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TALON

Remediation Work Plan (Off-Location)

Cotton Draw #181 SWD Battery |30-015-41649|2RP-3990|

Prepared For:

Devon Energy Production 6488 Seven Rivers Hwy Artesia, New Mexico 88210

Prepared By:

TALON/LPE 408 W. Texas Avenue Artesia, New Mexico 88210

March 23, 2017

Mr. Brett Fulks **Devon Energy Corporation**6488 Seven Rivers Hwy.

Artesia, New Mexico 88210

Subject:

Soil Assessment and Remediation Work Plan

Cotton Draw #181 SWD Battery Pasture Area

|30-015-41649| 2RP-3990|

Dear Mr. Fulks,

Devon Energy Corporation (Devon) has contracted Talon/LPE (Talon) to perform soil assessment and remediation services at the above referenced location. The results of our soil assessment and proposed remediation activities consist of the following.

Site Information

The Cotton Draw #181 SWD is located approximately forty (40) miles southeast of Carlsbad, New Mexico. The legal location for this release is Unit Letter H, Section 36, Township 24 South and Range 31 East in Eddy County, New Mexico. More specifically the latitude and longitude for the release are 32.1767349 North and -103.7268524 West. A site plan is presented in Appendix I.

According to the soil survey provided by the United States Department of Agriculture Natural Resources Conservation Service, the soil in this area is made up of Pajarito loamy fine sand with 0 to 3 percent slopes. Drainage courses in this area are normally dry.

Ground Water and Site Ranking

The New Mexico Office of the State Engineer (NMOSE) Water Rights Reporting System indicates that groundwater in the project vicinity is 450-feet below ground surface (BGS). According to the NMOSE GIS web app there are several wells in the project vicinity. However none of these wells have recorded groundwater depth. See Appendix II for the referenced groundwater data.

Therefore the ranking for this site is a **0** based on the following:

Depth to ground water >100'
Wellhead Protection Area >1000'
Distance to surface water body >1000'

Based upon the site ranking of **0**, NMOCD Recommended Remedial Action Levels (RRAL) are 50 mg/kg for BTEX, 10 mg/kg for Benzene, 5,000 mg/kg for TPH and the recommended guideline for Total Chlorides is 1,000 mg/kg.

Incident Description and Initial Remedial Actions

On November 3, 2016, the Cotton Draw #181 SWD Battery was struck by lightning resulting in a release of 2,450 barrels of produced water. Vacuum trucks were immediately dispatched to the location and recovered 960 barrels of fluid. The battery was immediately shut-in. A site plan is presented in Appendix I which illustrates the impacted area.

On November 4, 2016, Talon mobilized personnel to begin the site assessment and soil sampling activities for the construction of a work plan. Grab soil samples were collected in the ROW and in the pasture behind the battery utilizing a hand auger to a depth of 4-feet BGS.

Laboratory Results

See Appendix V for complete report of laboratory results.

Sample ID	Depth	BTEX	Chlorides	TPH (mg/kg)	TPH (mg/kg)
S-1	(feet) 0'	(mg/kg) <0.300	(mg/kg) 1440	GRO <10	DRO 11.9
9-1	1'				
,		<0.300	2160	<10	<10
	2'	< 0.300	2960	<10	<10
	3'	< 0.300	5360	<10	<10
	4'	< 0.300	7330	<10	<10
S-2	0'	< 0.300	2560	13	675
	1'	< 0.300	3480	<10	14.6
	2'	< 0.300	4880	<10	15.2
	3'		8930		
	4'		320		
S-3	0'	< 0.300	32	<10	<10
	1'		48		
	2'		32		
	3'		32		
	4'		32		
S-4	0'	< 0.300	3280	<10	<10
	1'		48		1
	2'		160		
	3'		48		
	4'		64		
S-5	0'	< 0.300	4000	<10	73.6
	1'	< 0.300	6000		
	2'		7200		
	3'		6930		
	4'		3280		

Sample ID	Depth (feet)	BTEX (mg/kg)	Chlorides (mg/kg)	TPH (mg/kg) GRO	TPH (mg/kg) DRO
S-6	0'	< 0.300	1840	<10	<10
	1'	< 0.300	5460	<10	<10
	2'		8800		
	3'		7330		
	4'		1870		
S-7	0,	< 0.300	48	<10	<10
	1'	< 0.300	48	<10	<10

⁻⁻ Analyte Not Tested

On January 26, 2017 Talon personnel returned to the location to obtain additional samples at greater depths utilizing an air rotary drill rig as directed by the NMOCD.

Sample ID	Depth (feet)	BTEX (mg/kg)	Chlorides (mg/kg)	TPH (mg/kg) GRO	TPH (mg/kg) DRO
B-1	1'		3600		
	2'		560		
	3'		144		
	4'		160		
	6'		208		
	10'		224		
B-2	1'		560		
	2'		48		
	3'		48		
	4'		48		
	5'		48		
B-3	5'	-	2560		
	10'		4400		
	15'		1680		
	20'		448		

⁻⁻Analyte Not Tested

Objective

The objective of this proposed remediation process is to flush target solutes (sodium and chloride) to a depth of 4-feet BGS. This depth should be sufficient to allow for the revegetation of local plant species. Based on the information provided by the United Nations Food and Agriculture Organization (FAO) the maximum capillary rise for a coarse textured soil is 50cm (19.7 inches). This proposed depth will prevent salt toxicity from the referenced solutes ascending through the soil profile back into the rhizosphere of species contained within BLM LPC seed mixture. The species contained within the LPC seed mixture with the deepest minimum rooting depth are Sand Dropseed (Sporobolus cryptandrus) and Big Bluestem (Andropogon gerardii). See Appendix IV for published data.

Proposed Remedial Actions

- Earthen berms will be constructed in the pasture to encompass the impacted area.
- Gypsum (CaSO4) will be worked into the top 0.5-feet of soil at a rate of 22 tons/acre (maximum recommended application rate) within the impacted area in order to replace sodium on the soil cation exchange complex.
- Following gypsum incorporation, the impacted area will be flooded with fresh water in order to solubilize they gypsum and incorporate it further into the soil profile.
- The treated soil will then be left in-situ to allow for natural percolation of solutes to occur following natural precipitation events.
- The impacted area will be contoured and left in a "rough" condition to approximate natural surface deviations, control erosion, promote revegetation and to hold water.
- The site will be monitored per the "monitoring regime" detailed below.

Monitoring Regime

• During the first 12 months of in-situ remediation quarterly soil samples will be collected in 1-foot intervals from the areas in the vicinity of sample locations S-1, S-2, S-4, S-5, and S-6 to a depth of 4-feet BGS in order to document the vertical movement of solutes. Samples will be analyzed for total chlorides, pH, Sodium Absorption Ratio (SAR), and Electrical Conductivity (EC). Vegetation growth will also be monitored.

- Should our stated goals be achieved during the initial 12 month period monitoring will continue on a biannual basis for 24 months in order to track the ongoing progress of this remediation.
- Once analytical results indicate that the solutes have been successfully flushed to the proposed depth. Soil borings will be advanced at sample locations S-1, S-5, and S-6 to define the total vertical depths of chloride impacts >250 mg/kg.
- Should the remediation goals not be achieved during the initial 12 month period based on quarterly sample results the work area will again be flooded with freshwater. The site will again be monitored on a quarterly basis for 12 months. If success is achieved as outlined per the objective section above. Sampling will then be moved to a semiannual basis for the following 24 months.

Revegetation Plan

- Once soil analytical data indicates that the seeding will be beneficial i.e. Sodium Absorption Ratio (SAR) <13 and Electrical Conductivity (EC) <4 dS/m. The site will be seeded with BLM LPC seed mixture per the manufacturers prescribed application rate utilizing a Culti-Pack seed drill.
- The site will be periodically monitored for revegetation to insure that revegetation matching or exceeding natural potential plant cover and diversity levels are achieved.
- The site will also be monitored for noxious weeds development, specifically African Rue. Should noxious weed issues occur or revegetation is slow to occur (accounting for precipitation levels) NMSLO will be consulted on the best course of action to reconcile the issue.

Should you have any questions or if further information is required, please do not hesitate to contact our office at (575)-746-8768

Respectfully submitted,

TALON/LPE

Sheldon L. Hitchcock

Project Manager

David J. Adkins
District Manager

Attachments

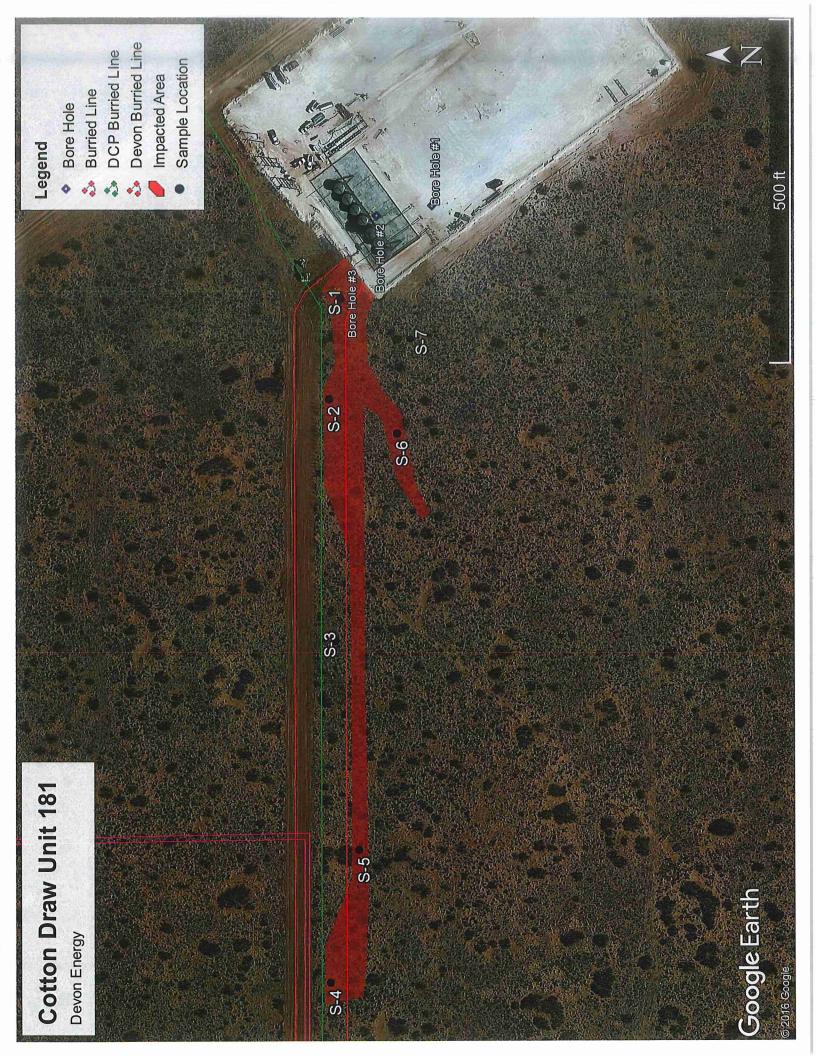
Appendix I Site Plan

Appendix II Groundwater Data

Appendix III Initial C-141

Appendix IV Rooting Depth Data Appendix V Laboratory Results

APPENDIX I SITE PLAN



APPENDIX II GROUNDWATER DATA



New Mexico Office of the State Engineer Water Column/Average Depth to Water

(A CLW##### in the POD suffix indicates the POD has been replaced & no longer serves a water right file.)

(R=POD has been replaced, O=orphaned, C=the file is

closed)

(quarters are 1=NW 2=NE 3=SW 4=SE)

(quarters are smallest to largest)

(NAD83 UTM in meters)

(In feet)

	POD												
	Sub-		Q	Q	3							Depth	Depth Water
POD Number	Code basin (County	64	16	4 Se	ec Tv	s R	ng	Х	Υ	Distanc	e Well	Water Column
C 02572		ED	4	2	2 0	25	S 3	31E	618695	3559294*) 199	852	
C 02568		ED	4	3	1 0	1 25	is 3	31E	619103	3558892*	9 203	7 1025	
C 02573		ED	1	4	2 0)2 25	is 3	31E	618499	3559091*) 227	8	
C 02569		ED	4	4	2 (25	is 3	31E	618699	3558891*) 228	0 1016	
C 02571		ED	4	1	2 (25	is 3	31E	618292	3559294*	231	5 860	
C 02574		ED	1	1	2 ()2 25	is 3	31E	618092	3559494*	238	2	
C 02570		ED	4	2	4 0)2 25	is 3	31E	618704	3558489*) 259	4 895	
C 03830 POD1	CUB	ED	4	2	4 ()2 25	S 3	31E	618632	3558432) 268	1 450	

Average Depth to Water:

Minimum Depth:

Maximum Depth:

Record Count: 8

Basin/County Search:

County: Eddy

UTMNAD83 Radius Search (in meters):

Easting (X): 620196

Northing (Y): 3560611

Radius: 5000

^{*}UTM location was derived from PLSS - see Help

OSE Well Locations

APPENDIX III INITIAL C-141

NM OIL CONSERVATION ARTESIA DISTRICT

State of New Mexico **Energy Minerals and Natural Resources**

Form C-141

NOV 1 0 2016

Revised August 8, 2011

Submit 1 Copy to appropriate District Office in accordance with 19.15.29 NMAC. **RECEIVED**

District I 1625 N. French Dr., Hobbs, NM 88240 District II 811 S. First St., Artesia, NM 88210 District III 1000 Rio Brazos Road, Aztec, NM 87410 District IV 1220 S. St. Francis Dr., Santa Fe, NM 87505

Oil Conservation Division 1220 South St. Francis Dr. Santa Fe, NM 87505

Release Notification and Corrective Action											
NAB 143 145 1 145						OPERATOR					
Name of Company Devon Energy Production Company 4/37						Contact Jake Harrington, Production Foreman					
		Rivers Hwy				Telephone l	No. 432-214-51	75			
Facility Na		The second second second second second					e Salt Water D				
Surface Ow	ner State		2	Mineral ()wner	State		***************************************	API No	30-015-41649	
						OF REI			***************************************		
Unit Letter	Section	Township	Range	Feet from the		/South Line	Feet from the	l .	West Line	County	
Н	36	24S	31E	1568		North	1189		East	Eddy	
			* -	24-1 00 17/7	240	¥	-i4d 102 724	0524	<u> </u>		
			Lat	aitude: 32.1767			g itude: -103.726	8324			
				NAI	UKE	OF REL			r		
Type of Rele						Volume of		_		Recovered	
Produced was							S Produced Water Hour of Occurre			S Produced Wate Hour of Discov	
Source of Re Produced Wa							@ 11:45pm	псе		6 @ 11:45pm	cı y
Was Immedi		Given?				If YES, To			111012010	у С ТТТТОРИТ	
vvas minieta	ate Notice		Yes 🗀	No 🔲 Not Re	equired	Mike Brate					
By Whom?						Date and					
Jake Harring						November 3, 2016 @ 9:50 AM 💥 If YES, Volume Impacting the Watercourse					
Was a Wate	rcourse Ke	acnea?	Yes 🗵	1 No		N/A					
If a Waterca	urea was I	mpacted, Des		-							
N/A											
The SWD wa	s struck by	olem and Ren lightning rest ease. The loca	ulting in a	tion Taken.* release of 2450 B partment was calle	BLS pred to ens	oduced water sure safety an	and a fire. The po	ower lin e fire. T	es to the fac he facility o	cility were imme did have lightnin	diately turned g protection on
Describe Area Affected and Cleanup Action Taken.* 2450 BBLS of produced water were released when lighting struck the SWD, causing the water tanks to rupture and start a fire. The liner was checked for holes and there were holes found due to the fire. Vacuum trucks recovered 960 BBLS of produced water. Environmental agency will be contacted for remediation.											
I hereby certify that the information given above is true and complete to the best of my knowledge and understand that pursuant to NMOCD rules and regulations all operators are required to report and/or file certain release notifications and perform corrective actions for releases which may endanger public health or the environment. The acceptance of a C-141 report by the NMOCD marked as "Final Report" does not relieve the operator of liability should their operations have failed to adequately investigate and remediate contamination that pose a threat to ground water, surface water, human health or the environment. In addition, NMOCD acceptance of a C-141 report does not relieve the operator of responsibility for compliance with any other federal, state, or local laws and/or regulations.						endanger of liability human health					
Signature: Sarah Gallegos-Troublefield Printed Name: Sarah Gallegos-Troublefield Approved by Environ Signad Breidist // Execution											
		llegos-Troubl	effeld							- 1//	
Title: Field	Admin Sup	port				Approval Da	ne: 1111416	<u> </u>	Expiration	Date: IV/A	
E-mail Addr	ess: Sarah.	Gallegos-Tro	ublefield	@dvn.com		Conditions of	f Approval:			Attached 🔽	1

* Attach Additional Sheets If Necessary

Phone: 575.748.1864

Date: 11/10/2016

APPENDIX IV ROOTING DEPTH DATA







You are here: Home / Characteristics / Conservation Plant Characteristics for Sporobolus



Characteristics

About PLANTS Characteristics Conservation Plant Characteristics Data Definitions PLANTS Characteristics species list

Conservation Plant Characteristics

Sporobolus cryptandrus (Torr.) A. Gray sand dropseed SPCR

Morphology/Physiology

Active Growth Period	Spring
After Harvest Regrowth Rate	Slow
Bloat	None
C:N Ratio	High
Coppice Potential	No
Fall Conspicuous	No
Fire Resistant	No
Flower Color	Yellow
Flower Conspicuous	No
Foliage Color	Green
Foliage Porosity Summer	Porous
Foliage Porosity Winter	Porous
Foliage Texture	Fine
Fruit/Seed Color	Brown
Fruit/Seed Conspicuous	No
Growth Form	Bunch
Growth Rate	Moderate
Height at 20 Years, Maximum (feet	:)
Height, Mature (feet)	3.0
Known Allelopath	No
Leaf Retention	No
Lifespan	Short
Low Growing Grass	No
Nitrogen Fixation	None

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Sporobolus cryptandrus Go

Scientific Name

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- ▶ Crop Nutrient Tool
- **Ecological Site Information** System
- ▶ PLANTS Identification Keys
- Plant Materials Web Site
- Plant Materials Publications
- ▶ USDA Plant Hardiness Map

Resprout Ability	No
Shape and Orientation	Erect
Toxicity	None

loxicity	None
Growth Requirements	
Adapted to Coarse Textured Soils	Yes
Adapted to Fine Textured Soils	No
Adapted to Medium Textured Soils	Yes
Anaerobic Tolerance	None
CaCO3 Tolerance	Medium
Cold Stratification Required	No
Drought Tolerance	High
Fertility Requirement	Low
Fire Tolerance	Medium
Frost Free Days, Minimum	150
Hedge Tolerance	None
Moisture Use	Low
pH, Minimum	6.6
pH, Maximum	8.0
Planting Density per Acre, Minimum	
Planting Density per Acre, Maximum	
Precipitation, Minimum	8

16 Precipitation, Maximum

18 Root Depth, Minimum (inches)

Medium Salinity Tolerance Intolerant Shade Tolerance

-38 Temperature, Minimum (°F)

Reproduction

Bloom Period	Late Summer
Commercial Availability	Routinely Available
Fruit/Seed Abundance	High
Fruit/Seed Period Begin	Summer
Fruit/Seed Period End	Fall
Fruit/Seed Persistence	No
Propagated by Bare Root	No
Propagated by Bulb	No
Propagated by Container	No
Propagated by Corm	No
Propagated by Cuttings	No
Propagated by Seed	Yes
Propagated by Sod	No
Propagated by Sprigs	No

No Propagated by Tubers 5600080 Seed per Pound Rapid Seed Spread Rate Low Seedling Vigor Small Grain No None Vegetative Spread Rate

Suitability/Use

No Berry/Nut/Seed Product No Christmas Tree Product No Fodder Product

Fuelwood Product

No Lumber Product No Naval Store Product No Nursery Stock Product

Palatable Browse Animal Medium Palatable Graze Animal Low No Palatable Human No Post Product Low Protein Potential No Pulpwood Product No Veneer Product

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E

Characteristics

Andropogon hallii

About PLANTS Characteristics Conservation Plant Characteristics Data Definitions PLANTS Characteristics species list

Conservation Plant Characteristics

Andropogon hallii Hack. sand bluestem ANHA

Morphology/Physiology

Active Growth Period

Summer

After Harvest Regrowth Rate

Moderate

Bloat

None

C:N Ratio

Medium

Coppice Potential

No

Fall Conspicuous

No

Fire Resistant

No

Flower Color
Flower Conspicuous

Yellow

No

Foliage Color

Green

Foliage Porosity Summer

Moderate

Foliage Porosity Winter

Porous

Foliage Texture

Coarse

Fruit/Seed Color

Brown

Fruit/Seed Conspicuous

No

Growth Form

Bunch

Growth Rate

Moderate

Height at 20 Years, Maximum (feet)

Height, Mature (feet)

6.1

Known Allelopath

No

Leaf Retention

No

Lifespan

Moderate

Low Growing Grass

No

Nitrogen Fixation

None

Search	
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Andropogon hallii Ha	ick
Scientific Name	Go
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Ecological Site Information System

▶ PLANTS Identification Keys

Plant Materials Web Site

Plant Materials Publications

USDA Plant Hardiness Map

Resprout Ability	No
Shape and Orientation	Erect
Toxicity	None

Growth Requirements	
Adapted to Coarse Textured Soils	Yes
Adapted to Fine Textured Soils	No
Adapted to Medium Textured Soils	No
Anaerobic Tolerance	Medium
CaCO3 Tolerance	High
Cold Stratification Required	No
Drought Tolerance	High
Fertility Requirement	High
Fire Tolerance	Low
Frost Free Days, Minimum	120
Hedge Tolerance	None
Moisture Use	Medium
pH, Minimum	5.6
pH, Maximum	8.4
Planting Density per Acre, Minimum	
Planting Density per Acre, Maximum	
Precipitation, Minimum	10
Precipitation, Maximum	32
Poot Denth Minimum (inches)	20

Root Depth, Minimum (inches) 20

Salinity Tolerance Low

Intolerant

-38 Temperature, Minimum (°F)

Reproduction

Shade Tolerance

Mid Summer
Routinely Available
Medium
Fall
Fall
No
No
No
No ·
No
No
Yes
No
No

Propagated by Tubers

No

Seed per Pound

96640

Seed Spread Rate

Slow

Seedling Vigor

Medium

Small Grain

No

Vegetative Spread Rate

Slow

Suitability/Use

Berry/Nut/Seed Product

No

Christmas Tree Product

No

Fodder Product

Yes

Fuelwood Product

Lumber Product

No

Naval Store Product

No

Nursery Stock Product

No

Palatable Browse Animal

Medium

Palatable Graze Animal

High

Palatable Human

No No

Post Product
Protein Potential

Medium

Pulpwood Product

No

Veneer Product

No

Andropogon hallii Hack. sand bluestem ANHA

Cultivar: Cherry

Morphology/Physiology

Active Growth Period

Summer

After Harvest Regrowth Rate

Moderate

Bloat

None

C:N Ratio

Medium

Coppice Potential

No

Fall Conspicuous

No

Fire Resistant

No

Flower Color

Foliage Color

Yellow No

Flower Conspicuous

Green

.....

Moderate

Foliage Porosity Summer

_ '

Foliage Porosity Winter

Porous

Foliage Texture

Coarse

Fruit/Seed Color

Brown

Fruit/Seed Conspicuous

No

Growth Form

Rhizomatous

Growth Rate

Moderate

Height at 20 Years, Maximum (feet)

Height, Mature (feet)

6.1

Known Allelopath

No

Leaf Retention

No

Lifespan

Moderate

Low Growing Grass

No

Nitrogen Fixation

None

Resprout Ability

No

Shape and Orientation

Erect

Toxicity

None

Growth Requirements

Adapted to Coarse Textured Soils

Yes

Adapted to Fine Textured Soils

No No

Adapted to Medium Textured Soils

Medium

Anaerobic Tolerance
CaCO3 Tolerance

Low

Cold Stratification Required

Frost Free Days, Minimum

No

Drought Tolerance

High

Fertility Requirement

High

Fire Tolerance

High

120

Hedge Tolerance

None Low

Moisture Use pH, Minimum

5.6

pH, Maximum

8.4

Planting Density per Acre, Minimum

Planting Density per Acre, Maximum

Precipitation, Minimum

10

Precipitation, Maximum

30

Root Depth, Minimum (inches)

20

Salinity Tolerance

Low

Shade Tolerance

Intolerant

Temperature, Minimum (°F)

-23

Reproduction

Bloom Period

Mid Summer

Commercial Availability

Routinely Available

Fruit/Seed Abundance

High

Fruit/Seed Period Begin

Summer

Fruit/Seed Period End Fall No Fruit/Seed Persistence No Propagated by Bare Root No Propagated by Bulb No Propagated by Container No Propagated by Corm No Propagated by Cuttings Propagated by Seed Yes No Propagated by Sod No Propagated by Sprigs No Propagated by Tubers 96640 Seed per Pound Seed Spread Rate Slow Medium Seedling Vigor No Small Grain Rapid Vegetative Spread Rate Suitability/Use

Berry/Nut/Seed Product No No Christmas Tree Product Yes Fodder Product Fuelwood Product No Lumber Product

No Naval Store Product Nursery Stock Product No Palatable Browse Animal Medium

High Palatable Graze Animal No Palatable Human No Post Product

Protein Potential Medium No Pulpwood Product

No Veneer Product

Andropogon hallii Hack. sand bluestem **ANHA**

Cultivar: Elida

Morphology/Physiology

Active Growth Period Summer After Harvest Regrowth Rate Moderate None Bloat Medium

C:N Ratio

No Coppice Potential No Fall Conspicuous No Fire Resistant Yellow Flower Color No Flower Conspicuous Green Foliage Color Moderate Foliage Porosity Summer Porous Foliage Porosity Winter Coarse Foliage Texture Brown Fruit/Seed Color No Fruit/Seed Conspicuous

Growth Form Rhizomatous
Growth Rate Moderate

Height at 20 Years, Maximum (feet)

Height, Mature (feet) 6.1

Known Allelopath No

Leaf Retention No

Lifespan Moderate

Low Growing GrassNoNitrogen FixationNoneResprout AbilityNoShape and OrientationErectToxicityNone

Growth Requirements

Precipitation, Minimum

Adapted to Coarse Textured Soils Yes No Adapted to Fine Textured Soils Adapted to Medium Textured Soils No Medium Anaerobic Tolerance Low CaCO3 Tolerance Cold Stratification Required No High **Drought Tolerance** High Fertility Requirement High Fire Tolerance 120 Frost Free Days, Minimum Hedge Tolerance None Low Moisture Use 5.6 pH, Minimum 8.4 pH, Maximum Planting Density per Acre, Minimum Planting Density per Acre, Maximum

10

30 Precipitation, Maximum Root Depth, Minimum (inches) 20 Salinity Tolerance Low

Intolerant Shade Tolerance

-23 Temperature, Minimum (°F)

Reproduction

Bloom Period Mid Summer

Routinely Available Commercial Availability

High Fruit/Seed Abundance Fruit/Seed Period Begin Summer Fall Fruit/Seed Period End

No Fruit/Seed Persistence No Propagated by Bare Root No Propagated by Bulb No Propagated by Container No Propagated by Corm Propagated by Cuttings No Yes Propagated by Seed No

No Propagated by Sprigs Propagated by Tubers No Seed per Pound 96640 Slow Seed Spread Rate

Medium Seedling Vigor

No Small Grain

Rapid Vegetative Spread Rate

Suitability/Use

Propagated by Sod

Berry/Nut/Seed Product No No Christmas Tree Product Fodder Product Yes

Fuelwood Product

No Lumber Product No Naval Store Product No Nursery Stock Product

Palatable Browse Animal Medium High Palatable Graze Animal No Palatable Human No Post Product

Medium Protein Potential

No Pulpwood Product No Veneer Product

Andropogon hallii Hack. sand bluestem **ANHA**

Cultivar: Garden

Morphology/Physiology

Active Growth Period

After Harvest Regrowth Rate

Bloat

C:N Ratio

Coppice Potential

Fall Conspicuous

Fire Resistant Flower Color

Flower Conspicuous

Foliage Color

Foliage Porosity Summer

Foliage Porosity Winter

Foliage Texture Fruit/Seed Color

Fruit/Seed Conspicuous

Growth Form

Growth Rate

Height at 20 Years, Maximum (feet)

Height, Mature (feet)

Known Allelopath

Lifespan

Low Growing Grass

Leaf Retention

Nitrogen Fixation

Resprout Ability

Shape and Orientation

Toxicity

Growth Requirements

Adapted to Coarse Textured Soils

Adapted to Fine Textured Soils

Adapted to Medium Textured Soils

Anaerobic Tolerance

CaCO3 Tolerance

Cold Stratification Required

Drought Tolerance

Summer

Moderate

None

Medium

No

No

No

Yellow

No

Green

Moderate

Porous

Coarse

Brown

No

Rhizomatous

Moderate

6.2

No

No

Moderate

No

None

No

Erect

None

Yes

No

No

Medium

Low

No

High

High Fertility Requirement High Fire Tolerance 120 Frost Free Days, Minimum None Hedge Tolerance Low Moisture Use 5.6 pH, Minimum 8.4 pH, Maximum Planting Density per Acre, Minimum Planting Density per Acre, Maximum 10 Precipitation, Minimum 30 Precipitation, Maximum 20 Root Depth, Minimum (inches) Salinity Tolerance Low Intolerant Shade Tolerance -38 Temperature, Minimum (°F)

Reproduction

Bloom Period Routinely Available Commercial Availability High Fruit/Seed Abundance Summer Fruit/Seed Period Begin Fall Fruit/Seed Period End Fruit/Seed Persistence No No Propagated by Bare Root No Propagated by Bulb No Propagated by Container No Propagated by Corm Propagated by Cuttings No Yes Propagated by Seed Propagated by Sod No No Propagated by Sprigs No Propagated by Tubers 96640 Seed per Pound Slow Seed Spread Rate Medium Seedling Vigor No Small Grain Rapid Vegetative Spread Rate Suitability/Use

Mid Summer

Berry/Nut/Seed Product No Christmas Tree Product No Yes Fodder Product

Fuelwood Product

Lumber Product

No

Naval Store Product

No

Nursery Stock Product

No

Palatable Browse Animal

Medium

Palatable Graze Animal

High

Palatable Human

No

Post Product

No

Protein Potential

Medium

Pulpwood Product

No

Veneer Product

No

Andropogon hallii Hack. sand bluestem ANHA

Cultivar: Goldstrike

Morphology/Physiology

Active Growth Period

Summer

After Harvest Regrowth Rate

Moderate

Bloat

None

C:N Ratio

Medium

Coppice Potential

No

Fall Conspicuous

No

Fire Resistant Flower Color No

Yellow

Flower Conspicuous Foliage Color No

-

Green

Foliage Porosity Summer

Moderate

Foliage Porosity Winter

Porous

Foliage Texture

Coarse

Fruit/Seed Color

Brown No

Fruit/Seed Conspicuous

Rhizomatous

Growth Form Growth Rate

Moderate

Height at 20 Years, Maximum (feet)

Height, Mature (feet)

6.2

Known Allelopath

No

Leaf Retention

No

Lifespan

...

Moderate

Low Growing Grass

No

Nitrogen Fixation

None

Resprout Ability

No

Shape and Orientation	Erect
Toxicity	None
Growth Requirements	
Adapted to Coarse Textured Soils	Yes
Adapted to Fine Textured Soils	No
Adapted to Medium Textured Soils	No
Anaerobic Tolerance	Medium
CaCO3 Tolerance	Low
Cold Stratification Required	No
Drought Tolerance	High
Fertility Requirement	High
Fire Tolerance	High
Frost Free Days, Minimum	120
Hedge Tolerance	None
Moisture Use	Low
pH, Minimum	5.6
pH, Maximum	8.4
Planting Density per Acre, Minimum	
Planting Density per Acre, Maximum	1
Precipitation, Minimum	10
Precipitation, Maximum	30
Root Depth, Minimum (inches)	20
Salinity Tolerance	Low
Shade Tolerance	Intolerant
Temperature, Minimum (°F)	-38
Reproduction	
Bloom Period	Mid Summer
Commercial Availability	Routinely Available
Fruit/Seed Abundance	High
Fruit/Seed Period Begin	Summer
Fruit/Seed Period End	Fall
Fruit/Seed Persistence	No

No

No

No

No

No

Yes No

No

No

Propagated by Bare Root

Propagated by Container

Propagated by Bulb

Propagated by Corm
Propagated by Cuttings

Propagated by Seed

Propagated by Sod

Propagated by Sprigs

Propagated by Tubers

Seed per Pound

96640

Seed Spread Rate

Slow

Seedling Vigor

Medium

Small Grain

No

Vegetative Spread Rate

Rapid

Suitability/Use

Berry/Nut/Seed Product

No

Christmas Tree Product

No

Fodder Product

Yes

Fuelwood Product

Lumber Product

No

Naval Store Product

No

Nursery Stock Product

No

Palatable Browse Animal

Medium

Palatable Graze Animal

High

Palatable Human

No No

Post Product

Medium

Protein Potential

No

Pulpwood Product Veneer Product

No

Andropogon hallii Hack.

ANHA

Cultivar: Woodward

Morphology/Physiology

Active Growth Period

sand bluestem

Summer

After Harvest Regrowth Rate

Moderate

Bloat

None

C:N Ratio

Medium

Coppice Potential

No No

Fall Conspicuous

No

Fire Resistant Flower Color

Yellow

Flower Conspicuous

No

Foliage Color

Green

Foliage Porosity Summer

Moderate

Foliage Porosity Winter

Porous

Foliage Texture

Coarse

Fruit/Seed Color

Brown

Fruit/Seed Conspicuous

No

Growth Form Rhizomatous
Growth Rate Moderate

Height at 20 Years, Maximum (feet)

Height, Mature (feet) 6.4

Known Allelopath No

Leaf Retention No

Lifespan Moderate

Low Growing Grass No
Nitrogen Fixation None
Resprout Ability No
Shape and Orientation Erect
Toxicity None

Growth Requirements

Adapted to Coarse Textured Soils Yes

Adapted to Fine Textured Soils No

Adapted to Medium Textured Soils No

Anaerobic Tolerance Medium

CaCO3 Tolerance Low
Cold Stratification Required No
Drought Tolerance High

Fertility Requirement High

Fire Tolerance High
Frost Free Days, Minimum 150

Hedge Tolerance None

Moisture Use Low

pH, Minimum 5.6
pH, Maximum 8.4

Planting Density per Acre, Minimum
Planting Density per Acre, Maximum

Precipitation, Minimum 10
Precipitation, Maximum 30
Root Depth, Minimum (inches) 20

Root Depth, Minimum (inches) 20
Salinity Tolerance Low

Shade Tolerance Intolerant

Temperature, Minimum (°F) -13

Reproduction

Bloom Period Mid Summer

Commercial Availability Routinely Available

Fruit/Seed Abundance High
Fruit/Seed Period Begin Summer

Fruit/Seed Period End Fall

Fruit/Seed Persistence	No
Propagated by Bare Root	No
Propagated by Bulb	No
Propagated by Container	No
Propagated by Corm	No
Propagated by Cuttings	No
Propagated by Seed	Yes
Propagated by Sod	No
Propagated by Sprigs	No
Propagated by Tubers	No
Seed per Pound	96640
Seed Spread Rate	Slow
Seedling Vigor	Medium
Small Grain	No
Vegetative Spread Rate	Rapid
Suitability/Use	

Suitability/Use

Berry/Nut/Seed Product No Christmas Tree Product No Yes Fodder Product

Fuelwood Product

No Lumber Product Naval Store Product No No Nursery Stock Product

Medium Palatable Browse Animal High Palatable Graze Animal No Palatable Human No Post Product Medium Protein Potential No

Pulpwood Product Veneer Product No

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Characteristics

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Conservation Plant Characteristics

Schizachyrium scoparium (Michx.) Nash little bluestem SCSC

Morphology/Physiology

Active Growth Period

Summer and Fall

After Harvest Regrowth Rate

Moderate

Bloat

None

C:N Ratio

Medium

Coppice Potential

No

Fall Conspicuous

No

Fire Resistant

No

Flower Color

Yellow

Flower Conspicuous

No

Foliage Color

Gray-Green

Foliage Porosity Summer

Dense

Foliage Porosity Winter

Porous

Foliage Texture

Medium

Fruit/Seed Color

Brown

Fruit/Seed Conspicuous

No

Growth Form

Bunch

Growth Rate

Moderate

Height at 20 Years, Maximum (feet)

Height, Mature (feet)

3.0

Known Allelopath

No

Leaf Retention

No

Lifespan

Long

No

Low Growing Grass Nitrogen Fixation

None

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	Þ	Introduced, Invasive, and Noxious Plants
	Þ	Threatened & Endangered
١	Þ	Wetland Indicator Status
SECTION SECTION	lli	nage Gallery
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System

▶ Crop Nutrient Tool

Ecological Site Information

PLANTS Identification Keys
 Plant Materials Web Site
 Plant Materials Publications
 USDA Plant Hardiness Map

Resprout Ability	No
Shape and Orientation	Erect
Toxicity	None
Growth Requirements	
Adapted to Coarse Textured Soils	Yes
Adapted to Fine Textured Soils	Yes
Adapted to Medium Textured Soils	Yes
Anaerobic Tolerance	None
CaCO3 Tolerance	High
Cold Stratification Required	No
Drought Tolerance	High
Fertility Requirement	Low
Fire Tolerance	Medium
Frost Free Days, Minimum	100
Hedge Tolerance	None
Moisture Use	Low
pH, Minimum	5.0
pH, Maximum	8.4
Planting Density per Acre, Minimum	
Planting Density per Acre, Maximum	
Precipitation, Minimum	12
Precipitation, Maximum	45
Root Depth, Minimum (inches)	14
Salinity Tolerance	None
Shade Tolerance	Intolerant
Temperature, Minimum (°F)	-38
Reproduction	
Bloom Period	Summer
Commercial Availability	Routinely Available
Fruit/Seed Abundance	Medium
Fruit/Seed Period Begin	Summer
Fruit/Seed Period End	Fall
Fruit/Seed Persistence	No
Propagated by Bare Root	No
Propagated by Bulb	No
Propagated by Container	No
Propagated by Corm	No
Propagated by Cuttings	No

Yes

No

No

Propagated by Seed

Propagated by Sod

Propagated by Sprigs

Propagated by Tubers

No

Seed per Pound

240670

Seed Spread Rate

Moderate

Seedling Vigor

Low

Small Grain

No

Vegetative Spread Rate

None

Suitability/Use

Berry/Nut/Seed Product

No

Christmas Tree Product

No

Fodder Product

Yes

Fuelwood Product

Lumber Product

No

Naval Store Product

No

Nursery Stock Product

No

Palatable Browse Animal

Medium

Palatable Graze Animal

High

Palatable Human

No Νo

Post Product Protein Potential

Medium

Pulpwood Product

No

Veneer Product

No

Schizachyrium scoparium (Michx.) Nash little bluestem SCSC

Cultivar: Aldous

Morphology/Physiology

Active Growth Period

Summer and Fall

After Harvest Regrowth Rate

Moderate

Bloat

None

C:N Ratio

Medium

Coppice Potential

No No

Fall Conspicuous

No

Fire Resistant Flower Color

Yellow

Flower Conspicuous

No

Foliage Color

Gray-Green

Foliage Porosity Summer

Dense

Foliage Porosity Winter

Porous

Medium

Foliage Texture

Fruit/Seed Color

Brown

Fruit/Seed Conspicuous	No		
Growth Form	Bunch		
Growth Rate	Moderate		
Height at 20 Years, Maximum (feet)			
Height, Mature (feet)	3.0		
Known Allelopath	No		
Leaf Retention	No		
Lifespan	Long		
Low Growing Grass	No		
Nitrogen Fixation	None		
Resprout Ability	No		
Shape and Orientation	Erect		
Toxicity	None		
Growth Requirements			

Growth Requirements		
Adapted to Coarse Textured Soils	Yes	
Adapted to Fine Textured Soils	Yes	
Adapted to Medium Textured Soils	Yes	
Anaerobic Tolerance	None	
CaCO3 Tolerance	High	
Cold Stratification Required	No	
Drought Tolerance	High	
Fertility Requirement	Low	
Fire Tolerance	Medium	
Frost Free Days, Minimum	110	
Hedge Tolerance	None	
Moisture Use	Low	
pH, Minimum	5.5	
pH, Maximum	8.4	
Planting Density per Acre, Minimum		
Planting Density per Acre, Maximum		
Precipitation, Minimum	16	
Precipitation, Maximum	45	
Root Depth, Minimum (inches)	14	
Salinity Tolerance	None	

Reproduction

Temperature, Minimum (°F)

Fruit/Seed Period Begin

Shade Tolerance

Bloom Period	Late Summer
Commercial Availability	Routinely Available
Fruit/Seed Abundance	Medium

Intolerant

Summer

-33

Fall Fruit/Seed Period End Fruit/Seed Persistence No Propagated by Bare Root No Propagated by Bulb No Propagated by Container No Propagated by Corm No Propagated by Cuttings No Propagated by Seed Yes Propagated by Sod No Propagated by Sprigs No Propagated by Tubers No 240670 Seed per Pound Moderate Seed Spread Rate Low Seedling Vigor Small Grain No None Vegetative Spread Rate Suitability/Use No Berry/Nut/Seed Product Christmas Tree Product No Fodder Product Yes Fuelwood Product Lumber Product No No Naval Store Product No **Nursery Stock Product**

Schizachyrium scoparium (Michx.) Nash little bluestem SCSC

Cultivar: Badlands

Palatable Browse Animal
Palatable Graze Animal

Palatable Human

Protein Potential

Pulpwood Product Veneer Product

Post Product

Morphology/Physiology

Active Growth Period

Spring and Summer

After Harvest Regrowth Rate

Moderate

Bloat

None

Medium

Medium

High No

No

No

No

C:N Ratio

Medium

Coppice Potential	No
Fall Conspicuous	No
Fire Resistant	No
Flower Color	Yellow
Flower Conspicuous	No
Foliage Color	Grav-Gre

Gray-Green Foliage Color Moderate Foliage Porosity Summer Porous Foliage Porosity Winter Medium Foliage Texture Brown Fruit/Seed Color No Fruit/Seed Conspicuous Bunch Growth Form Moderate Growth Rate

Height at 20 Years, Maximum (feet)

3.0 Height, Mature (feet) No Known Allelopath No Leaf Retention Lifespan Long No Low Growing Grass None Nitrogen Fixation No Resprout Ability Shape and Orientation Erect None Toxicity

Growth Requirements

Adapted to Coarse Textured Soils Yes Adapted to Fine Textured Soils Yes Adapted to Medium Textured Soils Yes None Anaerobic Tolerance High CaCO3 Tolerance Cold Stratification Required No High **Drought Tolerance** Fertility Requirement Low Medium Fire Tolerance 95 Frost Free Days, Minimum None Hedge Tolerance Low Moisture Use pH, Minimum 5.0 8.4 pH, Maximum Planting Density per Acre, Minimum Planting Density per Acre, Maximum 16 Precipitation, Minimum

30 Precipitation, Maximum

12 Root Depth, Minimum (inches)

None Salinity Tolerance

Intolerant Shade Tolerance

Temperature, Minimum (°F)

Reproduction

Bloom Period Summer

Commercial Availability Routinely Available

-38

No

Medium Fruit/Seed Abundance Fruit/Seed Period Begin Summer

Fall Fruit/Seed Period End No Fruit/Seed Persistence No Propagated by Bare Root

No Propagated by Bulb Propagated by Container No

No Propagated by Corm No Propagated by Cuttings Yes Propagated by Seed

Propagated by Sod Propagated by Sprigs No Propagated by Tubers No

Seed per Pound 240670 Moderate Seed Spread Rate

Low Seedling Vigor No Small Grain

Vegetative Spread Rate None

Suitability/Use

No Berry/Nut/Seed Product No Christmas Tree Product Yes Fodder Product

Fuelwood Product

No Lumber Product No Naval Store Product No Nursery Stock Product

Palatable Browse Animal Medium Palatable Graze Animal High No Palatable Human

Post Product No

Medium Protein Potential

No **Pulpwood Product** No Veneer Product

Schizachyrium scoparium (Michx.) Nash little bluestem

SCSC

Cultivar: Blaze

Morphology/Physiology

Active Growth Period Summer and Fall

After Harvest Regrowth Rate Moderate

Bloat None

C:N Ratio Medium

Coppice Potential No
Fall Conspicuous No
Fire Resistant No
Flower Color Yellow

Flower Conspicuous No

Foliage Color Green
Foliage Porosity Summer Dense

Foliage Porosity Winter Porous
Foliage Texture Medium
Fruit/Seed Color Brown

Fruit/Seed Conspicuous No
Growth Form Bunch

Growth Rate Moderate

Height at 20 Years, Maximum (feet)

Height, Mature (feet) 3.0

Known Allelopath No

Leaf Retention No

Lifespan Long

Low Growing Grass No

Nitrogen Fixation None
Resprout Ability No
Shape and Orientation Erect

Toxicity None

Growth Requirements

Adapted to Coarse Textured Soils Yes
Adapted to Fine Textured Soils Yes
Adapted to Medium Textured Soils Yes
Anaerobic Tolerance None
CaCO3 Tolerance High
Cold Stratification Required No

Drought Tolerance High

Low Fertility Requirement Medium Fire Tolerance 110 Frost Free Days, Minimum None Hedge Tolerance Low Moisture Use 5.5 pH, Minimum 8.4 pH, Maximum Planting Density per Acre, Minimum Planting Density per Acre, Maximum 16 Precipitation, Minimum

Precipitation, Maximum 45
Root Depth, Minimum (inches) 14
Salinity Tolerance None

Shade Tolerance Intolerant

Temperature, Minimum (°F) -33

Reproduction

Bloom Period Late Summer

Commercial Availability Routinely Available

Fruit/Seed Abundance Medium

Fruit/Seed Period Begin Fall
Fruit/Seed Period End Fall

Fruit/Seed Persistence No
Propagated by Bare Root No

Propagated by Bulb No
Propagated by Container No

Propagated by Corm No
Propagated by Cuttings No
Propagated by Seed Yes

Propagated by Sprigs No
Propagated by Tubers No

Seed per Pound 240670
Seed Spread Rate Moderate
Seedling Vigor Medium

No

Small Grain No

Vegetative Spread Rate Moderate

Suitability/Use

Propagated by Sod

Berry/Nut/Seed Product No
Christmas Tree Product No
Fodder Product Yes

Fuelwood Product

Lumber Product

No

Naval Store Product

No

Nursery Stock Product

No

Palatable Browse Animal

Medium

Palatable Graze Animal

High

Palatable Human

No

Post Product

No

Protein Potential

Medium

Pulpwood Product

No

Veneer Product

No

Schizachyrium scoparium (Michx.) Nash

little bluestem

SCSC

Cultivar: Camper

Morphology/Physiology

Active Growth Period

Summer and Fall

After Harvest Regrowth Rate

Moderate

Bloat

None

C:N Ratio

Medium No

Coppice Potential

No

Fall Conspicuous

Fire Resistant

No

Flower Color

Yellow

Flower Conspicuous

No

Foliage Color

Gray-Green

Foliage Porosity Summer

Dense

Foliage Porosity Winter

Porous

Foliage Texture

Medium

Fruit/Seed Color

Brown

Fruit/Seed Conspicuous

No

Growth Form

Bunch

Growth Rate

Moderate

Height at 20 Years, Maximum (feet)

Height, Mature (feet)

3.0

Known Allelopath

No

Leaf Retention

No

Lifespan

Long

Low Growing Grass

No

Nitrogen Fixation

None

Resprout Ability

No

Shape and Orientation	Erect
Toxicity	None

Growth Requirements

Adapted to Coarse Textured Soils Yes Adapted to Fine Textured Soils Yes Yes Adapted to Medium Textured Soils None Anaerobic Tolerance High CaCO3 Tolerance Cold Stratification Required No High Drought Tolerance Low Fertility Requirement Medium Fire Tolerance 100 Frost Free Days, Minimum None Hedge Tolerance Low Moisture Use 5.2 pH, Minimum 8.4 pH, Maximum Planting Density per Acre, Minimum Planting Density per Acre, Maximum 18 Precipitation, Minimum 45 Precipitation, Maximum

14 Root Depth, Minimum (inches) None

Shade Tolerance Intolerant

Temperature, Minimum (°F) -38

Reproduction

Salinity Tolerance

Fall Bloom Period

Routinely Available Commercial Availability

Medium Fruit/Seed Abundance

Fruit/Seed Period Begin Fall Fall Fruit/Seed Period End Fruit/Seed Persistence No Propagated by Bare Root No No Propagated by Bulb No Propagated by Container No Propagated by Corm Propagated by Cuttings No

Yes Propagated by Seed No Propagated by Sod No Propagated by Sprigs

Propagated by Tubers

No

240670 Seed per Pound

Seed Spread Rate Moderate

Seedling Vigor Low Small Grain No

Vegetative Spread Rate None

Suitability/Use

Berry/Nut/Seed Product No Christmas Tree Product No Fodder Product

Yes

Fuelwood Product

Lumber Product No Naval Store Product No **Nursery Stock Product** No

Palatable Browse Animal Medium Palatable Graze Animal High Palatable Human No

Post Product No

Protein Potential Medium

Pulpwood Product No Veneer Product No

Schizachyrium scoparium (Michx.) Nash little bluestem

SCSC

Cultivar: Cimarron

Morphology/Physiology

Active Growth Period Summer and Fall

After Harvest Regrowth Rate Moderate

Bloat None

C:N Ratio Medium

Coppice Potential No Fall Conspicuous No Fire Resistant No Flower Color White

Flower Conspicuous No

Foliage Color Gray-Green

Foliage Porosity Summer Dense Foliage Porosity Winter Porous Foliage Texture Medium

Fruit/Seed Color Brown Fruit/Seed Conspicuous No

Growth Form	Bunch
Growth Rate	Moderate
Height at 20 Years, Maximum (feet)	
Height, Mature (feet)	3.5
Known Allelopath	No
Leaf Retention	No
Lifespan	Long
Low Growing Grass	No
Nitrogen Fixation	None
Resprout Ability	No
Shape and Orientation	Erect
Toxicity	None

Growth Requirements

Adapted to Coarse Textured Soils	Yes
Adapted to Fine Textured Soils	Yes
Adapted to Medium Textured Soils	Yes
Anaerobic Tolerance	None
CaCO3 Tolerance	High
Cold Stratification Required	No
Drought Tolerance	High
Fertility Requirement	Low
Fire Tolerance	Medium
Frost Free Days, Minimum	150
Hedge Tolerance	None
Moisture Use	Low
pH, Minimum	5.6
pH, Maximum	8.4
Planting Density per Acre, Minimum	
Planting Density per Acre, Maximum	
Precipitation, Minimum	12
Precipitation, Maximum	40
Root Depth, Minimum (inches)	14
Salinity Tolerance	None
Shade Tolerance	Intolerant
Temperature, Minimum (°F)	-23

Reproduction

Bloom Period	Late Summer
Commercial Availability	Routinely Available
Fruit/Seed Abundance	High
Fruit/Seed Period Begin	Summer
Fruit/Seed Period End	Fall

No Fruit/Seed Persistence No Propagated by Bare Root Propagated by Bulb No Propagated by Container No No Propagated by Corm Propagated by Cuttings No Propagated by Seed Yes Propagated by Sod No Propagated by Sprigs No Propagated by Tubers No 255000 Seed per Pound Seed Spread Rate Slow Seedling Vigor Low Small Grain No Vegetative Spread Rate None

Suitability/Use

Berry/Nut/Seed Product No
Christmas Tree Product No
Fodder Product Yes

Fuelwood Product

Lumber Product No
Naval Store Product No
Nursery Stock Product No

Palatable Browse Animal Medium
Palatable Graze Animal High
Palatable Human No
Post Product No
Protein Potential Medium

Veneer Product No

Schizachyrium scoparium (Michx.) Nash little bluestem

No

SCSC

Cultivar: Pastura

Pulpwood Product

Morphology/Physiology

Active Growth Period Summer and Fall

After Harvest Regrowth Rate Moderate

Bloat None

C:N Ratio Medium

Coppice Potential No

Fall Conspicuous	No
Fire Resistant	No
Flower Color	White
Flower Conspicuous	No
Foliage Color	Green
Foliage Porosity Summer	Dense
Foliage Porosity Winter	Porous
Foliage Texture	Medium
Fruit/Seed Color	Brown
Fruit/Seed Conspicuous	No
Growth Form	Bunch
Growth Rate	Moderate
Height at 20 Years, Maximum (feet)	
Height, Mature (feet)	3.5
Known Allelopath	No
Leaf Retention	No
Lifespan	Long
Low Growing Grass	No
Nitrogen Fixation	None
Resprout Ability	No
Shape and Orientation	Erect
Toxicity	None
Growth Requirements	
Adapted to Coarse Textured Soils	Yes
Adapted to Fine Textured Soils	Yes
Adapted to Medium Textured Soils	Yes
Anaerobic Tolerance	None
CaCO3 Tolerance	High
Cold Stratification Required	No
Drought Tolerance	High
Fertility Requirement	Low
Fire Tolerance	Medium

120 Frost Free Days, Minimum None Hedge Tolerance Low Moisture Use pH, Minimum 5.6

8.4 pH, Maximum

Planting Density per Acre, Minimum Planting Density per Acre, Maximum

Precipitation, Minimum 12 40 Precipitation, Maximum

Root Depth, Minimum (inches)

14 None

Salinity Tolerance Shade Tolerance

Intolerant

Temperature, Minimum (°F)

-33

Reproduction

Bloom Period

Late Summer

Commercial Availability

Routinely Available

Fruit/Seed Abundance

High

Fruit/Seed Period Begin

Summer

Fruit/Seed Period End

Fall

Fruit/Seed Persistence

No

Propagated by Bare Root
Propagated by Bulb

No No

Propagated by Container

No

Propagated by Corm

No

Propagated by Cuttings

No

Propagated by Seed

Yes

Propagated by Sod

No No

Propagated by Sprigs Propagated by Tubers

No

Seed per Pound

240670

Seed Spread Rate

Slow

Seedling Vigor

High

Small Grain

No

Vegetative Spread Rate

None

Suitability/Use

Berry/Nut/Seed Product

No

Christmas Tree Product

No

Fodder Product

Yes

Fuelwood Product

. .

Lumber Product

No

Naval Store Product

No No

Nursery Stock Product Palatable Browse Animal

Medium

Palatable Graze Animal

High

Palatable Human

...

Post Product

No No

Protein Potential

Medium

Pulpwood Product

No

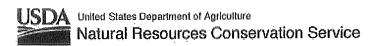
Veneer Product

No

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Conservation Plant Characteristics

Coreopsis tinctoria Nutt. golden tickseed COTI3

Morphology/Physiology

Active Growth Period Spring and Summer

After Harvest Regrowth Rate Slow
Bloat None

C:N Ratio Medium

Coppice Potential No
Fall Conspicuous No
Fire Resistant No

Flower Conspicuous Yes

Foliage Color Green
Foliage Porosity Summer Porous

Foliage Porosity Winter Porous

Foliage Texture Medium
Fruit/Seed Color Brown
Fruit/Seed Conspicuous No

Growth Form Single Crown

Growth Rate Rapid

Height at 20 Years, Maximum (feet)

Height, Mature (feet) 3.0

Known Allelopath No Leaf Retention No

Lifespan Short
Low Growing Grass No

Nitrogen Fixation None

Search

Name Search

coreopsis

Common Name



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PLANTS Topics

- Alternative Crops Characteristics
- ▶ Classification
- ▶ Cover Crops
- ▶ Culturally Significant
- Distribution Update
- Documentation
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- **Ecological Site Information**
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- Plant Materials Publications
- ▶ USDA Plant Hardiness Map

Resprout Ability	No
Shape and Orientation	Erect
Toxicity	None

Growth Requirements

Adapted to Coarse Textured Soils No Adapted to Fine Textured Soils Yes Adapted to Medium Textured Soils Yes Medium Anaerobic Tolerance Medium CaCO3 Tolerance

No Cold Stratification Required

Drought Tolerance Low

Medium Fertility Requirement Fire Tolerance Low

90 Frost Free Days, Minimum

None Hedge Tolerance

High Moisture Use 5.2 pH, Minimum

7.8 pH, Maximum

Planting Density per Acre, Minimum Planting Density per Acre, Maximum

20 Precipitation, Minimum

55 Precipitation, Maximum Root Depth, Minimum (inches) 8

None Salinity Tolerance

Intermediate Shade Tolerance

Temperature, Minimum (°F) 52

Reproduction

Propagated by Bulb

Late Spring Bloom Period

Routinely Available Commercial Availability

High Fruit/Seed Abundance Summer Fruit/Seed Period Begin

Fruit/Seed Period End Summer

No Fruit/Seed Persistence

Propagated by Bare Root No No

No Propagated by Container

No Propagated by Corm

No Propagated by Cuttings Propagated by Seed Yes

Propagated by Sod No No

Propagated by Tubers	No
Seed per Pound	3222222
Seed Spread Rate	Moderate
Seedling Vigor	High
Small Grain	No
Vegetative Spread Rate	None
Suitability/Use	
Berry/Nut/Seed Product	No
Christmas Tree Product	No
Fodder Product	No
Fuelwood Product	
Lumber Product	No
Naval Store Product	No
Nursery Stock Product	Yes
Palatable Browse Animal	
Palatable Graze Animal	
Palatable Human	No
Post Product	No
Protein Potential	
Pulpwood Product	No
Veneer Product	No

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Characteristics

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Conservation Plant Characteristics

Setaria vulpiseta (Lam.) Roem. & Schult. plains bristlegrass SEVU2

Morphology/Physiology

Active Growth Period

Spring and Summer

After Harvest Regrowth Rate

Moderate

Bloat

None

C:N Ratio

Medium

Coppice Potential

No No

Fall Conspicuous

140

Fire Resistant

No

Flower Color

Yellow

Flower Conspicuous

No

Foliage Color

Green

Foliage Porosity Summer

Dense

Foliage Porosity Winter

Porous

Foliage Texture

Medium

Fruit/Seed Color

Brown

Fruit/Seed Conspicuous

No

Growth Form

Bunch

Growth Rate

Moderate

Height at 20 Years, Maximum (feet)

Height, Mature (feet)

3.0

Known Allelopath

No

Leaf Retention

No

Lifespan

Moderate

Low Growing Grass

No

Nitrogen Fixation

None

\$	eairch	
Na	me Search	
cc	reopsis	
С	ommon Name	Go
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P	LANTS Topics	
Þ	Alternative Crops	
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- ▶ USDA Plant Hardiness Map

Resprout Ability	No
Shape and Orientation	Erect
Toxicity	None

Growth Requirements

•	
Adapted to Coarse Textured Soils	No
Adapted to Fine Textured Soils	No
Adapted to Medium Textured Soils	Yes
Anaerobic Tolerance	None
CaCO3 Tolerance	Medium
Cold Stratification Required	No
Drought Tolerance	Medium
Fertility Requirement	Medium
Fire Tolerance	Medium
Frost Free Days, Minimum	180
Hedge Tolerance	None
Moisture Use	Medium
pH, Minimum	6.0
pH, Maximum	8.0
Planting Density per Acre, Minimum	

Planting Density per Acre, Minimum

Planting Density per Acre, Maximum

Precipitation, Minimum 12
Precipitation, Maximum 24
Root Depth, Minimum (inches) 18

Salinity Tolerance None
Shade Tolerance Intermediate

Temperature, Minimum (°F) -13

Reproduction

Bloom Period	Early Summer
Commercial Availability	Routinely Available
Fruit/Seed Abundance	Medium
Fruit/Seed Period Begin	Summer
Fruit/Seed Period End	Fall
Fruit/Seed Persistence	No
Propagated by Bare Root	No
Propagated by Bulb	No
Propagated by Container	No
Propagated by Corm	No
Propagated by Cuttings	No
Propagated by Seed	Yes
Propagated by Sod	No
Propagated by Sprigs	No

Propagated by Tubers

No

Seed per Pound

290000

Seed Spread Rate

Moderate

Seedling Vigor

High

Small Grain

No

Vegetative Spread Rate

None

Suitability/Use

Berry/Nut/Seed Product

No

Christmas Tree Product

No

Fodder Product

Yes

Fuelwood Product

Lumber Product

No

Naval Store Product

No

Nursery Stock Product

No

Palatable Browse Animal

Medium

Palatable Graze Animal

High No

Palatable Human

No

Post Product
Protein Potential

Medium

Pulpwood Product

No

Veneer Product

No

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Characteristics

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Conservation Plant Characteristics

Andropogon gerardii Vitman big bluestem ANGE

Morphology/Physiology

Active Growth Period	Summer
After Harvest Regrowth Rate	Moderate
Bloat	Low
C:N Ratio	Medium
Coppice Potential	No
Fall Conspicuous	No
Fire Resistant	No
Flower Color	Yellow
Flower Conspicuous	No
Foliage Color	Green
Foliage Porosity Summer	Dense
Foliage Porosity Winter	Porous
Foliage Texture	Medium
Fruit/Seed Color	Brown
Fruit/Seed Conspicuous	No
Growth Form	Bunch
Growth Rate	Moderate
Height at 20 Years, Maximum (feet)	
Height, Mature (feet)	6.0
Known Allelopath	No
Leaf Retention	No
Lifespan	Long
Low Growing Grass	No
Nitrogen Fixation	None

No Erect

None

Yes

Yes

Yes Medium High

No High

Low High 155

None Low 6.0 7.5

12

55

20

-46

Medium Intolerant

Search	Resprout Ability
Name Search coreopsis	Shape and Orientation
Common Name Go	Toxicity
State Search	Growth Requirements
Advanced Search	Adapted to Coarse Textured Soils
○ Search Help	Adapted to Fine Textured Soils
PLANTS Topics	Adapted to Medium Textured Soils
▶ Alternative Crops	Anaerobic Tolerance
Characteristics	CaCO3 Tolerance
▶ Classification	Cold Stratification Required
▶ Cover Crops	·
▶ Culturally Significant	Drought Tolerance
Distribution Update	Fertility Requirement
▶ Documentation	Fire Tolerance
▶ Fact Sheets & Plant Guides	Frost Free Days, Minimum
Introduced, Invasive, and	Hedge Tolerance
Noxious Plants Threatened & Endangered	Moisture Use
	pH, Minimum
	pH, Maximum
Image Gallery	Planting Density per Acre, Minimum
▶ 50,000+ Plant Images	Planting Density per Acre, Maximum
Download	Precipitation, Minimum
Complete PLANTS Checklist	Precipitation, Maximum
▶ State PLANTS Checklist	Root Depth, Minimum (inches)
▶ Advanced Search Download	Salinity Tolerance
Symbols for Unknown	Shade Tolerance
Plants NRCS State GSAT Lists	Temperature, Minimum (°F)
NRCS State Plants Lists	Reproduction
Related Tools	Bloom Period
	Commercial Availability
▶ Crop Nutrient Tool	

Ecological Site Information

▶ PLANTS Identification Keys Plant Materials Web Site ▶ Plant Materials Publications ▶ USDA Plant Hardiness Map

System

Bloom Period	Summer
Commercial Availability	Routinely Available
Fruit/Seed Abundance	Medium
Fruit/Seed Period Begin	Summer
Fruit/Seed Period End	Fall
Fruit/Seed Persistence	No
Propagated by Bare Root	No
Propagated by Bulb	No
Propagated by Container	No
Propagated by Corm	No
Propagated by Cuttings	No
Propagated by Seed	Yes
Propagated by Sod	No
Propagated by Sprigs	No

Propagated by Tubers No

Seed per Pound 144240

Seed Spread Rate Slow

Seedling Vigor Low

Small Grain No

Vegetative Spread Rate Slow

Suitability/Use

Berry/Nut/Seed Product No
Christmas Tree Product No
Fodder Product Yes

Fuelwood Product

Lumber ProductNoNaval Store ProductNoNursery Stock ProductNo

Palatable Browse Animal Medium
Palatable Graze Animal High
Palatable Human No
Post Product No

Protein Potential Medium
Pulpwood Product No
Veneer Product No

Andropogon gerardii Vitman big bluestem ANGE

Cultivar: Bison

Active Growth Period

Morphology/Physiology

After Harvest Regrowth Rate Moderate
Bloat Low
C:N Ratio Medium
Coppice Potential No

Summer

Fall Conspicuous No
Fire Resistant No

Flower Color Yellow
Flower Conspicuous No

Foliage Color Green

Foliage Porosity Summer Dense
Foliage Porosity Winter Porous

Foliage Texture Medium
Fruit/Seed Color Brown

No
Bunch
Moderate
6.0
No
No
Long
No
None
No
Erect
None

Growth Requirements

Growth Requirements	
Adapted to Coarse Textured Soils	Yes
Adapted to Fine Textured Soils	Yes
Adapted to Medium Textured Soils	Yes
Anaerobic Tolerance	Medium
CaCO3 Tolerance	High
Cold Stratification Required	No
Drought Tolerance	High
Fertility Requirement	Low
Fire Tolerance	High
Frost Free Days, Minimum	155
Hedge Tolerance	None
Moisture Use	High
pH, Minimum	6.0
pH, Maximum	7.5
Planting Density per Acre, Minimum	
Planting Density per Acre, Maximum	
Precipitation, Minimum	12
Precipitation, Maximum	55
Root Depth, Minimum (inches)	20
Salinity Tolerance	Medium
Shade Tolerance	Intolerant

Reproduction

Temperature, Minimum (°F)

Bloom Period	Summer
Commercial Availability	Routinely Available
Fruit/Seed Abundance	Low
Fruit/Seed Period Begin	Summer

-43

Fall Fruit/Seed Period End No Fruit/Seed Persistence No Propagated by Bare Root Propagated by Bulb No Propagated by Container Νo No Propagated by Corm Propagated by Cuttings No Yes Propagated by Seed No Propagated by Sod No Propagated by Sprigs No Propagated by Tubers 144240 Seed per Pound Slow Seed Spread Rate Low Seedling Vigor No Small Grain Slow Vegetative Spread Rate Suitability/Use No Berry/Nut/Seed Product No Christmas Tree Product Yes Fodder Product Fuelwood Product No **Lumber Product** Naval Store Product No No Nursery Stock Product

Protein Potential Medium No Pulpwood Product

No Veneer Product

Andropogon gerardii Vitman big bluestem **ANGE**

Cultivar: Bonilla

Palatable Browse Animal

Palatable Graze Animal

Palatable Human Post Product

Morphology/Physiology

Active Growth Period

Summer

After Harvest Regrowth Rate

Moderate

Bloat

None

High

High

No

No

C:N Ratio

Medium

No Coppice Potential No Fall Conspicuous No Fire Resistant Yellow Flower Color No Flower Conspicuous Green Foliage Color Foliage Porosity Summer Dense Porous Foliage Porosity Winter Medium Foliage Texture Brown Fruit/Seed Color No Fruit/Seed Conspicuous Bunch Growth Form Moderate Growth Rate

Height at 20 Years, Maximum (feet)

6.5 Height, Mature (feet) No Known Allelopath No Leaf Retention Long Lifespan Low Growing Grass No None Nitrogen Fixation No Resprout Ability Erect Shape and Orientation None Toxicity

Growth Requirements

Precipitation, Minimum

Adapted to Coarse Textured Soils Yes Adapted to Fine Textured Soils Yes Adapted to Medium Textured Soils Yes Anaerobic Tolerance Medium High CaCO3 Tolerance Cold Stratification Required No **Drought Tolerance** High Fertility Requirement Medium High Fire Tolerance 120 Frost Free Days, Minimum Hedge Tolerance None Moisture Use Medium 6.5 pH, Minimum 7.5 pH, Maximum Planting Density per Acre, Minimum Planting Density per Acre, Maximum

12

30 Precipitation, Maximum Root Depth, Minimum (inches) 20

Medium Salinity Tolerance Intolerant Shade Tolerance

-39 Temperature, Minimum (°F)

Reproduction

Mid Summer Bloom Period

Routinely Available Commercial Availability

High Fruit/Seed Abundance Summer Fruit/Seed Period Begin Fall Fruit/Seed Period End No Fruit/Seed Persistence No Propagated by Bare Root No Propagated by Bulb

No Propagated by Container Propagated by Corm No Propagated by Cuttings No

Propagated by Seed No Propagated by Sod No Propagated by Sprigs

Yes

Propagated by Tubers No

144240 Seed per Pound Slow Seed Spread Rate Medium Seedling Vigor

No Small Grain Vegetative Spread Rate Slow

Suitability/Use

No Berry/Nut/Seed Product No Christmas Tree Product Fodder Product Yes

Fuelwood Product

Veneer Product

No Lumber Product No Naval Store Product Nursery Stock Product No Palatable Browse Animal High High Palatable Graze Animal No Palatable Human Post Product No

Medium Protein Potential Pulpwood Product No

No

Andropogon gerardii Vitman big bluestem ANGE

Cultivar: Champ

Morphology/Physiology

Summer Active Growth Period Moderate After Harvest Regrowth Rate Low Bloat Medium C:N Ratio No Coppice Potential Fall Conspicuous No No Fire Resistant Yellow Flower Color No Flower Conspicuous Foliage Color Green

Foliage Porosity Summer Dense
Foliage Porosity Winter Porous
Foliage Texture Medium
Fruit/Seed Color Brown
Fruit/Seed Conspicuous No
Growth Form Bunch

Growth Rate Moderate

Height at 20 Years, Maximum (feet)

6.5 Height, Mature (feet) No Known Allelopath No Leaf Retention Long Lifespan No Low Growing Grass None Nitrogen Fixation No Resprout Ability Shape and Orientation Erect None Toxicity

Growth Requirements

Adapted to Coarse Textured Soils

Adapted to Fine Textured Soils

Adapted to Medium Textured Soils

Anaerobic Tolerance

CaCO3 Tolerance

Cold Stratification Required

Drought Tolerance

No

High

Fertility Requirement Medium

Fire Tolerance High

Frost Free Days, Minimum 180

Hedge Tolerance None

Moisture Use Medium

pH, Minimum 6.0

pH, Maximum 7.5

Planting Density per Acre, Minimum
Planting Density per Acre, Maximum

Precipitation, Minimum 12
Precipitation, Maximum 35
Root Depth, Minimum (inches) 20

Salinity Tolerance Medium
Shade Tolerance Intolerant

Temperature, Minimum (°F) -30

Reproduction

Bloom Period Late Spring

Commercial Availability Routinely Available

Fruit/Seed Abundance High
Fruit/Seed Period Begin Summer

Fruit/Seed Period End Fall
Fruit/Seed Persistence No
Propagated by Bare Root No
Propagated by Bulb No
Propagated by Container No
Propagated by Corm No

Propagated by Cuttings No
Propagated by Seed Yes
Propagated by Sod No
Propagated by Sprigs No

Seed per Pound 144240 Seed Spread Rate Slow

No

Seedling Vigor Medium

Small Grain No Vegetative Spread Rate Slow

Suitability/Use

Propagated by Tubers

Berry/Nut/Seed Product No
Christmas Tree Product No
Fodder Product Yes

Fuelwood Product

No Lumber Product No Naval Store Product No Nursery Stock Product Medium Palatable Browse Animal High Palatable Graze Animal No Palatable Human No Post Product Medium Protein Potential

Pulpwood Product No No Veneer Product

Andropogon gerardii Vitman big bluestem **ANGE**

Cultivar: Kaw

Morphology/Physiology

Active Growth Period Summer After Harvest Regrowth Rate Moderate

Low Bloat

Medium C:N Ratio

No

Coppice Potential Fall Conspicuous No Fire Resistant No

Yellow Flower Color

Flower Conspicuous No Foliage Color Green

Foliage Porosity Summer Dense Foliage Porosity Winter **Porous**

Medium Foliage Texture Fruit/Seed Color Brown

Fruit/Seed Conspicuous No

Bunch Growth Form Moderate

Growth Rate

Height at 20 Years, Maximum (feet)

Height, Mature (feet) 6.9

No Known Allelopath No Leaf Retention

Long Lifespan

No Low Growing Grass Nitrogen Fixation None

No Resprout Ability

Shape and Orientation	Erect
Toxicity	None
Growth Requirements	·
Adapted to Coarse Textured Soils	Yes
Adapted to Fine Textured Soils	Yes
Adapted to Medium Textured Soils	Yes
Anaerobic Tolerance	Medium
CaCO3 Tolerance	High
Cold Stratification Required	No
Drought Tolerance	High
Fertility Requirement	Low
Fire Tolerance	High
Frost Free Days, Minimum	180
Hedge Tolerance	None
Moisture Use	Low
pH, Minimum	6.0
pH, Maximum	8.0
Planting Density per Acre, Minimum	
Planting Density per Acre, Maximum	1
Precipitation, Minimum	13
Precipitation, Maximum	45
Root Depth, Minimum (inches)	20
Salinity Tolerance	Medium
Shade Tolerance	Intolerant
Temperature, Minimum (°F)	-28
Reproduction	
Bloom Period .	Summer
Commercial Availability	Routinely Available
Fruit/Seed Abundance	Medium
Fruit/Seed Period Begin	Summer
Fruit/Seed Period End	Fall
Fruit/Seed Persistence	No
Propagated by Bare Root	No
Propagated by Bulb	No
Propagated by Container	No
Propagated by Corm	No
Propagated by Cuttings	No

Yes

No

No No

Propagated by Seed

Propagated by Sod

Propagated by Sprigs

Propagated by Tubers

Seed per Pound 144240
Seed Spread Rate Slow
Seedling Vigor Low
Small Grain No
Vegetative Spread Rate Slow

Suitability/Use

Berry/Nut/Seed Product No
Christmas Tree Product No
Fodder Product Yes

Fuelwood Product

Lumber ProductNoNaval Store ProductNoNursery Stock ProductNo

Palatable Browse Animal Medium
Palatable Graze Animal High
Palatable Human No
Post Product No

Protein Potential Medium
Pulpwood Product No
Veneer Product No

Andropogon gerardii Vitman big bluestem ANGE

Cultivar: Niagara

Morphology/Physiology

Summer Active Growth Period Moderate After Harvest Regrowth Rate None Bloat Medium C:N Ratio No Coppice Potential No Fall Conspicuous No Fire Resistant Yellow Flower Color No Flower Conspicuous Green Foliage Color Dense Foliage Porosity Summer Porous Foliage Porosity Winter Medium Foliage Texture Brown Fruit/Seed Color No Fruit/Seed Conspicuous

Growth Form Bunch
Growth Rate Moderate

Height at 20 Years, Maximum (feet)

Height, Mature (feet) ^ 6.3 Known Allelopath No Leaf Retention No Lifespan Long No Low Growing Grass Nitrogen Fixation None Resprout Ability No Erect Shape and Orientation None Toxicity

Growth Requirements

Adapted to Coarse Textured Soils Yes

Adapted to Fine Textured Soils Yes

Adapted to Medium Textured Soils Yes

Anaerobic Tolerance Medium

CaCO3 Tolerance High

Cold Stratification Required No

Drought Tolerance High

Fertility Requirement Medium

Fire Tolerance High

Frost Free Days, Minimum 120

Hedge Tolerance None

Moisture Use Low

pH, Minimum 5.0

Planting Density per Acre, Minimum
Planting Density per Acre, Maximum

Precipitation, Minimum 12
Precipitation, Maximum 45
Root Depth, Minimum (inches) 20

Salinity Tolerance Medium
Shade Tolerance Intolerant

Temperature, Minimum (°F) -23

Reproduction

pH, Maximum

Bloom Period Early Summer

Commercial Availability Routinely Available

7.0

Fall

Fruit/Seed Abundance Medium
Fruit/Seed Period Begin Summer

Fruit/Seed Period End

No Fruit/Seed Persistence No Propagated by Bare Root Propagated by Bulb No Propagated by Container No No Propagated by Corm Propagated by Cuttings No Yes Propagated by Seed No Propagated by Sod Propagated by Sprigs No Propagated by Tubers No 144240 Seed per Pound

Seed Spread Rate Slow
Seedling Vigor Medium
Small Grain No

Vegetative Spread Rate Slow

Suitability/Use

Berry/Nut/Seed Product No
Christmas Tree Product No
Fodder Product Yes

Fuelwood Product

Lumber Product No
Naval Store Product No
Nursery Stock Product No

Palatable Browse Animal Medium
Palatable Graze Animal High
Palatable Human No
Post Product No

Protein Potential Medium

Pulpwood Product No
Veneer Product No

Andropogon gerardii Vitman big bluestem ANGE

Cultivar: Pawnee

Coppice Potential

Morphology/Physiology

Active Growth Period Summer

After Harvest Regrowth Rate Moderate

Bloat Low

C:N Ratio Medium

No

Fall Conspicuous No Fire Resistant No Flower Color Yellow Flower Conspicuous No Foliage Color Green Foliage Porosity Summer Dense Foliage Porosity Winter Porous Foliage Texture Medium Fruit/Seed Color Brown Fruit/Seed Conspicuous No Growth Form Bunch Growth Rate Moderate Height at 20 Years, Maximum (feet) 7.0 Height, Mature (feet) Known Allelopath No Leaf Retention No Lifespan Long Low Growing Grass No Nitrogen Fixation None Resprout Ability No Shape and Orientation Erect Toxicity None **Growth Requirements** Adapted to Coarse Textured Soils No

Precipitation, Maximum

Adapted to Fine Textured Soils Yes Adapted to Medium Textured Soils Yes Anaerobic Tolerance Medium CaCO3 Tolerance High Cold Stratification Required No **Drought Tolerance** High Fertility Requirement Medium Fire Tolerance High Frost Free Days, Minimum 180 Hedge Tolerance None Moisture Use Low pH, Minimum 5.5 pH, Maximum 8.0 Planting Density per Acre, Minimum Planting Density per Acre, Maximum Precipitation, Minimum 12

35

Root Depth, Minimum (inches)

20

Salinity Tolerance

Medium

Shade Tolerance

Intolerant

Temperature, Minimum (°F)

-38

Reproduction

Bloom Period

Late Spring

Commercial Availability

Routinely Available

Fruit/Seed Abundance

Medium

Fruit/Seed Period Begin

Summer

Fruit/Seed Period End

Fall

Fruit/Seed Persistence

No

Propagated by Bare Root

No

Propagated by Bulb
Propagated by Container

No

Propagated by Corm

No

Tropagated by com

No

Propagated by Cuttings

No

Propagated by Seed

Yes

Propagated by Sod

No

Propagated by Sprigs

No

Propagated by Tubers

No

Seed per Pound

144240 Slow

Seed Spread Rate

31011

Seedling Vigor Small Grain Medium

Vegetative Spread Rate

No Slow

Suitability/Use

Berry/Nut/Seed Product

No

Christmas Tree Product

No

Fodder Product

Yes

Fuelwood Product

No

Lumber Product

No

Naval Store Product
Nursery Stock Product

No

Palatable Browse Animal

Medium

Palatable Graze Animal

High

Palatable Human

No

Post Product

No

Protein Potential

Medium

Pulpwood Product

No

Veneer Product

No

Andropogon gerardii Vitman big bluestem ANGE

Cultivar: Rountree

Morphology/Physiology

Active Growth Period

After Harvest Regrowth Rate

Moderate

Summer

Bloat

Low

C:N Ratio

Medium

Coppice Potential

No

Fall Conspicuous
Fire Resistant

No

Flower Color

No Yellow

Flower Conspicuous

No

Foliage Color

Green

Foliage Porosity Summer

Dense

Foliage Porosity Winter

Porous

Foliage Texture

Medium

Fruit/Seed Color

Brown

Fruit/Seed Conspicuous

No

Growth Form

Bunch

Growth Rate

Moderate

Height at 20 Years, Maximum (feet)

Height, Mature (feet)

6.5

Known Allelopath

No

Leaf Retention

No

Lifespan

Long

Low Growing Grass

No

Nitrogen Fixation

None

Resprout Ability

No

Shape and Orientation

Erect

Toxicity

None

Growth Requirements

Adapted to Coarse Textured Soils

No

Adapted to Fine Textured Soils

Yes Yes

Adapted to Medium Textured Soils

Medium

Anaerobic Tolerance
CaCO3 Tolerance

High

No

Cold Stratification Required

High

Drought Tolerance Fertility Requirement

Medium

High Fire Tolerance 180 Frost Free Days, Minimum Hedge Tolerance None Moisture Use Low 5.5 pH, Minimum 8.5 pH, Maximum

Planting Density per Acre, Minimum Planting Density per Acre, Maximum

20 Precipitation, Minimum 35 Precipitation, Maximum 20 Root Depth, Minimum (inches)

Salinity Tolerance Medium Intolerant Shade Tolerance

Temperature, Minimum (°F) -28

Reproduction

Bloom Period Late Spring

Routinely Available Commercial Availability

Fruit/Seed Abundance Medium Fruit/Seed Period Begin Summer

Fruit/Seed Period End Fall Fruit/Seed Persistence No Propagated by Bare Root No Propagated by Bulb No Propagated by Container No Propagated by Corm No Propagated by Cuttings Νo Propagated by Seed Yes Propagated by Sod No Propagated by Sprigs No

Seed per Pound 144240 Seed Spread Rate Slow Seedling Vigor Low Small Grain No Slow

No

Vegetative Spread Rate

Suitability/Use

Propagated by Tubers

Berry/Nut/Seed Product No Christmas Tree Product No Fodder Product Yes

Fuelwood Product

Lumber Product No Naval Store Product

No

Nursery Stock Product

No

Palatable Browse Animal

Medium

Palatable Graze Animal

High

Palatable Human

No

Post Product

No

Protein Potential

Medium

Pulpwood Product

No

Veneer Product

No

Andropogon gerardii Vitman big bluestem ANGE

Cultivar: Sunnyview

Morphology/Physiology

Active Growth Period

Spring and Summer

After Harvest Regrowth Rate

Moderate

Bloat

Low

C:N Ratio

Medium

Coppice Potential

No

Fall Conspicuous

No

Fire Resistant Flower Color No

Flower Conspicuous

Yellow No

Foliage Color

Green

Foliage Porosity Summer

Dense

Foliage Porosity Winter

Porous

Foliage Texture

Medium

Fruit/Seed Color

Brown

Fruit/Seed Conspicuous

No

Growth Form

Bunch

Growth Rate

Moderate

Height at 20 Years, Maximum (feet)

Height, Mature (feet)

6.0

Known Allelopath

No No

Leaf Retention Lifespan

Long

Low Growing Grass

No

LOW Growing Grass

NO

Nitrogen Fixation

None No

Resprout Ability

Shape and Orientation

Erect

Toxicity	None
Growth Requirements	
Adapted to Coarse Textured Soils	No
Adapted to Fine Textured Soils	Yes
Adapted to Medium Textured Soils	Yes
Anaerobic Tolerance	Medium
CaCO3 Tolerance	High
Cold Stratification Required	No
Drought Tolerance	High
Fertility Requirement	Medium
Fire Tolerance	High
Frost Free Days, Minimum	120
Hedge Tolerance	None
Moisture Use	Low
pH, Minimum	5.5
pH, Maximum	8.0
Planting Density per Acre, Minimum	
Planting Density per Acre, Maximum	
Precipitation, Minimum	12
Precipitation, Maximum	30
Root Depth, Minimum (inches)	18
Salinity Tolerance	Medium
Shade Tolerance	Intolerant
Temperature, Minimum (°F)	-36
Reproduction	
Bloom Period	Mid Summer
Commercial Availability	Routinely Available
Fruit/Seed Abundance	Medium
Fruit/Seed Period Begin	Summer
Fruit/Seed Period End	Fall
Fruit/Seed Persistence	No
Propagated by Bare Root	No
Propagated by Bulb	No
Propagated by Container	No
Propagated by Corm	No
Propagated by Cuttings	No
Propagated by Seed	Yes
Propagated by Sod	No
Propagated by Sprigs	No
Propagated by Tubers	No
Seed per Pound	144240

Seed Spread Rate

Slow

Seedling Vigor

Low

Small Grain

No

Vegetative Spread Rate

Slow

Suitability/Use

Berry/Nut/Seed Product

No

Christmas Tree Product

No

Fodder Product

Yes

Fuelwood Product

Lumber Product

No

Naval Store Product

No

Nursery Stock Product

No

Palatable Browse Animal

Medium

Palatable Graze Animal

High

Palatable Human

No

Post Product

No

Protein Potential Pulpwood Product

No

Medium

Veneer Product

No

Andropogon gerardii Vitman big bluestem **ANGE**

Cultivar: T-1947

Morphology/Physiology

Active Growth Period

Summer

After Harvest Regrowth Rate

Moderate

Bloat

Low

C:N Ratio

Medium

Coppice Potential

No

Fall Conspicuous

No No

Fire Resistant

Yellow

Flower Color

No

Flower Conspicuous

Foliage Color

Green Dense

Foliage Porosity Summer

Porous

Foliage Porosity Winter

Foliage Texture

Medium

Fruit/Seed Color

Brown

Fruit/Seed Conspicuous

No

Growth Form

Bunch

Growth Rate	Moderate
Height at 20 Years, Maximum (feet)	
Height, Mature (feet)	7.0
Known Allelopath	.No
Leaf Retention	No
Lifespan	Long
Low Growing Grass	No
Nitrogen Fixation	None
Resprout Ability	No
Shape and Orientation	Erect
Toxicity	None
Growth Requirements	
Adapted to Coarse Textured Soils	Yes
Adapted to Fine Textured Soils	Yes
Adapted to Medium Textured Soils	Yes
Anaerobic Tolerance	Medium
CaCO3 Tolerance	High
Cold Stratification Required	No
Drought Tolerance	High
Fertility Requirement	Low
Fire Tolerance	High
Frost Free Days, Minimum	190
Hedge Tolerance	None
Moisture Use	Low
pH, Minimum	5.5
pH, Maximum	7.5
Planting Density per Acre, Minimum	
Planting Density per Acre, Maximum	
Precipitation, Minimum	12
Precipitation, Maximum	33
Root Depth, Minimum (inches)	20
Salinity Tolerance	Low
Shade Tolerance	Intolerant

Reproduction

Temperature, Minimum (°F)

Bloom Period	Mid Summer
Commercial Availability	Routinely Available
Fruit/Seed Abundance	Medium
Fruit/Seed Period Begin	Summer
Fruit/Seed Period End	Fall
Fruit/Seed Persistence	No

-9

Propagated by Bare Root	No
Propagated by Bulb	No
Propagated by Container	No
Propagated by Corm	No
Propagated by Cuttings	No
Propagated by Seed	Yes
Propagated by Sod	No
Propagated by Sprigs	No
Propagated by Tubers	No
Seed per Pound	144240
Seed Spread Rate	Slow
Seedling Vigor	Low
Small Grain	No
Vegetative Spread Rate	Slow
Suitability/Use	
Berry/Nut/Seed Product	No
Christmas Tree Product	No
Fodder Product	Yes
Fuelwood Product	

Lumber Product No No Naval Store Product Nursery Stock Product No Medium Palatable Browse Animal

Palatable Graze Animal High No Palatable Human No Post Product

Medium

Protein Potential No **Pulpwood Product** No Veneer Product

Time Generated: 03/08/2017

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APPENDIX V LABORATORY RESULTS



November 08, 2016

KIMBERLY WILSON

TALON LPE

408 W. TEXAS AVE.

ARTESIA, NM 88210

RE: COTTON DRAW #181 BATTERY

Enclosed are the results of analyses for samples received by the laboratory on 11/07/16 13:45.

Cardinal Laboratories is accredited through Texas NELAP under certificate number T104704398-16-8. Accreditation applies to drinking water, non-potable water and solid and chemical materials. All accredited analytes are denoted by an asterisk (*). For a complete list of accredited analytes and matrices visit the TCEQ website at www.tceq.texas.gov/field/qa/lab accredited through Texas NELAP under certificate number T104704398-16-8. Accreditation applies to drinking water, non-potable water and solid and chemical materials. All accredited analytes are denoted by an asterisk (*). For a complete list of accredited analytes and matrices visit the TCEQ website at www.tceq.texas.gov/field/qa/lab accredited certifi.html.

Cardinal Laboratories is accreditated through the State of Colorado Department of Public Health and Environment for:

Method EPA 552.2

Haloacetic Acids (HAA-5)

Method EPA 524.2

Total Trihalomethanes (TTHM)

Method EPA 524.4

Regulated VOCs (V1, V2, V3)

Accreditation applies to public drinking water matrices.

Celey D. Keine

This report meets NELAP requirements and is made up of a cover page, analytical results, and a copy of the original chain-of-custody. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Celey D. Keene

Lab Director/Quality Manager



TALON LPE
KIMBERLY WILSON
408 W. TEXAS AVE.
ARTESIA NM, 88210
Fax To: (575) 745-8905

Received:

11/07/2016

Sampling Date:

11/03/2016

Reported:

11/08/2016

Sampling Type:

Soil

Project Name:

COTTON DRAW #181 BATTERY

Sampling Condition:

Cool & Intact

Project Number:

700794.205.01

Sample Received By:

Jodi Henson

Project Location:

EDDY COUNTY, NM

Sample ID: S-1 0 (H602507-01)

BTEX 8021B	mg/kg		Analyze	Analyzed By: MS					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	<0.050	0.050	11/07/2016	ND	2.25	113	2.00	0.355	
Toluene*	<0.050	0.050	11/07/2016	ND	2.28	114	2.00	1.03	
Ethylbenzene*	<0.050	0.050	11/07/2016	ND	2.18	109	2.00	1.00	
Total Xylenes*	<0.150	0.150	11/07/2016	ND	6.63	110	6.00	0.532	
Total BTEX	<0.300	0.300	11/07/2016	ND					
Surrogate: 4-Bromofluorobenzene (PIL	111 9	% 73.6-14	0						
Chloride, SM4500Cl-B	mg/kg		Analyzed By: AC			~~~			
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	1440	16.0	11/08/2016	ND	400	100	400	0.00	
TPH 8015M	mg/	kg	Analyze	d By: MS					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	<10.0	10.0	11/07/2016	ND	196	98.1	200	2.83	
DRO >C10-C28	11.9	10.0	11/07/2016	ND	190	95.2	200	2.96	
Surrogate: 1-Chlorooctane	104 :	% 35-147	7						
Surrogate: 1-Chlorooctadecane	99.4	% 28-171	!						

Cardinal Laboratories

*=Accredited Analyte

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Celey D. Keine



TALON LPE KIMBERLY WILSON 408 W. TEXAS AVE. ARTESIA NM, 88210 (575) 745-8905 Fax To:

Received:

11/07/2016

Sampling Date:

11/03/2016

Reported:

Sampling Type:

Soil

11/08/2016

Sampling Condition:

Cool & Intact

Project Name:

COTTON DRAW #181 BATTERY 700794.205.01

Sample Received By:

Jodi Henson

Project Number: Project Location:

EDDY COUNTY, NM

Sample ID: S-1 1 (H602507-02)

BTEX 8021B	mg/kg		Analyze	Analyzed By: MS					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	<0.050	0.050	11/07/2016	ND	2,25	113	2.00	0.355	
Toluene*	<0.050	0.050	11/07/2016	ND	2.28	114	2.00	1.03	
Ethylbenzene*	<0,050	0.050	11/07/2016	ND	2.18	109	2.00	1.00	
Total Xylenes*	<0.150	0.150	11/07/2016	ND	6.63	110	6.00	0.532	
Total BTEX	<0.300	0.300	11/07/2016	ND					
Surrogate: 4-Bromofluorobenzene (PIL	111 9	% 73.6-140)						
Chloride, SM4500Cl-B	mg/kg		Analyzed By: AC						
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	2160	16.0	11/08/2016	ND	400	100	400	0.00	
TPH 8015M	mg,	/kg	Analyze	d By: MS					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	<10.0	10.0	11/07/2016	ND	196	98.1	200	2.83	
DRO >C10-C28	400	10.0	11/07/2016	ND	190	95.2	200	2.96	
	<10.0	10.0	22,07,2020						
Surrogate: 1-Chlorooctane	99.5								

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Celeg D. Keene



TALON LPE
KIMBERLY WILSON
408 W. TEXAS AVE.
ARTESIA NM, 88210
Fax To: (575) 745-8905

Received: Reported: 11/07/2016

11/08/2016

Project Name:

COTTON DRAW #181 BATTERY

Project Number:

700794.205.01

Project Location:

EDDY COUNTY, NM

90.9 %

28-171

Sampling Date:

11/03/2016

Sampling Type:

Soil

Sampling Condition: Sample Received By: Cool & Intact

Jodi Henson

Sample ID: S-1 2 (H602507-03)

BTEX 8021B	mg/kg		Analyze	Analyzed By: MS				·	
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	<0.050	0.050	11/07/2016	ND	2.25	113	2.00	0.355	
Toluene*	<0.050	0.050	11/07/2016	ND	2.28	114	2.00	1.03	
Ethylbenzene*	<0.050	0.050	11/07/2016	ND	2.18	109	2.00	1.00	
Total Xylenes*	<0.150	0.150	11/07/2016	ND	6.63	110	6.00	0.532	
Total BTEX	<0.300	0.300	11/07/2016	ND					
Surrogate: 4-Bromofluorobenzene (PID	111 9	% 73.6-14	0						
Chloride, SM4500Cl-B	mg/	'kg	Analyzed By: AC						
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	2960	16.0	11/08/2016	ND	400	100	400	0.00	
TPH 8015M	mg,	/kg	Analyze	d By: MS					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	<10.0	10.0	11/07/2016	ND	196	98.1	200	2.83	
DRO >C10-C28	<10.0	10.0	11/07/2016	ND	190	95.2	200	2.96	
Surrogate: 1-Chlorooctane	88.3	% 35-14	7						

Cardinal Laboratories

Surrogate: 1-Chlorooctadecane

*=Accredited Analyte

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408 W. TEXAS AVE.
ARTESIA NM, 88210
Fax To: (575) 745-8905

Received:

11/07/2016

11/08/2016

Reported: Project Name:

COTTON DRAW #181 BATTERY

28-171

89.3 %

Project Number: Project Location:

700794.205.01 EDDY COUNTY, NM Sampling Date:

11/03/2016

Sampling Type:

Soil

Sampling Condition:

Cool & Intact

Sample Received By:

Jodi Henson

Sample ID: S-1 -3 (H602507-04)

BTEX 8021B	mg/kg		Analyze	d By: MS					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifie
Benzene*	<0.050	0.050	11/07/2016	ND	2.25	113	2.00	0.355	
Toluene*	<0.050	0.050	11/07/2016	ND	2.28	114	2.00	1.03	
Ethylbenzene*	<0.050	0.050	11/07/2016	ND	2.18	109	2.00	1.00	
Total Xylenes*	<0.150	0.150	11/07/2016	ND	6.63	110	6.00	0,532	
Total BTEX	<0.300	0.300	11/07/2016	ND					
Surrogate: 4-Bromofluorobenzene (PID	112 9	% 73.6-14	0						
Chloride, SM4500Cl-B	mg/	'kg	Analyzed By: AC						
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifie
Chloride	5360	16.0	11/08/2016	ND	400	100	400	0.00	
TPH 8015M	mg,	'kg	Analyze	Analyzed By: MS		· · · · · · · · · · · · · · · · · · ·			
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifie
GRO C6-C10	<10.0	10.0	11/07/2016	ND	196	98.1	200	2.83	
DRO >C10-C28	<10.0	10.0	11/07/2016	ND	190	95,2	200	2.96	
Surrogate: 1-Chlorooctane	89.5	% 35-147	7						

Cardinal Laboratories

Surrogate: 1-Chlorooctadecane

*=Accredited Analyte

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TALON LPE
KIMBERLY WILSON
408 W. TEXAS AVE.
ARTESIA NM, 88210
Fax To: (575) 745-8905

Received:

11/07/2016

Sampling Date:

11/03/2016

Reported:

11/08/2016

Sampling Type:

Soil

Project Name:

COTTON DRAW #181 BATTERY

Sampling Condition:

Cool & Intact

Project Number:

700794.205.01

Sample Received By:

Jodi Henson

Project Location:

EDDY COUNTY, NM

Sample ID: S-1 4 (H602507-05)

BTEX 8021B	mg/kg		Analyze	Analyzed By: MS					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	<0.050	0.050	11/07/2016	ND	2.25	113	2.00	0.355	
Toluene*	< 0.050	0.050	11/07/2016	ND	2.28	114	2.00	1.03	
Ethylbenzene*	<0.050	0.050	11/07/2016	ND	2.18	109	2.00	1.00	
Total Xylenes*	<0.150	0.150	11/07/2016	ND	6.63	110	6.00	0.532	
Total BTEX	<0.300	0,300	11/07/2016	ND					
Surrogate: 4-Bromofluorobenzene (PIL	110 %	6 73.6-14	0						
Chloride, SM4500Cl-B	mg/kg		Analyzed By: AC						
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	7330	16.0	11/08/2016	ND	400	100	400	0.00	
TPH 8015M	mg/	kg	Analyze	d By: MS					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	<10.0	10.0	11/07/2016	ND	196	98.1	200	2.83	
DRO >C10-C28	<10.0	10.0	11/07/2016	ND	190	95.2	200	2.96	
Surrogate: 1-Chlorooctane	98.0	% 35-147	7						
Surrogate: 1-Chlorooctadecane	102 5	% 28-171		•					

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TALON LPE
KIMBERLY WILSON
408 W. TEXAS AVE.
ARTESIA NM, 88210
Fax To: (575) 745-8905

Received:

11/07/2016

Sampling Date:

11/03/2016

Reported:

11/08/2016

Sampling Type:

Soil

Project Name:

COTTON DRAW #181 BATTERY

Sampling Condition:

Cool & Intact

Project Number:

700794.205.01

Sample Received By:

Jodi Henson

Project Location:

EDDY COUNTY, NM

Sample ID: S-2 0 (H602507-06)

BTEX 8021B	mg/kg		Analyzed By: MS				0-		
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	<0.050	0.050	11/07/2016	ND	2,25	113	2.00	0.355	
Toluene*	<0.050	0.050	11/07/2016	ND	2,28	114	2.00	1.03	
Ethylbenzene*	<0.050	0.050	11/07/2016	ND	2,18	109	2.00	1.00	
Total Xylenes*	<0.150	0.150	11/07/2016	ND	6.63	110	6.00	0.532	
Total BTEX	<0.300	0.300	11/07/2016	ND					
Surrogate: 4-Bromofluorobenzene (PIL	112 %	6 73.6-14	0						
Chloride, SM4500Cl-B	mg/kg		Analyzed By: AC			·····			
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	2560	16.0	11/08/2016	ND	400	100	400	0.00	
TPH 8015M	mg/	kg	Analyze	d By: MS					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	13.0	10.0	11/07/2016	ND	196	98.1	200	2.83	
DRO >C10-C28	675	10.0	11/07/2016	ND	190	95.2	200	2.96	
Surrogate: 1-Chlorooctane	88.7	% 35-147	7						
Surrogate: 1-Chlorooctadecane	100	% 28-171							

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*=Accredited Analyte

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Celeg & Keene



TALON LPE KIMBERLY WILSON 408 W. TEXAS AVE. ARTESIA NM, 88210 Fax To: (575) 745-8905

Received:

11/07/2016

Reported:

11/08/2016

Project Name:

COTTON DRAW #181 BATTERY

Project Number:

700794,205.01

Project Location:

EDDY COUNTY, NM

Sampling Date:

Sampling Type:

Soil

Sampling Condition:

Cool & Intact

11/03/2016

Sample Received By:

Jodi Henson

Sample ID: S-2 1 (H602507-07)

BTEX 8021B	mg/kg		Analyze	d By: MS					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	<0.050	0.050	11/08/2016	ND	2.25	113	2.00	0.355	
Toluene*	<0.050	0.050	11/08/2016	ND	2.28	114	2.00	1.03	
Ethylbenzene*	<0.050	0.050	11/08/2016	ND	2.18	109	2.00	1.00	
Total Xylenes*	<0.150	0.150	11/08/2016	ND	6,63	110	6.00	0.532	
Total BTEX	<0.300	0.300	11/08/2016	ND					
Surrogate: 4-Bromofluorobenzene (PID	111 %	6 73.6-14	0						
Chloride, SM4500Cl-B	mg/kg		Analyzed By: AC						
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	3480	16.0	11/08/2016	ND	400	100	400	0.00	
TPH 8015M	mg/	kg	Analyze	d By: MS					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	<10.0	10.0	11/07/2016	ND	196	98.1	200	2.83	
DRO >C10-C28	14.6	10.0	11/07/2016	ND	190	95.2	200	2.96	
Surrogate: 1-Chlorooctane	85.4	% 35-14%	7						
Surrogate: 1-Chlorooctadecane	96.8	% 28-17.	1						

Cardinal Laboratories

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Celeg & Keene



TALON LPE KIMBERLY WILSON 408 W. TEXAS AVE. ARTESIA NM, 88210 Fax To: (575) 745-8905

Received:

11/07/2016

Sampling Date:

11/03/2016

Reported:

11/08/2016

Sampling Type:

Soil

Project Name:

Sampling Condition:

Cool & Intact

COTTON DRAW #181 BATTERY 700794.205.01

Sample Received By:

Jodi Henson

Project Number: Project Location:

EDDY COUNTY, NM

Sample ID: S-2 2 (H602507-08)

BTEX 8021B	mg/kg		Analyze	Analyzed By: MS					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS % Recovery	True Value QC	RPD	Qualifier	
Benzene*	<0.050	0.050	11/08/2016	ND	2.25	113	2.00	0.355	
Toluene*	<0.050	0.050	11/08/2016	ND	2.28	114	2.00	1.03	
Ethylbenzene*	<0.050	0.050	11/08/2016	ND	2,18	109	2.00	1.00	
Total Xylenes*	<0.150	0.150	11/08/2016	ND	6.63	110	6.00	0,532	
Total BTEX	<0.300	0.300	11/08/2016	ND					
Surrogate: 4-Bromofluorobenzene (PIL	111 9	% 73.6-14	0						
Chloride, SM4500CI-B	mg/	'kg	Analyzed By: AC				and the first of t		
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	4880	16.0	11/08/2016	ND	400	100	400	0.00	
TPH 8015M	mg,	/kg	Analyze	d By: MS					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	<10.0	10.0	11/07/2016	ND	196	98.1	200	2.83	
DRO >C10-C28	15.2	10.0	11/07/2016	ND	190	95.2	200	2.96	

Surrogate: 1-Chlorooctane

91.4%

35-147

Surrogate: 1-Chlorooctadecane

105 %

28-171

Sample ID: S-2 3 (H602507-09)

Chloride, SM4500Cl-B mg/kg		Analyzed By: AC							
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	8930	16.0	11/08/2016	ND	400	100	400	0.00	QM-07

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TALON LPE KIMBERLY WILSON 408 W. TEXAS AVE. ARTESIA NM, 88210 Fax To: (575) 745-8905

Received:

11/07/2016

Sampling Date:

11/03/2016

Reported:

Sampling Type:

11/08/2016

Soil

200

Project Name:

COTTON DRAW #181 BATTERY

Sampling Condition:

Cool & Intact

Project Number:

700794.205.01

Sample Received By:

Jodi Henson

Project Location:

EDDY COUNTY, NM

Sample ID: S-2 4 (H602507-10)

			(
Chloride,	SM450	DCI-B			

Chloride, SM4500Cl-B	mg/kg		Analyzed By: AC				- Maria Carata de Propinsiones de Carata de Ca		
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	320	16.0	11/08/2016	ND	400	100	400	0.00	

Sample ID: S-3 0 (H602507-11)

BTEX 8021B	mg/kg		Analyze	d By: MS				l .	
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD .	Qualifier
Benzene*	<0.050	0.050	11/08/2016	ND	2.25	113	2.00	0.355	
Toluene*	<0.050	0.050	11/08/2016	ND	2.28	114	2.00	1.03	
Ethylbenzene*	<0.050	0.050	11/08/2016	ND	2.18	109	2.00	1.00	
Total Xylenes*	<0.150	0.150	11/08/2016	ND	6.63	110	6.00	0.532	
Total BTEX	<0.300	0.300	11/08/2016	ND					
Surrogate: 4-Bromofluorobenzene (PIL	110	% 73.6-14	0						
Chloride, SM4500Cl-B	mg,	/kg	Analyze	d By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	32.0	16.0	11/08/2016	ND	400	100	400	0.00	
TPH 8015M	mg,	/kg	Analyze	d By: MS			·		
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	<10.0	10.0	11/07/2016	ND	196	98.1	200	2.83	

Surrogate: 1-Chlorooctane

DRO >C10-C28

95.0 % 35-147

10.0

<10.0

Surrogate: 1-Chlorooctadecane 87.6%

28-171

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2.96

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ND

190

95.2

11/07/2016

Celeg D. Keen



TALON LPE KIMBERLY WILSON 408 W. TEXAS AVE. ARTESIA NM, 88210

Fax To:

(575) 745-8905

Received:

11/07/2016

Sampling Date:

11/03/2016

Reported:

11/08/2016

Sampling Type:

Soil

Project Name:

COTTON DRAW #181 BATTERY

Sampling Condition:

Cool & Intact

Project Number:

700794,205,01

Sample Received By:

Jodi Henson

Project Location:

Analyte

EDDY COUNTY, NM

Sample ID: S-3 1' (H602507-12)

Chloride, SM4500CI-B

mg/kg

Reporting Limit

Reporting Limit

Analyzed By: AC

Method Blank

% Recovery

True Value QC

RPD

Qualifier

Chloride

Result 48.0

16.0 11/08/2016

Analyzed

Analyzed

ND

BS 400

100

% Recovery

100

400

0.00

Sample ID: S-3 2 (H602507-13)

Chloride, SM4500Cl-B

Analyte

mg/kg

Analyzed By: AC

True Value QC

400

Qualifier

Chloride

Result 32.0

11/08/2016 16.0

ND

Method Blank

BS 400

RPD

0.00

Sample ID: S-3 3 (H602507-14)

Chloride, SM4500CI-B

mg/kg

Analyzed By: AC

Analyte

Analyte

Result

Analyzed Reporting Limit

Method Blank

BS % Recovery True Value QC

Qualifier

Chloride

32.0

16.0 11/08/2016

Reporting Limit

ND

400

100

400

RPD

0.00

Sample ID: S-3 4 (H602507-15)

Chloride, SM4500CI-B

mg/kg

Analyzed By: AC

Method Blank

BS

% Recovery

100

True Value QC

RPD

Qualifier

Chloride

Result 32.0

16.0

Analyzed 11/08/2016

ND

400

400

0.00

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Celeg D. Keene



TALON LPE KIMBERLY WILSON 408 W. TEXAS AVE. ARTESIA NM, 88210 (575) 745-8905 Fax To:

Received: Reported: 11/07/2016

11/08/2016

Project Name: Project Number: COTTON DRAW #181 BATTERY

Project Location:

700794.205.01 EDDY COUNTY, NM

90.9 %

28-171

Sampling Date:

11/03/2016

Sampling Type:

Soil

Sampling Condition:

Cool & Intact

Sample Received By:

Jodi Henson

Sample ID: S-4 0 (H602507-16)

BTEX 8021B	mg/kg		Analyze	Analyzed By: MS			AND THE RESERVE OF THE PERSON		sanialistifetation properties and the contraction of the contraction o
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	<0.050	0.050	11/08/2016	ND	2,25	113	2.00	0.355	
Toluene*	<0.050	0.050	11/08/2016	ND	2.28	114	2.00	1.03	
Ethylbenzene*	<0.050	0.050	11/08/2016	ND	2,18	109	2.00	1.00	
Total Xylenes*	<0.150	0.150	11/08/2016	ND	6.63	110	6.00	0.532	
Total BTEX	<0.300	0.300	11/08/2016	ND					
Surrogate: 4-Bromofluorobenzene (PID	111 9	6 73.6-14	0						
Chloride, SM4500Cl-B	mg/	kg	Analyze	d By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	3280	16.0	11/08/2016	ND	400	100	400	0.00	
TPH 8015M	mg/	'kg	Analyze	d By: MS					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	<10.0	10.0	11/08/2016	ND	196	98.1	200	2.83	
DRO >C10-C28	<10.0	10.0	11/08/2016	ND	190	95.2	200	2.96	
Surrogate: 1-Chlorooctane	83.2	% 35-142	7						

Sample ID: S-4 1 (H602507-17)

Surrogate: 1-Chlorooctadecane

Chloride, SM4500CI-B		mg/kg Analyzed By: AC								
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier	
Chloride	48.0	16.0	11/08/2016	ND	400	100	400	0.00		

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Celeg & Keene



TALON LPE KIMBERLY WILSON 408 W. TEXAS AVE. ARTESIA NM, 88210 (575) 745-8905 Fax To:

Received:

11/07/2016

11/08/2016

Reported:

Project Name: Project Number: COTTON DRAW #181 BATTERY

700794.205.01

Project Location:

EDDY COUNTY, NM

Sampling Date:

Sampling Type:

Soil

Sampling Condition: Sample Received By: Cool & Intact

Jodi Henson

11/03/2016

Sample ID: S-4 2 (H602507-18)

Chloride, SM4500Cl-B

mg/kg

Analyzed By: AC

160

Result

48.0

Result Reporting Limit Analyzed

Analyzed

11/08/2016

Analyzed

Method Blank

BS

% Recovery

True Value QC

RPD

Qualifier

Chloride

Chloride

16.0 11/08/2016

Reporting Limit

16.0

ND

400

BS

400

100

400

0.00

Sample ID: S-4 3 (H602507-19)

Analyte

Analyte

Chloride, SM4500Cl-B

mg/kg

Analyzed By: AC

Method Blank

% Recovery

100

True Value QC 400

RPD

0.00

Qualifier

Sample ID: S-4 4 (H602507-20)

Chloride, SM4500Cl-B

mg/kg

Analyzed By: AC

Analyte	Result	Reporting Limit	
Chloride	64.0	16.0	

11/08/2016

Method Blank ND

ND

BS 400 % Recovery 100

True Value QC 400

RPD 0.00 Qualifier

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Celego treene



TALON LPE KIMBERLY WILSON 408 W. TEXAS AVE. ARTESIA NM, 88210 Fax To: (575) 745-8905

Received:

11/07/2016

11/08/2016

Reported: Project Name:

COTTON DRAW #181 BATTERY

Project Number:

700794.205.01

Project Location:

EDDY COUNTY, NM

Sampling Date:

11/03/2016

Sampling Type:

Soil

Sampling Condition: Sample Received By: Cool & Intact

Jodi Henson

Sample ID: S-5 0 (H602507-21)

BTEX 8021B	mg/kg		Analyze	Analyzed By: MS		·			
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	<0.050	0.050	11/08/2016	ND	2.25	113	2.00	0.355	
Toluene*	<0.050	0.050	11/08/2016	ND	2.28	114	2.00	1.03	
Ethylbenzene*	<0.050	0.050	11/08/2016	ND	2.18	109	2.00	1.00	
Total Xylenes*	<0.150	0.150	11/08/2016	ND	6.63	110	6.00	0.532	
Total BTEX	<0,300	0.300	11/08/2016	ND					
Surrogate: 4-Bromofluorobenzene (PID	111 %	6 73.6-14	0						
Chloride, SM4500Cl-B	mg/	kg	Analyze	d By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	4000	16.0	11/08/2016	ND	400	100	400	0.00	
TPH 8015M	mg/	kg	Analyze	d By: MS					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	<10.0	10.0	11/08/2016	ND	196	98.1	200	2.83	
DRO >C10-C28	73.6	10.0	11/08/2016	ND	190	95.2	200	2,96	
Surrogate: 1-Chlorooctane	105	% 35-14%	7						
Surrogate: 1-Chlorooctadecane	113 9	% 28-17.	1						

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Celego Keine



TALON LPE KIMBERLY WILSON 408 W. TEXAS AVE. ARTESIA NM, 88210 Fax To: (575) 745-8905

Received:

11/07/2016

11/03/2016

Reported:

Sampling Date:

11/08/2016

Sampling Type:

Soil

Project Name:

COTTON DRAW #181 BATTERY

Sampling Condition:

Cool & Intact

Project Number: Project Location:

700794.205.01 EDDY COUNTY, NM Sample Received By:

Jodi Henson

Sample ID: S-5 1 (H602507-22)

BTEX 8021B	mg/kg		Analyze	Analyzed By: MS			000000000000000000000000000000000000000		,,,,,
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	<0.050	0.050	11/08/2016	ND	2.25	113	2.00	0.355	
Toluene*	<0.050	0.050	11/08/2016	ND	2.28	114	2.00	1.03	
Ethylbenzene*	<0.050	0.050	11/08/2016	ND	2.18	109	2.00	1.00	
Total Xylenes*	<0.150	0.150	11/08/2016	ND	6.63	110	6.00	0.532	
Total BTEX	<0.300	0.300	11/08/2016	ND					
Surrogate: 4-Bromofluorobenzene (PID	112 9	% 73.6-14	0						
Chloride, SM4500Cl-B	mg/	'kg	Analyze	d By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	6000	16.0	11/08/2016	ND	400	100	400	0.00	
TPH 8015M	mg/	kg	Analyze	d By: MS					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	<10.0	10.0	11/08/2016	ND	196	98.1	200	2,83	
DRO >C10-C28	<10.0	10.0	11/08/2016	ND	190	95.2	200	2.96	
Surrogate: 1-Chlorooctane	99.4	% 35-147	•						
Surrogate: 1-Chlorooctadecane	105	% 28-171							

Sample ID: S-5 2 (H602507-23)

Chloride, SM4500Cl-B	mg/kg		Analyzed By: AC						
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	7200	16.0	11/08/2016	ND	400	100	400	0.00	

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Clay & Kune



TALON LPE KIMBERLY WILSON 408 W. TEXAS AVE. ARTESIA NM, 88210 Fax To: (575) 745-8905

Received: Reported: 11/07/2016

11/08/2016

Project Name:

COTTON DRAW #181 BATTERY

Reporting Limit

Project Number:

700794.205.01

Project Location:

Analyte

EDDY COUNTY, NM

Sampling Date:

11/03/2016

Sampling Type:

Soil

Sampling Condition: Sample Received By: Cool & Intact

Jodi Henson

Sample ID: S-5 3 (H602507-24)

Chloride, SM4500Cl-B

mg/kg

Analyzed By: AC

Analyzed

Method Blank

% Recovery

True Value QC

RPD

Qualifier

Chloride

Result 6930

16.0 11/08/2016 ND

BS 400

100

400

0.00

Sample ID: S-5 4 (H602507-25)

Chloride, SM4500Cl-B mg/kg		/kg	Analyzed By: AC						
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	3280	16.0	11/08/2016	ND	400	100	400	0.00	

Cardinal Laboratories

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Celego treene



TALON LPE KIMBERLY WILSON 408 W. TEXAS AVE. ARTESIA NM, 88210 Fax To: (575) 745-8905

Received:

11/07/2016

Sampling Date:

11/03/2016

Reported:

11/08/2016

Sampling Type:

Soil

Project Name:

COTTON DRAW #181 BATTERY

Sampling Condition:

Cool & Intact

Project Number:

700794.205.01

Sample Received By:

Jodi Henson

Project Location:

EDDY COUNTY, NM

Sample ID: S-6 0 (H602507-26)

BTEX 8021B	mg/kg		Analyzed By: MS						
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	<0.050	0.050	11/08/2016	ND	2.25	113	2.00	0.355	
Toluene*	<0.050	0.050	11/08/2016	ND	2.28	114	2.00	1.03	
Ethylbenzene*	<0.050	0.050	11/08/2016	ND	2.18	109	2,00	1.00	
Total Xylenes*	<0.150	0.150	11/08/2016	ND	6.63	110	6.00	0.532	
Total BTEX	<0.300	0.300	11/08/2016	ND					
Surrogate: 4-Bromofluorobenzene (PID	111 %	% 73.6-14	0						
Chloride, SM4500CI-B	mg/	'kg	Analyzed By: AC						
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	1840	16.0	11/08/2016	ND	400	100	400	0.00	
TPH 8015M	mg/	'kg	Analyze	d By: MS					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	<10.0	10.0	11/08/2016	ND	196	98.1	200	2.83	
DRO >C10-C28	<10.0	10.0	11/08/2016	ND	190	95.2	200	2.96	
Surrogate: 1-Chlorooctane	97.4	% 35-147	,				****		
Surrogate: 1-Chlorooctadecane	91.3	% 28-171							

Cardinal Laboratories

*=Accredited Analyte

PLEASE NOTE: Ulability and Damages. Cardinal's liability and client's exclusive remedy for any claim arising, whether based in contract or tort, shall be limited to the amount paid by client for analyses. All claims, including those for negligence and any other cause whatsoever shall be deemed waived unless made in writing and received by Cardinal within thirty (30) days after completion of the applicable service. In no event shall Cardinal be fable for including, without limitation, business interruptions, loss of use, or loss of profits incurred by client, its subsidiaries, affiliates or successors arising out of or related to the performance of the services hereunder by Cardinal, regardless of whether such claim is based upon any of the above stated reasons or otherwise. Results relate only to the samples identified above. This report shall not be reproduced except in full with written approval of Cardinal Laboratories.

Celego Keene



TALON LPE
KIMBERLY WILSON
408 W. TEXAS AVE.
ARTESIA NM, 88210
Fax To: (575) 745-8905

Received:

11/07/2016

Sampling Date:

11/03/2016

Reported:

11/08/2016

Sampling Type:

Soil

Project Name:

COTTON DRAW #181 BATTERY

Sampling Condition:

Cool & Intact

Project Number:

700794.205.01

Sample Received By:

Jodi Henson

Project Location:

EDDY COUNTY, NM

Sample ID: S-6 1 (H602507-27)

BTEX 8021B	mg/	kg	Analyze	d By: MS					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	< 0.050	0.050	11/08/2016	ND	2.25	113	2.00	0.355	
Toluene*	<0.050	0.050	11/08/2016	ND	2.28	114	2,00	1.03	
Ethylbenzene*	<0.050	0.050	11/08/2016	ND	2.18	109	2.00	1.00	
Total Xylenes*	<0.150	0.150	11/08/2016	ND	6.63	110	6.00	0.532	
Total BTEX	<0.300	0.300	11/08/2016	ND					
Surrogate: 4-Bromofluorobenzene (PIL	112 %	6 73.6-14	0						
Chloride, SM4500Cl-B	mg/	kg	Analyze	d By: AC			.,		
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	5460	16.0	11/08/2016	ND	400	100	400	0.00	
TPH 8015M	mg/	kg	Analyze	d By: MS					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	<10.0	10.0	11/08/2016	ND	196	98.1	200	2.83	
DRO >C10-C28	<10.0	10.0	11/08/2016	ND	190	95.2	200	2.96	
Surrogate: 1-Chlorooctane	97.4	% 35-147							
Surrogate: 1-Chlorooctadecane	85.5	% 28-171							

Sample ID: S-6 2 (H602507-28)

Chloride, SM4500CI-B	mg	/kg	Analyze	d By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	8800	16.0	11/08/2016	ND	400	100	400	0.00	

Cardinal Laboratories

*=Accredited Analyte

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Celeg D. Keene



TALON LPE
KIMBERLY WILSON
408 W. TEXAS AVE.
ARTESIA NM, 88210
Fax To: (575) 745-8905

Received: Reported:

11/07/2016

11/08/2016

Project Name:

COTTON DRAW #181 BATTERY

Project Number:

Project Location:

700794.205.01

EDDY COUNTY, NM

Sampling Date:

o " =

11/03/2016

Sampling Type:

Soil

Sampling Condition:

Cool & Intact

Sample Received By:

Jodi Henson

Sample ID: S-6 3 (H602507-29)

Chloride, SM4500Cl-B

Chloride

mg/kg

Result

Analyzed By: AC

Analyte

7330

Reporting Limit 16.0

Analyzed 11/08/2016

Method Blank ND BS 432 % Recovery

108

True Value QC

400

RPD 0.00 Qualifier QM-07

Sample ID: S-6 4 (H602507-30)

Chloride, SM4500Cl-B

mg/kg

Analyzed By: AC

Analyte Result Reporting Limit Analyzed Method Blank BS RPD % Recovery True Value QC Qualifier Chloride 1870 11/08/2016 ND 16.0 432 108 400 0.00

Cardinal Laboratories

*=Accredited Analyte

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Celeg D. Keene

Celey D. Keene, Lab Director/Quality Manager



TALON LPE KIMBERLY WILSON 408 W. TEXAS AVE. ARTESIA NM, 88210 (575) 745-8905 Fax To:

Received:

11/07/2016

Sampling Date:

11/03/2016

Reported:

Sampling Type:

11/08/2016

Soil

Project Name:

COTTON DRAW #181 BATTERY

Sampling Condition: Sample Received By: Cool & Intact Jodi Henson

Project Number: Project Location: 700794.205.01

EDDY COUNTY, NM

Sample ID: S-7 0' (H602507-31)

BTEX 8021B	mg/	kg	Analyze	d By: MS				****	
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	<0.050	0.050	11/08/2016	ND	2.25	113	2.00	0.355	
Toluene*	<0.050	0.050	11/08/2016	ND	2,28	114	2.00	1.03	
Ethylbenzene*	<0.050	0.050	11/08/2016	ND	2.18	109	2.00	1.00	
Total Xylenes*	<0.150	0.150	11/08/2016	ND	6.63	110	6.00	0.532	
Total BTEX	<0.300	0.300	11/08/2016	ND	0.03	110	6.00		
Surrogate: 4-Bromofluorobenzene (PIL	111 %	6 73.6-140)						
Chloride, SM4500CI-B	mg/	kg	Analyze	d By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	48.0	16.0	11/08/2016	ND	432	108	400	0.00	
TPH 8015M	mg/kg		Analyze	Analyzed By: MS		200			
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	<10.0	10.0	11/08/2016	ND	196	98.1	200	2.83	
DRO >C10-C28	<10.0	10.0	11/08/2016	ND	190	95.2	200	2.96	
Surrogate: 1-Chlorooctane	91.8	% 35-147							
Surrogate: 1-Chlorooctadecane	94.8	% 28-171							

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*=Accredited Analyte

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Celeg & Kenne



TALON LPE
KIMBERLY WILSON
408 W. TEXAS AVE.
ARTESIA NM, 88210
Fax To: (575) 745-8905

Received: Reported:

11/07/2016

1/00/2016

11/08/2016

Project Name: Project Number: COTTON DRAW #181 BATTERY

700794.205.01

Project Location:

EDDY COUNTY, NM

Sampling Date:

11/03/2016

Sampling Type:

Soil

Sampling Condition: Sample Received By: Cool & Intact

Jodi Henson

Sample ID: S-7 1' (H602507-32)

BTEX 8021B	mg/	kg	Analyze	d By: MS					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Benzene*	<0.050	0.050	11/08/2016	ND	2.25	113	2.00	0.355	
Toluene*	<0.050	0.050	11/08/2016	ND	2.28	114	2.00	1.03	
Ethylbenzene*	<0.050	0.050	11/08/2016	ND	2.18	109	2.00	1.00	
Total Xylenes*	<0.150	0.150	11/08/2016	ND	6.63	110	6.00	0.532	
Total BTEX	<0.300	0.300	11/08/2016	ND					
Surrogate: 4-Bromofluorobenzene (PID	110 %	6 73.6-140	0						
Chloride, SM4500CI-B	mg/	kg	Analyze	d By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	48.0	16.0	11/08/2016	ND	432	108	400	0.00	
TPH 8015M	mg/	kg .	Analyze	d By: MS					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
GRO C6-C10	<10.0	10.0	11/08/2016	ND	196	98.1	200	2.83	
DRO >C10-C28	<10.0	10.0	11/08/2016	ND	190	95.2	200	2.96	
Surrogate: 1-Chlorooctane	98.2 9	% 35-147					***************************************		
Surrogate: 1-Chlorooctadecane	106 %	6 28-171							

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Celeg D. Keene



Notes and Definitions

QM-07 The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS

recovery.

ND Analyte NOT DETECTED at or above the reporting limit

RPD Relative Percent Difference

** Samples not received at proper temperature of 6°C or below.

*** Insufficient time to reach temperature.

- Chloride by SM4500Cl-B does not require samples be received at or below 6°C

Samples reported on an as received basis (wet) unless otherwise noted on report

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Celeg & Keine



CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

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				· City:	evon	60.	Project Owner:	10 <u>-</u> 500 1000	• • •
			ess:	Address	905	Fax#: 575-746-8905	Faxまり	575-746-8768	Phone #: 575-7
				Attn:	8210	IM zip: 88210			cily: Artesia
		IT I	Company: Talon/LPE	Comi				v 3	Address: 408 W.
	•	í		P.O. 些		3	111118	Himsherl	Project Manager:
•	-							Talon/LPE	Company Name:
ANALYSIS REQUEST						2476	FAX (575) 393-2476	(575) 393-2326 FA	T
			•			88240	Hobbs, NW	101 East Mariand, Hobbs, NM 88240	m2

† Cardinal cannot accept verbal changes. Please fax written changes to (575) 3942326



Page 2 8 4 CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

101 East Warland, Hobbs, NW 88240		•
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THE SECTION OF A LANGE AND CONTRACTS SECURING AND CONTRACT OF REPORT OF THE PROPERTY OF THE PR	emed walved unless made in willing and received by Cardinal whin 30 days after Whout limitation, business interruptions, loss of use, or loss of profix incurred by c	exposition of the applicable into the second
Adding or acceptancy at day set of at related to the performance of considers hereinter by Considers and States, I also the considers hereinter by Considers and Considers hereinter by Considers he	Cardinal regardless of whether such cause seem to be any or one seem of the Received By:	Phone Respirt: □ Yes 및 No Add'i Phone #: Fax Respirt: □ Yes 및 No Add'i Fax #.
Times Times		REMARKS:
Relinquished By:	RECOMMENT BY:	Kush
Delivered By: (Circle One)	Cool Intact Officials	

† Cardinal cannot accept verbal changes, Please fax written changes to (675) 393-2626



CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

Project Manager: Company Name: Talon/LPE Phones: 575-746-8768 city: Artesia Project Name: Project#: 1001 uddress: 408 W. Texas Ave. Sampler Name: roject Location: HOSEN BY NO pieges Note: Liabilly and Compages. Continue stating and other comments and the contract of th Relinquish Tab ID Delivered By: (Circle One) 101 East Warland, Hobbs, NW 88240 (575) 393-2326 FAX (575) 393-2476 200 2.0 Vinne 500 sample I.D. 500 y ii State: NM Zip: 88210 Fax#: 575-746-8905 Project Owner: UNON Sakao. Date; 7/10 Times (G)RAB OR (C)OMP. Received By: 60 # CONTAINERS leived By: GROUNDWATER WASTEWATER NO THE SECOND MATRIX SOIL OIL SLUDGE City: P.O. 些 State: Affin Company: Phone 枳 Address OTHER: 下级地 ACID/BASE: ICE / COOL 01 110 OTHER Talon/LPE Zp: SAMPLING 12:15 2:18 7:25 3:03 3;0% 2:23 2:56 258 2:30 TIME w ö □ Yes 11 12 12 13 ANALYSIS REQUEST

Sampler-UPS - Bus - Other:

#

Cardinal cannot accept verbal changes. Please fax written changes to (575) 39\$2326



Page Hog W

CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

Relinquished By: Delivered By: (Circle One)	Relinquished By: Relinquished Times Tim	of Equation and Committee Continues and Cont		2 57 /	1605251 1657 OV OV DESCONIE	Sample D.	Sampler Name: King Willson	Project Name: Cotton Daw 181 Batter	Ave. state: NM	on East Marland, Hobbs, I 175) 393-2326 FAX (575) 1 Talon/LPE
Regeived By: Sample Condition CHECKED BY: Cool Indust (Infault)	C YES) (1)			GR W/ SC OIII	CONTAINERS COUNDWATER ASTEWATER DIL L L LUDGE THER: CID/BASE: EF/COOL THER:	MATRIX PRESERV. SAMPLING	State: Zip:	<u>company: Talon/LPE</u> <u>zip: 88210 Attn:</u> 46-8905 Address:	P.O. #:
lush.	No Add'i Fax #	5								ANALYSIS REQUEST

Sampler-UPS - Bus - Other:

† Cardinal cannot accept verbal changes. Please fax written changes to (575) 393-2526



February 02, 2017

KIMBERLY WILSON

TALON LPE

408 W. TEXAS AVE.

ARTESIA, NM 88210

RE: COTTON DRAW #181 BATTERY

Enclosed are the results of analyses for samples received by the laboratory on 02/01/17 12:00.

Cardinal Laboratories is accredited through Texas NELAP under certificate number T104704398-16-8. Accreditation applies to drinking water, non-potable water and solid and chemical materials. All accredited analytes are denoted by an asterisk (*). For a complete list of accredited analytes and matrices visit the TCEQ website at www.tceq.texas.gov/field/qa/lab accredited certif.html.

Cardinal Laboratories is accreditated through the State of Colorado Department of Public Health and Environment for:

Method EPA 552.2

Haloacetic Acids (HAA-5)

Method EPA 524.2

Total Trihalomethanes (TTHM)

Method EPA 524.4

Regulated VOCs (V1, V2, V3)

Accreditation applies to public drinking water matrices.

Celeg D. Keine

This report meets NELAP requirements and is made up of a cover page, analytical results, and a copy of the original chain-of-custody. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Celey D. Keene

Lab Director/Quality Manager



TALON LPE KIMBERLY WILSON 408 W, TEXAS AVE. ARTESIA NM, 88210 (575) 745-8905 Fax To:

Received:

02/01/2017

Sampling Date:

01/26/2017

Reported:

Sampling Type:

Soil

02/02/2017

Project Name:

COTTON DRAW #181 BATTERY

Reporting Limit

Reporting Limit

16.0

Reporting Limit

Reporting Limit

16.0

Sampling Condition: Sample Received By: ** (See Notes) Angela Cabrera

Project Number:

Analyte

Analyte

Analyte

Analyte

700794.205.01

Analyzed

Analyzed

Project Location:

EDDY COUNTY, NM

Sample ID: B-1 1' (H700244-01)

Chloride, SM4500Cl-B

mg/kg

Analyzed By: AC

Method Blank

% Recovery 108

True Value QC 400

RPD

Qualifier

Chloride

Result 3600

Result

560

16.0 02/02/2017 ND

BS 432

0.00

Sample ID: B-1 2' (H700244-02)

Chloride, SM4500Cl-B

mg/kg

Analyzed By: AC

% Recovery

108

True Value QC

400

RPD

Qualifier

Chloride

02/02/2017

Method Blank ND

432

BS

0.00

Sample ID: B-1 3' (H700244-03)

Chloride, SM4500Cl-B

mg/kg

Analyzed

Analyzed

02/02/2017

Analyzed By: AC

% Recovery

True Value QC

RPD

Qualifier

Chloride

Chloride

Result 144

Result

160

02/02/2017 16.0

Method Blank ND

BS 432

108

400

0.00

Sample ID: B-1 4' (H700244-04)

Chloride, SM4500Cl-B

mg/kg

Analyzed By: AC

Method Blank

ND

BS

432

% Recovery

108

True Value QC 400

RPD

0.00

Qualifier

Cardinal Laboratories

*=Accredited Analyte

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Celeg D. Keen

Celey D. Keene, Lab Director/Quality Manager



TALON LPE KIMBERLY WILSON 408 W. TEXAS AVE. ARTESIA NM, 88210 (575) 745-8905 Fax To:

Received:

02/01/2017

COTTON DRAW #181 BATTERY

Sampling Date:

01/26/2017

Reported:

02/02/2017

Sampling Type:

Soil

Project Name:

Sampling Condition:

** (See Notes)

Project Number:

700794.205.01

Sample Received By:

Angela Cabrera

Project Location:

EDDY COUNTY, NM

Sample ID: B-1 6' (H700244-05)

mg/kg

Analyzed By: AC

Analyte

Reporting Limit

Reporting Limit

16.0

Reporting Limit

Reporting Limit

Reporting Limit

16.0

Analyzed

Method Blank

% Recovery 108

True Value QC

RPD

0.00

RPD

Chloride

Result 208

02/02/2017 16.0

ND

432

BS

400

Qualifier

Sample ID: B-1 10' (H700244-06)

Chloride, SM4500Cl-B

Analyte

Analyte

Analyte

mg/kg

Analyzed By: AC

% Recovery

108

True Value QC

Qualifier

Chloride

224

Result

Analyzed 02/02/2017 Method Blank ND

432

BS

400

0.00

Sample ID: B-2 1' (H700244-07)

Chloride, SM4500Cl-B

mg/kg

Analyzed By: AC

Analyzed

Method Blank

ND

% Recovery

True Value QC

RPD

Qualifier

Chloride

16.0

560

Result

02/02/2017

432

BS

108

400

0.00

Sample ID: B-2 2' (H700244-08)

Chloride, SM4500Cl-B

mg/kg

Analyzed By: AC Analyzed

Method Blank

ND

BS

% Recovery

True Value QC

RPD

Qualifier

Chloride

Chloride

48.0

Result

48.0

Result

02/02/2017 16.0

432

108

400

0.00

Sample ID: B-2 3' (H700244-09)

Analyzed By: AC

432

108

Chloride, SM4500Cl-B

mg/kg

Analyzed

02/02/2017

Method Blank

ND

BS % Recovery

True Value QC 400

RPD 0.00

Qualifier

Cardinal Laboratories

Analyte

*=Accredited Analyte

medy for any claim arising, whether based in contract or tort, shall be limited to the amount paid by client for analyses. All claims, including those for negligence and any other cause whatsoever shall be deemed walved unless made in writing and received by Cardinal within thirty (30) days after completion of the applicable service. In no event shall Cardinal be liable for incidental or consequential damages, including, without limitation, business interruptions, loss of use, or loss of profits incurred by client, its subsidiaries, affiliates or successors arising out of or related to the performance of the services hereunder by Cardinal, regardless of whether such claim is based upon any of the above stated reasons or otherwise. Results relate only to the samples identified above. This report shall not be reproduced except in full with written approval of Cardinal Laboratories.

Celeg D. Kee

Celey D. Keene, Lab Director/Quality Manager



TALON LPE
KIMBERLY WILSON
408 W. TEXAS AVE.
ARTESIA NM, 88210
Fax To: (575) 745-8905

Received:

02/01/2017

Sampling Date:

01/26/2017

Reported:

Chloride, SM4500Cl-B

02/02/2017

Sampling Type:

Soil

Project Name:

COTTON DRAW #181 BATTERY

Sampling Condition:

** (See Notes)

Project Number:

700794.205.01

Sample Received By:

Angela Cabrera

Project Location:

EDDY COUNTY, NM

mg/kg

Sample ID: B-2 4' (H700244-10)

Chloride, SM4500Cl-B	niy	/ Kg	Anatyze	u by: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	48.0	16.0	02/02/2017	ND	432	108	400	0.00	
Sample ID: B-2 5' (H700)	244-11)								
Chloride, SM4500Cl-B	,	/kg	Analyze	d By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	48.0	16.0	02/02/2017	ND	432	108	400	0.00	
Sample ID: B-3 5' (H7002	244-12)								
Chloride, SM4500Cl-B	mg	/kg	Analyze	d By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	2560	16.0	02/02/2017	ND	432	108	400	0.00	
Sample ID: B-3 10' (H700)244-13)								
Chloride, SM4500CI-B	mg	/kg	Analyze	d By: AC			125.01.		
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	4400	16.0	02/02/2017	ND	432	108	400	0.00	
Sample ID: B-3 15' (H700	0244-14)								
Chloride, SM4500Cl-B	mg	/kg	Analyze	d By: AC		········			
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	1680	16.0	02/02/2017	ND	432	108	400	0.00	

Analyzed By: AC

Cardinal Laboratories

*=Accredited Analyte

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Celeg D. Keene



TALON LPE
KIMBERLY WILSON
408 W. TEXAS AVE.
ARTESIA NM, 88210
Fax To: (575) 745-8905

Received:

02/01/2017

Sampling Date:

01/27/2017

Reported:

02/02/2017

Sampling Type:

Soil

Project Name:

COTTON DRAW #181 BATTERY

Sampling Condition:

** (See Notes)

Project Number:

700794.205.01

Sample Received By:

Angela Cabrera

Project Location:

EDDY COUNTY, NM

Sample ID: B-3 20' (H700244-15)

Chloride, SM4500Cl-B	mg	/kg	Analyze	d By: AC					
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier
Chloride	448	16.0	02/02/2017	ND	432	108	400	0.00	

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ND

Notes and Definitions

RPD Relative Percent Difference

** Samples not received at proper temperature of 6°C or below.

*** Insufficient time to reach temperature.

- Chloride by SM4500Cl-B does not require samples be received at or below 6°C

Samples reported on an as received basis (wet) unless otherwise noted on report

Analyte NOT DETECTED at or above the reporting limit

Cardinal Laboratories

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Celeg & Keene



CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

101 East Mariand, Hobbs, NM 88249 (575) 393-2326 FAX (575) 393-2476 Talon/LPE Talon/LPE Talon/LPE State: NM Zip: 8821 746-8768 Fax #: 575-746-8905 746-8768 Froject Owner: Mellor To Hom Wilson To Hom Wilson	SOIL OIL SLUDGE OTHER: Phone # ICE / COOL OTHER: OTHER: PRESERV PRESERV ICE / COOL OTHER: ICE / COOL OTHER: ICE / COOL OTHER: ICE / COOL OTHER: ICE / COOL OTHER: ICE / COOL OTHER: ICE / COOL OTHER: ICE / COOL OTHER: ICE / COOL OTHER: ICE / COOL OTHER: ICE / COOL OTHER: ICE / COOL OTHER: ICE / COOL OTHER: ICE / COOL OTHER: ICE / COOL IC	ANALYSIS REQUEST
C)OMP. RS	MATRIX PRESERV SAMPLING	
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32.). G	7.26/1 12:38	
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8	2:55	
2 1	7 +0:4	
2 3	01:4	
PLEASE NOTE: Linking and Countries in Salling and clear's contents money for any clean action whether feated in cantract or cut, that to infinite to the answer paid by the clear to applicable processors of the character whether the method in willing and received by Countries which 30 days after completion of the applicable, analysis. All clears to be character in the content of the character in the content of the character in t	ther feech in contract or text, shall be limited to the amount paid by the cloud for the services in contract or text and be limited in which so days after exceptation of the applicable sends in which and received by Cardinal which see days after exceptation of the applicable subscitturies, loss of use, or has of profile in cardinal by cloud, to subscitturies,	
Relinquished By: Main born Million Date: Received Receive	Phone Result: Yes	EI No Add'l Phone #* EI No Add'l Fax#:
Delivered By: (Circle One) Sampler - UPS - Bas - Other: #15 17.40	Sample Condition CHECKED BY: Cool Indact Cool Indact No No No	



Fage 2 8 2

CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

Same Manue Talon(LPE Scales AVE Scon Company Talon(LPE Scales AVE Scon AVE To 235 AVE Scon AV
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Delivered By: (Circle One)
Sampler - UPS - Bus - Other:

* Cardinal cannot accept verbal changes. Please fax written changes to (575) 393-1326