

NON-METALLIC MINING RECLAMATION PLAN

Operator: Haas Sons, Inc.

Owner: Michael & Patricia LaGesse

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Summary

This reclamation plan has been developed to provide information about the existing site of the proposed mine, the proposed site operations, and how the mine will be reclaimed to the proposed post mining land use.

This reclamation plan is for a 36 acre field located on the corner of State Highway 124 and County Highway SS. The land is currently used for agricultural production and managed for row crop production.

The operator will mine sand and gravel that is located on glacial outwash that is characterized as meltwater stream sediment from the Chippewa Lobe. A small portion of the site will be mined below the water table and reclaimed as a wildlife pond. The majority of the site will be mined above the water table and will be reclaimed to wildlife habitat and agricultural land uses.

A. Site Information

1. Landowner

Landowner: Michael & Patricia LaGesse
Address: 13992 County Road SS
City, State, ZIP: Bloomer, WI 54724

Applicant: Haas Sons, Inc.
Address: 203 E. Birch Street
City, State, ZIP: Thorp, WI 54771

2. Lease:

The operator has signed a lease with the landowner for the purpose of mining sand and gravel on their property for 10 years.
See attached lease (Appendix C).

3. Legal Description

Tax Parcel Number(s): 23008-0744-00020000
Described as follows: SE of SE Sec. 7, T30N, R8W

4. Property Owners Within 660 Feet of Project Sit

Tomas D. McCann	Haas Sons Properties	Joe Hilger
Jack Stelter	David & Berdine Decker	Scott & Rhonda Decker
Cary & Lori Lueck	Michael & Patricia LaGesse	Universal Telephone of Northern WI Inc.

5. Soil Information

Soil Survey of Chippewa County shows the soils at the mine site are mapped as Billett sandy loam (BIA) and Sattre loam (SbA). Billett sandy loam soils have approximately 9 inches of topsoil and 24 inches of subsoil. Approximately 4 acres of the mine site are mapped as Billett sandy loam soils. Sattre loam soils have approximately 9 inches of topsoil and 23 inches of subsoil. Approximately 32 acres of the mine site are mapped as Sattre loam soils.

During site investigations the operator documented the following soils horizon thicknesses in the test holes.

A horizon – 6 inches of topsoil

B horizon - Approx. 10 inches of red/brown clay (SbA, BIA)

Using the soil survey estimates the maximum volume of topsoil for the entire mine site is 29,040 cubic yards of topsoil and 48,400 cubic yards of subsoil.

B. Site Operations

1. Description of Materials to be Extracted

Sand and gravel products will be extracted and processed at the site.

2. Extraction and Processing to be Conducted at the Site

A driveway will be installed along the western mine boundary off of County Highway SS. Sand & gravel will be mined, crushed, washed, and removed from the site. A portable crushing & washing plant will be used to process the material and stockpile it on site. Materials within the mine will be excavated and transported using bulldozers, excavators, draglines, and conveyors.

Sand and gravel will be excavated from the mine above the water table in one lift approximately 15 feet deep. An area in the floor of the mine will be excavated below the water table to create wash ponds. Water for sand and gravel washing process will be pumped from these ponds. The area of the ponds will be approximately five acres they will be located in Cell 1 and Cell 2. No high capacity wells will be installed or used to support sand and gravel processing.

No flocculants or other chemicals will be used to support sand and gravel processing. No waste materials that are generated off-site will be hauled to the mine, stockpiled or used in site reclamation.

3. Volumes of Materials

A sequence of mine Cells are planned to systematically mine and reclaim the site. The anticipated area of disturbance and estimated volume of raw materials to be removed during the life of the mine is as follows.

Cell	Area (acre)	During 1 st two years (cubic yards)	During Full Life of Operation (cubic yards)
1	10	Approx. 100,000 yds.	208,000
2	10	0	208,000
3	6	0	175,000
4	10	0	208,000
Total	36	Approx. 100,000	800,000

4. Site Dewatering and Effluent Discharge

This will be an internally drained site located in glacial outwash plain. No site dewatering or effluent discharge will take place. It is anticipated that sand and gravel will be mined below the water table in Cell 1 and Cell 2.

5. Stormwater Permits/Management

The operator will obtain a Wisconsin DNR Nonmetallic Mining stormwater permit and manage stormwater in accordance with the standards established in the permit. At a minimum stormwater will be contained within the mine boundaries for all rainfall events up the 10 year, 24 hour frequency storm (4.1 inches).

Soil berms created during topsoil and subsoil stripping will be stabilized and used to contain and direct stormwater runoff towards the excavated floor of the mine where it will infiltrate. Stormwater will be managed this way over the entire life of the mine. A notice of intent will be sent to the DNR.

6. Erosion Control & Permits

All topsoil and subsoil stockpiles will be graded to a slope of 3:1 or flatter and stabilized as soon as conditions allow to conserve soil and limit erosion. Silt fence will be installed along all soil stockpiles to control erosion. Berms will be stabilized using best management practices including seeding, mulching, erosion control mat, hydro-seeding, etc. Erosion and sediment control best management practices will be installed as determined by the Wisconsin Erosion Control Product Acceptability List (PAL) Channel and Slope Erosion Control Matrices (Appendix F).

7. Reclamation Activities During Operations

A process of contemporaneous reclamation will be used to systematically mine and reclaim the site. Under this process the site will be reclaimed as soon as possible after materials have been extracted and processed using the planned Cell sequence.

Cell 1 will be restored as Cell 2 is being mined. Cell 2 will be restored as Cell 3 is being mined. Cell 3 will be restored as Cell 4 is being mined. Cell 4 will be restored at the end of mining operations.

At the beginning of the mining operations for each cell all of the topsoil (estimated 9 inches) will be stripped and stockpiled in berms. Following topsoil stripping operations all of the subsoil (estimated 23 inches) will be stripped and stockpiled in berms that are separate from the topsoil berms. All berms will be shaped to a 3:1 slope or flatter and seeded with DOT Seed Mix 20. Mining operations will then excavate, process, and remove sand and gravel from the site.

When excavation of sand and gravel in a Cell is complete rough grading work will be performed to create slopes around the perimeter of the mine that are 3:1 or flatter. Rough grading will also be performed to establish reclamation grades for the mine floor. Subsoil will then be placed over the slopes and flat lying areas of mine to a depth of 10 inches or more.

Topsoil will then be placed over the subsoil to a depth of 6 inches or more. Upon completion of subsoil and topsoil re-application, soils testing will be performed following procedures established in the Wisconsin Nutrient Management Standard 590 to determine the organic matter, phosphorus, potassium and pH. Soil amendments (including lime and fertilizer) will be applied based on the soil test results to meet the fertility requirements needed to achieve the intended post mining land use.

The site will then be seeded. Areas with slopes steeper than 10:1 will have straw mulch applied. Areas flatter than 10:1 will not receive mulch.

Reclamation test plots will be established within the first two years of mining. Test plots will be established for each post mining land use. These test plots will be monitored and used to help determine success in future areas of mine reclamation.

8. Timetable/Sequence of Operations

Location Activity

Cell 1 Plant will be set and we will mine and establish pile in the initial stockpile and plant area. We will start on the west boundary of that area and mine towards the east until we reach the mine boundary. This will take approx. 3 years.

Cell 2 We will set and pile east of the initial stockpile and plant area. Then we will mine out the initial area from east to west. This will take approximately 2 years. While mining this area, we will restore east boundary of Cell 1.

Cell 3 We will set plant in Cell 2 on the east end. Then we will mine Cell 3 from North to South. This will take approx. 2 years. We will restore the west boundary of Cell 1 while mining this area and pile into Cell 2.

Cell 4 We will then set the plant in Cell 3 on the east half, and mine from east to west. We will restore the east boundary of Cell 3 while mining towards the west boundary of Cell 4. This will take about 3 years.

9. Timetable

Estimated period of operation/extraction for each cell:

Cell 1	3 years
Cell 2	2 years
Cell 3	2 years
Cell 4	3 years
Total _____	10 years

C. Final Site

1. Disposition of Structures and Roads

A gravel paved driveway approximately 200 feet long will remain in place at the location of the mine access road connection to County Highway SS. The driveway will provide access to the agricultural field and wildlife habitat areas.

Structures such as the scale, scale house, and scale will be removed prior to final reclamation. The ponds created in Cell 1 and Cell 2 will remain in place as shown on the Final Site Map (See Appendix A – Cross Sections). There are no areas of concentrated flow entering, leaving, or within the reclaimed mine site.

2. Soil Reapplication & Reconditioning

Overburden piles will be leveled off or used on slopes. This work will be done with scrapers or bulldozers. Slopes will be stabilized using best management practices including seeding, mulching, erosion control mat, hydro-seeding, etc. Erosion and sediment control best management practices will be installed as determined by the Wisconsin Erosion Control Product Acceptability List (PAL) Channel and Slope Erosion Control Matrices (Appendix F).

Subsoil material will then be removed from the berms with excavators or loaders and transported in dump trucks to the area in the mine to be reclaimed. Trucks will be routed to limit traffic over areas where subsoil has already been applied. Trucks will dump subsoil and bulldozers will spread the material to be 10 inches thick on the slopes and floor of the mine. The use of tracked equipment while spreading subsoil will limit soil compaction.

Topsoil material will then be removed from the berms with excavators or loaders and transported in dump trucks to the area in the mine to be reclaimed. Trucks will be routed to limit traffic over areas where subsoil or topsoil has already been applied. Trucks will dump topsoil and bulldozers will spread the material to be 6 inches thick on the slopes and floor of the mine. The use of tracked equipment while spreading topsoil will limit soil compaction.

In the event that rubber tire equipment cannot be routed to prevent subsoil and topsoil compaction deep tillage equipment will be used to alleviate compaction in the upper 12 to 14 inches of the soil profile.

Soils testing will be performed following procedures established in the Wisconsin Nutrient Management Standard 590 to determine the organic matter, phosphorus, potassium and pH. Soil amendments (including lime and fertilizer) will be applied based on the soil test results to meet the fertility requirements needed to achieve the intended post mining land use.

3. Safety Assurances

Given the slopes on the reclaimed mine site and the post mining land uses there are very limited safety concerns. The pond will have a 3:1 slope that extends 6 feet below the water line. Areas reclaimed as Wildlife habitat will have 3:1 slopes. Areas reclaimed to Agricultural use will be nearly flat.

4. Seeding Plan

Seeding will be selected to achieve the post mining land use that is planned for each designated area. Areas that will be reclaimed to wildlife habitat will be seeded to native grasses. Seed will be broadcast seeded and rolled to improve seed – soil contact. DNR Seed Mix 2 will be used in these areas and applied at the rates listed (see Appendix B). The wildlife pond area will be allowed to vegetate using below the water line natural seed distribution without seeding by the operator.

Areas that will be reclaimed to agricultural row crop production will be planted to a crop rotation of alfalfa and corn. A crop rotation of four years of alfalfa, and four years of corn will be implemented. To establish the rotation the initial seeding will be alfalfa with a cover crop of oats. Seeding rates will be 15lb/ac. for alfalfa and 15lb/ac for oats. The seeding rate for corn will be 30,000 seeds per acre.

5. Future Use

The mine site will be reclaimed to establish three different post mining land uses including non-irrigated agricultural row crop production, upland grassland wildlife habitat, and wildlife pond habitat. The approximate location of each post mining land use is shown on the Final Site Map.

Agricultural Post Mining Land Use

The flatter lying portions of the reclaimed mine will be reclaimed to Non-Irrigated Agricultural Row Crop Production. Agricultural operations shall be conducted to meet NR 151 agricultural performance standards and follow an NRCS standard 590 nutrient management plan.

Prior to mining the soils at this site were categorized by the Soil Survey of Chippewa County with a Land Capability Class of IIs. The post mining soil Land Capability Class is expected to drop to IIIs. Crop yields can be expected to be reduced 10% to 20%.

The proposed performance measures used to determine reclamation success are:

- a. The establishment of a mine soil profile with a minimum of 6 inches of topsoil and 10 inches of subsoil.
- b. The establishment of full plant rooting depth and density.
- c. The establishment of target soil chemistry and fertility to achieve and sustain the post mining land use.
- d. The successful establishment of crops to achieve the target production of:
 - i. Alfalfa production of two tons per acre per year (dry weight)
 - ii. Corn production of 100 bushels per acre per year

Site monitoring will be conducted to assess the success of the seeding and monitor the site for invasive or noxious plant species. Areas of failed seeding shall be examined to determine the cause of the failure. Treatments to eliminate the cause of the failure will be applied. Agricultural herbicides will be applied as necessary according to the product label to control unwanted plant species.

Upland Grassland Wildlife Habitat Post Mining Land Use

Steep slopes around the perimeter of the mine will be reclaimed to an Upland Grassland Wildlife Habitat.

The proposed performance measures used to determine reclamation success are:

- a. The establishment of a mine soil profile with a minimum of 6 inches of topsoil and 10 inches of subsoil.
- b. The establishment of full plant rooting depth.

- c. The establishment of target soil chemistry and fertility to achieve and sustain the post mining land use.
- d. The establishment of the seeding so that:
 - i. All species in the seeding are present.
 - ii. No more than 50% of the total vegetation is one species from the seed mix.
 - iii. Biomass shall be a minimum of one ton per acre per year.

Site monitoring will be conducted to assess the success of the seeding and monitor the site for invasive or noxious plant species. Areas of failed seeding shall be examined to determine the cause of the failure. Invasive or noxious species will be spot treated with herbicide according to the product label or hand removal and disposed of properly.

Wildlife Pond Habitat Post Mining Land Use

Areas of the mine that are below the water table will be reclaimed as a Wildlife Pond.

The proposed performance measures used to determine reclamation success are:

- a. The establishment of irregular shorelines that vary in shape and slope.
- b. The establishment of shoreline slopes that vary from 3:1 to 10:1 and extend a minimum of 6 feet vertically below the water line.
- c. The establishment of a minimum of 6 inches of topsoil placed along the shoreline and on the slope a minimum of two feet vertically below the water line to encourage vegetative growth.

Site monitoring will be conducted to assess the success of vegetation establishment and monitor the site for invasive or noxious plant species. Areas poor vegetation establishment shall be examined to determine the cause. Invasive or noxious species will be spot treated with herbicide according to the product label or hand removal and disposed of properly.

Attachments

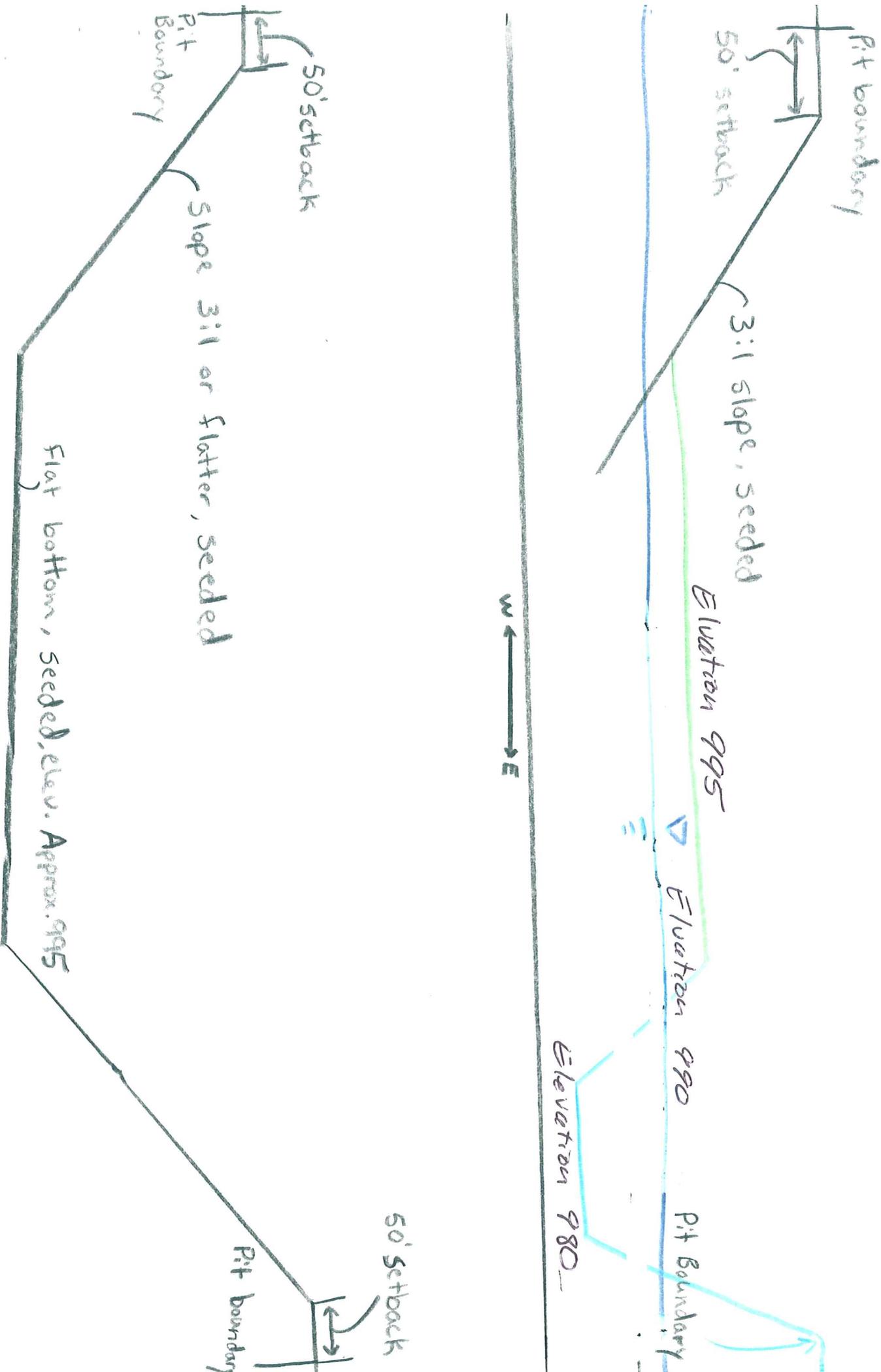
- APPENDIX A: Cross Section
- APPENDIX B: Seeding Plan
- APPENDIX C: Land Lease
- APPENDIX D: Land Location Map
- APPENDIX E: Soils & Groundwater Map
- APPENDIX F: PAL Erosion Control Matrices

Appendix A

Cross Sections

S ← → N

W ← → E



Appendix B

Seeding Plan

MIX 1 - PASTURE

<u>Common Name</u>	<u>Scientific Name</u>	<u>Lb./Ac.*</u>
Timothy	<i>Phleum pratense</i>	4
Tall Fescue	<i>Festuca arundinaceae</i>	5
Canada Wild Rye	<i>Elymus canadensis</i>	3
Agricultural Rye	<i>Secale cereale</i>	4.5
Alfalfa**	<i>Medicago sativa</i>	10
Alsike Clover**	<i>Trifolium hybridum</i>	4.5
	Total	31 lbs.

MIX 2 – STABILIZATION/WILDLIFE/GRAZING

<u>Common Name</u>	<u>Scientific Name</u>	<u>Lb./Ac.*</u>
Agricultural Rye	<i>Secale cereale</i>	4
Timothy	<i>Phleum pratense</i>	2
Tall Fescue	<i>Festuca arundinaceae</i>	3
Switchgrass	<i>Panicum virgatum</i>	1
Big Bluestem	<i>Andropogon gerardi</i>	1
Canada Wild Rye	<i>Elymus canadensis</i>	3
Alsike Clover**	<i>Trifolium hybridum</i>	4
Red Clover**	<i>Trifolium repens</i>	4
Alfalfa**	<i>Medicago sativa</i>	5
	Total	27 lbs.

MIX 3 – NATIVE MIX FOR WILDLIFE/PASSIVE RECREATION

<u>Common Name</u>	<u>Scientific Name</u>	<u>Unit</u>	<u>Unit/Ac.*</u>
Big Bluestem	<i>Andropogon gerardi</i>	lb.	1
Canada Wild Rye	<i>Elymus canadensis</i>	lb.	3
Switchgrass	<i>Panicum virgatum</i>	lb.	1
Indiangrass	<i>Sorghastrum nutans</i>	lb.	3
Purple Prairie Clover**	<i>Dalea purpurea</i>	oz.	2
Canada Tick Trefoil**	<i>Desmodium canadensis</i>	oz.	5
New England Aster	<i>Aster novae angliae</i>	oz.	0.2
Purple Cone Flower	<i>Echinacea purpurea</i>	oz.	4
Dotted Mint**	<i>Monarda punctata</i>	oz.	4
Bergamot**	<i>Monarda fistulosa</i>	oz.	5
Yellow Coneflower	<i>Ratibida pinnata</i>	oz.	3
Blackeyed Susan	<i>Rudbeckia hirta</i>	oz.	0.5
Blue Vervain	<i>Verbena hastata</i>	oz.	1
	Total		~9.5 lbs.

* Seeding rates assume broadcast seeding and may be multiplied by 0.5 to approximate rates if drilled.

** Denotes legumes, which must be inoculated according to the seed provider's instructions prior to seeding.

Appendix C

Mineral Lease

MINERAL LEASE

This lease entered into on Dec. 15, 2012, by and between Michael and Patricia Lagesse, whose address is 13992 Cty Hwy SS, Bloomer, WI 54724, phone # 715-288-6106 (OWNER), and Haas Sons, Inc., 203 E. Birch Street, Thorp, WI 54771, phone #715-669-5469 (LESSEE).

In consideration of the mutual covenants contained herein OWNER and LESSEE agree as follows:

OWNER, hereby leases exclusively to LESSEE, its successors and assigns, for a term of 10-years, revisiting lease every 3-years to adjust royalty, commencing from the date of this agreement this 38-acre parcel of land located in the Township of Woodmohr, Chippewa County, Wisconsin, described as: SE ¼ of the SE ¼, Sec. 07, T30N, R08W. (PROPERTY). Tax Parcel # (s): 23008-0744-00020000.

LESSEE shall have the option to renew this lease on said PROPERTY at the end of the term, herein for a 5-year term with approval of OWNER. All material will be removed in 10-years unless agreed upon by both parties. This is a lease of less than 99 years and not subject to a return.

During any term of the Lease, OWNER does hereby grant to LESSEE the right of first refusal to purchase the PROPERTY or any portion thereof, for an amount equal to any bonafide written offer to purchase tendered to OWNER by any third party.

LESSEE shall have the exclusive right to erect and operate materials processing equipment on the leased premises that is needed to produce, stockpile and sell mining products. The leased premises may be used for processing, stockpiling and selling mining products removed from the property. All stockpiled mining products shall remain the property of the LESSEE at the expiration of the lease term and shall be removed at the LESSEE'S convenience.

OWNER shall pay all real estate taxes and assessments levied against the PROPERTY. The OWNER may continue to use any unused portion of the land during the term of this lease.

In the event the PROPERTY is depleted of usable materials, or LESSEES operation becomes economically unfeasible for any reason as determined by LESSEE, LESSEE may terminate this Lease.

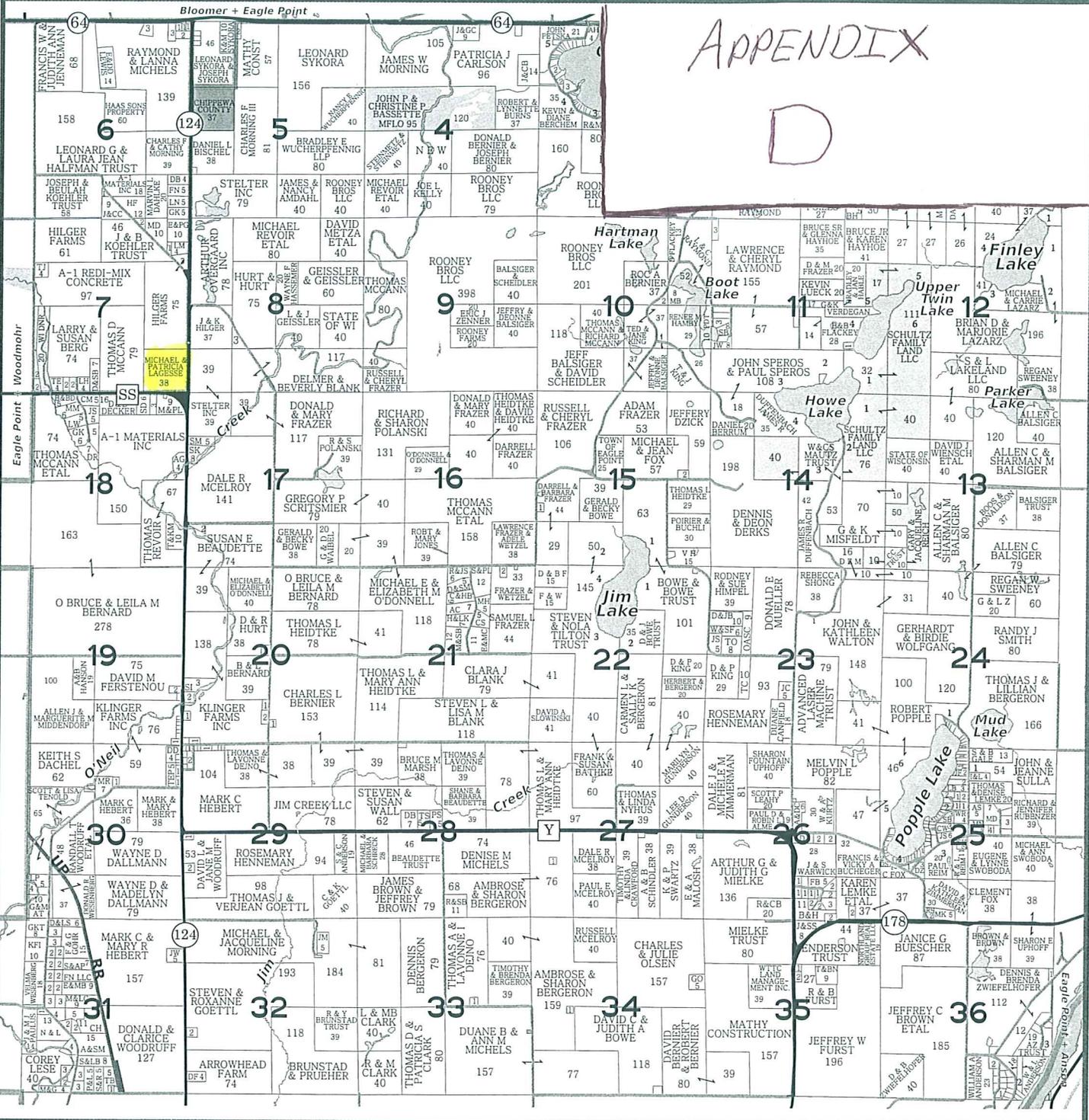
LESSEE may construct and utilize such access roads over the PROPERTY and over adjacent lands belonging to OWNER as may be required for LESSEES use of the PROPERTY.

LESSEE shall keep records of the total yards of all rock, sand and gravel it removes from the PROPERTY. Upon the basis of said records, LESSEE agrees to pay OWNER the following royalty for mineral extracted and removed:

Royalties will be paid quarterly.

AGLE POINT(C), WOODMOHR(E), BLOOMER(SE) T30N R08W

SEE PAGE 54



APPENDIX

D

SEE PAGE 44

13000 14000 15000 SEE PAGE 30 16000 17000 18000 19000
 *Please note - All acreages are computed & rounded to the closest acre, roadways are excluded from totals.
 011 Chippewa County, Wisconsin All mapping is for reference only and is not intended, or to be used for any legal purpose.

FRAZER EXCAVATING

- ▶ Septic Systems
- ▶ Drain Fields
- ▶ Mound Systems
- ▶ Perc Tests, City Hook-Ups
- ▶ Basements - Well Pumps



Darrell "Fuzz" Frazer

715-288-6225 MPRS-CST #221071

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Chippewa County Land Records
 711 North Bridge Street
 Chippewa Falls, WI 54729
 715.726.7928

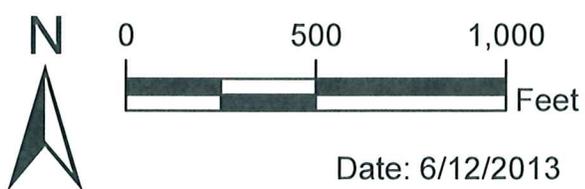
Soils & Groundwater Map



Photobase: 2011

Legend

-  Mine Site Boundary
-  Roads
-  Soils
-  Regional Groundwater Contours



Date: 6/12/2013



CHANNEL EROSION CONTROL MATRIX

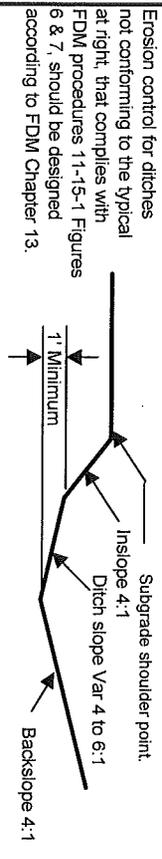
(Concentrated Flow Application)

TYPE OF EROSION CONTROL DEVICE	PERMISSIBLE SHEAR LB/S.F.	DITCH GRADE												REMARKS			
		< 2%			2% - 4%			4% - 6%			6% - 9% *				9% - 12% *		
		Max. Length (ft.)	300	600		Max. Length (ft.)	300	600									
Seed with properly anchored mulch	0.6	[Solid black bar]												Anchor mulch per specifications.			
Sod ditch checks with seed and mulch	N/A	[Solid black bar]												Install one ditch check for every 1 foot of drop. Sod stakes required.			
Temporary ditch checks (hay bales or approved manufactured alternatives listed in the WisDOT PAL)	N/A	[Solid black bar]												Install one ditch check for every 2 feet of drop. Maximum 200' spacing. Not recommended for slopes less than 1%.			
Sod ditch liner	1.0	[Solid black bar]												Upstream end must be buried. Additional sod stakes required.			
Double netted light duty (WisDOT Class I Type B) erosion mat	1.5	[Solid black bar]												Only mat type products allowed.			
Sod reinforced with a double netted jute (WisDOT Class II Type A) erosion mat	1.5	[Solid black bar]												Upstream end must be buried. Additional sod stakes required. Two bid items needed.			
Stone or rock ditch checks, or Rock-Filled Filter Bags	N/A	[Solid black bar]												Use No. 2 coarse aggregate, railroad ballast, or breaker run. Install one ditch check for every 2 feet of drop. Use in conjunction with a channel lining.			
Medium duty coconut erosion mat (WisDOT Class II Type B or C)	2.0	[Solid black bar]															
Heavy duty synthetic (WisDOT Class III Type A) erosion mat or turf reinforcement mat (WisDOT Class III Type B)	2.0	[Solid black bar]												Germination may be a problem with Class III Type A mats. An ECRM is required for initial erosion protection for Class III Type B mats.			
Heavy duty synthetic turf reinforcement (WisDOT Class III Type C) mat	3.5	[Solid black bar]												An ECRM is required for initial erosion protection. Contact manufacturer if higher shears are needed.			
Riprap ditch checks	N/A	[Solid black bar]												Place top of downstream ditch check level with bottom of upstream ditch check. Use in conjunction with a channel lining.			
Heavy duty synthetic turf reinforcement (Class III Type D) mat	5	[Solid black bar]												An ECRM is required for initial erosion protection. Contact manufacturer if higher shears are needed.			
Light riprap	4	[Solid black bar]												Outfalling, overlapping and scour need to be addressed. Use 2' minimum ditch depth.			
Medium riprap	5	[Solid black bar]															
Heavy riprap	8	[Solid black bar]															

Riprap measures apply to all ditch types. Use of these measure requires engineering judgement and design.

CHANNEL EROSION CONTROL MATRIX (Concentrated Flow Application)

TYPE OF EROSION CONTROL DEVICE	PERMISSIBLE SHEAR LB/S.F.	DITCH GRADE					REMARKS	
		< 2%	2% - 4%	4% - 6%	6% - 9% *	9% - 12% *		
		Max. Length (ft.)						
Gouted rip rap	N/A	300	600	1200	300	600	1200	Address outfalling, overtopping and scour. Line with Grotexlike fabric Type "HR", (see Chap. 10, Const. Detail and special provision). Use 2' minimum ditch depth.
Articulated Concrete Block Type A	5							ACBs apply to all ditch types. Use of these measures requires engineering judgement and design.
Articulated Concrete Block Type B	10							
Articulated Concrete Block Type C	15							
Articulated Concrete Block Type D	20							
Articulated Concrete Block Type E	30							
Standard Ditch Section								



Erosion control for ditches not conforming to the typical at right, that complies with FDM procedures 11-15-1 Figures 6 & 7, should be designed according to FDM Chapter 13.

- KEY**
- Effective range of device for Sandy or Clayey Soil:
 - Device applicable, may not be cost effective:
 - "C" effective for clayey soil only:
 - Not applicable: Use in conjunction with other BMPs:

ECRM - Erosion control revegetation mat. All Class I and II mats are ECRMs.
TRM - Turf reinforcement mat.
FDM - WisDOT Facilities Development Manual
BMP - Best Management Practice
PAL - See Note 6

* For ditch grades over 9% special design considerations may be required.
** Soils that are not sandy should be treated as clay soils.

NOTES

- 1) Ditch flow rates used to develop bar chart are based on a 60 ft. right of way from pavement centerline and a 2-Yr. rainfall event for temporary liners or a 25-Yr. rainfall event for permanent (Class III mat or riprap) liners. If the drainage area extends outside the 60 foot right of way or unusual flows are expected, use the shear stress column values to determine the suitability of a liner. See FDM procedures in Chapter 10 and in Section 13-30-10.
- 2) Erosion mats shall extend upslope 1.0 ft. min. vertically from the ditch bottom or 6" higher than the design flow depth. There shall be no joints within 18" of the low point.
- 3) Cost shall be a consideration in the selection of these devices.
- 4) Add sediment traps at the bottom of channel slopes.
- 5) Refer to FDM Chapter 10 for any channels exceeding the limits shown.
- 6) Approved materials for erosion products are referenced from the Wisconsin Department of Transportation Erosion Control Product Acceptability Lists (PAL), found at the web site: <http://www.dot.wisconsin.gov/business/engrser/pal.htm>
- 7) On long or steep channels that require a higher class mat, use the appropriate lower class mat for the first 300 ft to 600 ft of the channel.
- 8) Effective erosion control involves minimizing the amount of time soil is exposed and the selection of a combination of practices, and not reliance on just one practice.

SLOPE EROSION CONTROL MATRIX

TYPE OF EROSION CONTROL	SLOPE							REMARKS					
	6:1 or flatter (7)		4:1		3:1		2.5:1		2:1	1:1			
	SLOPE LENGTH	SLOPE LENGTH	SLOPE LENGTH	SLOPE LENGTH	SLOPE LENGTH	SLOPE LENGTH	SLOPE LENGTH		SLOPE LENGTH				
Seed with properly anchored mulch	0-30'	30-60'	60-120'	0-30'	30-60'	60-120'	0-30'	30-60'	60-120'	0-30'	30-60'	60-120'	
Single netted light duty (WSDOT Class I Type A) erosion mat	0-30'	30-60'	60-120'	0-30'	30-60'	60-120'	0-30'	30-60'	60-120'	0-30'	30-60'	60-120'	
Light duty single netted 100% biodegradable (WSDOT Urban Type A) erosion mat	0-30'	30-60'	60-120'	0-30'	30-60'	60-120'	0-30'	30-60'	60-120'	0-30'	30-60'	60-120'	Use only 100% biodegradable anchors for urban mats.
Light duty double netted 100% biodegradable (WSDOT Urban Type B) erosion mat	0-30'	30-60'	60-120'	0-30'	30-60'	60-120'	0-30'	30-60'	60-120'	0-30'	30-60'	60-120'	Use only 100% biodegradable anchors for urban mats.
Banded Mulch (WSDOT Type A Soil Stabilizer)	0-30'	30-60'	60-120'	0-30'	30-60'	60-120'	0-30'	30-60'	60-120'	0-30'	30-60'	60-120'	May be applied over Class III Type B, C, or D mats in place of erosion control revegetation mats.
Polymer (WSDOT Type B Soil Stabilizer)	Used in conjunction with other BMPs effective up to a 2:1 slope. Not effective in sand. When used alone effective up to a 3:1 slope. Stand alone use appropriate for earthen stock piles, temporary, and late season applications												
Double netted light duty (WSDOT Class I Type B) erosion mat	0-30'	30-60'	60-120'	0-30'	30-60'	60-120'	0-30'	30-60'	60-120'	0-30'	30-60'	60-120'	
Sod	0-30'	30-60'	60-120'	0-30'	30-60'	60-120'	0-30'	30-60'	60-120'	0-30'	30-60'	60-120'	
Medium duty coconut erosion mat (WSDOT Class II Type B or C)	0-30'	30-60'	60-120'	0-30'	30-60'	60-120'	0-30'	30-60'	60-120'	0-30'	30-60'	60-120'	
Sod reinforced with a double netted jute (WSDOT Class II Type A) erosion mat	0-30'	30-60'	60-120'	0-30'	30-60'	60-120'	0-30'	30-60'	60-120'	0-30'	30-60'	60-120'	Sod stakes required. Two bid items needed.
Heavy duty synthetic erosion control revegetation mat (WSDOT Class III Type A)	0-30'	30-60'	60-120'	0-30'	30-60'	60-120'	0-30'	30-60'	60-120'	0-30'	30-60'	60-120'	Germination may be a problem with Class III Type A mats
Riprap	0-30'	30-60'	60-120'	0-30'	30-60'	60-120'	0-30'	30-60'	60-120'	0-30'	30-60'	60-120'	Angle of repose must be considered, see FDM Chapter 13.
Heavy duty synthetic turf reinforcement (WSDOT Class III Type B or C) mat	0-30'	30-60'	60-120'	0-30'	30-60'	60-120'	0-30'	30-60'	60-120'	0-30'	30-60'	60-120'	A soil stabilizer or ECRM will be required for initial erosion protection.
Heavy duty synthetic turf reinforcement (WSDOT Class III Type D) mat	0-30'	30-60'	60-120'	0-30'	30-60'	60-120'	0-30'	30-60'	60-120'	0-30'	30-60'	60-120'	A soil stabilizer or ECRM will be required for initial erosion protection.
Slope paving or grouted riprap	0-30'	30-60'	60-120'	0-30'	30-60'	60-120'	0-30'	30-60'	60-120'	0-30'	30-60'	60-120'	Consider clear zone requirements. Only use in limited circumstances such as overflow areas near bridges.

SLOPE EROSION CONTROL MATRIX

Benches	Consider benches when cuts exceed 20'. bench at approximately 15' vertical intervals to collect and drain water. Treat benches as channels (ditches). Adjust elevations to provide drainage. Consider flumes at transitions.
Intercepting embankments	Used to intercept runoff from abutting lands. Flumes may be necessary to direct runoff.
Silt fence	Used at toe of slopes to intercept and detain small amounts of sediment. Use only WisDOT approved silt fence as listed in the PAL.
Temporary ditch checks or Erosion bales	Used at toe of slopes to intercept and detain small amounts of sediment.
Slope drains/flumes	May be necessary on slopes (see channel matrix for design guidance).
Sediment traps	Used to trap sediment laden runoff. Could be used at the inlet or outlet end of slope drain.

KEY:



NOTES

Not applicable. Use in conjunction with other BMPs:
 Effective range of device for Sandy or Clayey Soil:
 Device applicable, may not be cost effective:



- 1) Cost shall be a consideration in the selection of these devices.
- 2) Designers should review FDM Chapter 10 prior to selection of erosion mats.
- 3) Install intercepting ditches to limit slope lengths to 15' vertical intervals. (See FDM Chapter 10)
- 4) Refer to FDM Chapter 10 for any slopes exceeding the limits shown.
- 5) Approved materials for erosion products are referenced from the Wisconsin Department of Transportation Erosion Control Product Acceptability Lists (PAL), found at the web site: <http://www.dot.wisconsin.gov/business/engrserve/pal.htm>
- 6) On steeper slopes that require a higher class mat, use the appropriate lower class mat or seed and mulch for the first 30 ft to 60 ft of the slope.
- 7) Unless project conditions require otherwise, seed and mulch all slopes that are flatter than a 5% grade, regardless of length. If practicable, bench the slopes.
- 8) Effective erosion control involves minimizing the amount of time soil is exposed and the selection of a combination of practices, and not reliance on just one practice.

* Soils that are not sandy should be treated as clay soils.
 ECRM - Erosion control revegetation mat. All Class I and II mats are ECRMs.
 TRM - Turf reinforcement mat.
 FDM - WisDOT Facilities Development Manual
 PAL - See Note 5