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MAY 25 2023

MINERALS & MINING PROGRAM

506 Sixth Street  
Post Office Box 8045  
Rapid City, South Dakota 57709  
Main: (605) 342-1078  
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www.gpna.com

May 23, 2023

Richard M. Williams  
Email: rwilliams@gpna.com  
Direct Dial: (605) 719-3430

Roberta Hudson  
Department of Agriculture and Natural Resources  
Minerals and Mining Program  
Joe Foss Building  
523 East Capitol Avenue  
Pierre, SD 57501-3182

Re SDO Services, LLC  
GPNA File No. 16413.0002

Dear Ms. Hudson:

On behalf of our client, SDO Services, LLC ("SDO") we are submitting this Exploration Notice of Intent (EXNI) and supplemental information.

At this time, the application for the EXNI only includes private land in Pennington County, South Dakota.

Included in this Exploration Notice of Intent are the following;

- The EXNI application form – SD form 0429
- A Plan of Reclamation Pursuant to Section 8
- A Topographic Map Pursuant Section 9
- A fee of \$250.00 pursuant to Section 17 in check form
- A completed Certification of Applicant form for Longview Minerals, LLC
- Confidential Exhibits B, C, E, F, G, H

All reasonable efforts have been made to verify the accuracy and validity of information regarding the proposed activities for exploratory drilling and associated reclamation.

If there are any questions or concerns, please do not hesitate to contact me. Thank you in advance for your time and attention.

Sincerely,

Richard M. Williams

RMW:lf

Department of Agriculture and Natural Resources  
Minerals and Mining Program  
523 East Capitol Avenue  
Pierre, South Dakota 57501-3182  
605 773-4201; Fax: 605 773-5286

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**NOTICE OF INTENT TO CONDUCT  
MINERAL EXPLORATION OPERATION  
(Excluding Uranium)**

Pursuant to SDCL 45-6C

Operator's name: SDO SERVICES, LLC ("SDO")

Contact Person for SDO:

Michael Schlumpberger  
General Manager  
Telephone: 419-371-3331

Mailing Address: 506 6<sup>th</sup> Street  
Rapid City, SD 57701

Telephone: (605)-342-1078

Resident agent (if out-of-state corporation):

Gunderson Palmer Registered Agents, LLC

Resident agent address: 506 6<sup>th</sup> Street  
Rapid City, SD 57701

Telephone: (605) 342-1078

Legal description of area to be explored by Section, Township, and Range:

Section 6, Township 2S, Range 6E, BHM, Pennington County, South Dakota

County: Pennington County

Give a brief description of the type of exploration to be conducted. Include a list of all minerals to be explored and a description of methods (e.g. drill rig type, number of holes to be drilled, number of drill pads to be constructed, proposed depth for each test hole, length of existing access roads and/or new access road construction).

SDO proposes to conduct exploratory drilling for pegmatite minerals, particularly spodumene, on patented claims. Exploration will be by means of diamond core water drilling. Drilling will take place from drilling pads. SDO proposes to drill 50 exploration holes. The location of the holes will depend on a geological examination of surface conditions and structures. The proposed holes may be up to 850 feet in depth depending on geology and test results. Existing roads will be utilized to access the drill sites. If the need for additional access is necessary, the new roads / trails will be reclaimed in accordance with the reclamation plan.

Public Map, **Exhibit A** and **CONFIDENTIAL Exhibit B** show access to the exploration area.

Date exploration will commence: Upon issuance of the final Restriction Letter issued by DANR.

What legal authority does the operator have to conduct exploration on the above-described land? Include a copy if available.

Deed  Lease  US Forest Service Permit  Pending US Forest Service Permit  Other

SDO will be conducting operations under an Option agreement which specifically grants access for exploration and permitting. See **CONFIDENTIAL Exhibit C** (partial and redacted to eliminate confidential terms).

Will the operator conduct uranium exploration?  Yes  No If yes, a permit pursuant to SDCL 45-6D must be obtained.

**INSTRUCTIONS:**

Please reference SDCL 45-6C. This Notice of Intent must be accompanied by:

1. A plan of reclamation pursuant to Section 8.
2. A topographic map pursuant to Section 9.
3. A fee of \$250 payable to the Department of Agriculture and Natural Resources pursuant to Section 17.
4. A surety in an amount to be determined by the department pursuant to Section 19.
5. Any written landowner consultations giving alternative preferences for the reclamation of the affected land pursuant to Section 16.

Applicant affirms that the surface owner has been notified of the proposed mineral development and that said surface owner is aware of his rights to compensation for damages to property pursuant to SDCL 45-5A. Applicant hereby affirms that the mineral exploration will be conducted pursuant and subject to the provisions of SDCL 45-6C, and all regulations promulgated thereunder, that he will grant access to the SD Board of Minerals and Environment or its agents to the area under notice from the date of the notice and thereafter to assure compliance with the provisions of SDCL 45-6C.

*I declare and affirm under the penalties of perjury that this claim (petition, application, information) has been examined by me, and to the best of my knowledge and belief, is in all things true and correct.*

Michael X. Schlumberger  
Signature

Date: 17 Apr 2023

Title: General Manager

STATE OF South Dakota

COUNTY OF Pennington

On this 17th day of April, 2023, before me personally appeared Michael X. Schlumberger who acknowledged himself to be the General Manager (Title)

for \_\_\_\_\_ and that he is authorized to execute the Notice of Intent for the purposes contained therein.  
(Operator)

Anda S. Fletcher My Commission Expires: 12/19/2024  
Notary Public



**FOR DEPARTMENT USE ONLY**

DATE APPROVED: BOND AMOUNT: EXNI NUMBER:

\_\_\_\_\_  
**Chairman, SD Board of Minerals & Environment**

STATE OF SOUTH DAKOTA  
BEFORE THE SECRETARY OF

THE DEPARTMENT OF AGRICULTURE AND NATURAL RESOURCES

IN THE MATTER OF THE )  
APPLICATION OF )  
SDO SERVICES, LLC )  
\_\_\_\_\_)  
STATE OF SOUTH DAKOTA )  
\_\_\_\_\_)  
COUNTY OF PENNINGTON )

CERTIFICATION OF  
APPLICANT

I, Michael X. Schlumpberger, the applicant in the above matter after being duly sworn upon oath hereby certify the following information in regard to this application:

I have read and understand South Dakota Codified Law Section 1-41-20 which provides:

*"The secretary may reject an application for any permit filed pursuant to Titles 34A or 45, including any application by any concentrated swine feeding operation for authorization to operate under a general permit, upon making a specific finding that:*

- (1) The applicant is unsuited or unqualified to perform the obligations of a permit holder based upon a finding that the applicant, any officer, director, partner, or resident general manager of the facility for which application has been made:
 
  - (a) Has intentionally misrepresented a material fact in applying for a permit;*
  - (b) Has been convicted of a felony or other crime involving moral turpitude;*
  - (c) Has habitually and intentionally violated environmental laws of any state or the United States which have caused significant and material environmental damage;*
  - (d) Has had any permit revoked under the environmental laws of any state or the United States; or*
  - (e) Has otherwise demonstrated through clear and convincing evidence of previous actions that the applicant lacks the necessary good character and competency to reliably carry out the obligations imposed by law upon the permit holder; or**
- (2) The application substantially duplicates an application by the same applicant denied within the past five years which denial has not been reversed by a court of competent jurisdiction. Nothing in this subdivision may be construed to prohibit an applicant from submitting a new application for a permit previously denied, if the new application represents a good faith attempt by the applicant to correct the deficiencies that served as the basis for the denial in the original application.*

*All applications filed pursuant to Titles 34A and 45 shall include a certification, sworn to under oath and signed by the applicant, that he is not disqualified by reason of this section from obtaining a permit. In the absence of evidence to the contrary, that certification shall constitute a prima facie showing of the suitability and qualification of the applicant. If at any point in the application review, recommendation or hearing process, the secretary finds the applicant has intentionally made any material misrepresentation of fact in regard to this certification,*

consideration of the application may be suspended and the application may be rejected as provided for under this section.

Applications rejected pursuant to this section constitute final agency action upon that application and may be appealed to circuit court as provided for under chapter 1-26."

I certify pursuant to 1-41-20, that as an applicant, officer, director, partner, or resident general manager of the activity or facility for which the application has been made that I; a) have not intentionally misrepresented a material fact in applying for a permit; b) have not been convicted of a felony or other crime of moral turpitude; c) have not habitually and intentionally violated environmental laws of any state or the United States which have caused significant and material environmental damage; (d) have not had any permit revoked under the environmental laws of any state or the United States; or e) have not otherwise demonstrated through clear and convincing evidence of previous actions that I lack the necessary good character and competency to reliably carry out the obligations imposed by law upon me. I also certify that this application does not substantially duplicate an application by the same applicant denied within the past five years which denial has not been reversed by a court of competent jurisdiction. Further;

"I declare and affirm under the penalties of perjury that this claim (petition, application, information) has been examined by me, and to the best of my knowledge and belief, is in all things true and correct."

Dated this 17 day of April, 2023.

Applicant (print) Michael X. Schlumberger

Michael X. Schlumberger  
Applicant (signature)

Subscribed and sworn before me this 17th day of April, 2023.

Linda S. Fletcher  
Notary Public (signature)

My commission expires: 12/19/2024



PLEASE ATTACH ANY ADDITIONAL INFORMATION NECESSARY TO DISCLOSE ALL FACTS AND DOCUMENTS PERTAINING TO SDCL 1-41-20 (1) (a) THROUGH (e). ALL VIOLATIONS MUST BE DISCLOSED, BUT WILL NOT AUTOMATICALLY RESULT IN THE REJECTION OF AN APPLICATION

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In preparing this reclamation plan, please address each item in detail, referencing SDCL 45-6C-8 and 45-6D-9. Please refer to the reclamation standards outlined in SDCL 45-6C-27 through 45-6C-34, SDCL 45-6D-33 through 45-6D-39, and the state's hole plugging regulations as detailed in ARSD 74:11.

1. Describe the type of reclamation the operator proposes to achieve in the reclamation of the affected land.

See attached – Reclamation Plan

2. Provide a proposed timetable for seeding and replanting indicating when and how the reclamation plan will be implemented. Such timetable shall be developed in consultation with the County District Conservationist as to the nature of the soils and native vegetation in the area of the proposed operation. These recommendations shall be followed, if any are provided, and copies of all correspondence shall be provided to the Department.

See attached – Reclamation Plan

3. Describe how the reclamation plan will rehabilitate the affected land.

See attached – Reclamation Plan

4. Describe the anticipated temporary and permanent plugging and capping procedures to be used. Please refer to SDCL 45-6C-28 through 45-6C-30, SDCL 45-6D-33 through 45-6D-35, and the state's hole plugging regulations as detailed in ARSD 74:11.

See attached – Reclamation Plan

5. Provide the estimated cost of implementing and completing the proposed reclamation, and, the estimated cost of plugging and sealing each test hole.

See attached – Reclamation Plan

*I declare and affirm under the penalties of perjury that this claim (petition, application, information) has been examined by me, and to the best of my knowledge and belief, is in all things true and correct.*

Michael X Schlangen  
Signature

Date: 17 Apr 2023

Title: General Manager

## Reclamation Plan

**(1) A description of the type of reclamation the operator proposes to achieve in the reclamation of the affected land;**

The proposed exploratory drilling project will be conducted entirely on patented claims in Pennington County, South Dakota, on land subject to an Option which includes the right to access for mineral exploration and permitting. *See CONFIDENTIAL Exhibit C.* All surface reclamation (regrading, contouring, travel route rehabilitation, seeding, etc.), travel restrictions, and timing will be as directed by SDO in accordance with SDCL 45-6C-16 and under the terms of the Option.

SDO and its contractors will strive to minimize the surface impact of the exploratory drilling program by minimizing the disturbed area and maintaining open communication with DANR. Seeding mix will be approved by the NRCS office or as otherwise directed by DANR. Reclamation will continue during the course of the project following completion of drilling.

To the extent it is necessary to do so, SDO will construct all roads and trails developed for the exploration project to minimize sedimentation and erosion by the placement of water bars and similar structures, road placement on the contour, revegetation of roadwork and embankment slopes, or by using other methods in accordance with SDCL 45-6C-32.

Topsoil will be salvaged and stockpiled for later use in reclamation.

In the event that bones, artifacts, foundation remains, or other evidence of previously unrecorded past human use is uncovered during exploration, the area will be avoided, and the South Dakota Archeological Research Center will be contacted.

**(2) A proposed timetable for seeding and replanting indicating when and how the reclamation plan will be implemented. Such timetable shall be developed after consulting the local conservation district as to the nature of the soils and native vegetation in the area of the proposed exploration operation. The recommendations of the local conservation district shall be followed if any are provided;**

Replanting and reseeding will take place following recontouring and regrading of disturbed areas as seasonally acceptable. All reclamation processes, seed mixes, seasonal constraints and timing and guidance will be based on NRCS or DANR guidance and requirements. To the extent not otherwise controlled by DANR, the land will be reclaimed as directed by SDO pursuant to SDCL 45-6C-16 and the Option. *See Seeding Plan Exhibit D.*

**(3) A narrative description of how the reclamation plan will rehabilitate the affected land;**

The goal of the reclamation process will be to restore surface impacts of the proposed exploratory drilling program to pre-project conditions, or as near as possible. Any deviation



from this objective will be guided by SDO, the Option, and DANR. Reclamation actions will include recontouring to conform with surrounding topography where practical. Stockpiled topsoil will be used where available. Seeding with local native species will occur as guided by the NRCS or as directed by DANR. Stabilizing and/or growth medium may be used to encourage regrowth of native species, the use of which will be directed by DANR

**(4) A narrative description of the temporary and permanent plugging and capping procedure to be used;**

Plugging, capping, and sealing of test holes will be consistent with ARSD 74:11:08. Pursuant to ARSD 74:11:08:04, test holes that encounter no water or only low-permeability formations such as clays, shales, and till will be backfilled to restore natural conditions as nearly as possible. Except as provided in §§ 74:11:08:05 to 74:11:08:07.02, inclusive, the test hole plugging method will return the excess drill cuttings to the drill hole to a point not less than eight feet below the ground surface. Backfill material will be free of contamination and have a permeability equal to or less than the permeability of the formations encountered in the borehole. A nondegradational, nonslip plug will be placed at a point not less than eight feet below the ground surface, and a five-foot column of cement grout will be placed above the plug. Topsoil or material representative of the undisturbed surface material will be tamped into the upper three feet of the drill hole. SDO may use bentonite chips as an alternative to cement grout in the top eight feet of the test hole if bentonite grout or bentonite chips are used to plug the test hole.

In the unlikely event that a drill hole needs to remain open for more than 30 days for downhole data collection purposes, SDO will apply in writing to DANR for permission to temporarily keep the test hole open.

**(5) The estimated cost of implementing and completing the proposed reclamation and the estimated cost of plugging and sealing each test hole pursuant to the provisions of §§ 45-6C-28 and 45-6C-29.**

SDO will place a statewide surety bond of \$20,000 in lieu of drill program specific surety bonds with the State of South Dakota prior to project commencement (SDCL 45-6C-19).

**(6) Application of SDCL 45-6C-9.**

In addition to Exhibit A and **CONFIDENTIAL EXHIBIT B**, the below maps show the location of the know roads and trails in the area. The old Ingersoll Mine mill can be seen on some of the maps. It is our understanding that the old mill burned to the ground in February of 2022. Based on the well completion reports on file with the State of South Dakota, there is one water well in the exploration area, but the water right has been cancelled. Other than indicated on the maps, there are no known other known springs, lakes, ponds, reservoirs, water pipelines, or earthen dams. The attached Water Well Completion Report map shows the nearest water wells that we are aware of.

**CONFIDENTIAL**

1. Topographic maps, Exhibit E and F.

2. Map showing additional roads, trails, rail, and geography, Exhibit G.
3. Well Completion Report map, Exhibit H.

Instructions

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SEEDING PLAN

MLRA

Producer SDO RE, LLC Conservation District: Pennington MINERALS & MINING PROGRAM MLRA 62

Program CTA Practice No. 342 Practice Name: Critical Area Seeding

Cl or Referral No. \_\_\_\_\_ Contract # \_\_\_\_\_

Resource Concern (CPPE Impact) \_\_\_\_\_ Purpose: 342- Stabilize areas with existing or expected high rates of soil erosion by wind or water



PLANNED

Tract		Seedbed Preparation
Field	NA	Clean, smooth, weed free seedbed will be prepared
Acres	1.00	
Group or Site	Critical Area Group	
Site	Loamy or Silty Texture	
Date to be Planted	Early Spring Prior to 5/15	
Alternative planting dates		Protection Provided
Seeding Equipment	Special Grass Drill	Clip weeds before they compete for moisture and light
Companion Crop		

PLANNED

Species * **	1/ Select Improved Variety (recommended) or select common seed (see note below)	Percent in Mixture	Pure Live Seeds (PLS) per square foot	Pure Live Seed (PLS) lbs/ac Needed	Acres to Seed	Pure Live Seed (PLS) lbs Required
Big bluestem		105	40.95			
Sideoats grama		15.0	6.75	1.67	1.00	1.67
Little bluestem		10.0	4.50	1.09	1.00	1.09
Green needlegrass		5.0	2.25	0.34	1.00	0.34
Canada wildrye		2.0	0.90	0.22	1.00	0.22
Western wheatgrass		11.0	3.30	1.25	1.00	1.25
Slender wheatgrass		50.0	18.75	7.29	1.00	7.29
Purple prairie clover		11.0	4.13	1.16	1.00	1.16
		1.0	0.38	0.06	1.00	0.06

**To meet SD NRCS Standards Please Note:**

1/ Improved varieties recommended above have no restrictions on their origin.

1/ Origin of Common grass seed must be ND, SD, NE, MT, WY, MN, or IA. Exception: Smooth Bromegrass any locale.

1/ Common Native forbs and legumes will originate or be grown in (USA): ND, SD, NE, MT, IA, WY, ID, WA, OR, MN, WI, and (CAN): AB, BC, MB, ON, SK.

- Seed test must be completed according to SD Seed laws (see link below) and no more than 9 months prior to the date planted.
- All legumes must be pre-inoculated. Producer will provide all seed tags to NRCS [Legume inoculants](#)
- Tetrazolium (TZ) tests may be used as a substitute for germination tests ONLY for Green Needlegrass
- For Alfalfa Salinity tolerance use F or G from the web site link ----> [Alfalfa Variety Ratings](#)

\* Pubescent wheatgrass and Intermediate wheatgrass are the same species and can be substituted for one another at any time.

\*\* Thickspike wheatgrass may be substituted for western wheatgrass if the later is not available but only west of the Missouri River.

To calculate the amount needed multiply the western wheatgrass seeding rate by .72

SD Seed Laws [Codified Laws Statute 38-12A](#) Seed testing [SD state seed-lab](#)

LOCATION MAP


Tract \_\_\_\_\_

Planning Assistance By: Mitch Faulkner 4/17/2023  
Name Date

Plan Meets SD Standards (if no explain) Yes  No

The seeding plan was developed from recommendations based on the NRCS Soil Survey and South Dakota Field Office Technical Guide.

Critical Area Group

Loamy or Silty Texture

This seeding is limited to

62

Major Land Resource Area (MLRA)

Variables/Cultures that are approved for South Dakota include



Common Name

<b>Big bluestem</b> Bison Central low Grassland Prairie	Bonica Champ Roundtop	Bonica Common Sullyville	Bounty Northern low Grassland
<b>Secoals grama</b> Buffs Northern low Grassland	Central low Grassland Prairie	Common Southern low Grassland	Killer Trickley
<b>Little bluestem</b> Badlands Ecology Common	Blue Yalls	Common Northern low Grassland	Central low Grassland Southern low Grassland
<b>Green needlegrass</b> AC Midland Ecology	Common	Latham	
<b>Canada wildrye</b> Common	Mendon		
<b>Western wheatgrass</b> Acacia Recovery	Barton Rolan	Common Robins	Flitock Walt
<b>Slender wheatgrass</b> AC Forest Ecology (Revised) Common Pyle	AC Song Ecology (Revised) Elias Reynolds	Alford Fred Stone	AEC Hillcrest Primer
<b>Purple prairie clover</b> Barnack	Common	Kings	

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## Guidance for Critical Area Planting (342)

The following is an excerpt from RANGE TECHNICAL NOTE NO. 4 PERENNIAL VEGETATION ESTABLISHMENT GUIDE.

[SD/Range Tech Note 4.pdf](#)

Seeding of a critical area may take place at any time of the year as long as a reasonable expectation of a successful seeding establishment is expected.

### Site Preparation:

Follow guidance for seedbed preparation (Section 2 above) and the additional following criteria.

If necessary, divert offsite water away from the critical area. This may require a permanent conservation practice, or in other instances, a temporary measure that will be effective during the period of establishment. Where practical, grade to permit the use of conventional equipment for seedbed preparation, seeding, mulch application, and anchoring. Cabling of equipment to prevent rollover may be necessary on some slopes such as newly constructed dams.

On construction sites where the exposed and underlying soil material will not support adequate vegetation, minimum topsoil dressing of six inches will be applied as part of construction.

After construction is complete, the seedbed will be worked to a depth of three to five inches to break up compacted areas and permit rapid root development. Drag or pack to break up large clods and firm the seedbed.

Where slopes are steeper than 1.5:1, use some means other than vegetation to stabilize slopes.

### Species Selection:

Allowable species will be selected from Table 7 for the appropriate MLRA.

A minimum of 75% of the mixture will be made up of sod forming species. Grass mixtures may include all native species, all introduced species, or a mixture of native and introduced species. Mixing smooth brome grass, Kentucky bluegrass, and/or crested wheatgrass with native species is not typically recommended.

When smooth brome is to be seeded in a mixture, do not include more than 10% of other native or introduced species for early establishment.

Single species may be used on saline or wet areas (Table 7).

Do not select aggressive species such as smooth brome grass when the adjacent area is dominated by native species.

When quick growth and/or protection of a critical area is needed, a quick establishing grass can be added in addition to the selected permanent seeding mixture. Use either slender wheatgrass or annual ryegrass. Slender wheatgrass can be used statewide and annual rye grass can be used in MLRAs 102A, 102B, 102C, 53B, 53C, 55B, 55C, 63B, 66, and 62. Add a maximum of three PLS pounds per acre of slender wheatgrass or a maximum of two PLS pounds per acre of annual ryegrass to the selected full seeding.

### Conventional Seeding:

Seeding activities will follow recommendations found elsewhere in this technical note unless otherwise stated in this section.

Seeding rates will be 1.5 times those recommended in Table 2 when using a drill (recommended rate multiplied by 1.5).

When possible, drilling will be accomplished perpendicular to the slope. On grassed waterways, drilling will follow a serpentine pattern.

**Broadcasting:**

Many critical area plantings are too steep or too small to efficiently and safely utilize a drill. In these cases, seed may be broadcast and incorporated by harrowing, packing, or raking by hand. When broadcast seeding, increase the seeding rates found in Table 2 by two times (recommended rate multiplied by two).

**Hydroseeding:**

On sites that are too steep for regular equipment to operate, the use of a hydro seeder is an acceptable alternative. Seed, fertilizer, and mulch materials will be applied in one operation. Limit the application of 150 pounds of solids per 100 gallons of water. If a legume seed is included in the mixture, any lime or fertilizer should be applied separately. A second trip may also be needed to apply an asphalt emulsion to long fiber mulches.

When using hydroseeding technique, increase seeding rates found in Table 2 by a factor of two (recommended rate multiplied by two).

**Sodding:**

Sod may be used on areas requiring immediate cover to prevent erosion. The sod should be in strips or blocks of native grass mixture, switchgrass, prairie cordgrass, reed canary grass, or other suitable grasses. Bluegrass sod is to be used only when the areas is irrigated and is desired for aesthetic purposes. Sod materials are to be taken from solid, thick growing stands.

Sod will be cut in strips of uniform width and to a uniform thickness of at least three inches for tall grass and ½ to 1½ inches for short grasses. Lay sod within 24 hours after it was cut.

Sod strips should be carefully placed in rows across (at right angles) to the direction of slope. The sod strips will be placed together tightly so that no open joints are left between the strips or between the end of strips. Joints between the end strips will be staggered. Any spaces between the joints will be filled with topsoil and all edges covered with topsoil at least two inches deep. The edge of the sod at the top of slopes will be turned under and a layer of soil compacted over the edge so as to conduct surface water over and onto the top of the sod. The sod will be well tramped to help it remain in place.

**Fertilizing:**

Do not fertilize predominantly warm-season grass seeding unless the soil material is very infertile.

Thoroughly mix all fertilizer into the upper three to five inches of the soil during final seedbed preparation.

Apply fertilizer based on the recommendations from a soil test or apply 30 to 40 lbs. of actual Nitrogen (N) and 40 to 60 pounds of Phosphorus pentoxide (P<sub>2</sub>O<sub>5</sub>) per ac. Ten to 15 tons of manure per ac may be used in lieu of the commercial fertilizer and will also increase organic matter.

On medium textured soils, the addition of 5 to 10 lbs. of zinc per ac may speed up growth.

**Mulching:**

All mulching will be done in accordance with the SD CPS for Mulching (484). Mulching of critical area plantings is required for any of the following conditions:

Where seeding cannot be accomplished during the approved seeding periods and a cover crop is not used;

On grassed waterways, where a cover crop or companion crop is not used, and seeding is placed on a bare seedbed, and the design velocity is more than 2.5 feet per second;

Where a grassed waterway is established at the time of terrace construction, and the channel slope is 2% or greater;

On slopes 3:1 or steeper that are 10 feet or more in vertical height or longer than 20 feet; on cut south and west facing slopes; On all saline and alkaline areas.

Drill grass in the prepared seedbed, immediately prior to mulching or at the next suitable seeding period after mulching.

### **Management of Critical Areas During and After Establishment :**

Weeds will be controlled as described elsewhere in this technical note. All use will be excluded until vegetation is well established.

Mow grassed waterways for hay annually after establishment. Other critical areas may be mowed as needed for stand maintenance.

Fertilize as necessary to maintain stand.

Inspect critical areas each spring and following heavy rain. Reshape and reseed eroded areas promptly.

Reinforce grass seeding where stands are thin.

Manage any grazing use to ensure long-term survival of the stand

Lift tillage implements and shut off sprayers when crossing critical areas. Do not till parallel to grassed waterways.

Avoid vehicular travel on critical areas.

Providing Food, Cover, and Shelter for Wildlife:

Wildlife habitat should be considered when developing critical area planting plans and species selection. For plant species to improve wildlife habitat, refer to the SD CPS Upland Wildlife Habitat Management (645).

## Perennial Vegetation Establishment

The following is an excerpt from RANGE TECHNICAL NOTE NO. 4 PERENNIAL VEGETATION ESTABLISHMENT GUIDE. For detailed information see Range Tech Note 4 at: [SD/Range Tech Note 4.pdf](#)

### 2. SEEDBED PREPARATION:

#### New Seedlings:

A seedbed will be prepared that is free of competing vegetation and is not subject to excessive erosion. A firm seedbed will be provided so the seed is placed at the designed depth. The seedbed should be firm enough so that the boot heel of an average adult penetrates the soil to a depth of approximately one-half inch.

The presence or absence of weed populations, especially noxious weeds, will impact seedbed preparations. Each field should be evaluated for weed pressure. Seeding on fields with significant weed populations should be delayed until weeds are controlled. This may mean a protective cover crop will need to be planted (see Section 11 for Cover Crop methods).

When planning a seeding, the previous three years of herbicide application should be considered. Use chemical labels to determine if there are any potential carryover issues. If the label doesn't specifically address grass, legume, or forb species, then utilize "all other crops not listed" portion of the label. Any potential carryover problems should be addressed by delaying seeding, establishing a cover crop, and/or changing species to be planted. If a cover crop is necessary, refer to Section 11.

Proper seedbed preparation should begin with the previous year's crop. Select a crop in the year prior to planting which is dissimilar to the species to be established. For example, soybean residue produces an excellent seedbed for grass species. Proper selection of crops the year prior to seeding will greatly enhance the success rate of the seeding and reduce seedbed preparation time.

Several crops (notably rye, wheat, barley, and alfalfa) are known to produce allelopathic chemicals which inhibit germination and new seedling establishment. Other commonly grown crops provide good cover and do not inhibit germination. Direct seeding into recently sprayed, hayed (or rolled) green rye or wheat will be avoided as the allelopathic effect will inhibit successful stand establishment. Fresh crop residue and freshly decomposing residue may have allelopathic impacts on growing seedlings. For dormant seedlings, this is not a consideration. Heavy residue should be baled and removed to avoid pinning and ensure good seed to soil contact. Do not seed alfalfa into an existing thinning alfalfa stand or into a newly killed alfalfa stand. Wait at least one year before reseeding alfalfa into a field previously in alfalfa or an alfalfa mix.

In the event that grass seeding follows allelopathic crops (e.g., rye, wheat, alfalfa), residue management becomes important. The degree of crop residue decomposition prior to the next crop affects this allelopathic response. Newly incorporated residues are highly allelopathic while a loss of allelopathy occurs as residues decompose. Therefore, stubble from these crops should be allowed to overwinter before attempting to establish new seedlings. In no-till situations, consider planting a cover crop will enhance residue decomposition. For additional information on no-till and cover crop methods, see below and Section 11.

#### Seedbed Preparation Methods:

**No-Till Method** – Seeding into standing stubble of a previous crop without further seedbed preparation. Seed to soil contact, seeding depth, and seed placement are critical and equipment settings and ability of equipment utilized to seed into heavy cover is critical.

Pinning, seeding too deep, or not placing seed in contact with soil are major reasons for poor stands or stand failures. Excess straw or chaff should be removed prior to seeding.

Use of harvest equipment, which spreads straw along a minimum of 80% of the header width, will prevent excess chaff problems. If weeds or excessive volunteering of previous crop are present, control with appropriate herbicide(s) in accordance with product label directions and any current recommendations from SDSU Cooperative Extension Service.



Cover Crop Method – Plant a cover crop the season prior to seeding perennial species. Cover crops may be a single species or a diverse mix but should not include overwintering species (i.e. winter wheat, cereal rye, etc.). Using cover crops to prepare the seedbed will help manage erosion, increase organic matter, enhance soil biology, reduce compaction, alleviate herbicide issues, trap moisture for dormant seedings, manage salinity or salt issues, reduce weed pressure, and/or reduce excessive residue by promoting decomposition and nutrient cycling. Cover crops may be hayed or grazed prior to seeding if excessive residue will inhibit seeding equipment from operating properly. No-till the perennial species directly into cover crop residue if possible. For more information about use of cover crops during perennial grass establishment see Section 11.

Clean-Till Method – Seed into a new, clean tilled, firmly packed seedbed. If erosion or potential climatic factors are a potential concern, a cover crop should be used. See Section 11 if a cover crop is to be used. Clean-till methods should not be utilized for a dormant seeding, unless cover crops are included.

### **3. STAND RENOVATION SEEDINGS:**

It may be desirable to replace an existing stand of introduced grass or grasses and legumes that has declined in. Prior to attempting this method, excess litter should be removed if necessary, allowing seeding equipment to function properly. The existing stand may be hayed, grazed heavily, or prescribed burned to remove excessive litter. Herbicides are then applied to the regrowth.

Glyphosate applied to actively growing plants in the fall of the year is the herbicide method of choice for eradication of cool-season grasses.

A spring follow-up application may be required to gain complete control. If no lush fall growth is present, defer application until the spring. In either case, all existing vegetation should be destroyed prior to drilling the new seeding. The new seeding is drilled directly into the destroyed stand.

This method of seeding is generally not as successful as seeding into a fully prepared seedbed due to several issues relating to seed to soil contact. It should only be used to renovate stands of introduced grasses, when soil conditions, availability of equipment, program restrictions, and other constraints make the use of a fully prepared seedbed impractical. It should never be used to rejuvenate rangelands. Rangelands are generally best improved through management techniques such as prescribed grazing or prescribed burning (please see the NRCS Conservation Practice Standard (CPS) Prescribed Grazing

(528) or CPS Prescribed Burning (338)).

Stand Enhancement Seedings:

It is often the goal of management to attempt to establish new species of grasses and/or legumes directly into existing stands. Established growing stands of grasses or grass/legumes fully utilize all water, soil, and solar resources especially in western portions of SD. Attempting to establish new species into existing stands generally results in failure due to the existing vegetation out competing new seedlings for water and sunlight.

Therefore, establishing new species directly into existing growing stands is not recommended. One exception is the enhancement of existing stands of introduced grasses through the addition of legumes.

Competition from existing vegetation is reduced either through tillage or herbicides. If tillage is used, it should consist of one chisel followed by one or two disking's. Tillage should be a minimum of three inches deep. If herbicides are used, they should be applied at rates which will temporarily impede the growth of existing vegetation. Legumes are then drilled directly into the tilled or herbicide treated seedbed.

Reinforcement Seeding:

Often when a new seeding is completed, portions fail to establish satisfactorily. Thin stands may exist across portions if not all of the stand. Areas of unsatisfactory plant populations may be improved by drilling seed directly into the existing thin portions of the stand. Weeds need to be controlled with herbicides prior to drilling. If excessive litter is present, it may have to be removed by mowing, raking, and removing the vegetation or through prescribed burning.

### **4. SEEDING EQUIPMENT:**

Seeding equipment that ensures proper seed placement and good seed–soil contact will be used. Modern grass seeding attachments that allow for proper seed flow, seed placement, and soil packing are needed to ensure a successful seeding.

Slower seeding speeds should be used for fluffy or rough-coated seed species. Three to five miles per hour should be the seeding speed for most types of grass drills. Seeding speeds in excess of six miles per hour may result in uneven or inconsistent grass and legume stands.

If a carrier is needed to help feed seed through the drill, cracked corn or rolled oats may be added to the mixture.

Drill calibration should be completed for both grass and grain drills prior to seeding. Please refer to Section 5 for guidance in completing drill calibration.

#### Grass Drill:

Grass drills are specifically designed and equipped to properly meter and place various grass, legume, and/or forb seed. They share the following design characteristics.

Different seed boxes are normally required to handle the three types of grass seed commonly used. This includes the relatively clean, smooth seed characteristic of many cool-season grasses, the chaffy or trashy seed characteristic of many warm-season grasses, and fine, smooth seed, characteristic of legumes or grasses such as switchgrass, hard fescue, or reed canarygrass.

Seed boxes having the capability of seeding chaffy or awned grasses (i.e., blue grama, bluestems, and Indiangrass) are needed, only if such species are planned in the seeding mixture; likewise, fine seed or legume seed boxes are needed, only if such species are to be seeded.

Agitators or similar mechanisms prevent bridging of chaffy or trashy seed. They ensure a constant flow of seed at the desired rate. The seed is uniformly mixed.

Feeder mechanisms (picker wheels, fluted feed, etc.) ensure uniform flow of all types of grass seed either separately or in a mixture.

Oversized feeder tubes that allow constant flow of chaffy or trashy type seed from boxes to placement point (if such seed is used) are necessary.

Individually mounted, adjustable, spring loaded, double-disc openers will help to achieve good seed-to-soil contact.

Depth bands or other depth control systems should provide positive seed placement over varying degrees of seedbed firmness for a final planting depth of one-fourth to three quarters of an inch.

Press/packer wheels should provide adequate covering and firming of soil over and around the seed for necessary seed to soil contact after proper seed placement. They can be mounted individually on each furrow opener or independently to follow behind each opener. Press/packer wheels are not intended to provide the basic "firm seedbed". The firm seedbed must exist before the drilling operation begins.

#### Small Grain Drill:

Free-flowing grass seed (i.e., wheatgrasses) and legume seed can be planted with a small grain drill, only if, proper seeding depth can be maintained throughout the field. Seeding depth is the most limiting factor to seeding success and contributes to most of the seeding failures when using a grain drill. It is extremely important to have a firm seedbed when using a grain drill. Periodic inspections should be done to check seeding depth especially when seeding across different soil types. Seeding depth will vary under actual planting conditions.

Checking the drill frequently and hand mixing the seed is essential to achieving a properly blended seed mix and helps ensure that seeds of different sizes are seeded evenly across the field. Periodic feeder mechanism adjustments are usually necessary to ensure proper seeding rates. A separate legume box is desirable for seeding small seeded species (i.e., switchgrass, hard fescue, reed canarygrass, and alfalfa). Ensure that the grain drill's drop tubes are placed in front of the packer wheels to allow for proper seed-soil contact.

Chaffy or awned seeds (i.e., bluestems, Indiangrass, and blue grama,) are extremely difficult to plant with a grain drill. Proper agitation is needed to prevent "bridging" of seed in the seed box and the feeder mechanism must be capable of metering a uniform flow of seed at the desired rate. Very few grain drills have this capability. Use of debarbed seeds is strongly recommended when considering seeding chaffy or awned seeds in a grain drill. It is recommended that a grass drill be used for these types of fluffy seeded grasses.

#### Broadcast Seeder:

Broadcast seeding may only be used when seeding some legume species (i.e., alfalfa, sweet clover) or when slope, soil conditions, and/or size of the area to be seeded make the use of a drill impractical. Obtaining proper seed depth is very difficult with broadcast seeders. All broadcast seedings will have an operation which incorporates the seed into the soil (i.e., covering operation using a drag harrow, cultipacker, roller packer, or other suitable

implement to cover and press the seed into the soil surface). When using the broadcast method, the seeding rates listed in Table 2 will be multiplied by 1.5.

Air seeders:

Some air seeders and similar types of equipment may be used to seed free flowing grass seed (i.e., wheatgrasses) and legume seed if proper seeding depth can be obtained (as specified in Section 10). The shallow planting depths for grasses and legumes can be difficult to maintain with this type equipment. The equipment must be able to provide a uniform flow of seed at the desired rate. Use packer wheels or other suitable packing implement to press soil firmly around the seeds.

Land Rollers

When tillage is deemed necessary for seedbed preparation, the use of a land roller may be needed to achieve a firm seedbed prior to using one of the previously mentioned seeding equipment. Using a land roller on non-tilled soil may also be an option if the seedbed is not firm enough.

## **6. SEED REQUIREMENTS:**

All seed must meet the requirements of SD State Seed Laws and Regulations. Information on state seed law is available under SD Article 12:36 Seed Inspection (<http://sdlegislature.gov/rules/DisplayRule.aspx?Rule=12:36>). All seed; including homegrown seed, must be officially tested for purity and germination to enable Pure Live Seed (PLS) calculations for determining the proper seeding rate. Tests must be made within a nine-month period, exclusive of the test month, prior to seeding. Retesting of seed is required if the nine month period has lapsed as stated in Article 12:36:04:01 (<http://sdlegislature.gov/rules/DisplayRule.aspx?Rule=12:36:04:01>). Information on sending seed to the seed lab at SDSU for testing is available at: <http://www.sdstate.edu/ps/seed-lab/index.cfm>.

Use certified seed when available.

Origin of non-varietal (common) grass seed of both native and introduced species for any planting is limited to North Dakota (ND), SD, Nebraska (NE), Montana (MT), Wyoming (WY), Minnesota (MN), and Iowa (IA).

Origin of non-varietal (common) native forbs and legumes is limited to ND, SD, NE, MT, WY, MN, IA, Idaho (ID), Washington (WA), Oregon (OR), Wisconsin (WI) in the United States and Alberta (AB), British Columbia (BC), Manitoba (MB), Ontario (ON), and Saskatchewan (SK) in Canada.

Foreign seed must be of adapted, named varieties.

Legume seed should be inoculated with the proper culture just prior to seeding in order to increase the potential for nitrogen fixation by the plant.

No noxious weed amounts are allowed on any seed tags. Recommended varieties for use in SD are included in Table 1.

## **7. SEEDING RATES:**

All seeding rates will be based on PLS. The PLS can be calculated from information on the seed tag. By state law, seed tags must contain certain information. Specific information on seed tag requirements can be found at <http://sdlegislature.gov/rules/DisplayRule.aspx?Rule=12:36>.

The PLS is derived by multiplying % pure seed by the % germination (plus % hard seed, if present) and dividing by 100. For example, if a sample of Indian grass has a purity of 96% and a germination of 74%, PLS would be calculated as follows:

$(96\% \times 74\%) / 100 = 71.04\%$  PLS per lbs. of bulk seed

To calculate the lbs. of bulk seed required, divide the PLS requirement for the seeding by the % PLS (expressed as a decimal). For example, if 1,000 lbs. of PLS of the above Indian grass is required for the seeding, the amount of bulk seed to purchase and apply to the field is:

$1,000 \text{ lbs. of PLS} / 0.7104 = 1,408 \text{ lbs. of bulk seed}$

Table 2 contains seeding rates for all species approved for use in SD by Major Land Resource Area (MLRA). Figure 2 provides a map showing SD MLRAs. Seeding rates have been developed to achieve an average distribution of 25 to 30 seeds per ft<sup>2</sup>.

The % that each species makes of the mixture when added together will equal at least 100% in the seeding plan (such as the SD-CPA-4).

## **8. SPECIES CHARACTERISTICS:**

Species vary in their ability to tolerate environmental conditions such as drought and flooding. They also vary widely in their ability to establish, recover after a harvest, and persist. Season of growth influences species selection in regard to forage preference and periods of use. Table 3 identifies numerous characteristics for all recommended species.

## **9. SPECIES SELECTION AND ADAPTABILITY BY SITE FOR VARIOUS LAND USES:**

Certain species are best adapted to specific site conditions. In order for a seeding to be successful, it should be adapted to the soil, landscape, climatic, and topographic conditions. Seedings are also designed for their specific uses. For example, a seeding designed for the production of hay or intensive spring livestock grazing will contain different species than a seeding which is designed to restore native tall grass prairies. When two or more ecological sites are planned to be seeded with the same mixture a single species can be counted toward the required minimum of species on each ecological site, provided they are eligible species for the included sites.

Table 4 contains species recommendations for Forage and Biomass Plantings (512). It is sorted by pasture and hay land suitability groups and by forage suitability groups, respectively (groupings of similar soil capabilities), and MLRA. More information detailing specific requirements of this practice can be found in the electronic Field Office Technical Guide (eFOTG) at: <https://efotg.sc.egov.usda.gov/#/>.

Table 5 contains species recommendations for all grassland restoration type plantings. It is sorted by ecological site (ES) (a grouping of similar soil capabilities) and MLRA. More information detailing specific requirements of this practice can be found in the eFOTG at: <https://efotg.sc.egov.usda.gov/#/>.

Table 6 has been combined with Table 5. All prairie restoration seedings should use Table 5.

Table 7 contains species recommendations for Critical Area Plantings (342). It is sorted by determining soil property (a grouping of similar soil capabilities) and MLRA. More information detailing specific requirements of this practice can be found in the eFOTG at: <https://efotg.sc.egov.usda.gov/#/>.

Table 8 contains suggested seeding mixtures for Vegetated Treatment Areas (635). It is sorted by MLRA and predominant site conditions. More information detailing specific requirements of this practices can be found in the eFOTG at: <https://efotg.sc.egov.usda.gov/#/>.

## **10. SEEDING DEPTH:**

Optimum seeding depths are between one-quarter to three-quarter inch. Proper seeding depth is extremely important in successfully establishing native and introduced vegetation from seed. Native grasses, forbs, and shrubs need to be seeded at a shallow depth, as light plays a key role in the germination of many native species. Seeding too deep is the number one reason for stand failures.

## **12. MANAGEMENT AND PROTECTION DURING ESTABLISHMENT:**

### **Grazing:**

Do not graze until stand is fully established. This period will be a minimum of one full growing season. If an adequate stand has not established during the first growing season, or if seedlings do not have well-developed root systems with adventitious roots above the sown seed, then deferment should be extended through the second growing season. Flash grazing treatments during the deferment period for weed control will be handled on a case- by-case basis provided no damage will be done to the seeded species.

### **Weed Control:**

During the establishment period, excessive amounts of competitive weeds will be controlled. Control weeds that compete with seedlings for sunlight and/or moisture during the growing season of the species planted. The first weed control operation will be needed early in seedling development or prior to weed seed maturity. Repeated weed control operations may be needed. Competitive weeds can be controlled either mechanically or chemically or by a combination of these methods.

**Mechanical** – When controlling competitive weeds by clipping or mowing, adjust the equipment to cut above the new seedlings and clip before the weeds set seed. If the clippings are dense enough to smother the new seedlings, promptly remove the clippings from the field.

**Chemical** – To control competitive weeds with herbicides use the appropriate herbicide(s) applied according to the manufacturer's label. The best control will generally be obtained when weeds are in the early stages of growth. Precautions should be taken to ensure that grass or legume seedlings are not injured by the selected herbicide(s). Please refer to SDSU Agricultural Weed Control Guides for specific herbicide recommendations on forage crops in SD.

Conditions may arise that limit weed control options. When weeds become too tall to manage with chemical or mechanical means, other options should be considered.

Prescribed burning in the fall (or spring), mow-rake-and-bale, or other options may be advisable on a case-by-case basis. Contact your local or area specialist for further guidance in these situations.

Noxious weeds must be controlled in accordance with state law.

**Insect Control:**

Insects can be a threat to seedlings. Contact the SDSU Extension office for recommendations on control of specific insects affecting seeded species.

**Caution:**

When using any pesticides (herbicides or insecticides), please read and follow the manufacturer's label recommendations. The use of pesticides must be consistent with the label and in accordance with state and federal laws and regulations.