.

Government regulatory and cost-share programs require many farmers applying manure to assess the potential for phosphorus loss from their fields in an effort to reduce phosphorus loss from agricultural fields. For example, the U.S. Environmental Protection Agency (EPA) is implementing amended rules requiring permitted concentrated animal feeding operations to assess phosphorus loss on all fields receiving manure. The Natural Resources Conservation Service (NRCS) of the U.S. Department of Agriculture has similar requirements for any manure application on farms receiving incentives or cost-share funds through programs like the Environmental Quality Incentives Program (EQIP).

The phosphorus index promotes conservation practices that reduce phosphorus loss from agricultural fields.

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Background

A phosphorus index (P-index) is one of the management tools that can be used to identify agricultural fields with a high potential for phosphorus losses in runoff. The P-index is a systematic method for integrating a wide range of field characteristics into a prediction of the potential for phosphorus loss from the field. This integrated approach is needed because of the number and the complexity of the factors affecting phosphorus loss from agricultural fields; no single measurement or indicator is sufficient to predict phosphorus loss susceptibility of an agricultural field.

Each state has developed its own P-index. Differences in climate, soil type, phosphorus soil testing method, crop management and sensitivity of receiv-

ing water all contribute to make locally developed P-indexes more effective than a single national or regional approach. Phosphorus indexes also differ among states because there is legitimate debate concerning the most effective approach and strategy for designing and using a phosphorus index. Phosphorus indexes continue to evolve and improve because the P-index is a relatively new concept.

The Missouri P-index is designed to help identify fields that have a high probability of phosphorus loss from the combined effects of erosion and soil test phosphorus. It is designed to be used as part of developing a one- to five-year nutrient management plan. The Missouri P-index integrates field information such as current soil test phosphorus level, expected presence or absence of tillage operations, anticipated land cover (based on crop and residue management), soil hydrologic category (a soil survey characteristic), and the distance of the field from a receiving body of water. The most complex parameter in the Missouri P-index is the estimate of erosion derived from the NRCS erosion prediction software, RUSLE2 (RUSLE2 stands for Revised Universal Soil Loss Equation, version 2). The Missouri P-index uses a simplified model approach to integrating the input information into a P-index rating for a field. The Missouri P-index is currently distributed as a Microsoft Excel spreadsheet available on the Web at *nmplanner.missouri.edu*.

Input data for the Missouri P-Index

This section details the specific requirements for all inputs in the Missouri P-index spreadsheet.

County

Select the Missouri county from the drop-down list. The Missouri county must be entered for each field. The Missouri P-index is not set up to work outside of Missouri.

Soil test P information

- Enter the numeric value for soil test P.
- Select the appropriate units from the drop-down list (lb/acre or ppm).
- Select the extraction procedure used by the laboratory to determine soil test P from the drop-down list (Bray-I, Mehlich-III or water).
- Select the sampling depth used when obtaining the soil sample from the drop-down list (2 inches, 3 inches or 6 to 8 inches).

All the information except sampling depth should be on the soil test report you received from the soil testing laboratory. The University of Missouri soil testing laboratory reports soil test P in units of lb/acre and uses the Bray-I extraction procedure. Most agronomic soil samples are taken to a 6- to 8-inch depth.

Most agencies require the soil test data used in a P-index be from samples taken less than three years

The phosphorus index is one of the tools used to develop a nutrient management plan.

prior to their use to evaluate phosphorus loss. A more recent sample may be required if phosphorus has been applied at rates that exceed crop removal since the last soil sample.

Avoid soil sampling a field soon after applying phosphorus. This would give artificially high results. It is best to wait at least three months after a phosphorus application to allow time for applied phosphorus to equilibrate with the soil.

Tillage

Select either "Tilled" or "No-till or forage" from the drop-down list. It is appropriate to select "Tilled" for any field that has had soil mixing in the past five years. The objective is to identify fields where lack of tillage has led to stratification, concentrating nutrients on the soil surface.

Erosion estimate from RUSLE2

Enter the RUSLE2 estimate of "average annual erosion loss" calculated for the cropping system for the field in the units of tons/acre/year. RUSLE2 is NRCS-supported software used to estimate erosion loss for a cropping sequence in a field. The erosion loss assessment includes the impact of soil type(s), crop cover, residue management and tillage activities. This analysis should be available for any field that has a completed NRCS conservation plan. Contact a local NRCS field office to see if they have RUSLE2 values for the field of interest.

Two points will help with using RUSLE2 with the Missouri P-index. First, Missouri P-index uses the dominant critical slope to estimate erosion losses within the field. The current P-index does not account for the impact of conservation practices such as field borders and filter strips that reduce sediment delivery to water bodies.

Second, applying manure may require additional tillage activities potentially increasing erosion and the soil binding characteristics of the manure may potentially reduce erosion. The impact of these activities on erosion typically is not accounted for in the current Mis-

The phosphorus index is an example of a phosphorus loss assessment tool.

souri P index. Many plans and planners have already run RUSLE2 before addressing manure management planning. Typically, we recommend using the existing RUSLE2 estimate of erosion for the Missouri P index. This approach avoids repeated runs of RUSLE2 and the Missouri P index as planners attempt to accommodate manure application scenarios on the RUSLE2 erosion estimates and the P-index. For example, a hog operation plans on injecting manure into a cornfield that is also spring tilled before planting corn. The RUSLE2 estimate of erosion loss need not include the impact of the injection of manure on erosion loss in this tilled system. In another example, a farmer surface-applies poultry litter to a pasture. The RUSLE2 estimate of erosion loss need not include the effect of the surface application of litter on erosion loss from the pasture.

The erosion estimate from RUSLE2 should be rerun for a field when manure applications require tillage activities in systems characterized as no-till. For example, if a farmer plans on injecting manure every other year into soybean stubble in a system that otherwise has no tillage, then RUSLE2 should be rerun to account for the effect of the two tillage events introduced into a no-till system.

In the future, RUSLE2 will be more fully integrated into the nutrient management process and we will be able to better account for the effects of manure application on erosion loss.

Land cover

Select from a drop-down list of 20 possible land cover selections. These options integrate crop selection and conservation practices (e.g., small grain-contoured).

Hydrologic soil group and condition

- Select from a drop-down list (A, B, C or D) of the soil hydrologic groups. Soil hydrologic group is a characteristic of the soil and can be determined from the soil survey. This information is also available in the Missouri Animal Feeding Operation Site Assessment report available online at *ims.missouri.edu/afosite.*
- Select the soil hydrologic condition from a drop-down list (good, fair or poor). This judgment call evaluates the soil structure of the field. If the field is much more compacted than typical for this soil the hydrologic condition is poor. Soils with good soil structure are rated good.

Distance from center of field to water feature

Estimate the distance (in feet) from the approximate center of the field to the closest identified water feature or direct conduit to a water feature. Examples of water features include an intermittent stream, water impoundment and tile-line inlet left open during manure application.

Interpreting Missouri P-index results

The Missouri P-index is used to assess the long-term potential for phosphorus from an agricultural field due to erosion and high soil test phosphorus. The Missouri P-index calculates a value for a field and then converts that value into a phosphorus loss assessment rating of low, medium, high or very high. The interpretation of the four rating levels is as follows:

- *Low*: Nitrogen-based nutrient management allowed.
- *Medium:* Nitrogen-based nutrient management allowed. Consider implementing phosphorus-based management of manure and other conservation practices to reduce phosphorus loss from the field.
- *High:* Phosphorus-based manure management required. Additional land conservation practices to reduce phosphorus loss from this field highly recommended.
- *Very high:* No manure applications recommended. Implement land conservation practices to reduce phosphorus loss from this field.

Nitrogen-based management implies that manure application rates can be determined annually based on the nitrogen need of the crop and the nitrogen content of the manure. For many types of manure, this strategy will result in significant increases in soil test phosphorus and an associated increase in potential phosphorus loss from the field. In some fields, raising soil test phosphorus is recommended to reverse the negative effect of low soil test phosphorus on crop yield and quality. In most fields, long-term use of nitrogen-based management will lead to a high phosphorus loss assessment rating. In other words, nitrogen-based management typically is not a long-term sustainable practice.

Phosphorus-based management is sustainable on a field. This strategy allows farmers to apply, in a single application, up to five years of phosphorus to a field

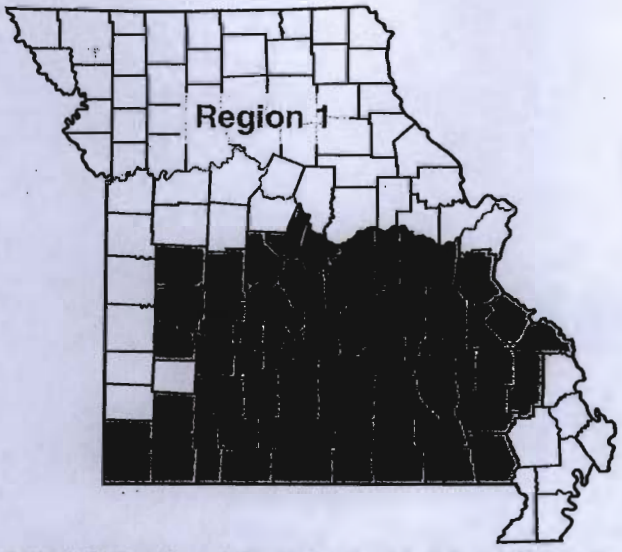

Figure 1. Delineation of Missouri regions for interpreting the P-index. The assessment system is more restrictive in the Ozark region (Region 2).

to meet crop needs and then refrain from additional applications until the excess phosphorus has been removed by subsequent crops. This allows manure to be used as the sole source of nitrogen fertilizer in the year of manure application while typically providing multiple years of phosphorus fertilizer for crops.

The Missouri P-index is more restrictive in the Ozark region of Missouri than in the rest of the state (see Figure 1). The Ozark region of Missouri has more restrictive interpretations because the water resource in that part of the state is more sensitive to phosphorus inputs. Table 1 details the ratings associated with specific P-index values in each region of Missouri.

Table 1. The P-index rating system as affected by region of Missouri.

	P-index calculate value	
P-index rating	Region 1	Region 2
Low	≤3	≤1
Medium	>3 to ≤7	>1 to ≤5
High	>7 to ≤12	>5 to ≤10
Very high	>12	>10

Finally, it is important to understand the mechanisms of phosphorus loss not addressed by the Missouri phosphorus index. The Missouri P-index does not address leaching of phosphorus. Fields at most risk for leaching losses have sandy soils with very high soil test phosphorvus test levels. It also does not address phosphorus losses associated with rainfall events soon after surface applications of manure or other phosphorus fertilizers. These losses can be significant but are primarily driven by short-term weather factors that cannot be addressed in a long-term planning tool. Management practices to avoid manure application when runoff events are likely should be addressed in other parts of the nutrient management plan.

The Missouri P-index is designed to be a phosphorus-loss assessment tool addressing phosphorus losses from erosion and soil test phosphorus in runoff from agricultural fields. The Missouri P-index is specifically designed as a phosphorus loss assessment tool for use in developing a one- to five-year nutrient management plan for a farm. The ratings should be used to identify fields that have a high long-term potential for phosphorus in runoff and to identify fields that require additional conservation practices to reduce potential phosphorus loss in runoff.

Implementing the Missouri P-index

The following examples show how the Missouri P-index can be used as part of a nutrient management planning process.

Scenario 1

A farmer uses a cool-season hayfield for fall manure applications when weather conditions restrict access to row-crop fields earlier in the year. Agronomic soil testing indicated that this practice has led to a Bray-I soil test P level (0- to 6-inch sample) of 100 lb/acre. The University of Missouri soil test recommendation was that no fertilizer phosphorus be applied on this field. The soil test P level exceeds the amount needed to provide the phosphorus for crop production, and there is little probability of an increase in yield from any application of phosphorus.

The farmer wants to continue to use this field as a backup field for manure applications. The P-index was used to evaluate the potential for phosphorus loss from this field that has elevated soil test P.

The field is in Pettis County, in Region 1. The average annual erosion loss is 1.3 tons/acre/year according to RUSLE2. The field is in hydrologic soil group C and is in good condition. The center of the field is approximately 300 feet from an intermittent stream.

Figure 2 shows P-index data input and results for this field. The P-index rating is "Medium," indicating that anticipated phosphorus losses from the field are low enough that use of the field for manure applications can continue.

Scenario 2

A farmer in Saline County (Region 1) has been using manure as a nitrogen fertilizer source for a field in a corn-soybean rotation. The field is tilled periodically with no soil conservation practices in place. Because of the repeated manure applications Bray-I soil test P level is 265 lb/acre for a 0- to 6-inch sample.

With high fertilizer prices, the farmer wants to continue to use manure as the main nitrogen fertilizer for this field. The P-index initially indicated a very high rating (Figure 3, Field 1-A). The nutrient man-

	A	B
3		Field 1
4	County	Pettis
5		
6	Soil test P level	100
7	Units	lbs/acre
8		
9	Extraction Procedure	Bray-I
10	Sampling depth	6 to 8 inches
11		
12	Tillage	Notill or Forage
13		
14	RUSLE value - average annual (tons/ac)	1.3
15		
16	Land cover	Hay ground
17		
18	Hydrologic soil group	C
19	Hydrologic condition	Good
20		
21	Distance from center of field to water feature	300
22		
23	Particulate P value	1.6
24		
25	Soluble P value	1.8
26		
27	Total P value	3.4
28		
32	P index rating	MEDIUM
33	Agronomic P rating (Opt.= 45 lbs/a)	VERY HIGH

Figure 2. P index results for scenario 1.

agement planner pointed out that erosion losses from the field were high because of the lack of conservation practices. The farmer agreed that planting on the contour and maintaining residue cover were important practices to conserve soil. These changes reduced estimated erosion to 4.5 tons/acre/year. The resulting P-index rating was medium.

The nutrient management planner advised the farmer that the soil conservation practices would allow continued nitrogen-based applications on this field. However, this approach would lead to continued increases in soil test P and phosphorus limits on manure application in the near future. The nutrient management planner recommended transitioning to less frequent manure applications that did not exceed phosphorus removal capacity of the rotation before such practices were mandatory based on the P-index.

	A	B	C	D	E
3		Field 1 - A		Field 1 - B	
4	County	Saline		Saline	
5					
6	Soil test P level	265		265	
7	Units	lbs/acre		lbs/acre	
8					
9	Extraction Procedure	Bray-I		Bray-I	
10	Sampling depth	6 to 8 inches		6 to 8 inches	
11					
12	Tillage	Tilled		Tilled	
13					
14	RUSLE value - average annual (tons/ac)	8		4	
15					
16	Land cover	Row crop - straight row		Row crop - contoured with residue	
17					
18	Hydrologic soil group	C		C	
19	Hydrologic condition	Good		Good	
20					
21	Distance from center of field to water feature	500		500	
22					
23	Particulate P value	9.4		4.7	
24					
25	Soluble P value	2.6		2.2	
26					
27	Total P value	12.0		6.9	
28					
32	P index rating	VERY HIGH		MEDIUM	
33	Agronomic P rating (Opt.= 45 lbs/a)	VERY HIGH		VERY HIGH	

Figure 3. P-index results for scenario 2 without (Field 1-A) or with (Field 1-B) soil conservation practices.

Overview of calculations used in the Missouri P-index

The Missouri P-index combines values for particulate phosphorus and dissolved phosphorus in the following way:

Missouri P-index value = [(soil test P (ppm) × 2.2 + native total P (ppm)) × (RUSLE2 erosion estimate (tons/acre/year))
× sediment delivery ratio coefficient × particulate P availability factor]
+ [soil test P (ppm) × (soil test P vs. runoff P coefficient)
× county runoff volume estimate × runoff curve number coefficient]

Some notes on the current calculation of the Missouri P-index:

- Soil test P is adjusted for sampling depth and tillage to reflect higher P concentrations in the surface soil layer of no-till and forages (calculation not shown).
- Soil test P multiplied by a factor (2.2) to estimate total P applied to raise soil test P to that value.
- Biological availability of particulate P in surface water is currently set at 0.75.
- Runoff volume calculated on county-by-county long-term average rainfall. An approach based on curve number adjusts runoff volume for specific soil cover.

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Calculating Plant-Available Nitrogen and Residual Nitrogen Fertilizer Value in Manure

Division of Plant Sciences and Commercial Agriculture Program

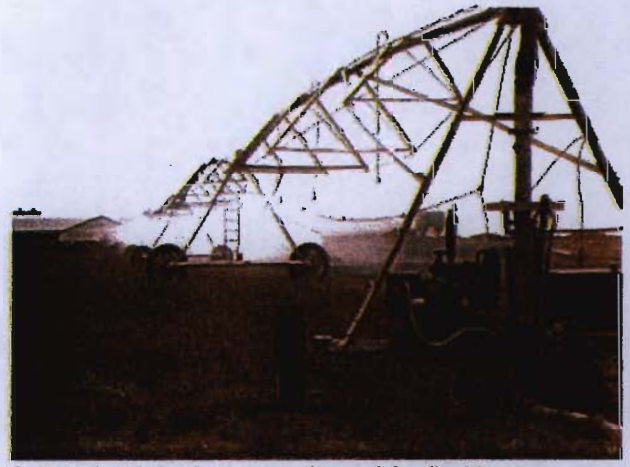
Manure typically is used as a fertilizer for crop production. This guide details the calculations needed to determine the fertilizer nitrogen value of manure, termed "plant-available nitrogen" (PAN). The guide also details "residual nitrogen fertilizer value" (RNFV), which is a method used to determine the amount of nitrogen released by manure in the year after application. There are also examples of incorporating an estimate of plant-available nitrogen and residual nitrogen value into a manure application recommendation for a crop.

These calculations can be complicated when done by hand. A companion Web page to this guide provides tools to make these calculations. The software package Manure Management Planner (MMP) from Purdue University also calculates manure application rates based on Missouri plant-available nitrogen recommendations. Links to both the PAN Web page and the MMP software can be found online at *nmplanner.missouri.edu*.

Manure versus other nitrogen sources

Most commercial nitrogen fertilizers are 100 percent plant available when applied to the soil. Fertilizers such as ammonium nitrate, anhydrous ammonia, urea and ammonium sulfate are in a form that is completely available to a plant or convert rapidly to a form usable by the plant when soils have sufficient warmth and moisture for crop growth.

Manure contains both organic nitrogen and mineral forms of nitrogen. The organic nitrogen is an integral component of cells in organic material in the manure. Plants cannot directly use organic nitrogen. Instead, plants rely on microbes in the soil to break down the organic nitrogen and release it into the soil in a mineral form plants can use. This process is called *mineralization*. One challenge of using manure as a fertilizer is predicting the amount of organic nitrogen that will be released to soil as mineral nitrogen and the rate it will be released.



Center-pivot irrigation system for applying liquid manure.

The mineral nitrogen in manure also poses unique challenges. Mineral nitrogen in most manure sources is in the ammonium form at the time of land application. Most manure sources also have a relatively high pH. This combination of high pH coupled with an ammonium nitrogen source can lead to significant ammonia volatilization when manure is surface-applied to soil. These losses of nitrogen can significantly reduce the fertilizer value of surface-applied manure.

Nitrogen losses occur from any source of nitrogen fertilizer. For detailed information on best management practices for minimizing nitrogen losses from any nitrogen application see the MU publications G9218, *Managing Nitrogen to Protect Water Quality*, and IPM1027, *Best Management Practices for Nitrogen Fertilizer in Missouri*.

This guide focuses on the unique challenges of managing manure as a nitrogen source and calculating the nitrogen fertilizer value of manure.

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Background on factors affecting nitrogen availability in manure

Nitrogen availability from organic nitrogen

Mineralization is the conversion of organic nitrogen into mineral forms that are available to crops. Long-term research has shown that nitrogen release from the organic nitrogen in manure takes place over years and some of the organic nitrogen is never released to plants. Most of the organic nitrogen is released in the growing season following application and the amount of nitrogen released beyond two years after application is relatively small. In Missouri, the residual fertilizer value of organic nitrogen requires tracking manure fertilizer contributions for two years.

Table 1 summarizes estimates of nitrogen availability for organic nitrogen in manure.

- Year-one availability ($k_{1(Y1)}$) predicts the fraction of organic nitrogen available as fertilizer in the first growing season after application. This factor is used in calculating the fertilizer nitrogen value of manure in the PAN equation.
- Year-two availability ($k_{1(Y2)}$) predicts the fraction of organic nitrogen available as fertilizer in the second growing season after application. This factor is used in calculations adjusting nitrogen recommendations in the year after manure application to account for residual nitrogen generated from organic nitrogen in the manure.
- Total availability ($k_{1(T)}$) is the sum of year-one and year-two availability and represents the fraction of the organic nitrogen that is accessible to growing plants. In all manure types the fraction of total available organic nitrogen is less than 1.

Mineralization is a biological process so it is affected by environmental conditions in the soil. Cold, excessively wet, or excessively dry soils all inhibit microbial activity, delaying availability of organic nitrogen in manure. Organic nitrogen availability factors estimate expected release of nitrogen but the timing and quantity released in a given year will vary based on local conditions. Not all organic nitrogen is equally available to plants. This can be seen in the differences in Table 1 based on manure type and storage method. Manure treatment processes that change the characteristics of manure organic matter may increase or reduce the availability of organic nitrogen. We are currently unable to predict year-to-year variation or all the impacts of storage and handling on organic nitrogen availability.

Nitrogen availability from ammonium nitrogen

Manure in storage facilities typically lacks free oxygen. High rates of biological activity in liquid storages, dry manure stacks, and compost piles exceed the rate of oxygen supply creating anaerobic conditions. Under these conditions all mineral nitrogen in the storage is converted to the ammonium form (NH_4^+). Nitrate nitrogen (NO_3^-) is unable to persist and is driven down to negligible levels.

Table 1. Organic nitrogen availability factors (k_1).

	Liquid storages, except poultry	Dry storages, no bedding, except poultry	Dry storages, with bedding, except poultry	All poultry
Year 1 ($k_{1(Y1)}$)	0.39	0.39	0.29	0.62
Year 2 ($k_{1(Y2)}$)	0.23	0.23	0.16	0.13
Total ($k_{1(T)}$)	0.62	0.62	0.45	0.75

Ammonium nitrogen in the manure is susceptible to losses by ammonia volatilization when manure is surface-applied. Timely incorporation of manure into the soil reduces ammonia volatilization.

Volatilization losses from surface-applied manure are highly variable. A review of 15 field experiments documented ammonia losses from surface-applied, unincorporated manure ranging from 10 to 99 percent of applied ammonium. The mean loss was 47 percent of the applied ammonium nitrogen. Losses tended to be more variable at low application rates.

Predicting nitrogen losses from ammonia volatilization is difficult. Many factors affect the rate of nitrogen loss and the total ammonia loss after surface application of manure.

- Conditions that promote water evaporation are similar to conditions that promote ammonia volatilization. Consequently surface manure applications during warm, windy conditions increase the rate of ammonia volatilization.
- Applications under cool conditions reduce the rate of volatilization but with time losses under cool conditions can match losses in hot, dry conditions.
- Application strategies that promote contact of manure with the soil reduce volatilization losses.
- Low rates of manure that coat plants and plant residues with a thin layer of manure increase ammonia losses.
- Higher application rates can lower losses by forcing more manure into contact with the soil and creating a thicker layer of manure inhibiting ammonia loss.
- Ammonia losses are most rapid at the time of application dropping rapidly with time. In dry conditions, another flush of ammonia loss can be initiated by rewetting the manure.

Table 2. Inorganic nitrogen availability factors (k_2).

Form of inorganic N	Injection	Partial (~40%) injection	Surface application			
			Days to incorporation			
			<0.2	0.2–1.0	>1.0–3.0	>3*
Ammonium N ($k_{2(NH4)}$)	0.95	0.70	0.90	0.75	0.60	0.50
Nitrate N ($k_{2(NO3)}$)	1.0	1.0	1.0	1.0	1.0	1.0

*more than 3 days or no incorporation

Ammonia losses from surface applications are chemically mediated reactions. The driving force in ammonia loss is high pH. Most manure has a near- or above-neutral pH, promoting ammonia loss. Initially, the chemistry of the manure controls rates of ammonia loss from manure. With time the loss of ammonia and the reaction of manure with soil drives down pH to a level that prevents further ammonia loss.

When manure is injected into the soil or immediately incorporated after application, ammonium in the manure reacts with the soil and is not prone to ammonia losses. Under these conditions, ammonium nitrogen from manure is equivalent to any other mineral nitrogen source. To avoid uncertainty in the availability of ammonium nitrogen in manure, inject manure into soil or incorporate manure immediately after application.

Nitrate is rarely a significant component of manure from conventional manure handling systems. Consequently, there typically is no reason to test for nitrate in manure. If a unique manure storage system sustains significant amounts of nitrate it will be 100 percent plant available with surface application, injection, or incorporation.

Table 2 summarizes estimates of nitrogen availability for mineral nitrogen in manure.

- Ammonium availability ($k_{2(NH4)}$) predicts the fraction of ammonium nitrogen available as fertilizer in the year of application. This factor is used in calculating the fertilizer nitrogen value of manure in the PAN equation.
- Nitrate availability ($k_{2(NO3)}$) predicts the fraction of nitrate nitrogen available as fertilizer in the year of application. Typically, nitrate concentrations in manure can be assumed to be zero and this factor is not needed when using the PAN equation.

In many software packages and web-based applications placement of the manure is established through the selection of manure application equipment. Table 3 associates the choices for manure application equipment used in MMP and the PAN Web site with placement of manure.

Table 3. Standard manure application list and the associated definitions used to determine inorganic nitrogen availability factors from Table 2.

Manure application equipment	Manure placement
Solids spreader	Surface
Tanker, injected	Injected
Tanker, surface-applied	Surface
Dragline, injected	Injected
Dragline, surface-applied	Surface
Dragline, AerWay® style	Partial injection
Traveling gun	Surface
Solid set irrigator	Surface
Center pivot	Surface

There is no expectation of residual effects with inorganic nitrogen sources in the years after application, so there is no residual availability factor as there is with organic nitrogen.

Calculating plant-available nitrogen (PAN) in manure

There are four steps to estimating nitrogen availability in manure:

1. Obtain a relevant estimate of organic and ammonium nitrogen in the manure.
2. Convert the manure test results into the desired units.
3. Calculate the plant-available nitrogen (PAN) released by the manure in the growing season associated with manure application.
4. Calculate the residual nitrogen fertilizer value (RNFV) released in the second growing season after manure application.

1. Obtaining a relevant estimate of nutrient concentrations in manure

Manure testing is the most accepted way to estimate nutrient concentrations in manure. The following analyses are needed to estimate plant-available nitrogen:

- Total or total Kjeldahl nitrogen (TKN)
- Ammonium or ammonia nitrogen
- % dry matter, % solids or % moisture (only needed if results are not on an "as-is" basis).

Manure samples should also be analyzed for total phosphorus and total potassium. If you are concerned about salt content of your manure request an electrical conductivity analysis.

In almost all manure storage systems, no analysis for nitrate nitrogen is needed. Manure storage systems like anaerobic lagoons, slurry pits, litter packs and manure piles have essentially no free oxygen in them resulting in nearly all mineral nitrogen being in the ammonium form. It is appropriate in all conventional manure handling systems to assume nitrate nitrogen concentration is zero.

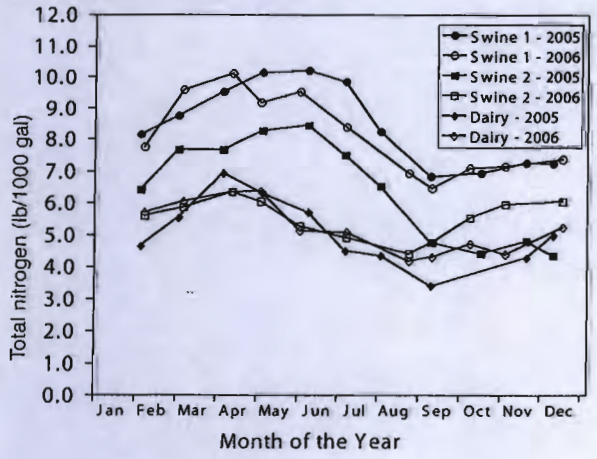
Permitted animal feeding operations are required to sample their manure at least once per year. Many operations will benefit from testing more frequently or combining information from more than one manure test to estimate nutrient concentrations in manure. Figure 1 shows the variation in total nitrogen concentration in three lagoons over two years. In these lagoons it would be prudent to sample in both spring and fall because nitrogen concentration decreased approximately 30 percent between spring and fall.

The best time for sampling manure varies among types of manure storages. Ideally, samples should be taken before manure application, leaving time for lab analysis of the manure so the results can be used in determining manure application rates. This approach works well for unagitated lagoon systems, solids piles and composting systems where there is no limitation on access to the manure. In other systems it is difficult to get a representative manure sample until the time of manure application. Agitated lagoons and pit slurry storages are examples of systems where it is difficult to obtain a representative sample of manure until the time of manure application. In these systems, sample the manure during manure agitation and application activities. The samples taken during application can confirm that the applied rates were correct and the results can be added to the historic data used to calculate rates applied the next time.

In some cases a manure test cannot be obtained (e.g., planning a new operation). In this situation you have the following options listed in order of preference.

- Manure tests from a similarly managed facility are particularly useful for poultry operations and hog slurry operations.
- Feed-based estimates of manure production (see ASAE publication D384, *Manure Production and Characteristics* (2005)) coupled with a measured or estimated volume of manure can be useful for slurry storages on hog operations.

Figure 1. Impact of date of sampling on total nitrogen concentration in unagitated lagoon effluent.



- Book values are the least desirable source of manure nutrient estimates because they do not account for operation specific characteristics such as animal genetics, feed management practices and water additions to the storage.

See "For further information" (page 8) for more references on sampling manure storages.

2. Converting manure test results to desired units

Manure test results come in a range of units and not all are equally useful or understood by the person using the manure. Table 4 defines the preferred basis and units for manure test results for solid and liquid manure. If your manure sample results differ from the preferred reporting standard in Table 4 follow the three-step sequence below to convert your results to the preferred reporting standard.

Table 4. Preferred manure test reporting standard for liquid and solid manure.

Manure form	Preferred moisture basis	Preferred nutrient basis	Preferred units
Liquid	"as-is"	N, P_2O_5, K_2O	pounds per 1000 gallons (lb/1000 gal)
Solid	"as-is"	N, P_2O_5, K_2O	pounds per ton (lb/ton)

Step 1: Confirm that manure test results are reported on an "as-is" basis (also referred to as "wet" basis). If they are instead reported on a dry matter basis use the appropriate equation in Table 5 to convert nutrient concentrations from your manure test results to an as-is basis.

Table 5. Conversion table from dry matter basis to as-is basis.

Manure solids reported as	Conversion equation
Percent dry matter (%DM)	Nutrient concentration, wet basis = Nutrient concentration, dry basis × %DM/100
Percent solids (%Solids)	Nutrient concentration, wet basis = Nutrient concentration, dry basis × %Solids/100
Percent moisture (%MC)	Nutrient concentration, wet basis = Nutrient concentration, dry basis × (100 − %MC)/100

Step 2: Confirm that phosphorus (P) is reported as P_2O_5 or phosphate and that potassium (K) is reported as K_2O or potash. If they are instead reported as P, phosphorus, or elemental P, and K, potassium, or elemental K, use Table 6 to convert them to a P_2O_5 and K_2O basis. Note that this conversion equation does not affect the units used to report manure test results (e.g., ppm, %, lb/ton, lb/acre-inch, or lb/ton).

Table 6. Conversion table from elemental phosphorus to a P_2O_5 (phosphate) basis and elemental potassium to a K_2O (potash) basis.

Manure test report	Conversion equation
Elemental P or P	P_2O_5 = Elemental P × 2.27
Elemental K or K	K_2O = Elemental K × 1.22

Step 3: Confirm that test results are in the preferred units of "pounds per 1000 gallons" for liquid samples or "pounds per ton" for solid samples. If they are not, use Table 7 to convert them to the preferred units.

Table 7. Conversion table for converting liquid samples to "pounds per 1000 gallons" and solid samples to "pounds per ton."

Manure form	Reported units	Conversion equation
Liquid	percent (%)	lb/1000 gallons = % × 84.3
Liquid	parts per million (ppm)	lb/1000 gallons = ppm × 0.00834
Liquid	mg/L or mg/kg	lb/1000 gallons = mg/L × 0.00834
Liquid	pounds per acre-inch	lb/1000 gallons = lb/acre-inch / 27.15
Solid	percent (%)	lb/ton = % × 20
Solid	parts per million (ppm)	lb/ton = ppm × 0.002
Solid	mg/L or mg/kg	lb/ton = mg/L × 0.002

Example 1

A manure test for poultry litter (solid manure) has the following results:

Moisture content (%)	26.3
Total nitrogen (%)	3.41
Organic nitrogen (%)	2.97
Elemental P (%)	2.04
Elemental K (%)	2.10

All results were reported on a dry matter basis.

Step 1: Convert all nutrient values to "as-is" basis (use Table 5).

Total N (%, as-is basis) = 3.41 × (100-26.3)/100 = 2.51
Organic N (%, as-is basis) = 2.97 × (100-26.3)/100 = 2.19
Elemental P (%, as-is basis) = 2.04 × (100-26.3)/100 = 1.50
Elemental K (%, as-is basis) = 2.10 × (100-26.3)/100 = 1.55

Step 2: Convert P to P_2O_5 and K to K_2O (use Table 6).

P_2O_5 (%, as-is basis) = 1.50 × 2.27 = 3.41
K_2O (%, as-is basis) = 1.55 × 1.22 = 1.89

Step 3: Convert to the preferred units (pounds per ton for solid manure, use Table 7).

Total N (lb/ton) = 2.51 (%, as-is basis) × 20 = 50
Organic N (lb/ton) = 2.19 (%, as-is basis) × 20 = 44
P_2O_5 (lb/ton) = 3.41 (%, as-is basis) × 20 = 68
K_2O (lb/ton) = 1.89 (%, as-is basis) × 20 = 38

Example 2

A manure sample for hog lagoon effluent (liquid manure) has the following results:

Dry matter (%)	0.5
Total N (lb/acre-inches)	175
Organic N (lb/acre-inches)	40
Phosphate (lb/acre-inches)	35
Potash (lb/acre-inches)	200

All results are on a wet basis.

Step 1: Convert all nutrient values to "as-is" basis (use Table 5).

All results are already on an "as-is" (wet) basis. No conversion needed.

Step 2: Convert P to P_2O_5 and K to K_2O (use Table 6).

Results are already reported as P_2O_5 (phosphate) and K_2O (potash). No conversion needed.

Step 3: Convert to the preferred units (pounds per 1000 gal. for liquid manure, use Table 7).

Total N (lb/1000 gal) = 175 (lb/acre-in, as-is basis) / 27.15 = 6.45
Organic N (lb/1000 gal) = 40 (lb/acre-in, as-is basis) / 27.15 = 1.47
P_2O_5 (lb/1000 gal) = 35 (lb/acre-in, as-is basis) / 27.15 = 1.29
K_2O (lb/1000 gal) = 200 (lb/acre-in, as-is basis) / 27.15 = 7.37

3. Calculating PAN

Plant-available nitrogen (PAN) is the sum of the organic nitrogen and inorganic nitrogen in the manure that is available for crop use in the year of application,

Equation 1

$$\text{PAN} = \text{organic N} \times k_{1(Y1)} + \text{ammonium N} \times k_{2(NH4)} + \text{nitrate N} \times k_{2(NO3)}$$

where k_1 values are from Table 1, k_2 values are from Table 2 and nutrient concentrations are from the manure test. Typically nitrate contribution is assumed to be zero and is not calculated.

Calculating PAN from a manure test in the preferred units is a three-step process.

Step 1: Calculate ammonium N concentration in the manure, if needed.

Manure test results frequently do not directly report ammonium concentration in the manure. Use Equation 2 to calculate ammonium nitrogen content in manure.

Equation 2

$$\text{Ammonium N} = \text{Total N} - \text{Organic N} - \text{Nitrate N}$$

Nitrate N is typically assumed to be zero when working with manure.

Step 2: Determine the appropriate manure availability factors needed to calculate PAN.

Look up the correct value for $k_{1(Y1)}$ in Table 1. You need to know the type of manure applied (e.g., poultry, liquid swine) to determine $k_{1(Y1)}$.

Look up the correct value for $k_{2(NH4)}$ in Table 2. You need to know the method of application (see Table 3) to obtain the correct value of $k_{2(NH4)}$. The correct PAN *cannot* be calculated until the method of application is known. Nitrate availability, if needed, is always assumed to be 1.0.

Step3: Calculate PAN using Equation 1 as your guide.

Example 3

Poultry litter (analysis in Example 1) is to be surface applied with a solid spreader to pasture.

Step 1: Calculate ammonium N concentration in the manure.

From Example 1, total N is 50 lb/ton and organic N is 44 lb/ton. Ammonium nitrogen was not reported. Using Equation 2:
Ammonium N (lb/ton) = 50 lb Total N/ton – 44 lb Organic N/ton = 6

Step 2: Determine the appropriate manure availability factors needed to calculate PAN.

From Table 1 $k_{1(Y1)}$ for poultry manure is 0.62. From Table 2 $k_{2(NH4)}$ is 0.50 for surface-applied manure that is not incorporated.

Step 3: Calculate PAN using Equation 1 as your guide.

PAN (lb/ton) = Organic N (lb/ton) × 0.62 + Ammonium N (lb/ton) × 0.50
= 44 (lb/ton) × 0.62 + 6 (lb/ton) × 0.50 = 30

Example 4

Lagoon effluent from a hog operation (analysis in Example 2) is to be injected into a corn crop with a tractor-pulled tanker.

Step 1: Calculate ammonium N concentration in the manure.

From Example 1, total N is 6.45 lb/1000 gallons and organic N is 1.47 lb/1000 gallons. Ammonium nitrogen was not reported. Using Equation 2:
Ammonium N (lb/1000 gal) = 6.45 lb Total N/1000 gallons – 1.47 lb Organic N/1000 gallons = 4.97

Step 2: Determine the appropriate manure availability factors needed to calculate PAN.

From Table 1 $k_{1(Y1)}$ for liquid hog manure is 0.39. From Table 2 $k_{2(NH4)}$ is 0.95 for injected manure.

Step 3: Calculate PAN using Equation 1 as your guide.

PAN (lb/1000 gal) = Organic N (lb/ton) × 0.39 + Ammonium N (lb/1000 gal) × 0.95
= 1.47 (lb/ton) × 0.39 + 4.97 (lb/1000 gal) × 0.95 = 5.30

4. Calculating residual nitrogen factor (RNFV)

Residual nitrogen fertilizer value (RNF) is the fraction of organic nitrogen in the manure that will become available the year after manure application. Only organic nitrogen has residual value in year two after application.

Equation 3

$$RNFV = \text{organic N} \times k_{k1(Y2)}$$

Example 5

Calculate the RNFV of poultry litter applied to the pasture (manure analysis from Example 1).

From Table 1, $k_{k1(Y2)} = 0.13$.

RNFV = organic N × $k_{k1(Y2)}$

= 44 lb/ton × 0.13 = 6 lb N/ton

This is the estimated amount of nitrogen that will be released from the poultry litter in the second year after application.

Example 6

Calculate the RNFV of lagoon effluent applied to cornfield (manure analysis from Example 2).

From Table 1, $k_{k1(Y2)} = 0.23$.

RNFV = organic N × $k_{k1(Y2)}$

= 1.47 lb/1000 gallons × 0.23 = 0.34 lb N/1000 gallons

This is the estimated amount of nitrogen that will be released from the lagoon effluent in the second year after application.

Dragline application of liquid manure.

Truck-mounted applicator of solid manure.

Calculating manure application rates with PAN

Examples 7 and 8 show how to determine the manure application rate based on a target nitrogen need for a crop, the amounts of phosphate and potash applied and the amount of nitrogen that will be released in the second year after manure application.

Example 7

The target application rate is 60 pounds per acre for a fall surface application on pasture.

From Example 3, PAN = 30 lb/ton.

Manure rate = Target N rate / PAN
= 60 lb/acre / 30 lb/ton = 2 tons/acre

From Example 1, phosphate in manure = 68 lb/ton and potash in manure = 38 lb/ton.

Phosphate applied = Manure rate × phosphate in manure
= 2 tons/acre × 68 lb/ton = 136 lb/acre

Potash applied = Manure rate × potash in manure
= 2 tons/acre × 38 lb/ton = 76 lb/acre

From Example 5, RNFV = 6 lb N/ton

Residual nitrogen = Manure rate × RFNV
= 2 tons/acre × 6 lb N/ton = 12 lb N/acre

Example 8

The target application rate is 150 pounds per acre for a lagoon effluent injected ahead of a corn crop.

From Example 4, PAN = 5.30 lb/1000 gallons.

Manure rate = Target N rate / PAN
= 150 lb/acre / 5.30 lb/1000 gallons = 28.3 thousand gallons/acre

From Example 2, phosphate in manure = 1.29 lb/1000 gallons and potash in manure = 7.37 lb/1000 gallons.

Phosphate applied = Manure rate × phosphate in manure
= 28.3 thousand gallons/acre × 1.29 lb/1000 gallons
= 36 lb/acre

Potash applied = Manure rate × potash in manure
= 28.3 thousand gallons/acre × 7.37 lb/1000 gallons
= 209 lb/acre

From Example 6, RNFV = 0.34 lb N/1000 gallons

Residual nitrogen = Manure rate × RFNV
= 28.3 thousand gallons/acre × 0.34 lb N/ton = 10 lb N/acre

For further information

From MU Extension Publications - 1-800-292-0969

EQ215, *Laboratory Analysis of Manure*
G9340, *Sampling Poultry Litter for Nutrient Testing*
G9218, *Managing Nitrogen to Protect Water Quality*
G9184, *The Missouri Phosphorus Index*
IPM1027, *Best Manavgement Practices for Nitrogen Fertilizer in Missouri*
MWPS-18, *Manure Characteristics,* 2nd Edition, 2004
ASAE D384.2, *Manure Production and Characteristics,* 2005

On the Web

Nutrient Management Planner: ***nmplanner.missouri.edu***

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Setback Distances for Land Application of Manure

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A land application setback distance is the minimum distance required between manure application areas and sensitive areas that may be vulnerable to water pollution. The purpose of a setback is to reduce the potential for contaminants to reach ground or surface water. Properly managed setbacks improve water quality by acting as filters for water passing over or through the soil toward a water resource.

Sensitive areas and their required setback distances vary from state to state. Missouri recommendations and requirements are listed in Table 1.

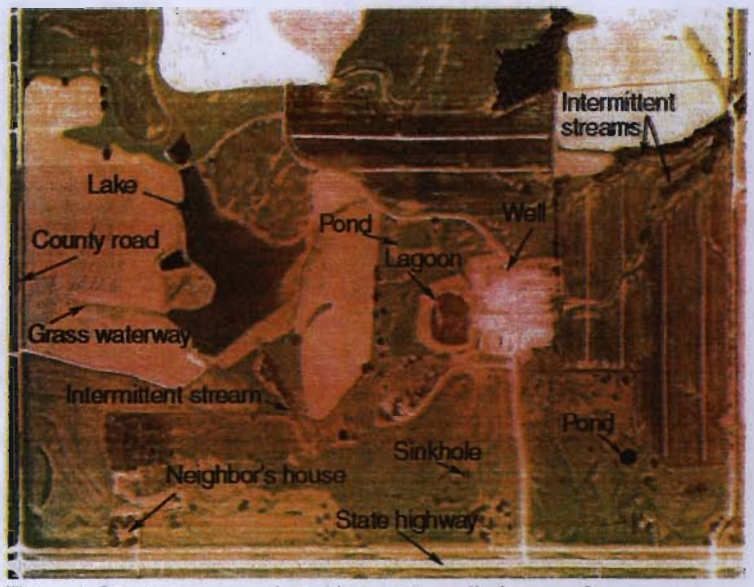

Figure 1. Common areas vulnerable to water pollution on a farm.

What do I need to do?

Figure 1 is an aerial map identifying some common sensitive areas on a farm. In preparing information for your nutrient management plan you should use a map like this that clearly represents the area receiving manure. Use a marker on the map to locate and clearly label known or possible sensitive areas in or near fields where you apply manure.

From the map you prepared (Figure 1), your planner will develop a map similar to Figure 2 detailing the sensitive areas and the required setback distances for manure application. Manure application is not permitted in areas shown in red in Figure 2.

You should provide a map of land application setbacks to anyone spreading manure on your farm so they know the areas that can and cannot receive manure.

Managing setback areas

Manure application is not allowed in setback areas. Setback areas can still be used for crop production. There also are no limits on the use of fertilizer materials other than manure and biosolids in the setback area.

The most effective conservation practice in setback areas for protecting water quality is a permanently vegetated filter strip. Consider removing setback areas from crop production and planting them to a mixture of grass and woody species. These species will maximize the ability of the setback to filter out nutrients and eroded soil moving toward the sensitive area. Work with your local office of the Natural Resources Conservation Service to plan vegetated filter strips.

Fertilizer applications to setback areas require special care because of their proximity to a water resource.

Table 1. Recommended separation distances for land application of biosolids.

Type of sensitive setback area	Separation distance
Wells, abandoned wells, sinkholes, caves and loosing streams[1]	300 ft
Permanently flowing and intermittent streams	100 ft
Privately owned impoundment (ponds) not used as a water supply[1]	100 ft
Property lines[1]	50 ft
Neighboring houses or public use areas[1]	150 ft

[1] Required by Missouri regulations (Department of Natural Resources, Clean Water Commission, Chapter 8, Design Guide (10 CSR 20-8.020)).

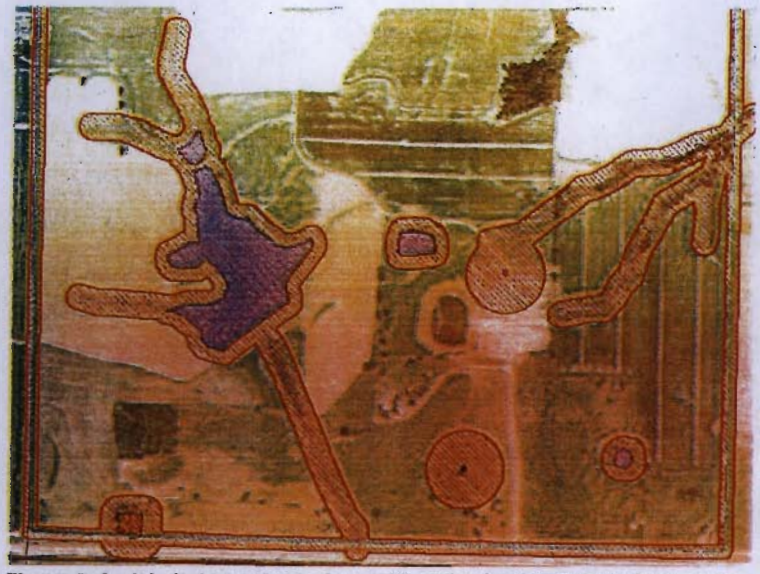

Figure 2. Aerial photograph of a farm with setbacks around sensitive areas shown in red.

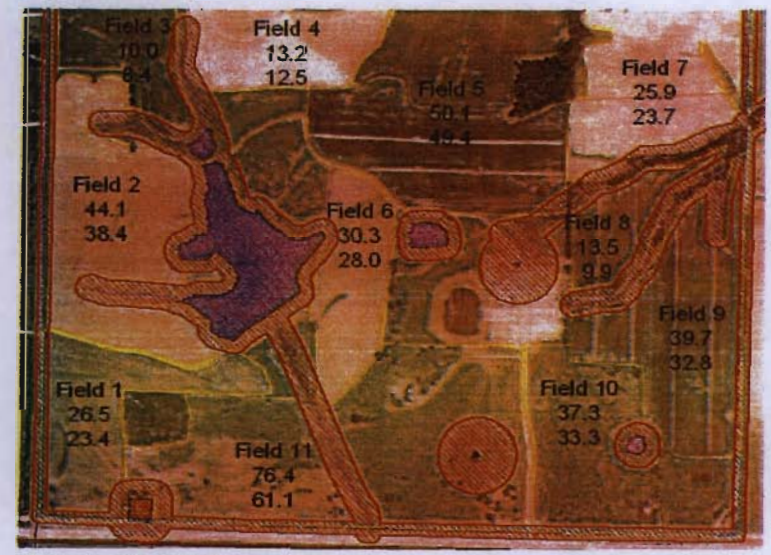

Figure 3. Map of a farm generated by the software program Spatial Nutrient Management Planner (SNMP).

Some fertilization will be needed on many setbacks to ensure dense, high-quality soil cover. When using fertilizer on setback areas:

- Carefully time any fertilizer applications to minimize the possibility of a runoff event soon after application.
- Do not overapply fertilizers to setback areas and apply mobile nutrients such as nitrogen during the active growing season to further limit losses.
- Remember, no manure or biosolids applications are allowed on the setback area — only commercial fertilizers.

Other considerations

Setbacks to streams also apply to any type of man-made structure that directs water to a stream or lake. For example, risers in a terraced field require a setback unless they are plugged during manure application. The centerline of a grassed waterway also requires an intermittent stream setback.

Missouri setbacks currently do not account for local topography. The setback requirement does not decrease if the slope in one direction falls way from a setback feature. For example, a riser in a terraced field has a circular setback even if the setback area extends over the up- or down-slope terrace.

Areas with expected flood frequencies of greater than once in ten years should also be noted and should not be the only land available for application of manure.

Setback distances can reduce the number of acres available for manure application depending on the proximity of the sensitive areas to fields on your farm. Figure 3 is a map developed using the University of Missouri Spatial Nutrient Management Planner (SNMP). This map includes an aerial map of the farm, delineation of field boundaries (yellow lines), in addition to the setback areas (shown in red). Each field is labeled with the field name (top label), field size (second label) and acres suitable for manure application (third label). For example, in Field 11 on the south side of the farm in Figure 3, field size is 76.4 acres but setbacks for a residence, road, stream and sinkhole result in 61.1 acres suitable for manure application; 15.3 acres of the field are off limits for manure application.

The setbacks in Table 1 and shown in Figures 2 and 3 are state recommendations and requirements. Some counties and townships in Missouri have more stringent requirements. Find your farm on the animal feeding operation site evaluation Web site at http://cares.missouri.edu/afosite/ to see if you are affected by local limits on land application of manure.

Also from MU Extension Publications

G9218, *Managing Nitrogen to Protect Water Quality*
G9220, *Strategies to Minimize Phosphorus Loss From Your Farm*
G9221, *Nutrients and Water Quality for Lakes and Streams*

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ENVIRONMENTAL QUALITY

MU Guide

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Fertilizer Nutrients in Livestock and Poultry Manure

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Many livestock and poultry producers fall into one of three categories: (1) they are willing to make high capital and labor outlays to maximize the use of their manure for crop production; (2) they are willing to minimize the amount of nutrients returned to the land for crop production in exchange for a relatively low-cost and low-labor method of manure handling; or (3) they have insufficient acreage to make use of the nutrients in their manure and depend on neighbors to accept or buy all or a portion of their manure.

Producers in the first category usually use slurry systems with tanks for manure storage, and tank wagons with injectors (or drag-hose systems) to transport and apply the manure. Producers in the second category use lagoons for storage/treatment, and irrigation equipment to transport and apply the manure to their fields. Producers in the third category may use their equipment to apply manure on neighbors' land or they may sell their manure through a broker.

To have value, manure nutrients must be used in a manner that results in a salable product. This publication describes methods of recovering a portion of the plant nutrient value of animal manure.

To keep the addition of nutrients from manure and fertilizer in balance with the nutrient removal by crops requires a record-keeping system that includes soil tests, laboratory analysis of the manure nutrient content, manure application rates, and crop yields. To obtain reliable nutrient data, it is necessary that the manure be well mixed before and during the loading, sampling, transport and land application processes.

Fresh manure nutrient production

Typical nutrient production values for various species and weights of animals are listed in Table 1 for fresh manure that has not been treated or altered.

Example calculation of manure volume produced: Find the volume of manure that must be hauled annually from 100 head of 1,400-pound lactating dairy cows (not including any wash water, rainwater or evaporation) using the manure production value from Table 1.

Table 1. Daily production of the major nutrients in the manure from various species and weights of animals (freshly excreted manure).

Animal	Size (lb)	Total manure (ft^3/day)	Water (%)	Nutrient content (lb/day) (N)	(P_2O_5)*	(K_2O)*
Dairy cattle						
Heifer	150	0.2	88	0.05	0.01	0.04
	250	0.32	88	0.08	0.02	0.07
	750	1	88	0.23	0.07	0.22
Lactating cow	1,000	1.7	88	0.58	0.3	0.31
	1,400	2.4	88	0.82	0.42	0.48
Dry cow	1,000	1.3	88	0.36	0.11	0.28
	1,400	1.82	88	0.5	0.2	0.4
Veal	250	0.14	96	0.04	0.03	0.06
Beef cattle						
Calf	450	0.42	92	0.14	0.1	0.11
High-forage	750	1	92	0.41	0.14	0.25
	1,100	1.4	92	0.61	0.21	0.36
High-energy	750	0.87	92	0.38	0.14	0.22
	1,100	1.26	92	0.54	0.21	0.32
Cow	1,000	1	88	0.31	0.19	0.26
Swine						
Nursery	25	0.04	89	0.02	0.01	0.01
Grow-finish	150	0.15	89	0.08	0.05	0.04
Gestating	275	0.12	91	0.05	0.04	0.04
Lactating	375	0.36	90	0.18	0.13	0.14
Boar	350	0.12	91	0.05	0.04	0.04
Sheep	100	0.06	75	0.04	0.02	0.04
Poultry						
Layer	4	0.004	75	0.0035	0.0027	0.0016
Broiler	2	0.003	74	0.0023	0.0014	0.0011
Turkey	20	0.014	75	0.0126	0.0108	0.0054
Duck	6	0.005	73	0.0046	0.0038	0.0028
Horse	1,000	0.8	78	0.28	0.11	0.23

* Phosphate (P_2O_5) = 2.29 x P, Potash (K_2O) = 1.21 x K
Source: MWPS-18, *Manure Management Systems Series*, Section 1, Manure Characteristics.
Notes: Values do not include bedding. The actual nutrient content can vary + or - 30% from table values. Increase nutrients by 4% for each 1% feed wasted above 5%.
Use only for planning purposes. These values should not be used in place of a regular manure analysis.

2.4 (ft^3/day) per head x 100 head x 365 days = 87,600 ft^3 = 655,000 gallons = 131 loads at 5,000 gallons/load

Table 2 lists the daily production of the major nutrients in pounds per day for swine manure in deep-pit buildings and the volume of manure produced daily.

Example calculation of manure volume produced: Find the required deep-pit volume to contain the manure produced in six months by 1,000 head of grow-finish swine with an average weight of 150 pounds using dry feeders as follows (refer to Table 2):

0.16 (ft^3/day) per head x 1,000 head x 183 days = 29,280 ft^3 = 218,865 gallons

Note: In calculating pit depth required, make allowance for clearance under the floor for any pit ventilation and for gas accumulation.

Table 3 lists the annual production of the major nutrients in pounds per year for liquid pit manure from various animals and the weight of manure

Table 2. Daily production of the major nutrients in swine manure in deep-pit buildings.

Animal	Size[a] (lb)	Total manure (ft^3/day)	Nutrient content (lb/day)		
Nursery	25	0.04	0.02	0.01	0.01
Wean-finish (wet/dry feeders) [b, c]	135	0.09	0.05	0.04	0.02
Wean-finish (dry feeders) [c, d]	135	0.12	0.05	0.04	0.03
Grow-finish (wet/dry feeders) Wean-finish (wet/dry feeders) [b]	150	0.12	0.06	0.05	0.03
Grow-finish (dry feeders) [d]	150	0.16	0.06	0.05	0.03
Gestating	275	0.12	0.05	0.04	0.04
Lactating	375	0.36	0.18	0.13	0.14
Boar	350	0.12	0.05	0.04	0.04

*Phosphate (P_2O_5) = 2.29 x P, Potash (K_2O) = 1.21 x K

[a] Weights represent the average size of the animal during the stage of production.

[b] Dry feeders used in conjunction with cup or swing waterers have similar results as wet/dry feeders.

[c] Wean-finish values calculated based on pigs spending 25% of their time in the nursery and 75% of their time in the grow-finish.

[d] Using nipple waterers.

Source: MWPS-18, *Manure Management Systems Series,* Section 1, Manure Characteristics. Actual nutrient values can vary ±30%. Values listed are typical of what can be found at the time of pumping. Includes dilution and spillage water. Increase nutrients by 4% for each 1% feed wasted above 5%.

Note: Use only for planning purposes. These values should not be used in place of a regular manure analysis.

Table 3. Estimated liquid pit manure characteristics.

Livestock stages	Production					Units	Concentration			
	Manure (lb/yr)	Total N (lb/yr)	NH_3-N (lb/yr)	P_2O_5* (lb/yr)	K_2O* (lb/yr)		Total N	NH_3-N	P_2O_5	K_2O
							lb/1,000 gallons of manure			
Farrowing	11,500	21	11	17	15	per pig space	15	8	12	11
Nursery	1,000	3	2	2	3	per pig space	25	14	19	22
Grow-finish (deep pit)	3,500	21	14	18	13	per pig space	50	33	42	30
Grow-finish (wet/dry feeder)	2,500	22	15	16	12	per pig space	75	50	54	40
Grow-finish (earthen pit)	3,500	13	10	9	8	per pig space	32	24	22	20
Breeding-gestation	7,000	21	10	21	20	per pig space	25	12	25	24
Farrow-finish	37,500	126	72	108	103	per production sow	28	16	24	23
Sow per pig	2,000	7	4	6	6	per pig sold per year	28	16	24	23
Farrow-feeder	10,000	25	13	22	23	per production sow	21	11	18	19
Dairy cow	54,000	200	39	97	123	per mature cow	31	6	15	19
Dairy heifer	25,000	96	18	42	84	per head capacity	32	6	14	28
Dairy calf	6,000	19	4	10	17	per head capacity	27	5	14	24
Veal calf	3,500	11	9	9	17	per head capacity	26	21	22	40
Dairy herd	73,000	271	53	131	193	per mature cow	31	6	15	22
Beef cows	30,000	72	25	58	86	per mature cow	20	7	16	24
Feeder calves	13,000	39	12	26	35	per head capacity	27	8	18	24
Finishing cattle	25,500	89	24	55	79	per head capacity	29	8	18	26
Broilers	83	0.63	0.13	0.4	0.3	per bird space	63	13	40	29
Pullets	49	0.35	0.07	0.21	0.2	per bird space	60	12	35	30
Layers	130	0.89	0.58	0.81	0.5	per bird space	57	37	52	33
Tom turkeys	282	1.79	0.54	1.35	1	per bird space	53	16	40	29
Hen turkeys	232	1.67	0.56	1.06	0.9	per bird space	60	20	38	32
Ducks	249	0.45	0.24	0.36	0.3	per bird space	22	5	15	8

* Phosphate (P_2O_5) = 2.29 x P, Potash (K_2O) = 1.21 x K, NH_3-N (ammonia N) = 1.22 x NH_3

Source: MWPS-18, *Manure Management Systems Series,* Section 1, Manure Characteristics.

Note: Use only for planning purposes. These values should not be used in place of a regular manure analysis.

produced annually. The concentration of nutrients per 1,000 gallons is also listed.

Example calculation of the value of manure produced: Find the value of the P_2O_5 in a 5,000 gallon load of liquid pit manure produced by mature dairy cows (refer to Table 3 and assume \$0.26/lb for P_2O_5 applied in the liquid manure):

15 lb P_2O_5 /K-gallons x 5 K-gallons x \$0.26/lb = \$19.50 (K-gallons = 1,000 gallons)

NOTE: This calculation assumes that a soil test indicates phosphate is needed. If phosphate level in the soil is already high, the P_2O_5 applied in the liquid manure may have a negative value, which should be deducted from the value of the N and K_2O in the manure. Missouri policy recommends that intense phosphorus nutrient management be considered when soil test phosphorus levels are rated *high* or greater.

Table 4 shows estimated lagoon nutrient accumulations for various animals. Nutrient concentrations in all properly operating lagoons are very low because of the high volume of dilution water, nutrient settling and ammonia volatilization. Lagoon effluent nutrient characteristics for different animal species (e.g., swine, beef, dairy and sheep) are similar. Using an estimated nutrient concentration of 4-2-3 pounds (N-P_2O_5-K_2O) per 1,000 gallons will be representative of many lagoons. About 80 to 90 percent of nitrogen in well-seasoned, steady-state anaerobic lagoons is in the ammonia form and is subject to high losses from volatilization when land applied without incorporation.

Table 4. Estimated manure and nutrients from lagoon effluent (lb per year).

Production	Units	Manure produced	Total N	NH_3	P_2O_5	K_2O
Grow-finish	lb per pig space	8,000	4	4	2	3
Farrow-finish	lb per production sow	64,000	36	32	23	29
Breeding-gestation	lb per pig space	11,500	5	4	4	5
Farrowing	lb per sow	16,500	8	7	6	8
Dairy cow	lb per mature cow	91,000	46	41	19	33
Dairy herd	lb per mature cow	138,000	70	63	30	50
Fattening cattle	lb per head capacity	44,000	27	24	21	27
Broilers	lb per bird space	130	0.14	0.1	0.07	0.1

Source: MWPS-18, *Manure Management Systems Series*, Section 1, Manure Characteristics.
Note: Use only for planning purposes. These values should not be used in place of a regular manure analysis.

Table 5. Estimated dairy milking center effluent characteristics.

Component	Units	Milkhouse	Milkhouse and parlor	Milkhouse, parlor & holding area (scraped & flushed)	
				Holding area manure	
				excluded	included
Volume	ft^3/day per 1,000 lb animal	0.22	0.6	1.4	1.6
Moisture	percent	99.72	99.4	99.7	98.5
Nitrogen (N)	lb per 1,000 gal	0.72	1.67	1	7.5
Phosphorus (P_2O_5)*	lb per 1,000 gal	0.58	0.83	0.23	0.83
Potassium (K_2O)*	lb per 1,000 gal	1.5	2.5	0.57	3.33
Carbon:nitrogen (C:N)	ratio	10	12	10	7

*Phosphate (P_2O_5) = 2.29 x P, Potash (K_2O) = 1.21 x K
Source: MWPS-18, *Manure Management Systems Series*, Section 1, Manure Characteristics.
Note: Use only for planning purposes. These values should not be used in place of a regular manure analysis.

Example calculation of the value of manure produced: Find the value of the K_2O in the lagoon effluent produced annually from a 1,000-head grow-finish unit (refer to Table 4 and assume \$0.16/lb for K_2O applied in the lagoon effluent):

3 lb K_2O/pig space-year x 1,000 pig spaces x \$0.16/lb = \$480.00

NOTE: This calculation assumes that a soil test indicates potash is needed.

Example calculation of the annual volume of effluent from a 100-cow milking parlor and milkhouse plus the manure and flush water from the holding area assuming the average cow weight is 1,400 lb each (reference Table 5):

1.6 ft^3/day x 100 cows x 1400 lb/1000 lb x 365 days/year = 81,760 ft^3 = 611,565 gallons

Table 6 lists the percent of original nutrient content of manure retained by various manure management systems.

Example calculation of the value of manure produced: Find the average gross value of the K_2O retained in the manure from 200 head of 1,100 lb beef feeders fed a high-energy ration in an open lot (in a cool, humid region) for 180 days (refer to Table 1 for the daily K_2O production and to Table 6 for the average percent of original manure nutrient content retained and assume \$0.16/lb for K_2O in the manure to be land applied):

0.32 lb K_2O/animal-day x 200 animals @1100 lb x 180 days x 0.625 retained x \$0.16/lb = \$1152.00

NOTE: This calculation assumes that a soil test indicates potash is needed.

Table 7 lists some of the important characteristics of beef manure from open feedlots in an arid region.

Example calculation of the weight of manure produced: Find the weight of manure to be hauled per year from 200 head of 1,000 lb beef feeders fed in an unsurfaced lot in a dry climate:

9.60 lb/animal-day x 200 animals @1000 lb x 365 days/2,000 lb/ton = 350.4 tons = 70 five-ton loads

Table 6. Percent of original nutrient content of manure retained by various management systems.

Management system	Beef			Dairy			Poultry			Swine		
	N	P	K	N	P	K	N	P	K	N	P	K
	Percent											
Manure stored in open lot, cool, humid region	55-70	70-80	55-70	70-85	85-95	85-95				55-70	65-80	55-70
Manure stored in open lot, hot, arid region	40-60	70-80	55-70	55-70	85-95	85-95						
Manure liquids and solids stored in a covered, essentially watertight structure	70-85	85-95	85-95	70-85	85-95	85-95				75-85	85-95	85-95
Manure liquids and solids stored in an uncovered, essentially watertight structure	60-75	80-90	80-90	65-75	80-90	80-90				70-75	80-90	80-90
Manure liquids and solids (diluted less than 50%) held in waster storage pond				65-80	80-95	80-95						
Manure and bedding held in roofed storage				65-80	80-95	80-95	55-70	80-95	80-95			
Manure and bedding held in unroofed storage, leachate lost				55-75	75-85	75-85						
Manure stored in pits beneath slatted floor	70-85	85-95	85-95	70-85	90-95	90-95	80-90	90-95	90-95	70-85	90-95	90-95
Manure treated in anaerobic lagoon or stored in waste storage pond after being diluted more than 50%	20-35	35-50	50-65	20-35	35-50	50-65	20-30	35-50	50-60	20-30	35-50	50-60

Source: *Agricultural Waste Management Field Handbook*, Part 651, Table 11-5.
Note: Use only for planning purposes. These values should not be used in place of a regular manure analysis.

Table 8 lists some of the important characteristics of beef feedlot runoff stored in a pond.

Example calculation of the value of the ammonia nitrogen (NH_3-N) per acre-inch of effluent from a beef feedlot runoff pond: (Assume that 25 percent of the ammonia nitrogen (NH_3-N) will be lost (volatilized) during land application by sprinkler irrigation (from Table 13), one acre-inch = 27,153 gallons, and a value of $0.26 per pound of N).

1.50 lb/K-gallon x 27.153 K-gallons x 0.75 retained x $0.26/lb of N = $7.94 per acre-inch

Table 7. Estimated beef feedlot manure characteristics.

Component	Units	Unsurfaced lot[a]	Surfaced lot[b]	
			High forage diet	High grain diet
Manure weight	lb/day per 1,000-lb animal	17.50	11.70	5.30
Moisture	percent	45.00	53.30	52.10
Total solids (TS)	percent wet basis	55.00	46.70	47.90
	lb/day per 1,000-lb animal	9.60	5.50	2.50
Nitrogen (N)	lb/day per 1,000-lb animal	0.21	--	--
Phosphorus (P_2O_5)*	lb/day per 1,000-lb animal	0.14	--	--
Potassium (K_2O)*	lb/day per 1,000-lb animal	0.03	--	--
Carbon:nitrogen (C:N)	ratio	13:1	--	--

*Phosphate (P_2O_5) = 2.29 x P, Potash (K_2O) = 1.21 x K
[a] Dry climate (annual rainfall less than 15 inches); annual manure removal.
[b] Dry climate; semiannual manure removal.
Source: MWPS-18, *Manure Management Systems Series,* Section 1, Manure Characteristics, Table 16.
Note: Use only for planning purposes. These values should not be used in place of a regular manure analysis.

Table 9 lists typical ranges of nutrient contents of anaerobic lagoon systems. Climatic effects such as rainfall and runoff from open lots can significantly affect the concentration of nutrients in lagoons. Additionally, some nutrients are concentrated in the sludge layer and may not be available if the lagoon is not agitated.

Example calculation of the average value of the ammonia nitrogen (NH_3-N) per acre-inch of effluent from an anaerobic beef lagoon: (Use the ammonia N content from Table 9a, assume that 25 percent of the ammonia nitrogen (NH_3-N) will be lost (volatilized) during land application by sprinkler irrigation (from Table 13), and a value of $0.26 per pound of N.)

50 lb of (NH_3-N)/acre-inch x 0.75 retained x $0.26/lb of N = $9.75 per acre-inch

Table 8. Beef feedlot runoff pond characteristics.

Component	Units	Runoff pond	
		Supernatant	Sludge
Moisture	%	99.7	82.8
Total solids (TS)	% wet basis	0.30	17.2
Nitrogen (N)	lb per 1,000 gal	1.67	51.7
Ammonia N (NH_3-N)*	lb per 1,000 gal	1.50	--
Phosphorus (P_2O_5)*	lb per 1,000 gal	--	17.5
Potassium (K_2O)*	lb per 1,000 gal	7.50	14.2

*Phosphate (P_2O_5) = 2.29 x P, Potash (K_2O) = 1.21 x K, NH_3-N (ammonia N) = 1.22 x NH_3
Source: MWPS-18, *Manure Management Systems Series,* Section 1, Manure Characteristics, Table 17.
Note: Use only for planning purposes. These values should not be used in place of a regular manure analysis.

Table 9. Nutrient content of anaerobic lagoon systems.

Animal	Total Kjeldahl N	Ammonia N*	Phosphorus (P_2O_5)*	Potassium (K_2O)*
a. Nutrient content (pounds per acre-inch)				
Swine	100–300	85–250	40–80	100–300
Dairy	80–150	45–80	50–100	100–200
Beef	40–120	40–60	80–250	100–250
Poultry	80–170	60–120	50–150	400–500
b. Nutrient content (pounds per 1,000 gallons)				
Swine	3.7–11	3.1–9.2	1.5–2.9	3.7–11
Dairy	2.9–5.5	1.7–2.9	1.8–3.7	3.7–7.4
Beef	1.5–4.4	1.5–2.2	2.9–9.2	3.7–9.2
Poultry	2.9–6.3	2.2–4.4	1.8–5.5	15–18

*Phosphate (P_2O_5) = 2.29 x P, Potash (K_2O) = 1.21 x K, NH_3-N (ammonia N) = 1.22 x NH_3

Source: MWPS-18, *Manure Management Systems Series*, Section 2, Manure Storages, Table 5-5.

Note: Use only for planning purposes. These values should not be used in place of a regular manure analysis.

Table 10. Nutrient concentrations in various types of solid manure, pounds per wet ton.

Manure type	Total Kjeldahl N	Ammonia N*	Phosphorus (P_2O_5)*	Potassium (K_2O)*
Poultry litter[1]	40–80	10–20	30–60	30–50
Separated dairy solids[2], 23% DM	5.8–7.4	0.3–0.7	1.8–2.4	2.4–3.6
Swine hoop structures[3]	15	6	12.6	14.4
Mortality compost[4]	15–25	3–6	1–3	4–8

[1] Range of values from NRCS-AWMFH, MWPS-18, Section 2, and University of Missouri studies.

[2] Performance of screen separator at University of Missouri dairy farm

[3] Study averages from Iowa State University. Rhodes Research Farm using cornstalk bedding

[4] Swine mortality compost, University of Missouri

* Phosphate (P_2O_5) = 2.29 x P, Potash (K_2O) = 1.21 x K, Ammonia N (NH_3-N) = 1.22 x NH_3

Source: MWPS-18, *Manure Management Systems Series*, Section 2, Manure Storages, Table 5-3.

Note: Use only for planning purposes. These values should not be used in place of a regular manure analysis.

Table 10 lists typical nutrient concentrations in various types of solid manure. Solid manure usually contains the manure as it is excreted by the animal and may be mixed with considerable bedding. Most of the phosphorous and potassium excreted by the animal is usually contained in the manure hauled to the field.

Example calculation of the average value of the total Kjeldahl N per wet ton of poultry litter: (Use the total Kjeldahl nitrogen content from Table 10, assume that 22.5 percent of the nitrogen will be lost (volatilized) from land application on fescue pasture without incorporation (from Table 13), and a value of $0.26 per pound of N.

Table 11. Nutrient concentrations in slurry manure, pounds per 1,000 gallons.

Animal	Total Kjeldahl N	Ammonia N*	Phosphorus (P_2O_5)*	Potassium (K_2O)*
Swine	30–75	20–60	20–50	20–30
Dairy	25–35	10–15	15–20	20–30
Beef	30–40	10–25	15–30	25–35
Poultry	60–80	15–60	35–45	30–95

* Phosphate (P_2O_5) = 2.29 x P, Potash (K_2O) = 1.21 x K, Ammonia N (NH_3-N) = 1.22 x NH_3

Source: MWPS-18, *Manure Management Systems Series*, Section 2, Manure Storages, Table 5-4.

Note: Use only for planning purposes. These values should not be used in place of a regular manure analysis.

Table 12. Nitrogen lost and retained with various handling and storage regimes.

System	Nitrogen lost	Nitrogen retained
	Percent	
Solid		
Daily scrape and haul	20–35	65–80
Manure pack	20–40	60–80
Open lot	40–55	45–60
Deep pit (poultry)	25–50	50–75
Litter	25–50	50–75
Liquid		
Underfloor pit*	15–30	70–85
Above-ground tank*	10–30	70–90
Holding pond	20–40	60–80
Anaerobic lagoon	70–85	15–30

*Indicates losses due to agitation.

Data source: MWPS-18, Third Edition, Table 10-1.

Note: Typical losses between excretion and land application, including losses incurred in transporting to storage, adjusted for dilution in the various systems. These losses are in addition to land application losses.

Use only for planning purposes. These values should not be used in place of a regular manure analysis.

Table 13. Percent of nitrogen of that in applied manure still available to the soil.

Application method	Percent remaining delivered		
Injection	95		
Sprinkling	75		
Broadcast (fresh solids)	40		
Days between application and incorporation	**Soil conditions**		
	Warm dry	**Warm wet**	**Cool wet**
1	70	90	100
4	60	80	95
7 or more	50	70	90

Note: Ammonia volatilization causes the predicted losses.

Source: *Agricultural Waste Management Field Handbook*, Part 651, National Engineering Handbook. 1992.

60 lb of N/ton x 0.775 retained x $0.26/lb of N = $12.09 per ton

Table 11 lists typical ranges of nutrient concentrations in slurry manure. Slurry manure is relatively concentrated, especially if the manure is from a covered pit and contains no rainwater. Slurry manure usually contains 5 to 10 percent solids and can be handled as a liquid with manure pumps and tank wagons.

Example calculation of the gallons of swine slurry manure required to knife-in (inject) 200 pounds (net after application loss) of total Kjeldahl N per acre for corn production: (Use the average total Kjeldahl nitrogen content at 52.5 lb/K-gallon from Table 11 and assume a 5 percent nitrogen loss (from Table 13)).

200 lb N/K-gallon /(52.5 lb of N/K-gallon x 0.95) = 4.01 K-gallons = 4,010 gallons

Nutrient losses/availability

Losses in nutrient value are inherent in any system of manure management, both during the collection and storage phase and the land application phase, especially nitrogen losses due to volatilization and denitrification. In the collection and storage phase, nitrogen can be lost to the air as ammonia and from manure stored in open lots by leaching and runoff, additionally. Table 14 lists typical nutrient losses incurred with some common systems of manure handling and storage. About 20 to 40 percent of the phosphorous and 30 to 50 percent of the potassium can be lost by leaching and runoff from open lots. Thus, to minimize nutrient losses as well as to reduce pollution problems from rainfall runoff, all operations (feeding, loafing, manure storage, etc.) should be kept under roofs — not in open lots. Phosphorous in lagoons tends to settle out of the liquid and concentrate in the sludge layer. Research at the University of Missouri suggests that as little as 5 to 10 percent of the excreted phosphorous may be pumped from unagitated lagoons using normal pumpdown procedures. Most of the remaining phosphorous will remain in the sludge layer. Potassium is soluble and evenly distributed in the liquid portion of the lagoon. Lagoons normally only have 20 to 30 percent of their volume pumped, depending on the ratio of treatment volume to total volume. A large amount of the potassium may remain in the treatment volume. Research at the University of Missouri suggests that as little as 15 to 30 percent of the excreted potassium may be pumped from unagitated lagoons.

Frequently, total nitrogen (N) in lagoon effluent is composed of 80 to 90 percent ammonium nitrogen and 10 to 20 percent organic nitrogen. The ammonium nitrogen is equivalent to nitrogen fertilizer and, except for losses to the air, is available to plants in the year of application. The amount of ammonia nitrogen lost to the atmosphere as a gas is difficult to predict because the process depends on many factors such as soil and atmospheric temperature, wind and humidity conditions at the time of spreading, application method and timing of application relative to the nitrogen uptake period (growing season). To minimize volatilization losses of the ammonia nitrogen, manure should be incorporated as soon as possible after surface application. Manure applied to cool, wet soil does not dry readily and thus does not volatilize for several days. Manure applied to hot, dry soil dries quickly and loses most of the ammonia fraction within 24 hours, particularly if there is a hot, dry wind. Dried manure, such as that from a feedlot in an arid or semiarid climate, has already lost much of its ammonia nitrogen and there is little additional loss with time until incorporation. Lagoon effluent applied by irrigation is assumes to be incorporated as soon as it enters the soil. Published values for plant-available ammonia nitrogen from surface-applied manure range from 20 to 80 percent. If manure is a significant part of a crop fertility program, the farmer must consider the possible need for supplemental application of commercial fertilizer nitrogen in the event that plant-available nitrogen is in the lower end of the range noted above. The Missouri Department of Natural Resources (MDNR) requires that a value of 60 percent (40% loss) be used in estimating plant-available (surface-applied, no incorporation) ammonia nitrogen unless supporting data or procedures suggest otherwise.

Organic nitrogen must be mineralized (converted to the ammonium form by soil bacteria) before it is available to plants. The rate at which this conversion takes place depends on several factors such as manure type, soil moisture, temperature and pH. Published values suggest that 20 to 90 percent of the organic nitrogen in manure may be converted to plant-available forms during the year in which it is applied. After several years of uniform application (usually about 3 years or more), the nitrogen available from the organic portion of applied manure will tend to stabilize. The MDNR requires that a value of 45 to 62 percent (depending on manure type) be used in estimating cumulative availability of organic nitrogen unless supporting data or procedures suggest otherwise.

Most volatilization (ammonia) losses occur within the first 24 hours after land application, if the waste is not incorporated. Manure spread on the surface and not worked into the soil may lose most of the volatile nitrogen compounds such as ammonia gas to the atmosphere. This lost nitrogen is not available for plant growth. The rate of loss increases with increasing temperature and is greater during dry, warm, windy days than during humid or cold days. Thus, ammonia loss is generally greater during late spring, summer and early fall.

Table 13 shows the decrease in plant-available nitrogen as incorporation is delayed.

Example calculation of the average gross value of the annual nitrogen production from 10,000 laying hens averaging 4 lb/bird if the deep pit manure is

incorporated 4 days after land application: (Use the N value from Table 1, the deep pit handling and storage loss from Table 12, the land application loss for wet and warm conditions from Table 13, and a value of $0.26 per pound of N.)

0.0035 lb of N/bird-day x 10,000 birds x 365 days/year x 0.625 after handling & storage x 0.80 after land application loss x $0.26/lb of N = $1660.75 per year

Nitrogen applied in excess of crop needs can leach through the soil after conversion to the nitrate form and cause groundwater contamination. Manure should not be applied on snow or frozen soil due to the potential for nutrient removal by runoff and resulting surface water pollution. Once incorporated into the soil, phosphorous and potassium are bound to soil particles such that the principal mode of loss is by soil erosion.

Solid and liquid manure should be plowed down or otherwise incorporated into the soil as soon as possible after land application to minimize odors and volatilization of nitrogen. Lagoon effluent applied by irrigation to soil dry enough to "take water" is assumed to be immediately incorporated, but some volatilization losses do occur with sprinkler irrigation. Although incorporating manure is an effective manure management tool, the vulnerability of the soil to increased erosion risks and other environmental considerations should be evaluated. Additionally, when soil test phosphorus is *very high* to *excessively high,* any phosphorus applied may increase leaching and surface runoff.

Table 14 compares typical nitrogen losses for solid, liquid (slurry), and lagoon systems during handling and storage. Losses are highly variable because of seasonal temperature, moisture, climatic and other factors.

Solid manure systems

In the future, it is likely that only poultry operations, smaller livestock operations and open-lot beef feeding operations will be handling manure as a solid. To handle dairy manure as a solid, one practice is to add about 4 pounds of dry straw per cow per day to reduce the moisture content of fresh manure and allow it to be handled as a solid. When this manure is applied to the land, all available nitrogen may be "tied up" by soil microorganisms during the process of decaying the straw. If the decaying process takes place during crop production time, a nitrogen allowance should be made for the decay process, in addition to the nitrogen required for crop production. A second and common practice employed to allow manure to be handled as a solid is to store semisolid manure and allow the liquids to drain off to a holding pond. The liquid is frequently drained through a "picket fence" dam.

Table 15 lists the minimum recommended bedding requirements for various housing systems.

Table 14. Typical nutrient losses during handling and storage.

System	N	P*	K*
	Percent lost		
Solid			
Daily scrape and haul[2]	20–35	5–15	5–15
Manure pack[2]	20–40	10–20	10–20
Poultry, deep pit or litter[2]	25–50	5–15	5–15
Solids on open lot			
Scrape once/year[2]	40–55	20–40	30–50
Daily scrape and haul[2]	20–35	10–20	15–25
Separated solids, 90 days storage[1]	30	10–20	10–20
Liquid (slurry)			
Anaerobic pit[2]	15–30	5–20[4]	5–20[4]
Aboveground storage[2]	10–30	5–15	5–15
Manure basin; or runoff storage pond, 120–180 days storage[3]	20–40	5–50[4]	5–50[4]
Liquid — lagoon[2]	70–85	50–80[4]	30–80[4]
Lagoon, 365 days storage[3]	90	50–80[4]	30–80[4]

* Phosphate (P_2O_5) = 2.29 x P, Potash (K_2O) = 1.21 x K, authors' estimate

[1]Authors' estimates.

[2]From MWPS-18.

[3]From Oregon State University Publication EC-1102.

[4]Losses vary widely, pending on degree of agitation during pumpout.

Table 15. Minimum recommended bedding requirements (lb per day per 1,000 lb of animal weight).

Bedding type	Long straw	Chopped straw	Wood shavings	Sawdust	Sand
Density (lb per cu ft)	2.5	7	9	12	—
Housing system					
Dairy					
Stanchion barn	5.4	5.7	—	—	—
Freestall housing	—	2.7	3.1	3.1	35
Loose housing bedded area	9.3	11	—	—	—
Swine (shed lot)	3.5	4.0	—	—	—
Poultry (floor level)	—	—	—	1.6	—

Source: MWPS-18. *Manure Management Systems Series,* Manure Characteristics, Section 1.

Liquid manure systems

Liquid systems (also called slurry systems) offer greater use of nutrients, if maximizing nutrient use is the goal. Therefore, liquid systems require the maximum soil-plant filter acreage for land application. Storage losses with a manure slurry are lower than with solids or lagoons, especially if stored in aboveground tanks (see Table 14). Knifing liquid into the soil minimizes application losses (see Table 13). The addition of nitrification inhibitors to the manure can slow the conver-

sion of ammonium nitrogen to nitrate nitrogen by certain soil bacteria, thus reducing nitrogen losses by leaching and denitrification. This is the system of choice for operators wishing to make the greatest use of the plant nutrients in their manure.

Lagoon systems

This is the system of choice for producers wanting to minimize one or more of the following: (1) the required soil-plant filter acreage, (2) labor costs, and (3) capital investment. Manure management systems employing lagoons for long-term storage are the least efficient in respect to nutrient use (see Table 14). Losses of up to 90 percent of the nitrogen during storage may occur. Up to 80 percent of the phosphate may remain in the lagoon bottom sludge if the lagoon is not properly agitated when pumped. Land application from lagoons by means of pipes, pumps and sprinkler irrigation is efficient in time and cost; however, without further mechanical incorporation, volatilization losses can be substantial (see Table 13).

For further information

ASAE Data D384.1, "Manure Production and Characteristics." ASAE Standards, 1999. St. Joseph, Mich.

Selecting a Dairy Waste Management System for the Willamette Valley. 1982. Oregon State University Extension Publication EC-1102, Oregon State University, Corvallis.

USDA-Natural Resources Conservation Service. 1992. *Agricultural Waste Management Field Handbook*, Part 651. USDA-NRCS, Washington, D.C.

Available from Extension Publications 1-800-292-0969

MU publications

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EQ 202 *Land Application Considerations for Animal Manure*

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