Restoration Planning and Monitoring Using GPS Technology

Dick Carr
C-M Environmental Group, Inc.
Pinedale, WY

Documentation of Seeding and Monitoring

Rainbow 11-31 – drill seeded 2004

Documentation of Seeding and Monitoring

Rainbow 11-31 – drill seeded 2004

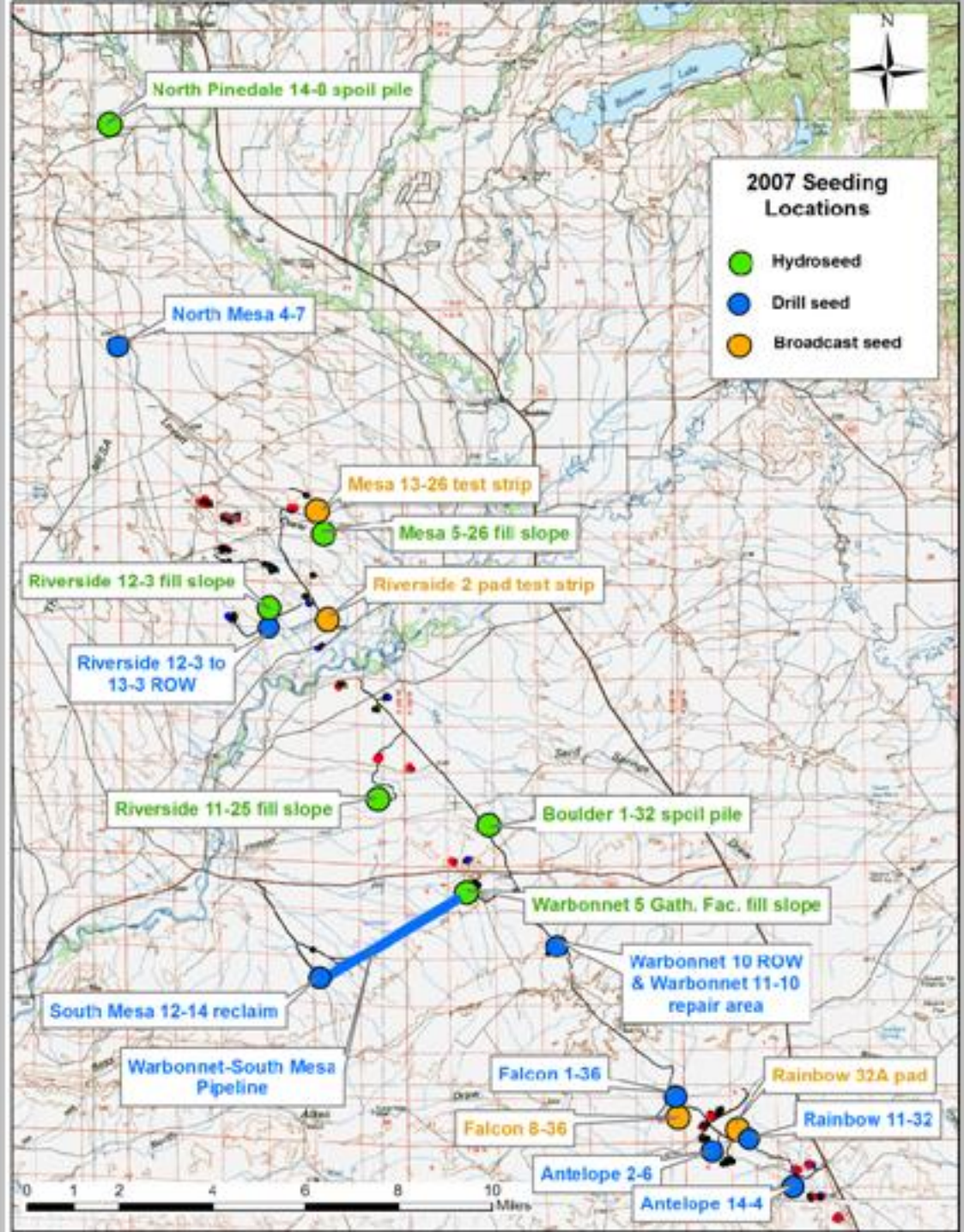
Documentation of Seeding and Monitoring

Antelope 2-9 - hydroseeded 2004

GPS USE FOR RECLAMATION WORK:

- **Map site locations**
- Accurate acreage calculations
  - soilbed preparation
  - seed order planning
- Location of soil samples
- Tracking soil amendment and seeding areas
- Document follow-up monitoring of success or failure
- Weed tracking – noxious or nuisance weeds

Mesa 12-28 – hydroseeded 2004


North Pinedale 14-8 spoil pile
North Mesa 4-7
Mesa 13-26 test strip
Mesa 5-26 fill slope
Riverside 12-3 fill slope
Riverside 2 pad test strip
Riverside 12-3 to 13-3 ROW
Riverside 11-25 fill slope
Boulder 1-32 spoil pile
Warbonnet 5 Gath. Fac. fill slope
Warbonnet 10 ROW & Warbonnet 11-10 repair area
South Mesa 12-14 reclaim
Warbonnet-South Mesa Pipeline
Falcon 1-36
Falcon 8-36
Rainbow 32A pad
Rainbow 11-32
Antelope 2-6
Antelope 14-4
2007 Seeding Locations
Hydroseed
Drill seed
Broadcast seed
N
0 1 2 4 6 8 10
Miles

GPS USE FOR RECLAMATION WORK:

- Site locations
- Accurate acreage calculations
  - soilbed preparation
  - seed order planning
- Location of soil samples
- Tracking soil amendment and seeding areas
- Document follow-up monitoring of success or failure
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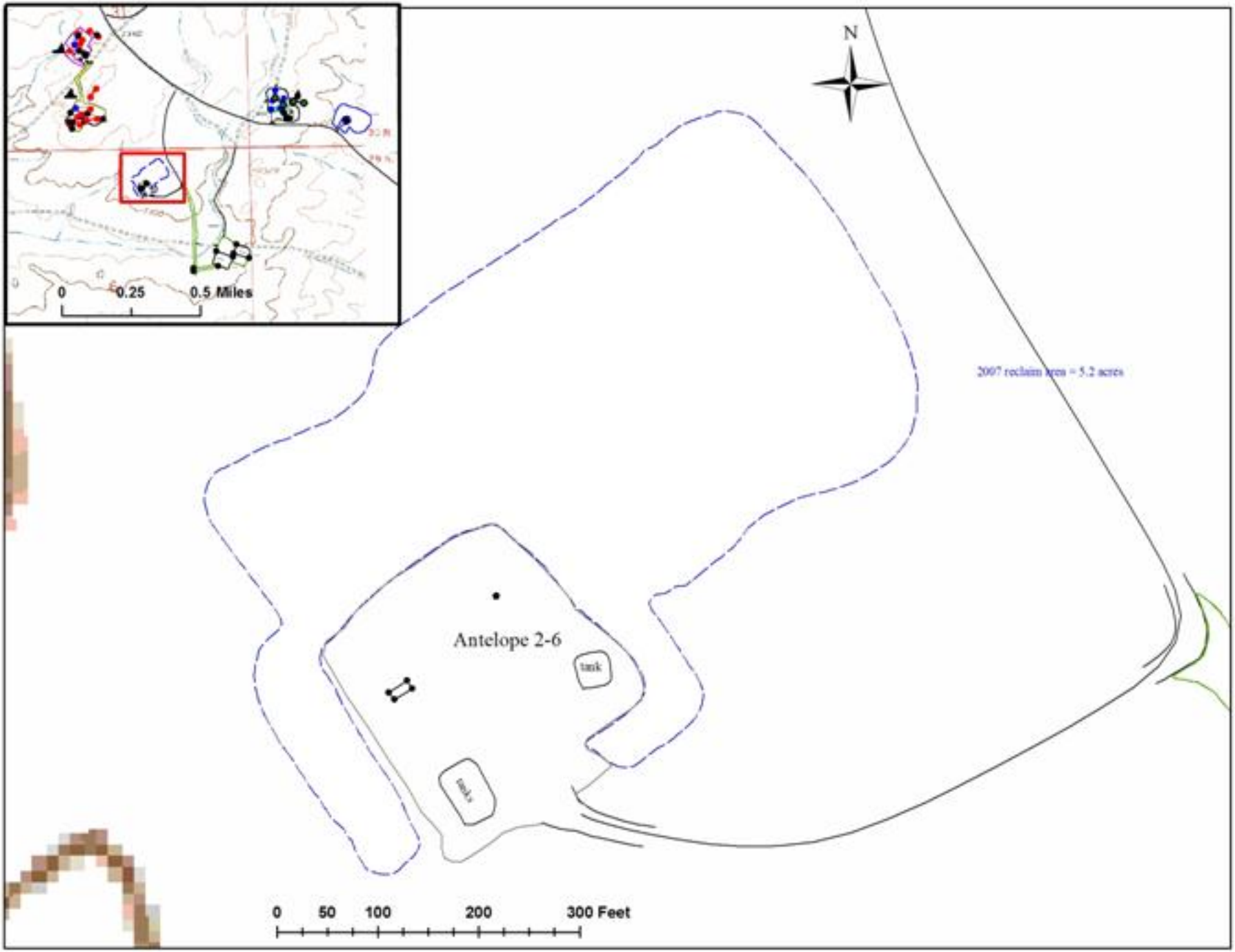
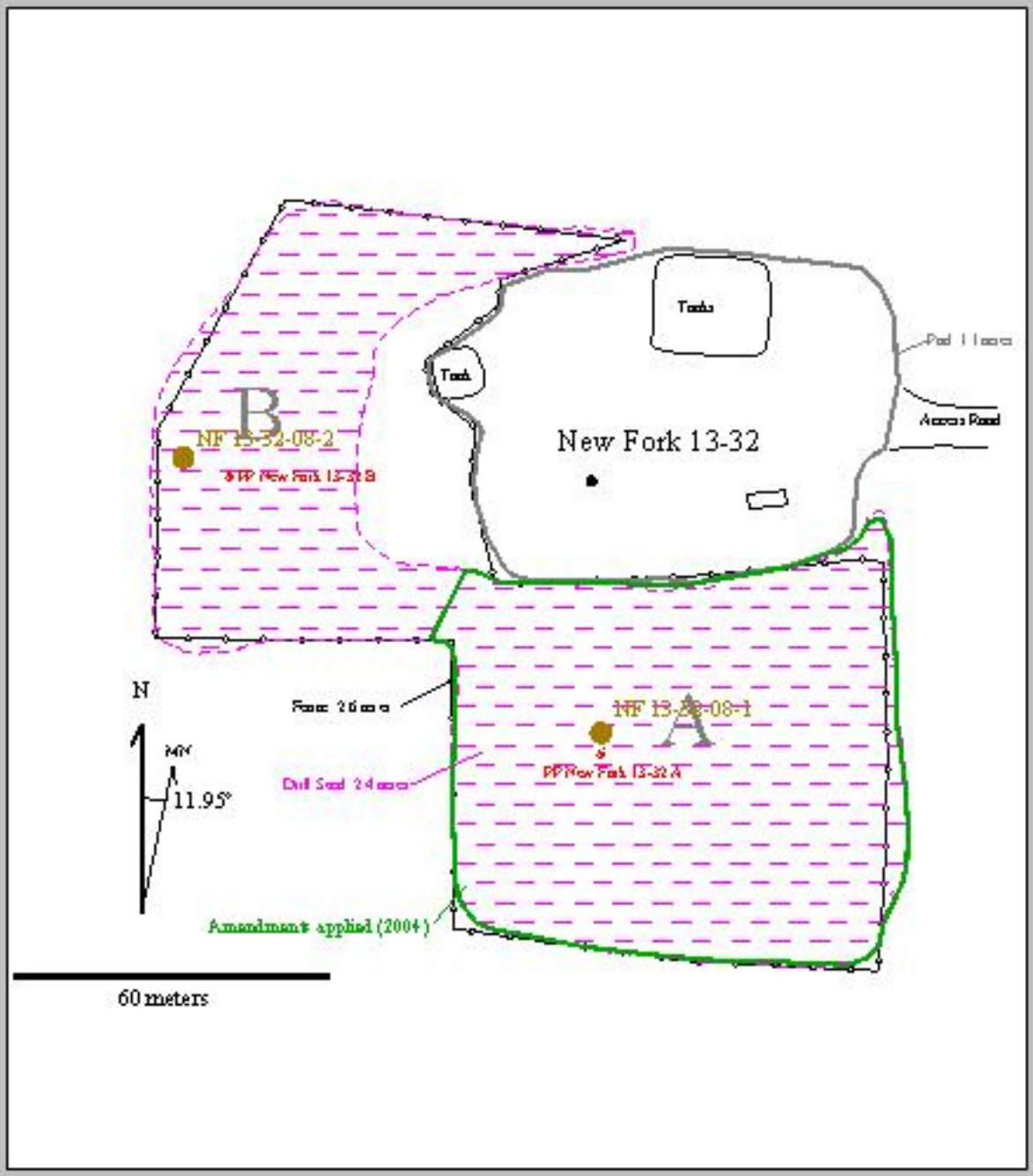
Mesa 12-28 – hydroseeded 2004


N
0
0.25
0.5 Miles
2007 reclaim area = 5.2 acres
Antelope 2-6
tank
tanks
0
50
100
200
300 Feet

GPS USE FOR RECLAMATION WORK:

- Site locations
- Accurate acreage calculations
  - soilbed preparation
  - seed order planning
- Location of soil samples
- Tracking soil amendment and seeding areas
- Document follow-up monitoring of success or failure
- Weed tracking – noxious or nuisance weeds

Mesa 12-28 – hydroseeded 2004


Tanks
Tank
Pad 1 acres
Access Road
New Fork 13-32
B
NF 13-32-08-2
SPP New Fork 13-32 B
N
MN
11.95°
Road 2.6 acres
Drill Seed 2.4 acres
A
SPP New Fork 13-32 A
Amendment applied (2004)
60 meters

GPS USE FOR RECLAMATION WORK:

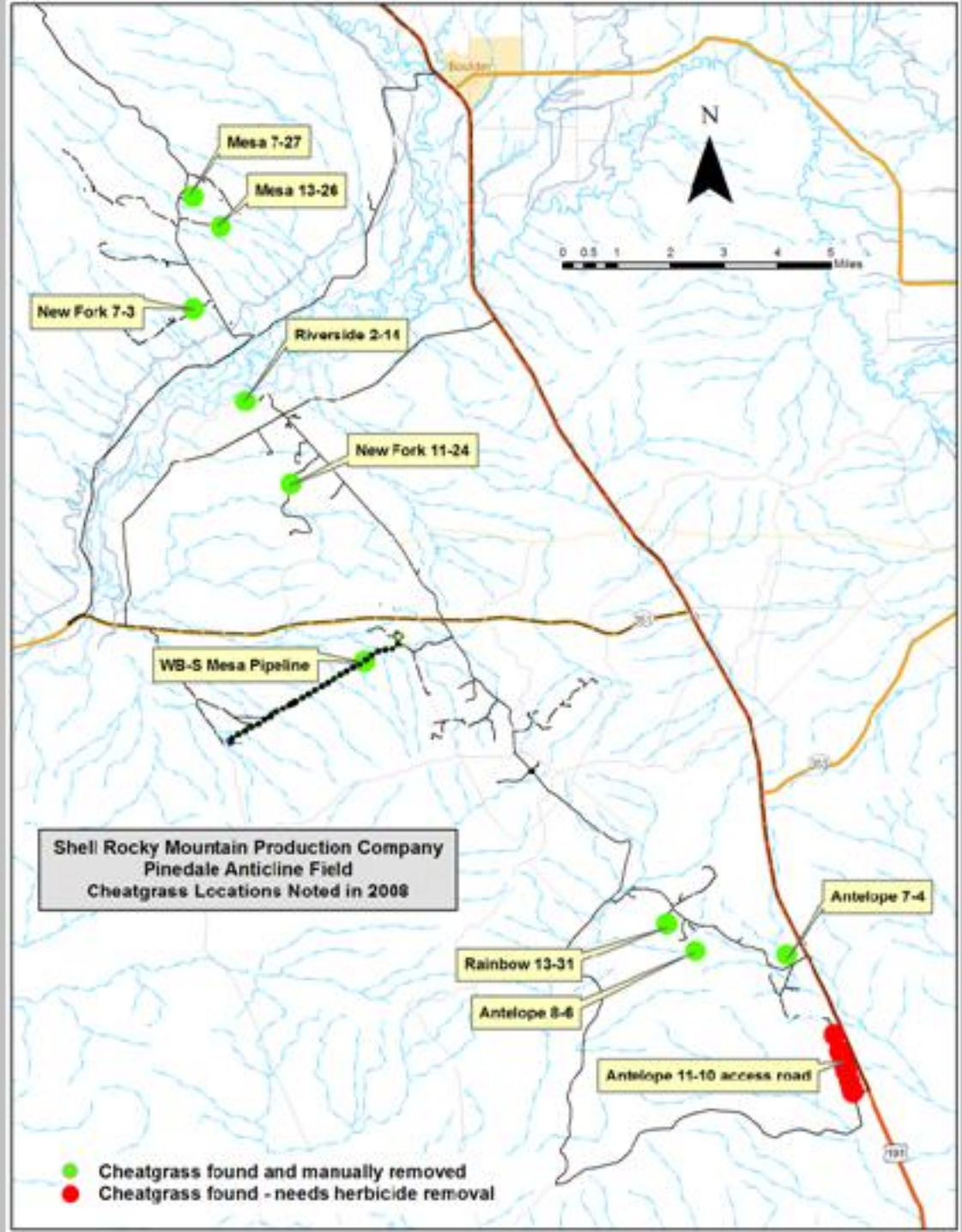
- Site locations
- Accurate acreage calculations
  - soilbed preparation
  - seed order planning
- Location of soil samples
- Tracking soil amendment and seeding areas
- **Document follow-up monitoring – transects, photoplots, etc.**
- Weed tracking – noxious or nuisance weeds

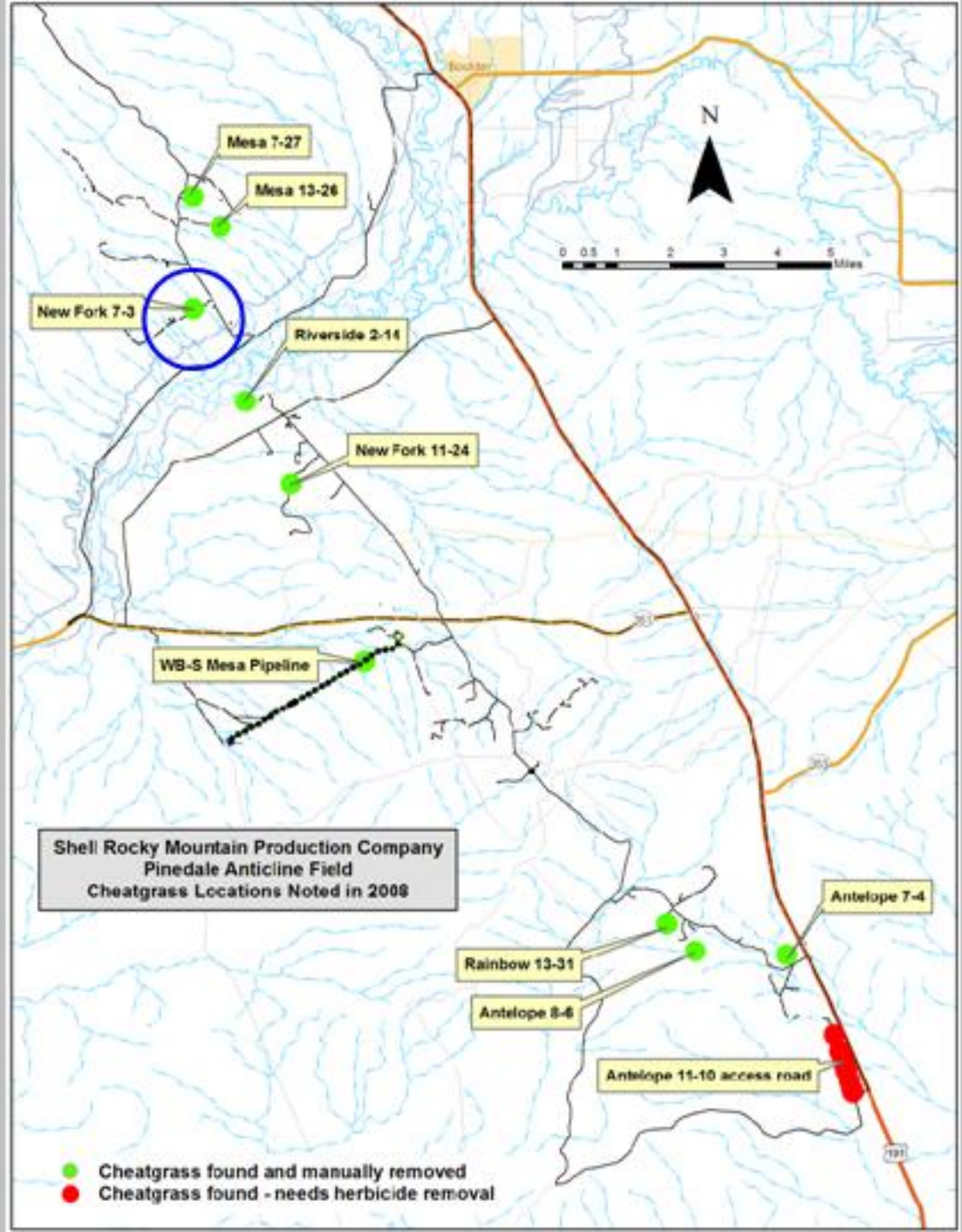
Mesa 12-28 – hydroseeded 2004

GPS USE FOR RECLAMATION WORK:

- Site locations
- Accurate acreage calculations
  - soilbed preparation
  - seed order planning
- Location of soil samples
- Tracking soil amendment and seeding areas
- Document follow-up monitoring of success or failure
- **Weed tracking – noxious or nuisance weeds**

Mesa 12-28 – hydroseeded 2004


Mesa 7-27
Mesa 13-26
New Fork 7-3
Riverside 2-14
New Fork 11-24
WB-S Mesa Pipeline
Antelope 7-4
Rainbow 13-31
Antelope 8-6
Antelope 11-10 access road
N
0 0.5 1 2 3 4 5 Miles
Shell Rocky Mountain Production Company
Pinedale Anticline Field
Cheatgrass Locations Noted in 2008
Cheatgrass found and manually removed
Cheatgrass found - needs herbicide removal


Mesa 7-27
Mesa 13-26
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Antelope 11-10 access road
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0 0.5 1 2 3 4 5 Miles
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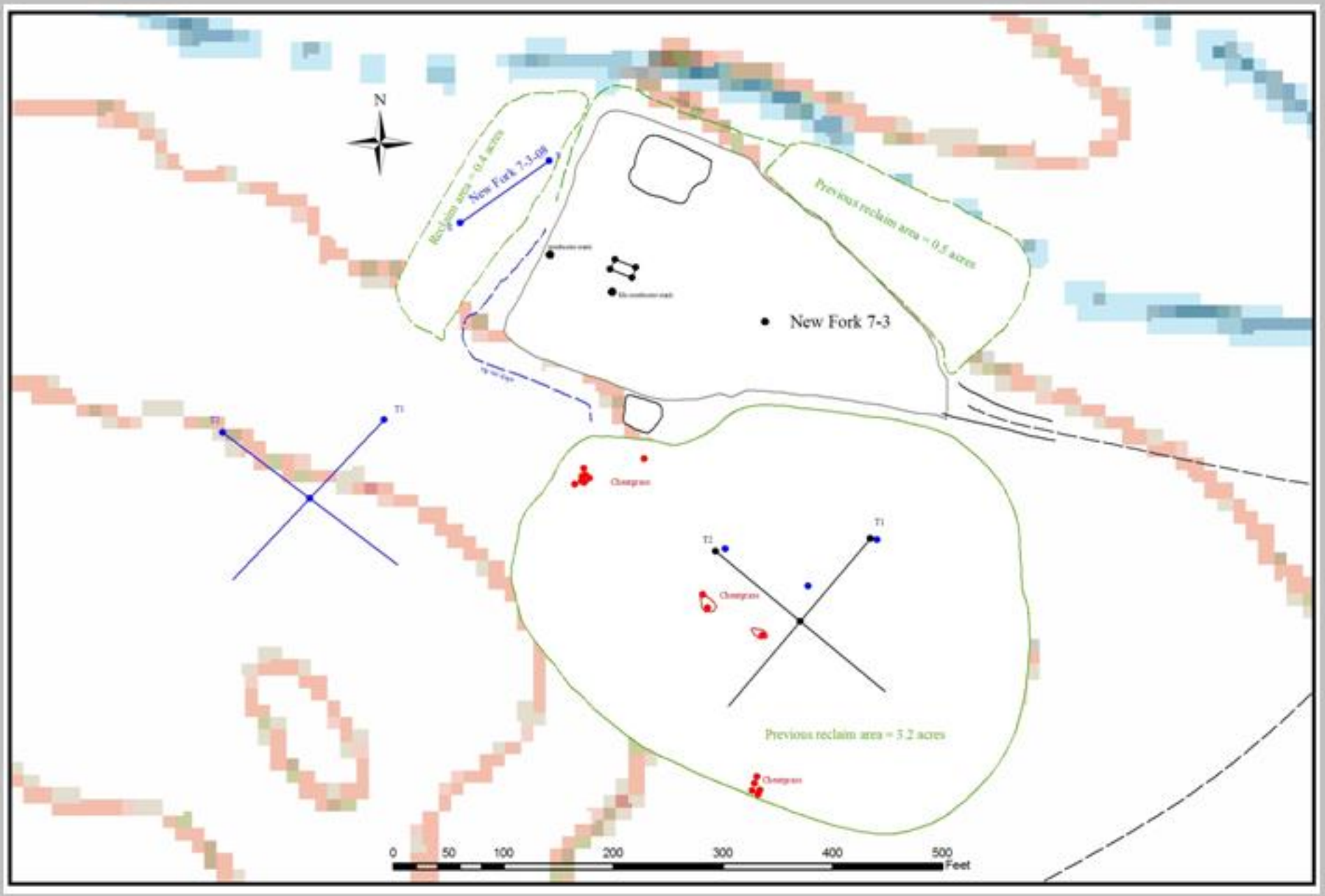
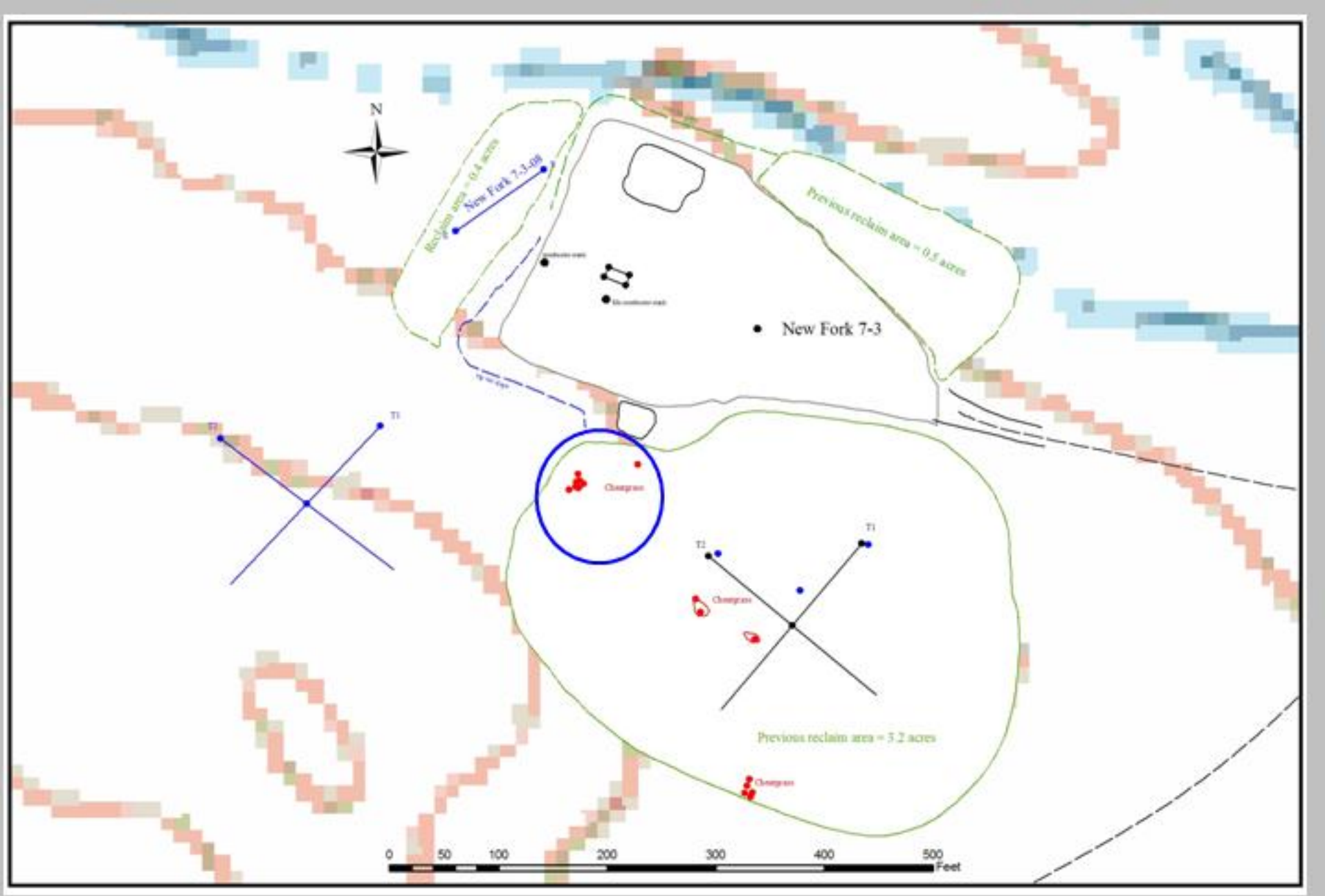
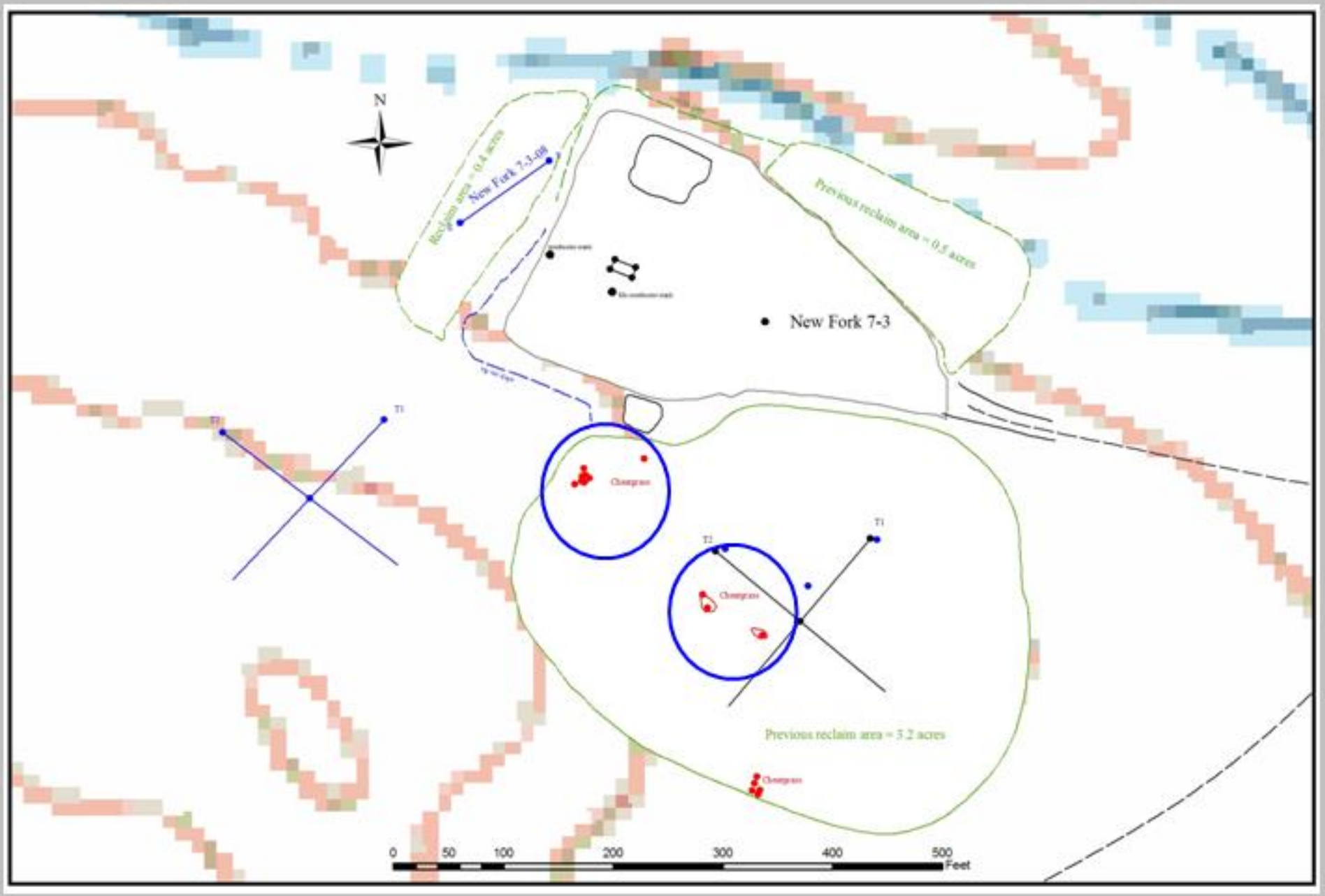
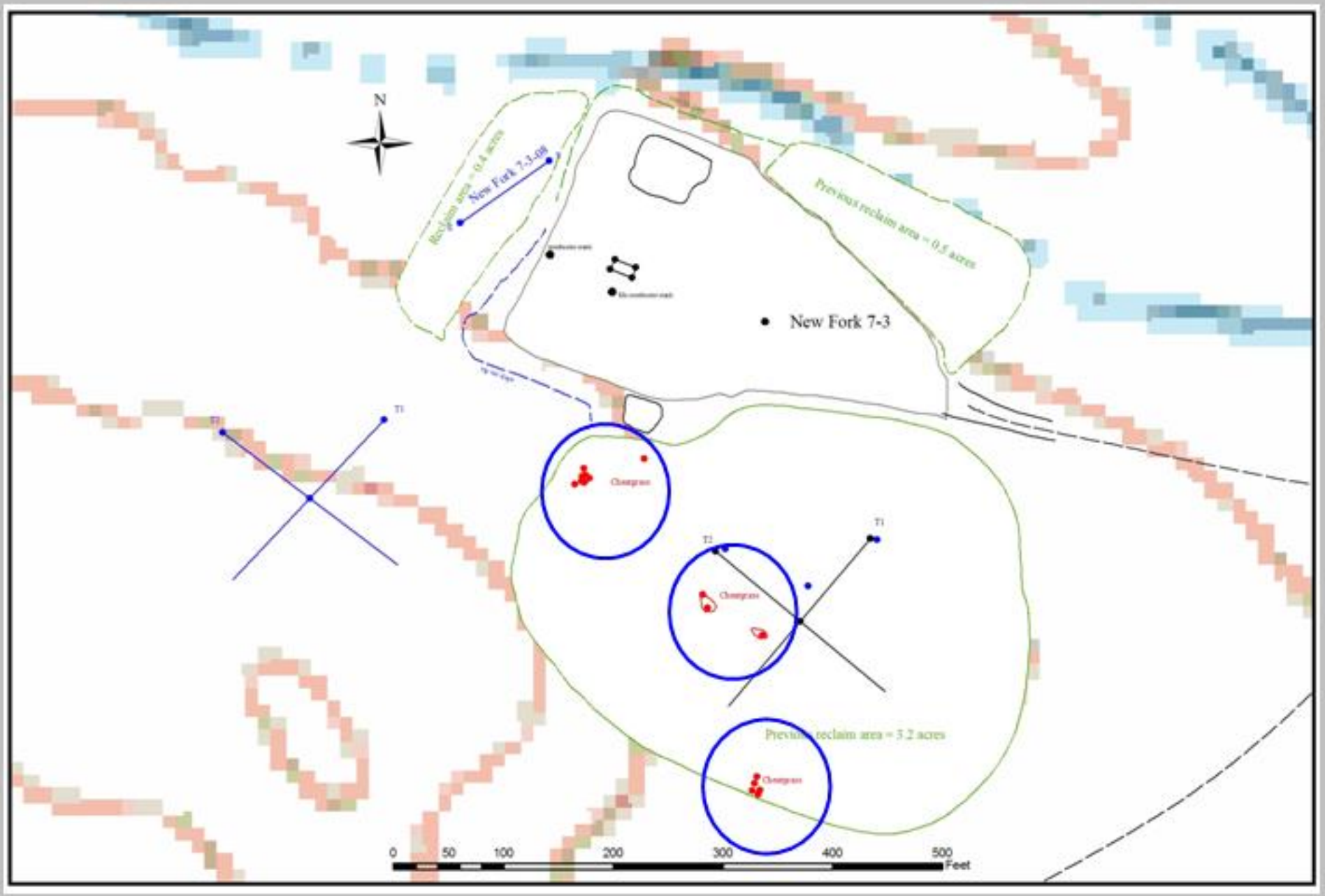

N
Reclaim area = 0.8 acres
New Fork 7-3-08
Previous reclaim area = 0.5 acres
New Fork 7-3
T1
T2
Cheatgrass
Previous reclaim area = 3.2 acres
0
50
100
200
300
400
500
Feet

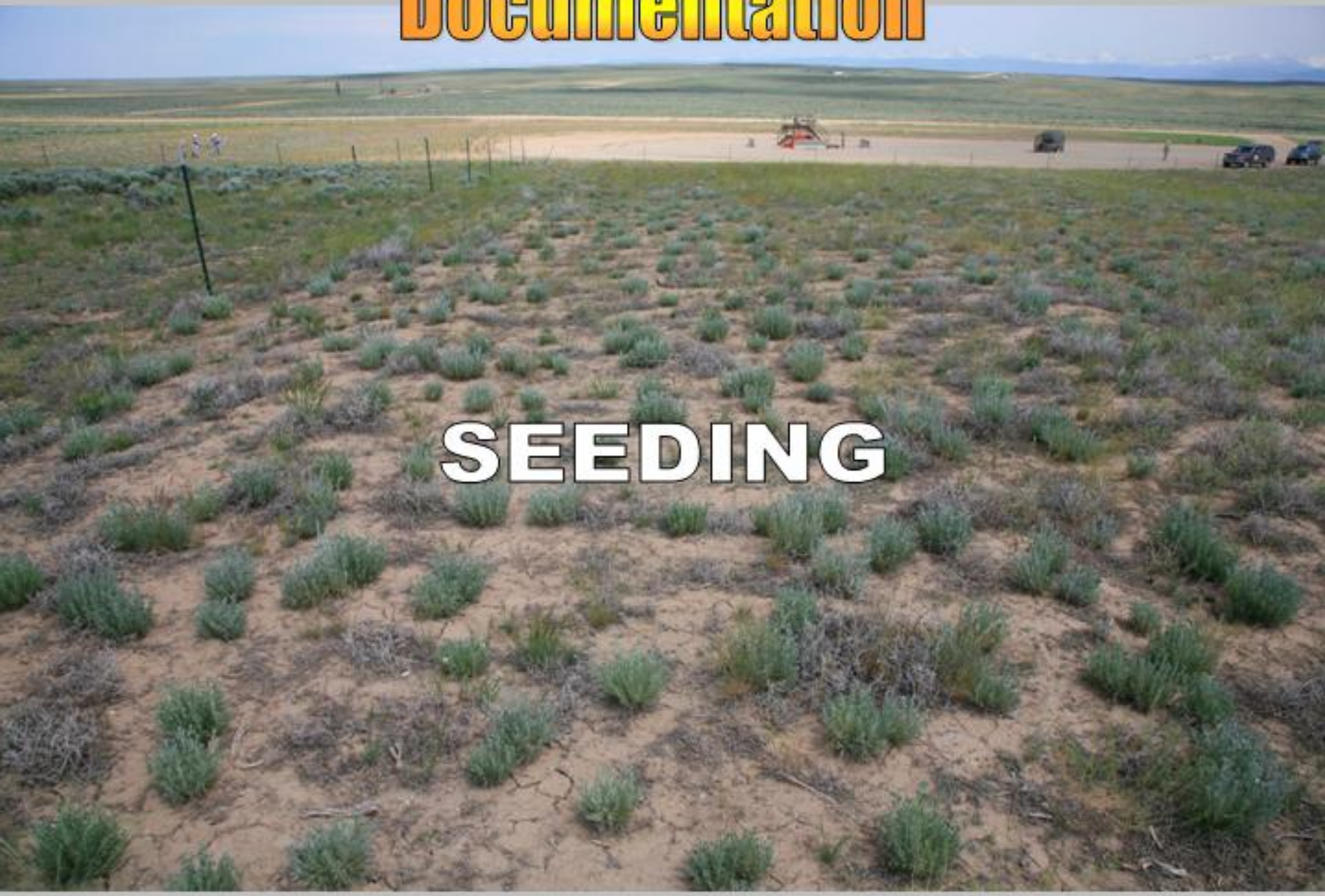

N
Reclaim area = 0.8 acres
New Fork 7-3-08
Previous reclaim area = 0.5 acres
New Fork 7-3
T1
T2
Clumpgrass
Previous reclaim area = 3.2 acres
0
50
100
200
300
400
500
Feet


N
Reclaim area = 0.8 acres
New Fork 7-3-08
Previous reclaim area = 0.5 acres
New Fork 7-3
T1
T2
Clumpgrass
Previous reclaim area = 3.2 acres
0
50
100
200
300
400
500
Feet

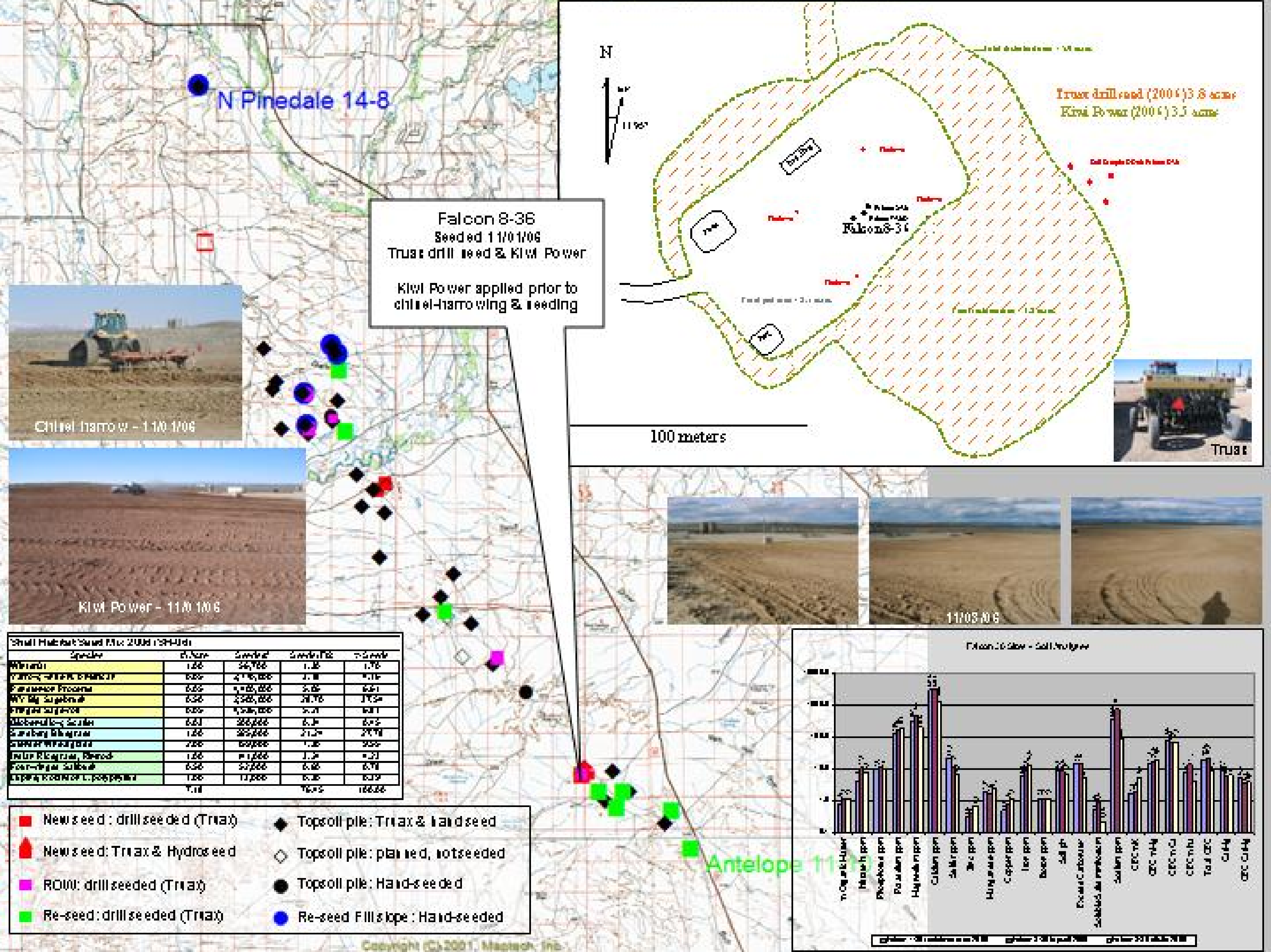

N
New Fork 7-3
Previous reclaim area = 0.5 acres
Previous reclaim area = 3.2 acres
T1
T2
0
50
100
200
300
400
500
Feet

New Fork 7-3 – drill seeded 2003; grass mix

Documentation



Antelope 2-9 - hydroseeded 2004



N Pinedale 14-8
Falcon 8-36
Seeded 11/01/06
Trus: drill seed & Kiwi Power
Kiwi Power applied prior to
chisel-harrowing & seeding
Chisel harrow - 11/01/06
Kiwi Power - 11/01/06
N
Truax drill seed (2006) 3.8 acres
Kiwi Power (2006) 3.5 acres
Falcon 8-36
100 meters
Truax
11/03/06
Antelope 11-11
New seed : drill seeded (Truax)
New seed: Truax & Hydroseed
ROW: drill seeded (Truax)
Re-seed: drill seeded (Truax)
Topsoil pile: Truax & hand seed
Topsoil pile: planned, not seeded
Topsoil pile: Hand-seeded
Re-seed Fillslope: Hand-seeded
Copyright (C) 2001, Maptech, Inc.

FALCON 8-36

Notes:

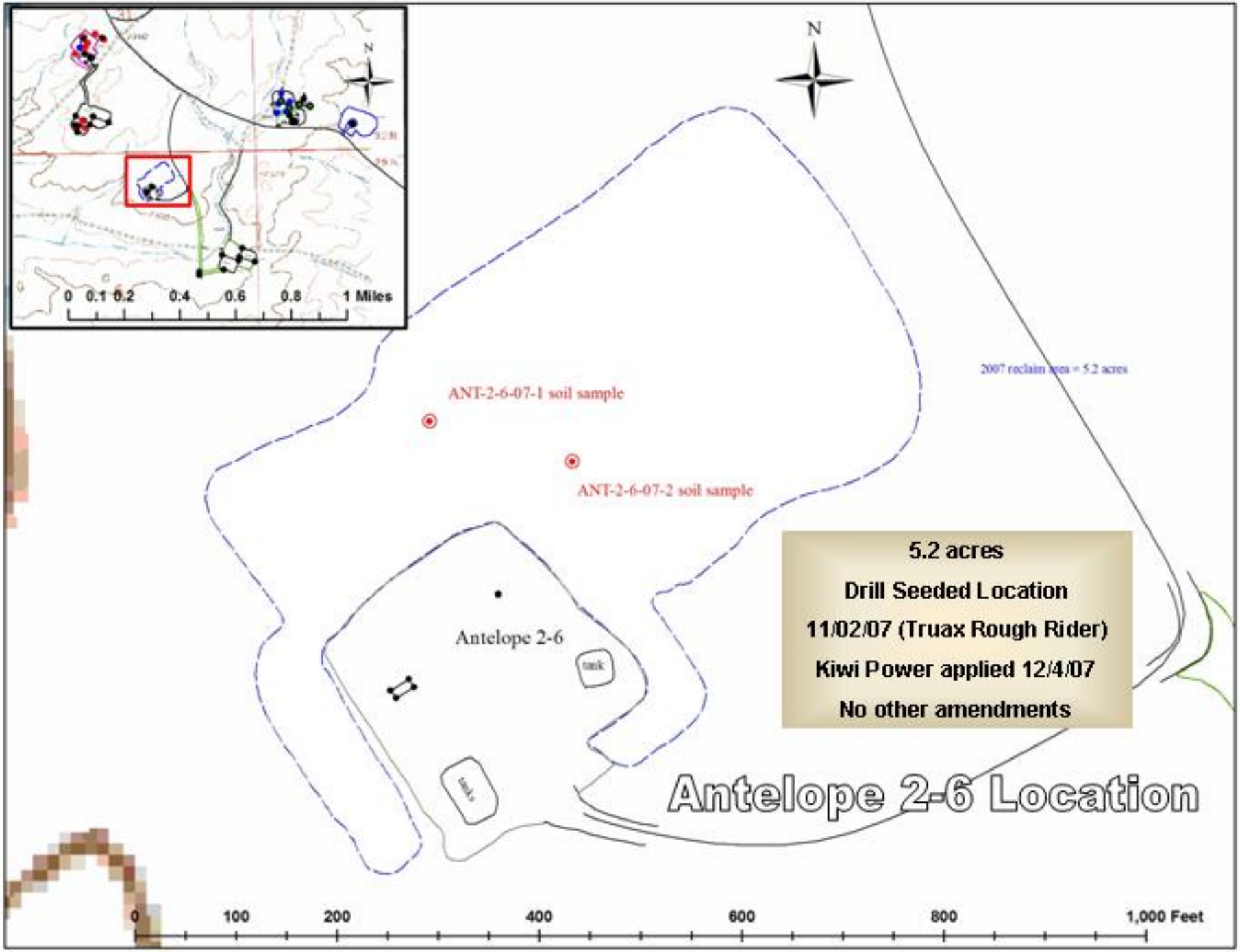
Used CDL chisel to rough up seedbed surface
Used CDL 8 ft. Traux drill seeder – 7 inch row spacing
Used CDL light bar and chain drag behind Truax

- Seed mix: SH06
- 2 grass/forb mixes combined to back box and calibrated to ~7.5 lbs/ac (15 grams @ 13.25 spins) - scale was only in 5 gram increments.. 4-wing Saltbush would not flow through front box with small plastic tubes.
- Calibrated fluffy box to ~ 10 lbs/ac (#3 sprocket) and let tubes hang loose.

Seeded 11/1/06.

Kiwi Power – 17.5 gallons applied with truck-mounted sprayer (Star Valley Sod Company) on 11/1/06 over topsoil prior to chisel-disc and seeding.

Reclaimed location was very hard-packed from earth-mover wheel traffic. CDL used Challenger tractor-pulled chisel to break up surface prior to seeding.


N
0 0.1 0.2 0.4 0.6 0.8 1 Miles
2007 reclaim area = 5.2 acres
ANT-2-6-07-1 soil sample
ANT-2-6-07-2 soil sample
Antelope 2-6
tank
tank
5.2 acres
Drill Seeded Location
11/02/07 (Truax Rough Rider)
Kiwi Power applied 12/4/07
No other amendments
Antelope 2-6 Location
0 100 200 400 600 800 1,000 Feet

Comstock Seed (CS); Granite Seed (GS); Wind River Seed (WR)

Shell Habitat Seed Mix SH07

Species	#/Acre	Seeds/#	Seeds/Ft2	% Seeds	Vendor	V.R.lot#
Globemallow, Scarlet	0.05	500,000	0.52	0.59	CS	
Sandberg Bluegrass	1.50	925,000	31.85	32.41	WR	
Winterfat	1.00	56,700	1.30	1.32	WR	[illegible]
Yarrow, Western	0.10	2,770,000	6.36	6.47	CS	
Penstemon eatonii (Firecracker P)	0.15	351,000	1.21	1.23	WR	
WY Big Sagebrush	0.50	2,500,000	28.70	29.20	WR	[illegible]
Fringed Sagewort	0.10	4,536,000	10.41	10.60	WR	[illegible]
Thickspike Wheatgrass Critana	1.00	145,000	3.33	3.39	WR	[illegible]
Slender Wheatgrass Revenue	2.00	159,000	7.30	7.43	WR	[illegible]
Indian Ricegrass, Rimrock	2.00	141,000	6.47	6.59	WR	[illegible]
Four-winged Saltbush	0.50	52,000	0.60	0.61	WR	
Silky Lupine (Lupinus sericeus) P	0.50	20,000	0.23	0.23	CS	
	9.40		98.28	100.00		

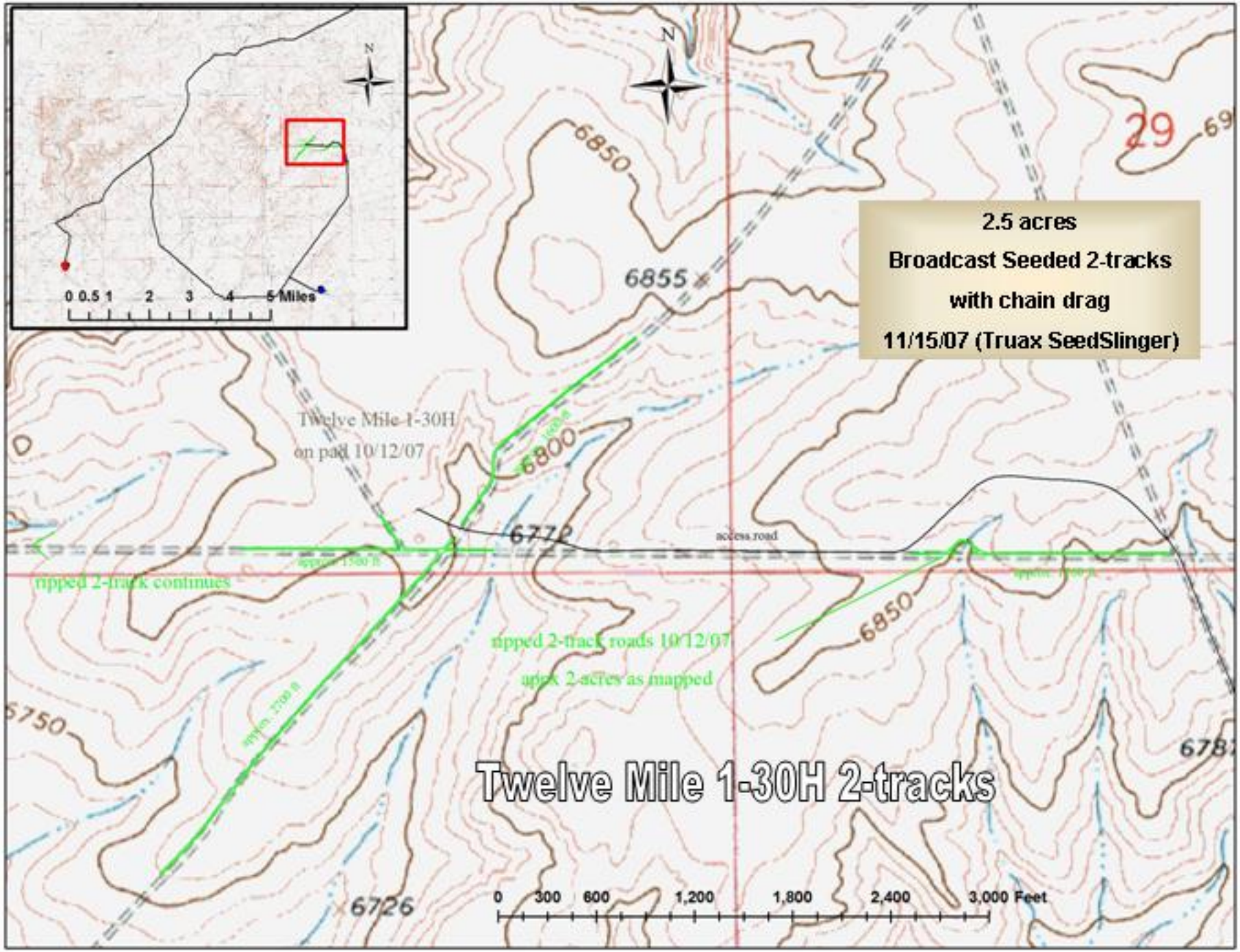
- Truax Range Drill (Small Seed Box = Front Box) — blue
- Truax Range Drill Surface Seed Box (Fluffy Box = Middle Box) — yellow
- Truax Range Drill (Grass "Cool Season" Box = Back Box) — green

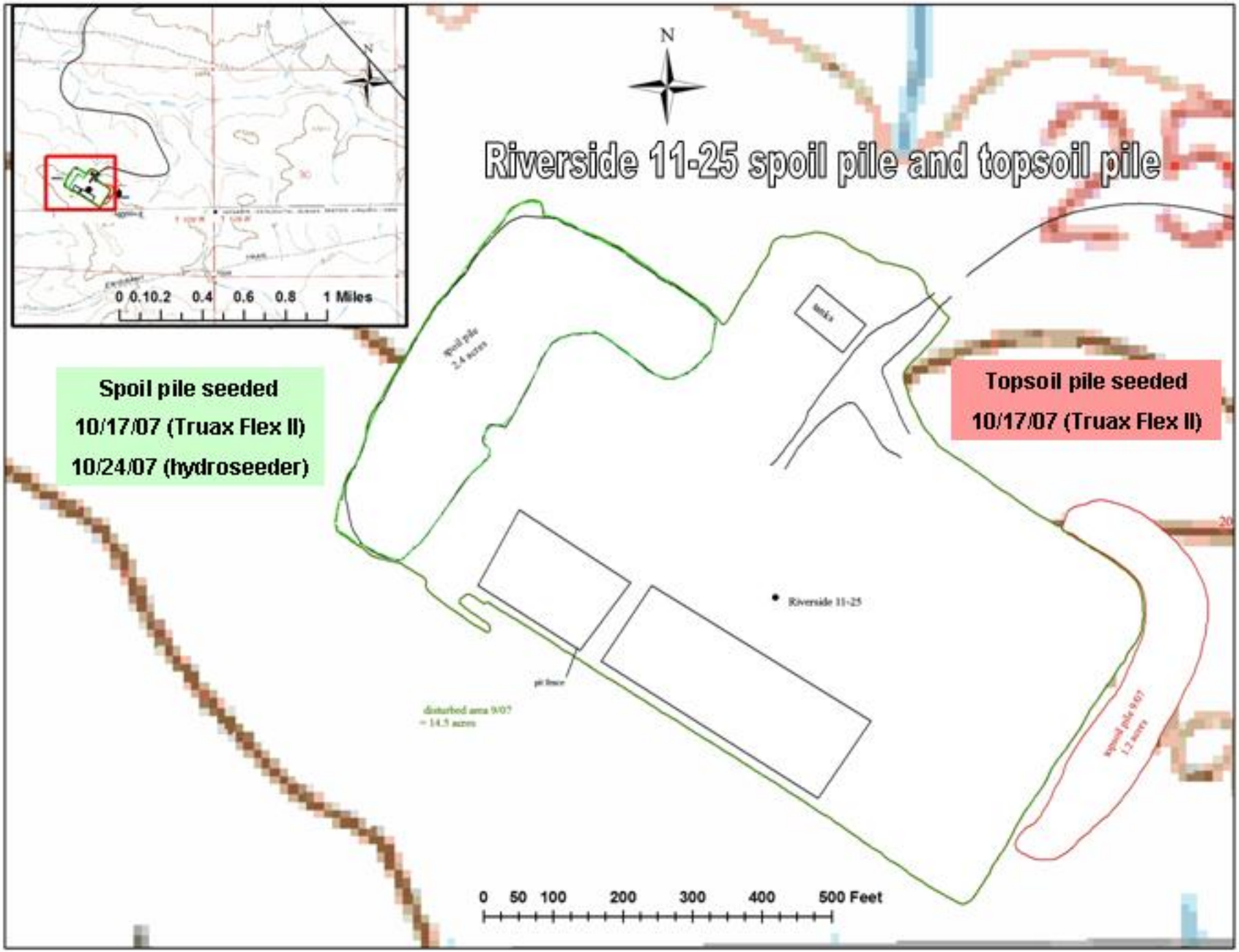
Soil Samples - 2004-2005-2006

Sample Number	Sample Location	Sample Type	Date	Depth Sampled	% Organic Matter	Nitrate-N ppm	Phosphorus ppm	Potassium ppm	Magnesium ppm	Calcium ppm	Sodium ppm	Zinc ppm	Manganese ppm	Copper ppm	Iron ppm	Boron ppm	Soil pH	Buffer Index	Sulfate ppm	Total CEC	Ca/Mg	CEC Ca/Mg	% Sand	% Silt	% Clay	Soil Texture
ANT 2-6-ST-2	[illegible]	SC	[illegible]	16	2.6	86.6	87	462	227	1956	25.6	1.5	9.6	1.6	127.1	6.6	6.2	7.1	26	11.9	6.4	3.8	73.2	20.8	6	Loamy Sand
ANT 2-6-ST-1	[illegible]	SC	[illegible]	16	1.2	36.6	12	218	333	2442	21.6	6.8	3.3	6.8	13.8	6.6	7.9		78	15.9	7.3	4.4	75.2	18.8	6	Sandy Loam

Shell Habitat Seed Mix for Broadcast on Twelvemile 1-30H 2-tracks

Species	PLS #/Acre	Seed #/#	Seed #/Ft2	Vendor	
Globemallow, Scarlet	0.05	500,000	0.52	CS	Front box SHMIX
Sandberg Bluegrass	1.50	925,000	31.85	WR	
Winterfat	1.00	96,700	1.30	WR	SHUTAS Blend
WY Big Sagebrush	0.50	2,500,000	28.70	WR	
Fringed Sagewort	0.10	4,536,000	10.41	WR	
Indian Ricegrass, Rimrock	1.00	141,000	3.24	WR	
Four-winged Saltbush	0.50	52,000	0.60	WR	SHUSAS-Truax Blend
Lupine, Robinson L. polyphyllus	1.00	13,000	0.30	WR	
Antelope Bitterbrush	0.25	15,000	0.09	WR	


0 0.5 1 2 3 4 5 Miles
2.5 acres
Broadcast Seeded 2-tracks
with chain drag
11/15/07 (Truax SeedSlinger)
Twelve Mile 1-30H
on pad 10/12/07
ripped 2-track continues
ripped 2-track roads 10/12/07
aprx. 2 acres as mapped
access road
6850
6855
6800
6772
6750
6726
29
Twelve Mile 1-30H 2-tracks
0 300 600 1,200 1,800 2,400 3,000 Feet


Riverside 11-25 spoil pile and topsoil pile
N
0 0.10.2 0.4 0.6 0.8 1 Miles
Spoil pile seeded
10/17/07 (Truax Flex II)
10/24/07 (hydroseeder)
Topsoil pile seeded
10/17/07 (Truax Flex II)
Riverside 11-25
0 50 100 200 300 400 500 Feet

Riverside 11-25 spoil pile and topsoil pile

Riverside 11-25 spoil pile

- 4 lb/Acre Zinc – liquid inform
- 10 lb/Acre Urea
- 25 lb/Acre P2O5
- 30 lb/Acre K2O
- 1 ton/Acre Fertile-Fibers
- 5 gal/Acre Kiwi Power
- 65 gal/acre Atlas Soil Loc
- 20 lbs/acre Tack fibers
- 52 lbs/acre Stronghold Fibers

Grass Mix for Spoil Piles (GSP)

V.R. Need

Species	#/Acre	Seed/sf	Seed/sf-2	% Seed	Vendor	
WW Big Sage	0.25	2,500,000	14.35	12.86	WR	GSP-H
Sagebrush Louisiana	0.10	4,500,000	10.33	9.26	WR	GSP-H
Sandberg Bluegrass	2.00	925,000	42.47	38.08	WR	GSP-H
Slender Wheatgrass Revenue	4.00	159,000	14.60	13.09	WR	GSP-0
Bluebunch Wheatgrass Secar	3.00	140,000	9.64	8.64	WR	GSP-0
Indian Ricegrass Rimrock	3.00	141,000	9.71	8.71	WR	GSP-0
Cereal Barley Hankington	20.00	11,000	5.05	4.53	CS	
	32.85		111.54	100.00		

Drill seed 2/3 of mix (Truax Flex II)
Hydroseed Mix (includes 1/3 of GSP-8 mix)

Covenant Seed (CS); Granite Seed (GS); Wire River Seed (WR)

Grass Mix for Topsoil Piles (GTP)

V.R. Need

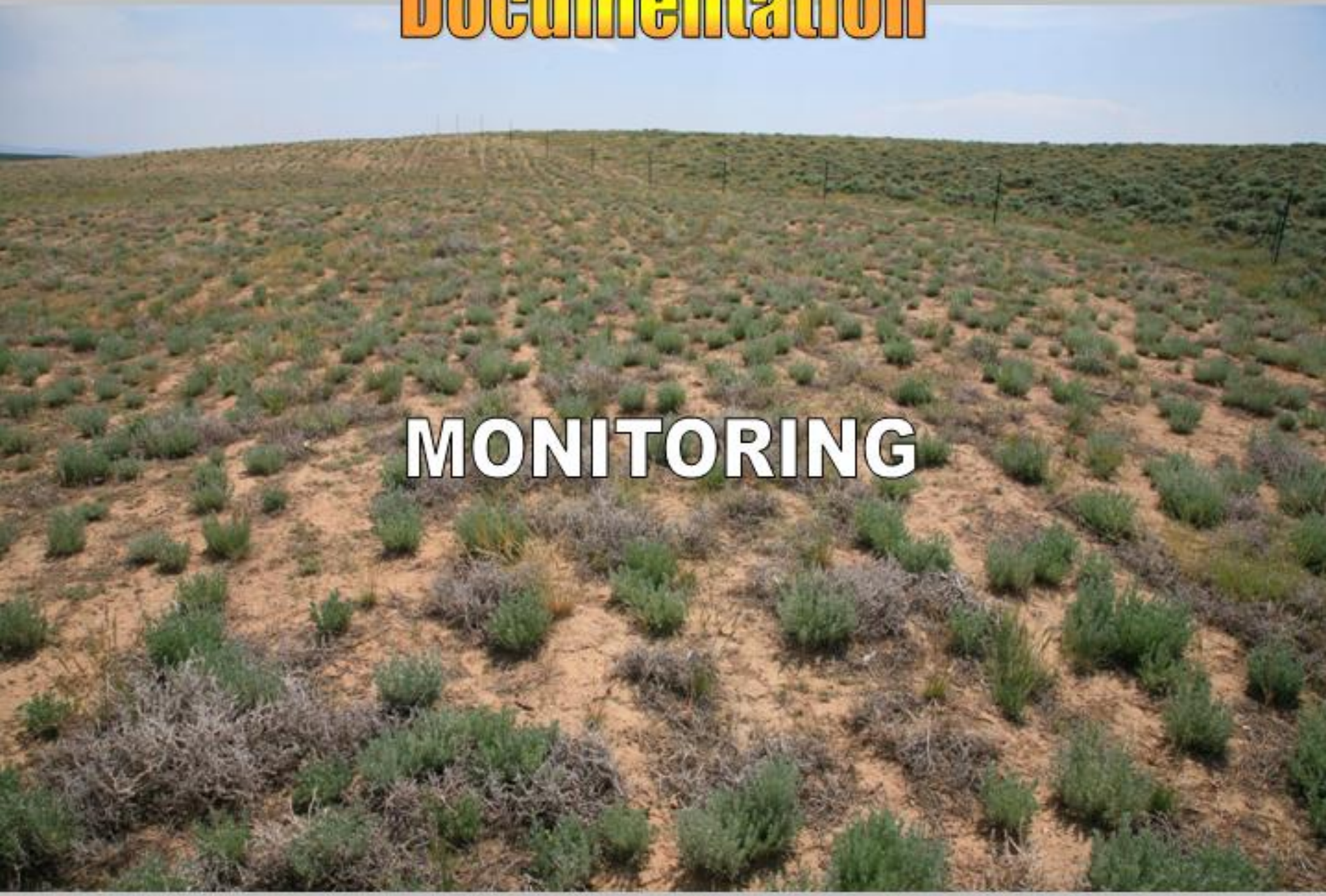
Species	#/Acre	Seed/sf	Seed/sf-2	% Seed	Vendor	
Sandberg Bluegrass	2.00	925,000	42.47	47.40	WR	
WW Big Sage	0.25	2,500,000	14.35	16.01	WR	
Slender Wheatgrass Revenue	4.00	159,000	14.60	16.29	WR	GTP-0
Bluebunch Wheatgrass Secar	2.00	140,000	8.64	10.76	WR	GTP-0
Indian Ricegrass Rimrock	2.84	141,000	8.55	9.54	WR	GTP-0
	11.09		89.81	100.00		

Truax Flex II Drill Small Seed Box. (+ Front Box)
Truax Flex II Drill Surface Seed Box. (Fluffy Box + Middle Box)
Truax Flex II Drill Grass "Cool Season" Box. (+ Back Box)

Soil Samples

Sample Number	Sample Location	Sample Type	Date	% Organic Matter	Nitrate N ppm	Phosphorus ppm	Potassium ppm	Magnesium ppm	Calcium ppm	Sulfur ppm	Zinc ppm	Manganese ppm	Copper ppm	Iron ppm	Boron ppm	Soil pH	Soluble Salts mmhos/cm	Sodium ppm	Total CEC	Ca/Mg	CEC Ca/Mg	% Sand	% Silt	% Clay	Soil Texture
RIV 11-25 SP-ST	Riverside 11-25 spoil pile	SP	10/17/07	0.7	3.6	1	81	181	3842	97.6	6.2	1.7	0.4	53	0.9	8.4	0.64	241	23.5	7.6	1.5	77.2	16.8	6	Loamy Sand

Documentation



Antelope 2-9 - hydroseeded 2004

Whitebark, Inc.

Antelope 2-9 - hydroseeded 2004


Aster Canyon Consulting
Antelope 7-4 reference site


C-M Environmental Group, Inc.
Antelope 14-4 – drill seeded 2007


C-M Environmental Group, Inc.
Warbonnet pipeline – drill seeded 2007


C-M Environmental Group, Inc.
Antelope 11-10 – drill seeded 2005

Date:	7/27/2005
Transect Name:	Rainbow 11-31-05
Transect Length (ft):	200
Observers:	Dale, Carr

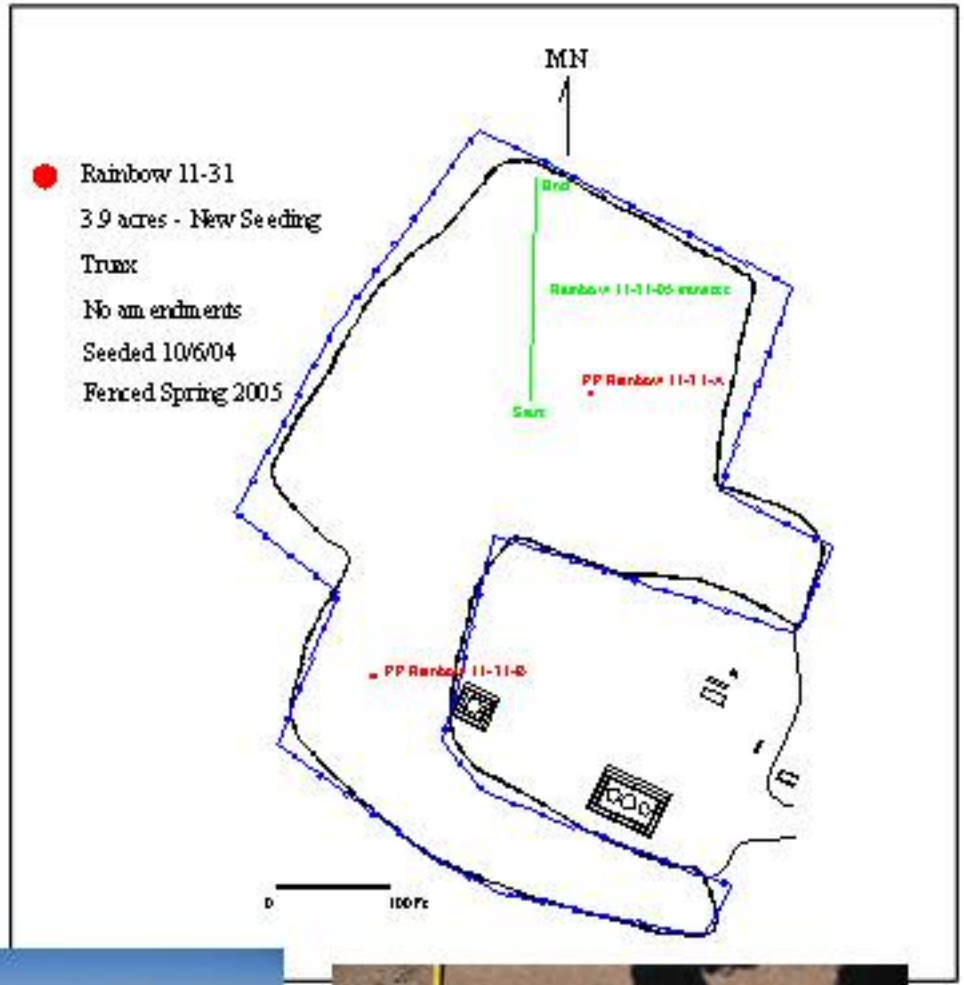
Basal Ground Cover Point Intercept	
Grass	5%
Forb	5%
Shrub	
Bare Ground	90%
Gravel	
Rock	
Litter	
Woody Litter	
Cryptogam	

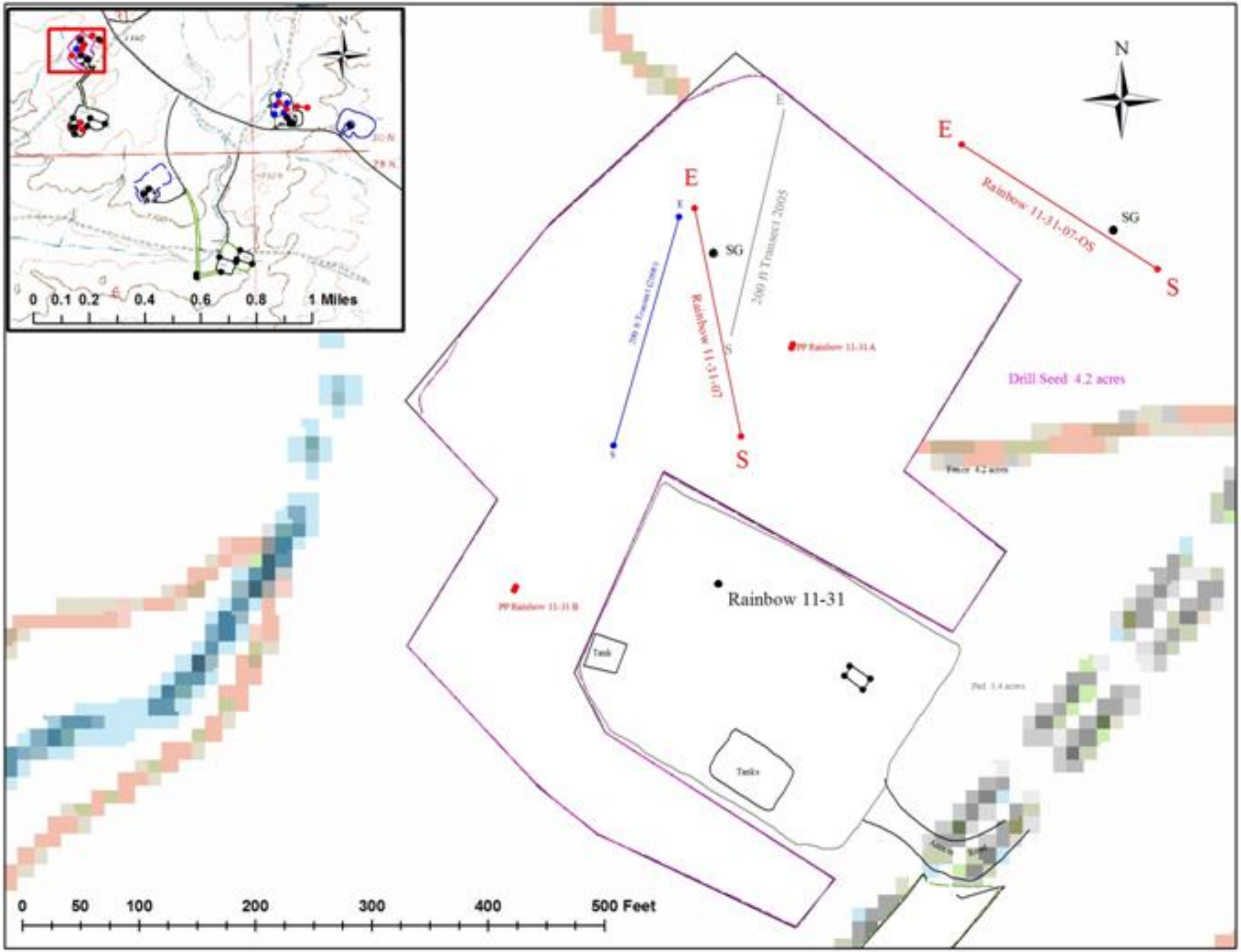
	Mean (cm)	Std Dev.
Sage Ht w/in 5 ft radius (excl. no-sage points):	3.7	1.0
Sage Ht w/in 5 ft radius (incl. all points):	3.7	1.0
Total %canopy:	0.69%	

Species	% Composition
Undesirable forbs	52.1
Sandberg Bluegrass	21.6
Sage	12.1
Ricegrass	10.5
Unkn. forb 2	2.1
Lupine	0.5
Unkn. forb 1	0.5
Four-wing saltbush	0.5
Yarrow	0.0

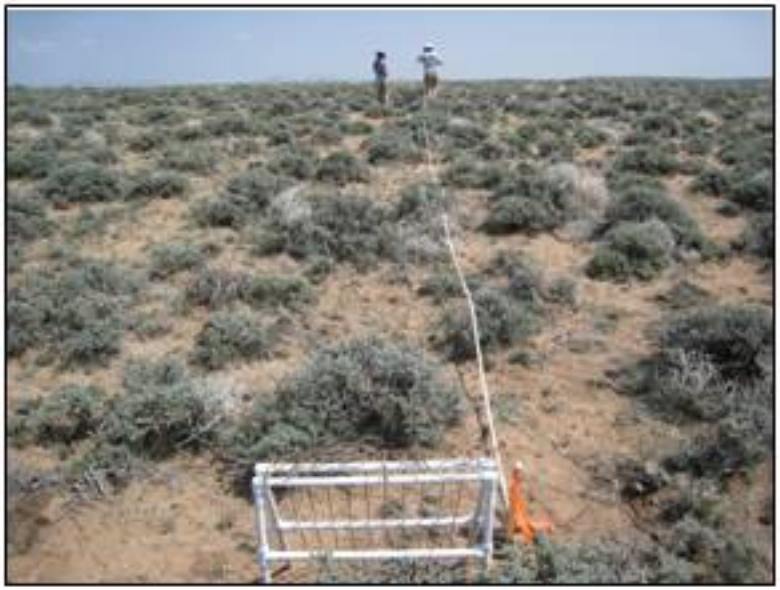
Weeds:

Also present:



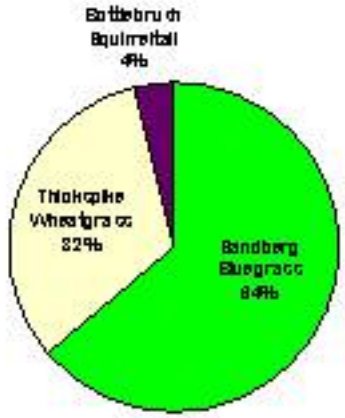

N
E
Rainbow 11-31-07-DS
SG
S
E
E
SG
200 ft Transect 2005
Rainbow 11-31-07
S
PP Rainbow 11-31A
Drill Seed 4.2 acres
Rainbow 11-31
PP Rainbow 11-31B
Tank
Tanks
0 0.1 0.2 0.4 0.6 0.8 1 Miles
0 50 100 200 300 400 500 Feet

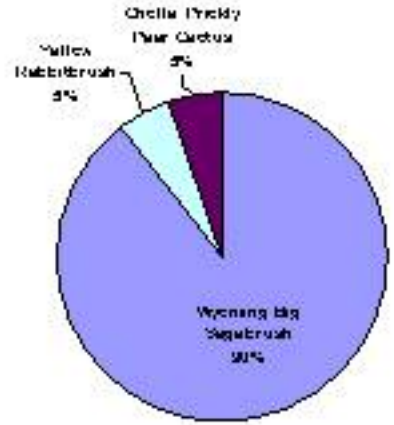
Rainbow 11-31-07-OS Offsite



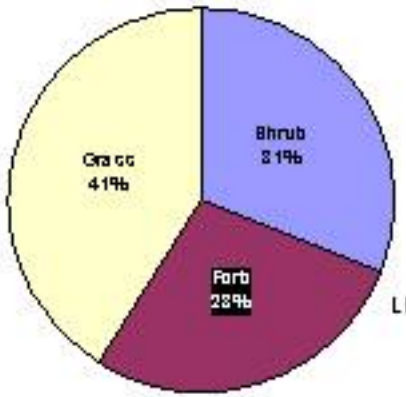
2007 relative basal ground cover data

10 point frames (2000 points total)





Grasses **Shrubs**



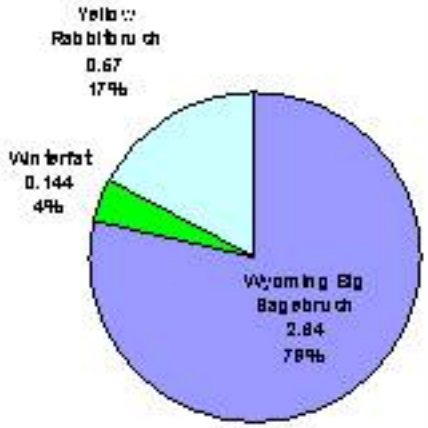
Vegetation

200 ft Transect

5/15/07

Average shrub heights (n of 20 pts):

WB Sage = 245 mm (20)



Shrub Density (plts/m2)

Percent Canopy Cover:

TOTAL: 30.70%

WB Sage = 30.50%

Y Rabbitbrush = 0.20%

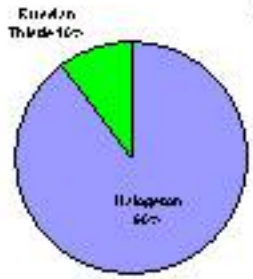
2007 belt and line transect data

Rainbow 11-31-07 Onsite

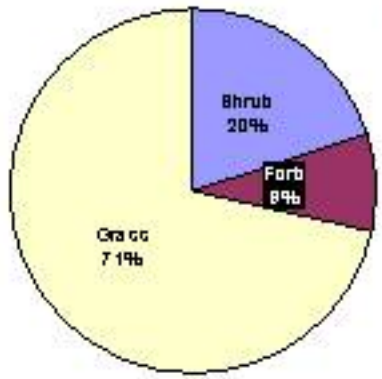
2007 relative basal ground cover data

10 point frames (2000 points total)

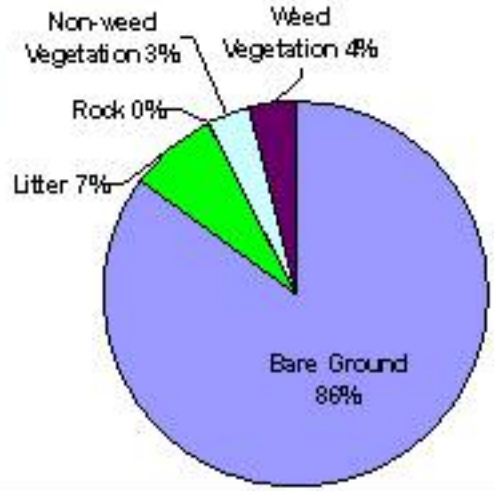
Grasses **Shrubs**



Weeds



Non-Weed Vegetation



200 ft Transect

5/15/07

Average shrub heights (n of 20 pts):

WB Sage = 71 mm (20)

Winterfat = 60 mm (1)

Fourwing Saltbush = 64 mm (7)

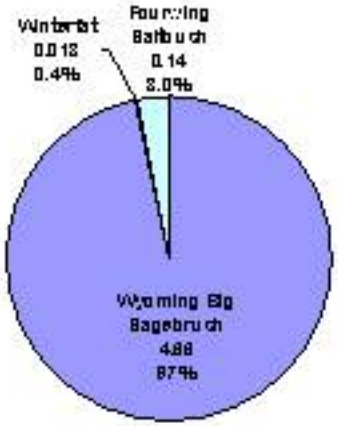
Y Rabbitbrush = 70 mm (2)

Percent Canopy Cover:

TOTAL: 6.32%

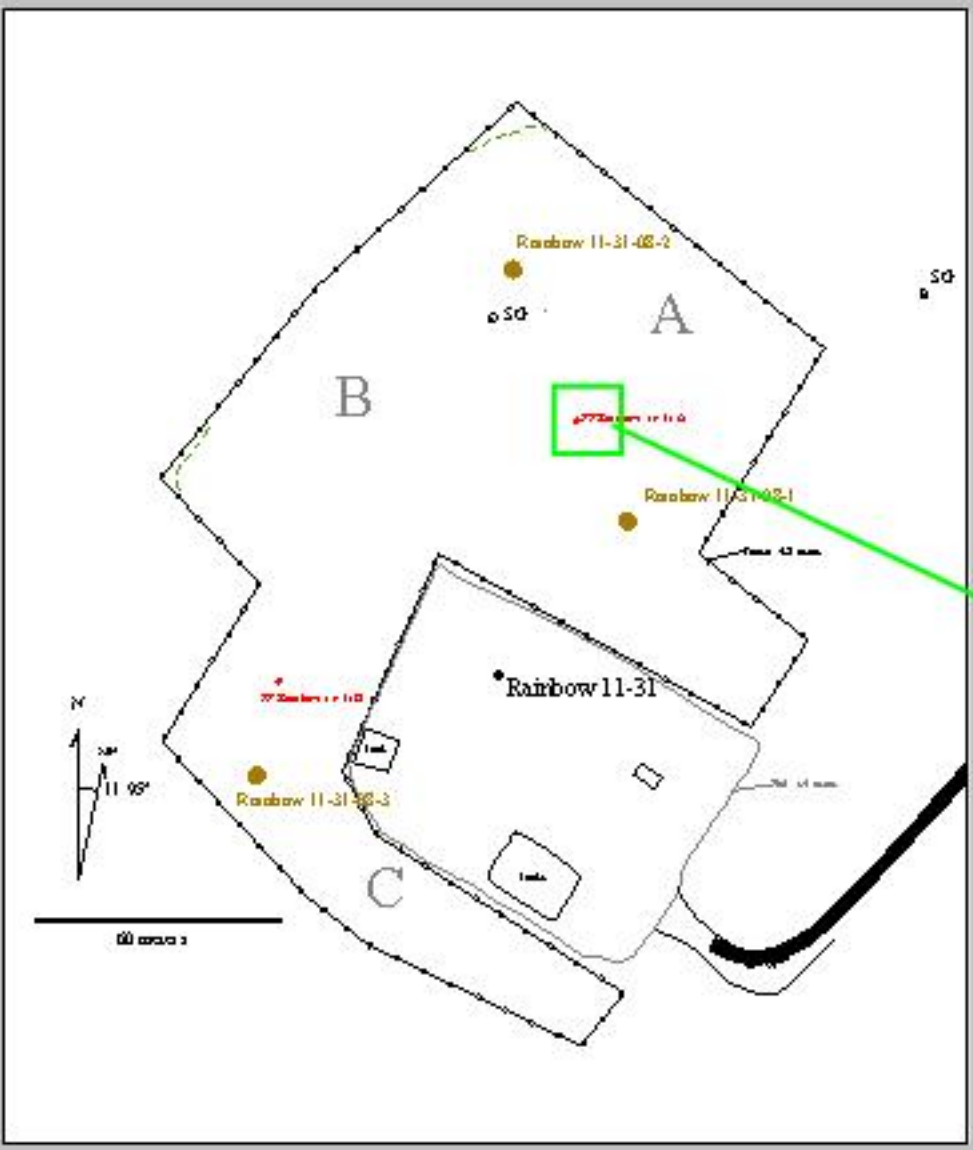
WB Sage = 6.26%

Fourwing Saltbush = 0.06%



Shrub Density (plts/m2)

2007 belt and line transect data



North

South

Photo Plot
Rainbow 11-31 A
2007

View to South

View to East

View to West

7/9/07 photos

View to North

Rainbow 11-31: Onsite Data Summary

Datum: NAD 83 **UTM Zone:** 12 **Point Center: Easting:** 611020.41 **Northing:** 4708868.00
Vegetation Type: Sagebrush-Steppe
Date Last Seeded: 10/06/2004 **Seeded Area Type:** Pit **Reclaim Acres:** 4.2 **Current Growing Season:** 4
Seed Mix: ARFR4, ARTRW8, ATCA2, KRLA2, ACHY, POSE, ACLA3, LUPO2, PEPR2, SPCO
Data Collected By: Povirk, Lingle, and Black

QUANTITATIVE EVALUATION ELEMENTS

- % Total Canopy Cover: 45.00
- % Canopy Cover Compared to Reference (Goal >50%): 76
- % Canopy Cover Comprised of Desirable spp. (Goal >50%): 84
- % Shrub Cover: 12.50
- % Grass Cover: 30.50
- % Forb Cover: 3.5
- % Weed Cover (Goal <15%): 7.00
- % Litter: 31.00
- % Lichen: 0.00
- % Moss: 0.00
- % Rock: 4.50
- % Bare Ground: 39.50

Diversity Index (Goal >0.50): 0.62
Shrub Density (Goal >50% of Reference): 30977/acre - 330%
ARTRW8 Density: 30445/acre
Average Shrub Height (inches): 3.91
Shrub Decadence: 0.00
Highest % Cover of a Single Species: 18.00/ACHY

QUALITATIVE EVALUATION ELEMENTS

- Site Free of Trash: Yes
- Stable Soil Surface/Subsurface: Yes
- Runoff/Erosion Evident: No
- Area Dominated by Weeds/Undesirables: No
- Noxious Weeds Present: No
- Vegetative Reproduction: Yes
- Site Stabilized by Vegetation: Yes
- Evidence of New Disturbance: No
- Area Utilized by Wildlife: Yes

ADDITIONAL VEGETATION DATA

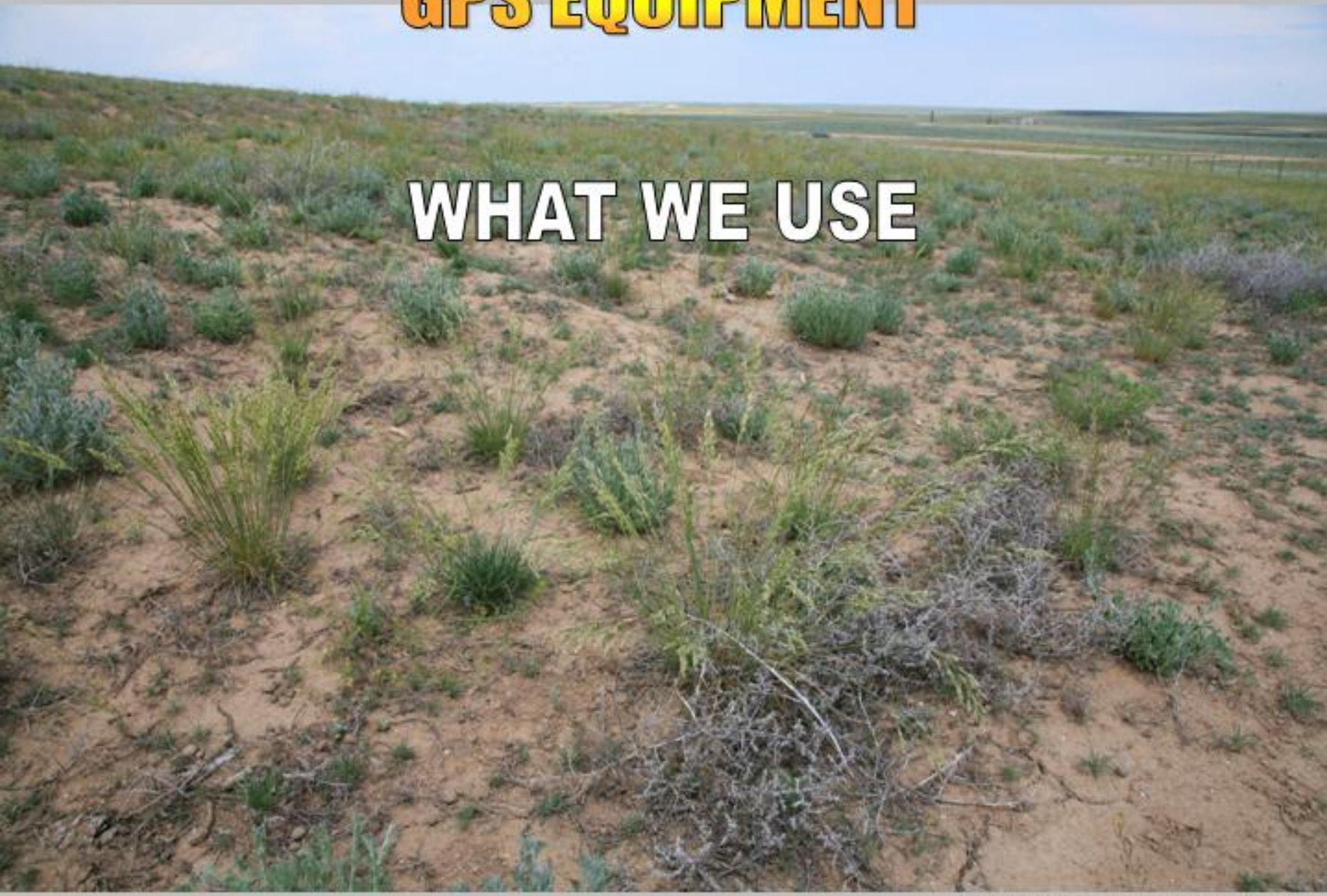
- Dominant Shrub: ARTRW8
- Subdominant Shrub: no subdominant
- Dominant Grass: ACHY
- Subdominant Grass: POSE
- Dominant Forb: SAKA
- Subdominant Forb: HAGL

PELLET TRANSECT DATA (Groups):

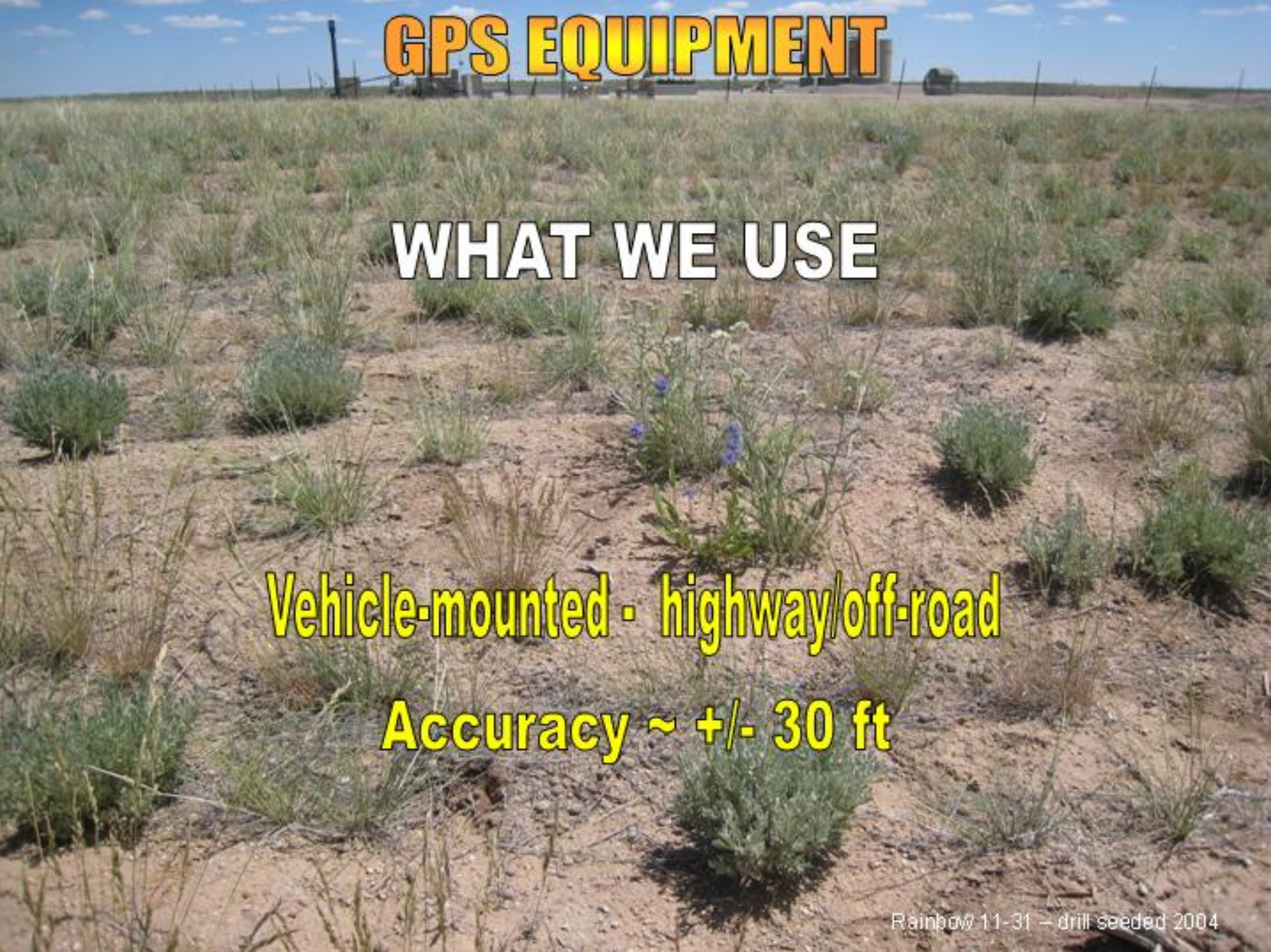
- Antelope- 4
- Jackrabbit- 6

Does site fully meet revegetation success protocol? Yes

GPS EQUIPMENT



Antelope 2-9 - hydroseeded 2004


GPS EQUIPMENT
WHAT WE USE
Vehicle-mounted · highway/off-road
Accuracy ~ +/- 30 ft
Rainbow 11-31 – drill seeded 2004

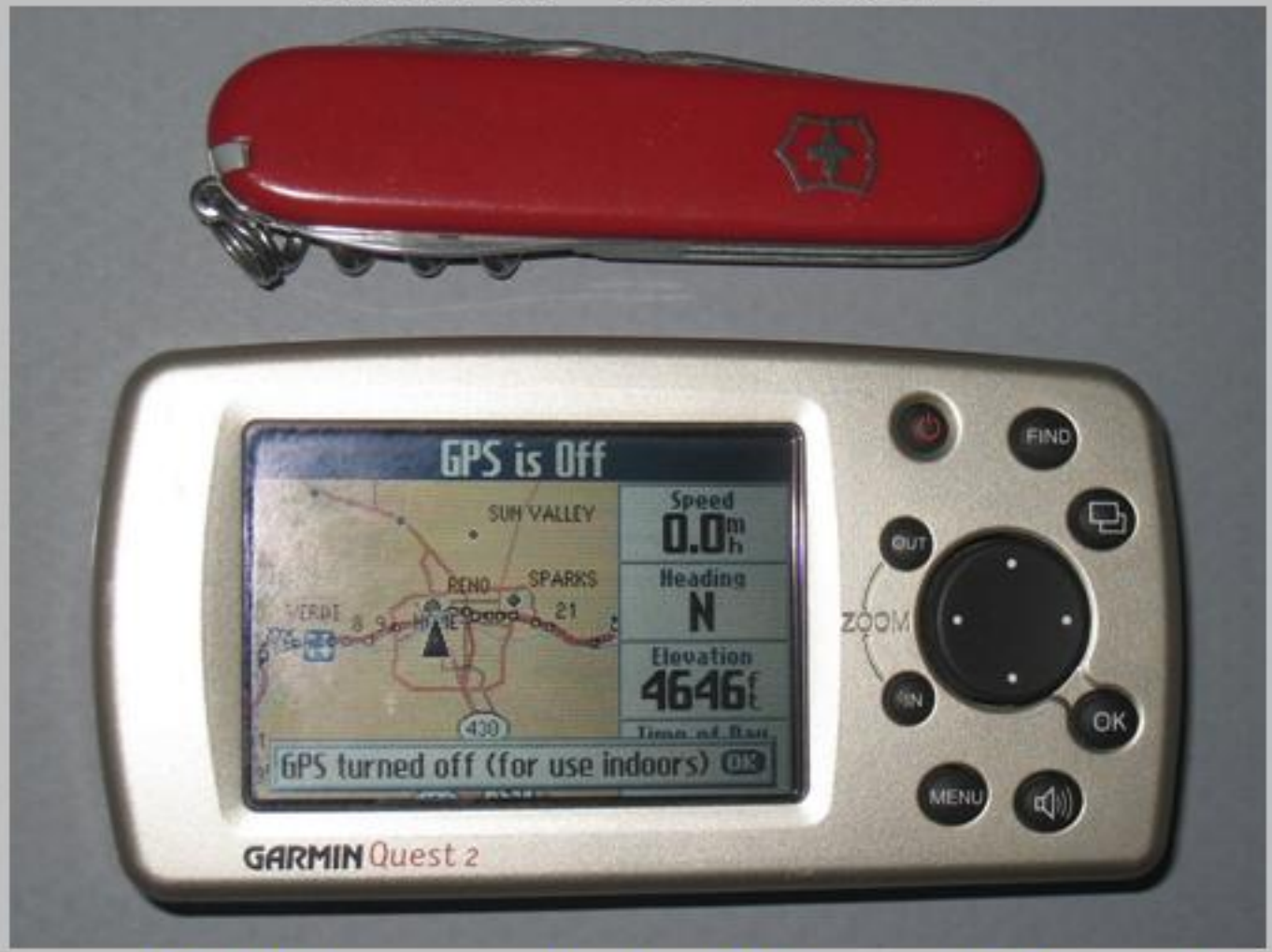
GPS EQUIPMENT

WHAT WE USE

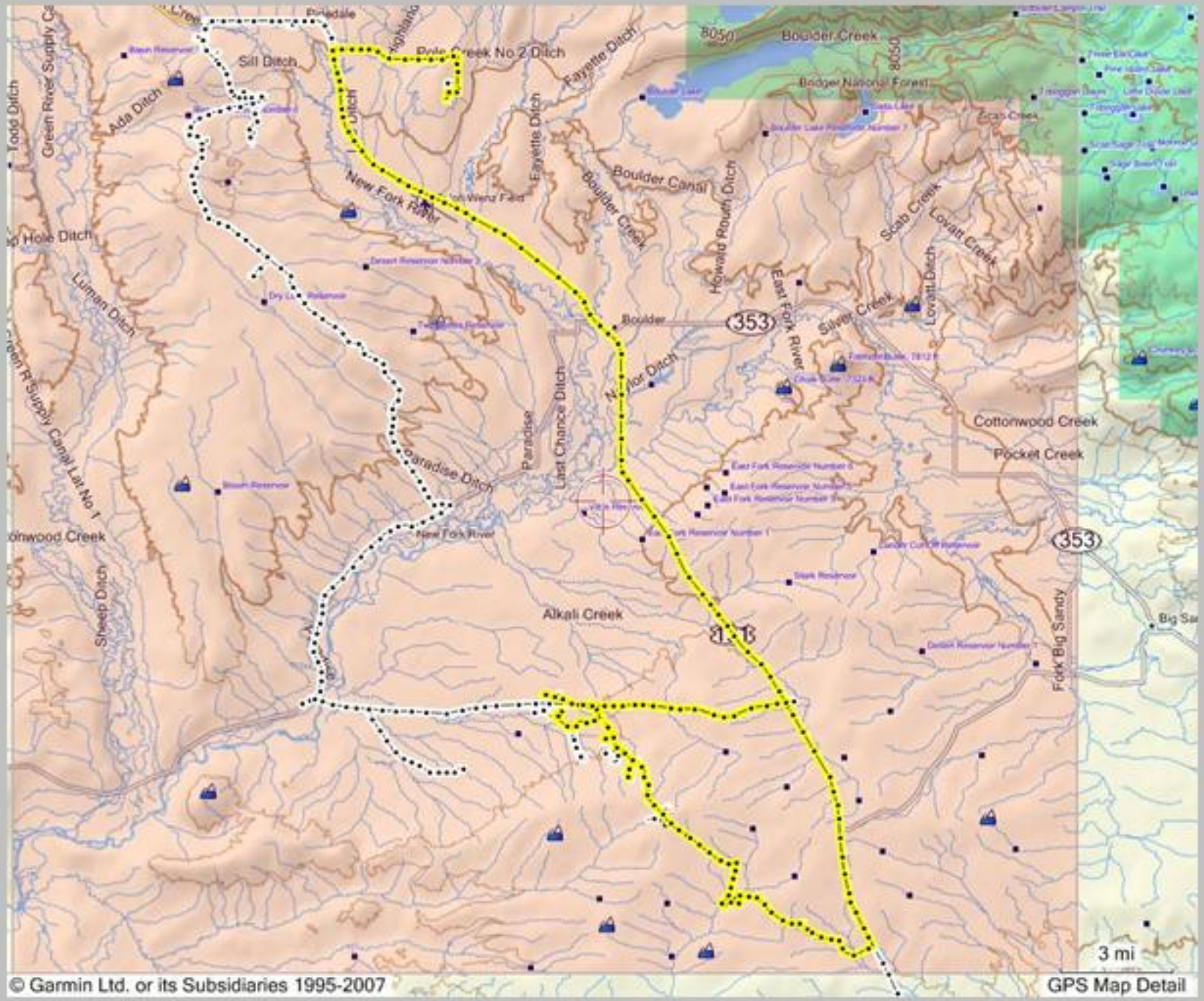
Vehicle-mounted - highway/off-road

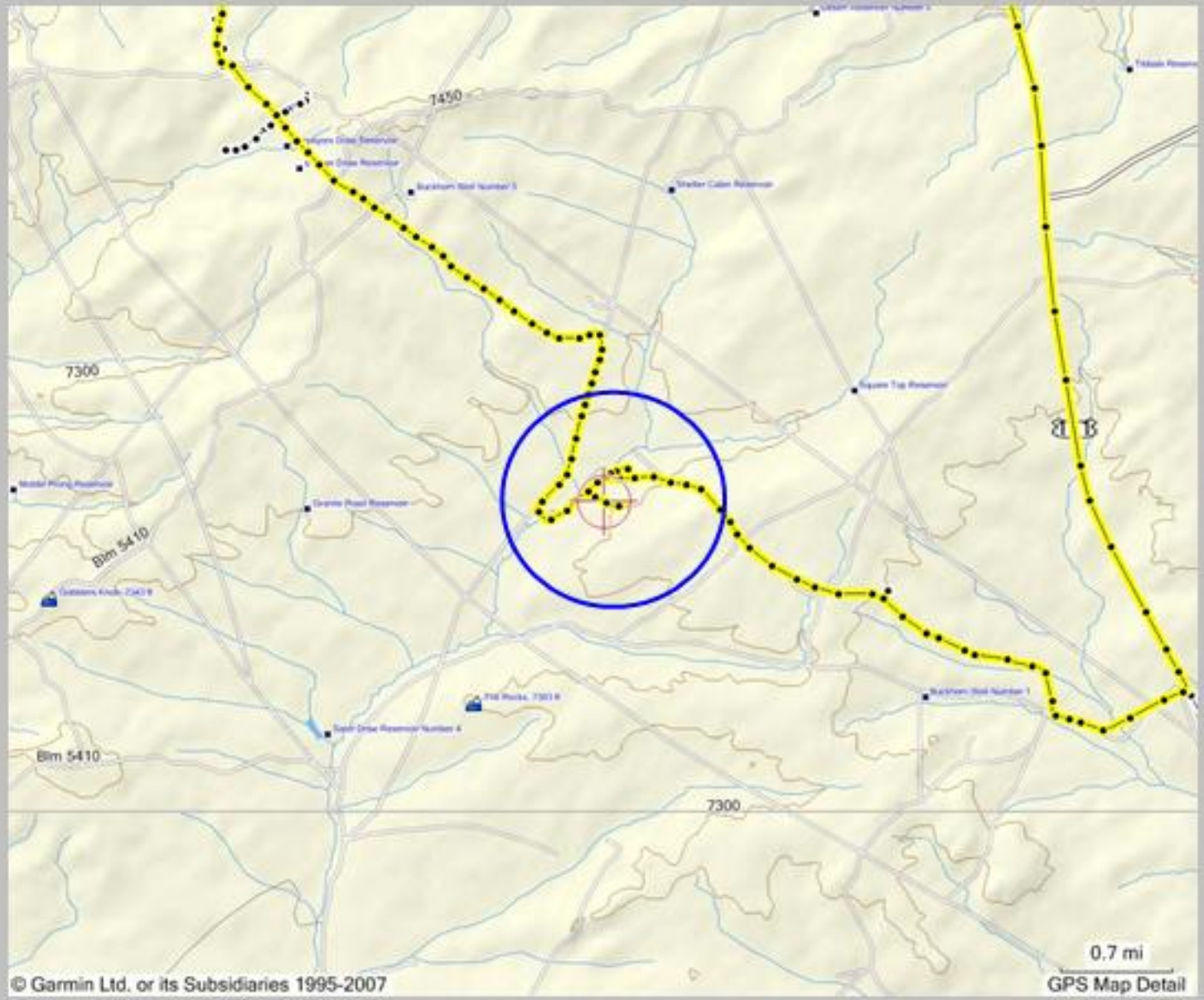
GPS EQUIPMENT

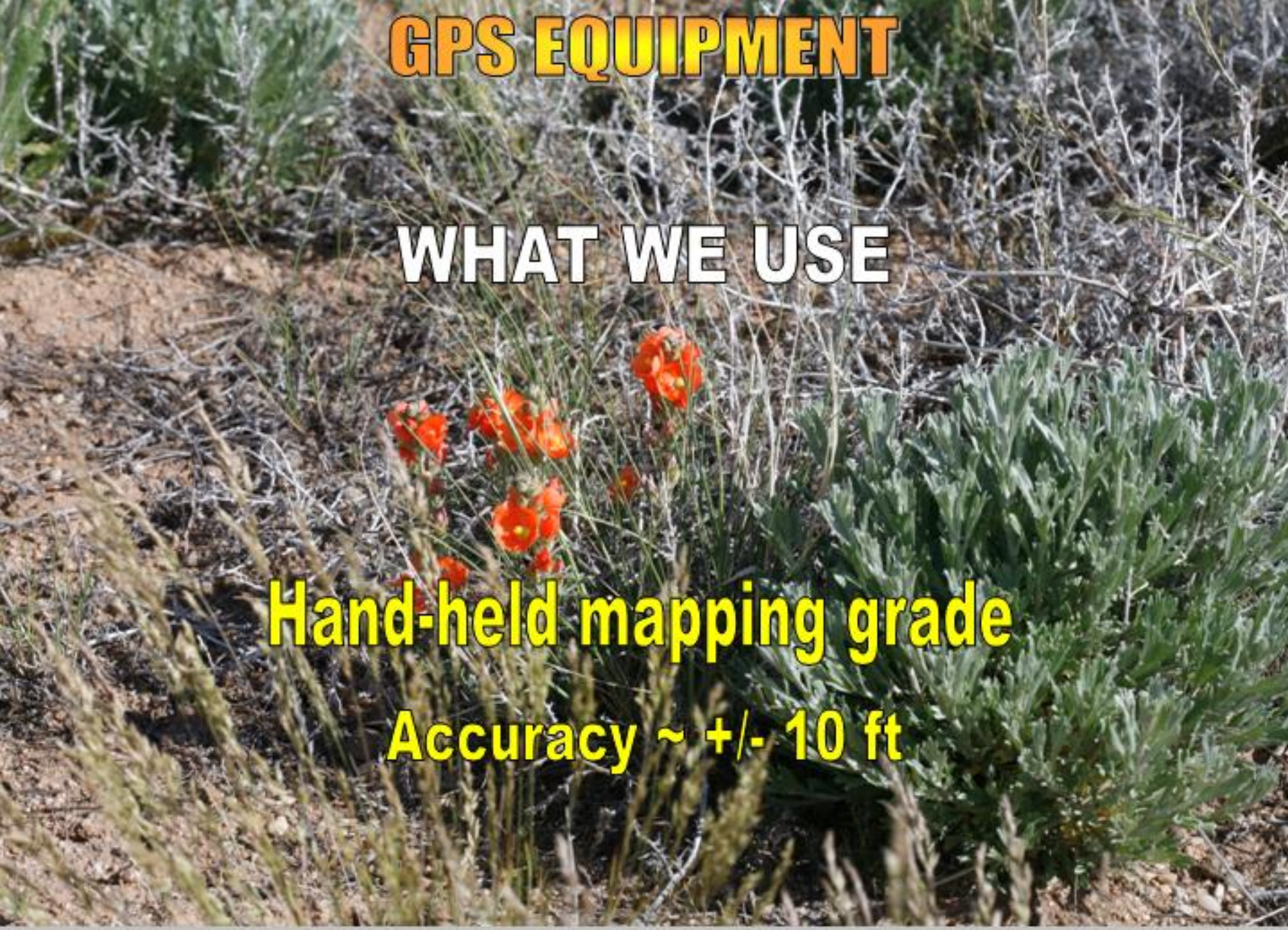
WHAT WE USE



Vehicle-mounted - highway/off-road


Boulder Creek
Badger National Forest
Sill Ditch
Ada Ditch
Fayette Ditch
Boulder Canal
Howald Rouch Ditch
Scab Creek
Lovatt Creek
Lovatt Ditch
East Fork River
Silver Creek
Boulder
353
Cottonwood Creek
Pocket Creek
Paradise Ditch
Last Chance Ditch
New Fork River
Alkali Creek
Sheep Ditch
Fork Big Sandy
3 mi
© Garmin Ltd. or its Subsidiaries 1995-2007
GPS Map Detail


7450
7300
Blm 5410
Blm 5410
7300
0.7 mi
© Garmin Ltd. or its Subsidiaries 1995-2007
GPS Map Detail



Rainbow 11-31 – drill seeded 2004

GPS EQUIPMENT

WHAT WE USE

Hand-held mapping grade

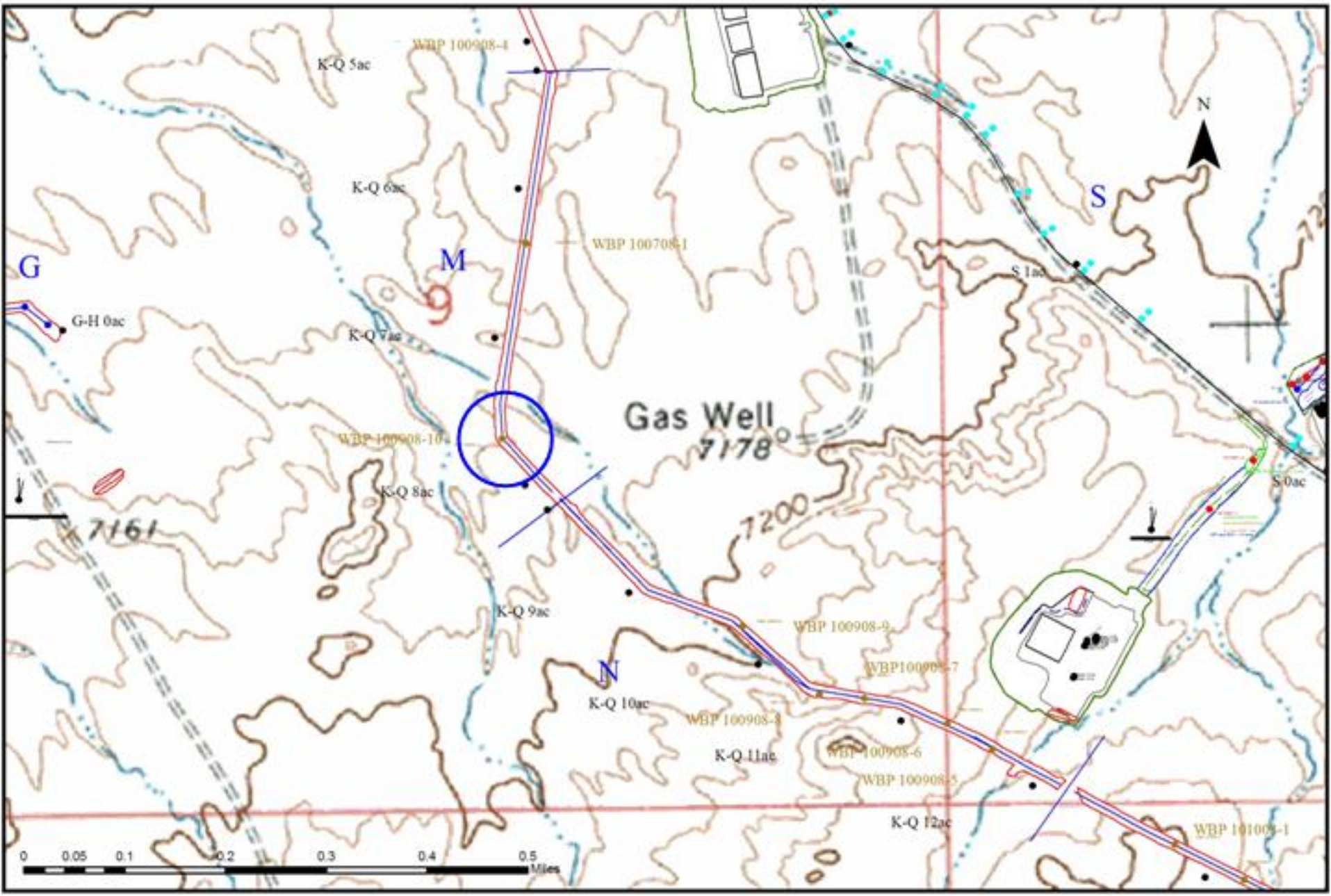
Accuracy ~ +/- 10 ft

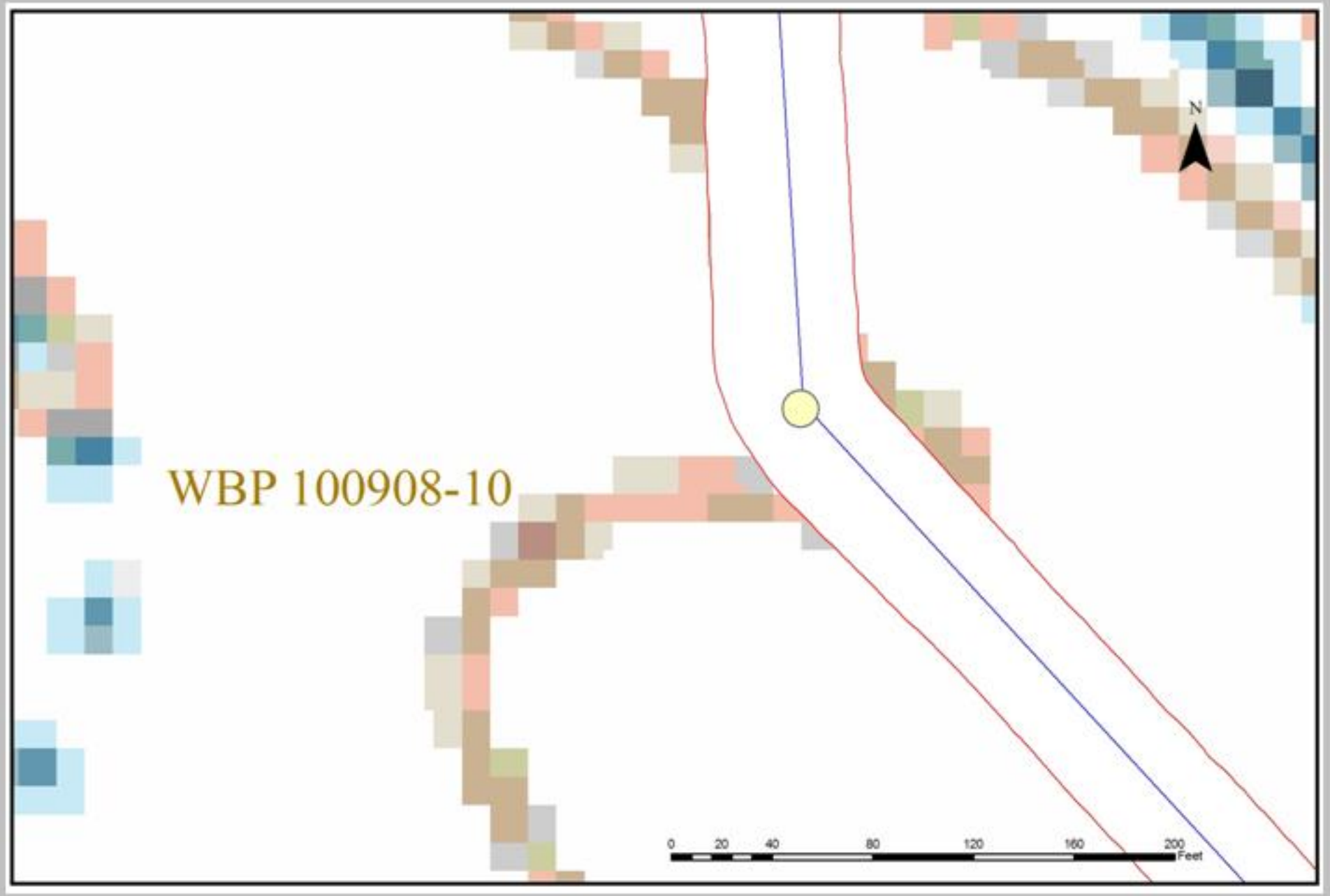
GPS EQUIPMENT

WHAT WE USE

Hand-held mapping grade

Accuracy ~ +/- 10 ft


K-Q 5ac
WBP 100908-4
K-Q 6ac
WBP 100708-1
M
G
G-H 0ac
K-Q 7ac
Gas Well
7178
WBP 100908-10
K-Q 8ac
7161
7200
K-Q 9ac
N
K-Q 10ac
WBP 100908-9
WBP100908-7
WBP 100908-8
K-Q 11ac
WBP 100908-6
WBP 100908-5
K-Q 12ac
WBP 101008-1
S
S 1ac
S 0ac
N
0
0.05
0.1
0.2
0.3
0.4
0.5
Miles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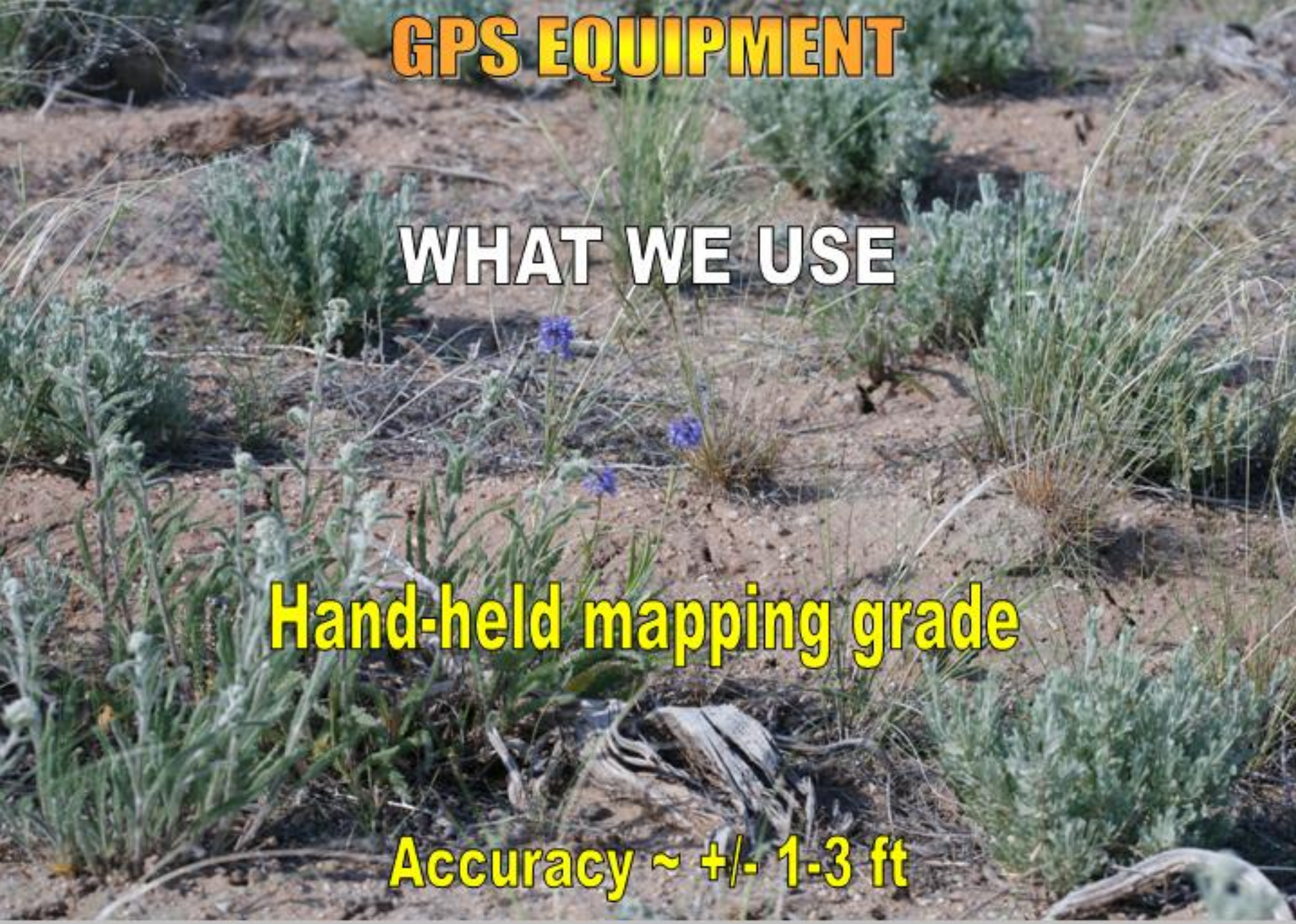
N
0
20
40
80
120
160
200
Feet



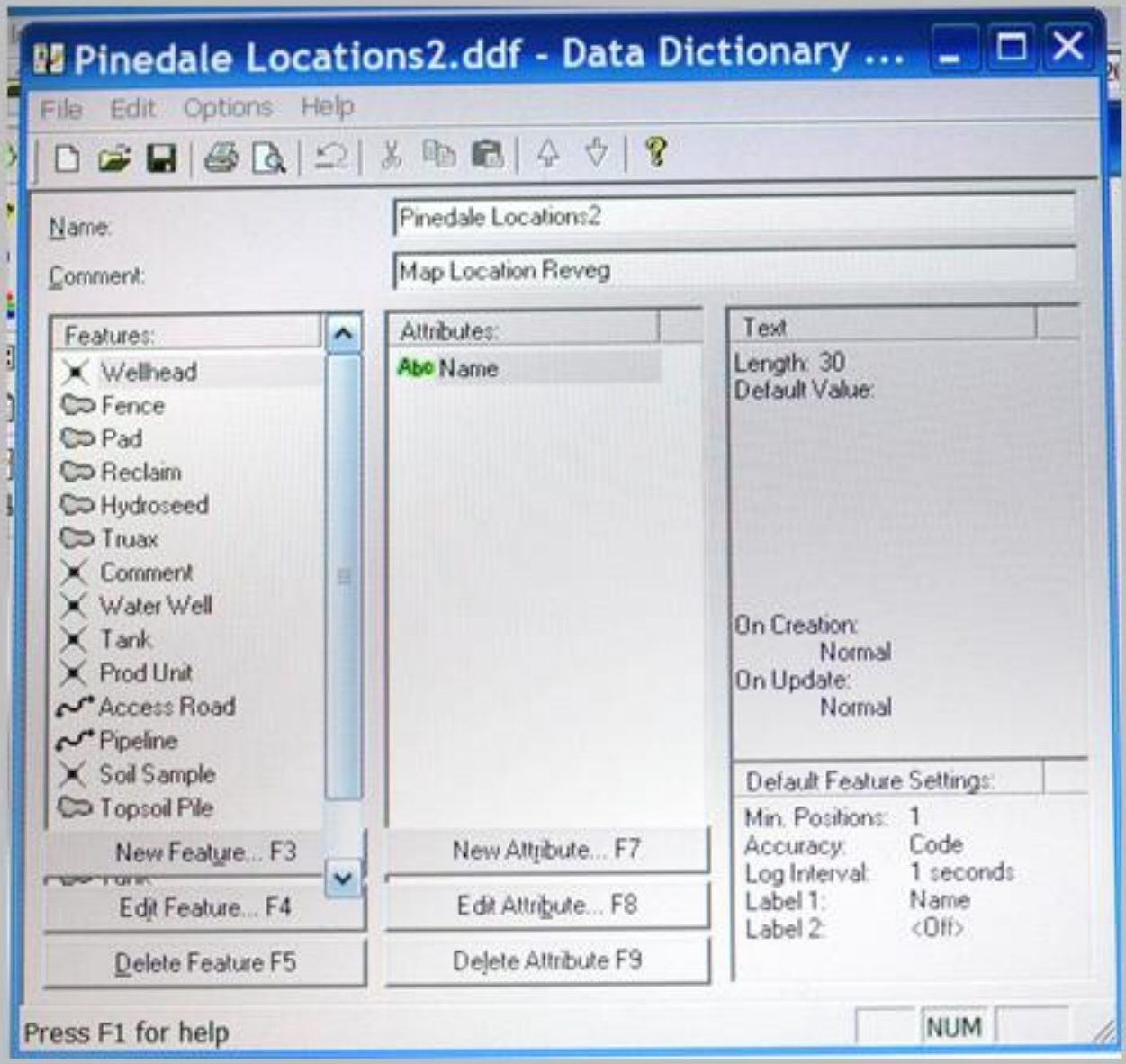
Rainbow 11-31 – drill seeded 2004

GPS EQUIPMENT

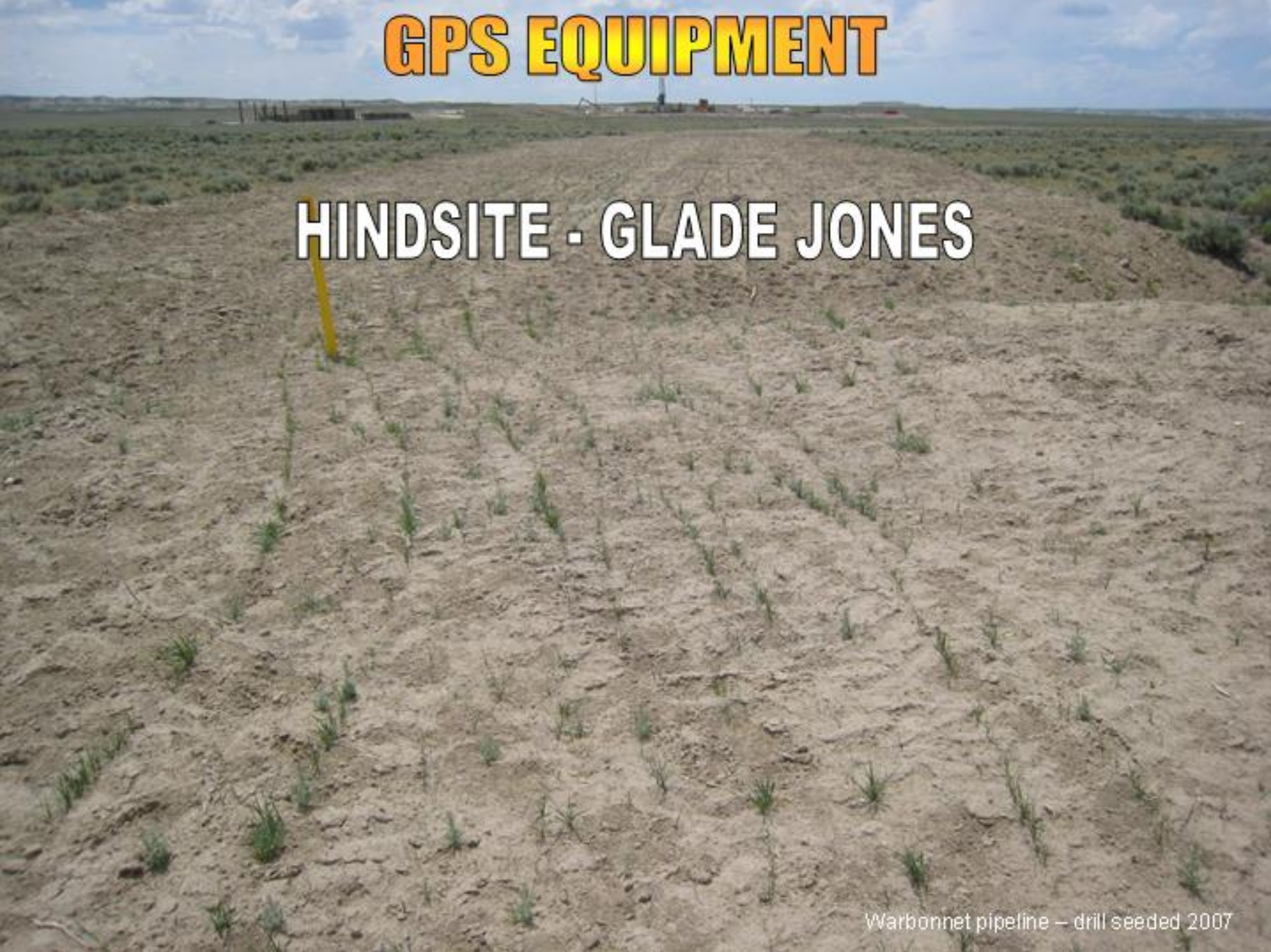
WHAT WE USE

Hand-held mapping grade

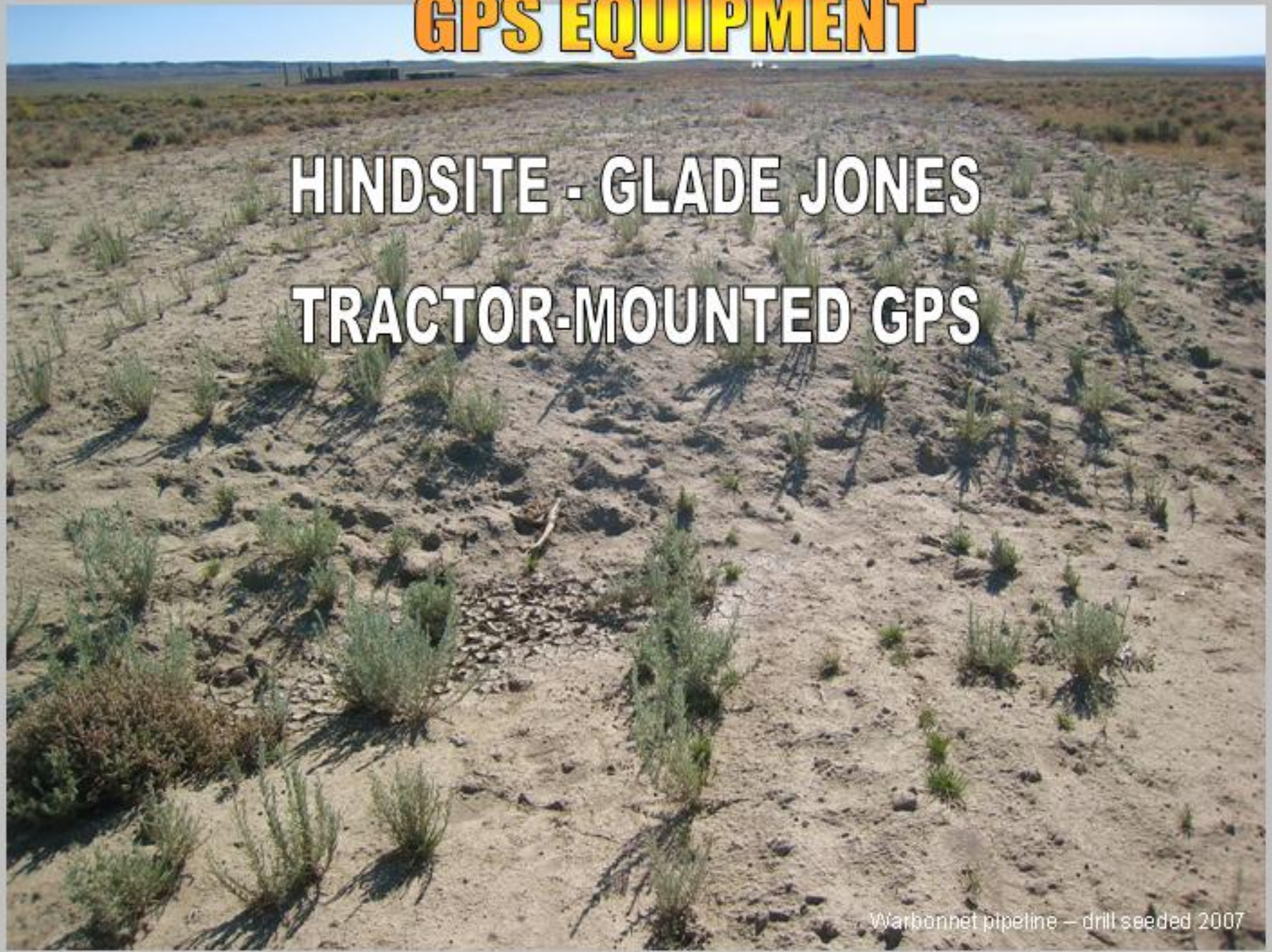
Accuracy ~ +/- 1-3 ft


Pinedale Locations2.ddf - Data Dictionary ...
File Edit Options Help
Name:
Pinedale Locations2
Comment:
Map Location Reveg
Features:
Wellhead
Fence
Pad
Reclaim
Hydroseed
Truax
Comment
Water Well
Tank
Prod Unit
Access Road
Pipeline
Soil Sample
Topsoil Pile
New Feature... F3
Edit Feature... F4
Delete Feature F5
Attributes:
Abc Name
New Attribute... F7
Edit Attribute... F8
Delete Attribute F9
Text
Length: 30
Default Value:
On Creation:
Normal
On Update:
Normal
Default Feature Settings:
Min. Positions: 1
Accuracy: Code
Log Interval: 1 seconds
Label 1: Name
Label 2: <Off>
Press F1 for help
NUM

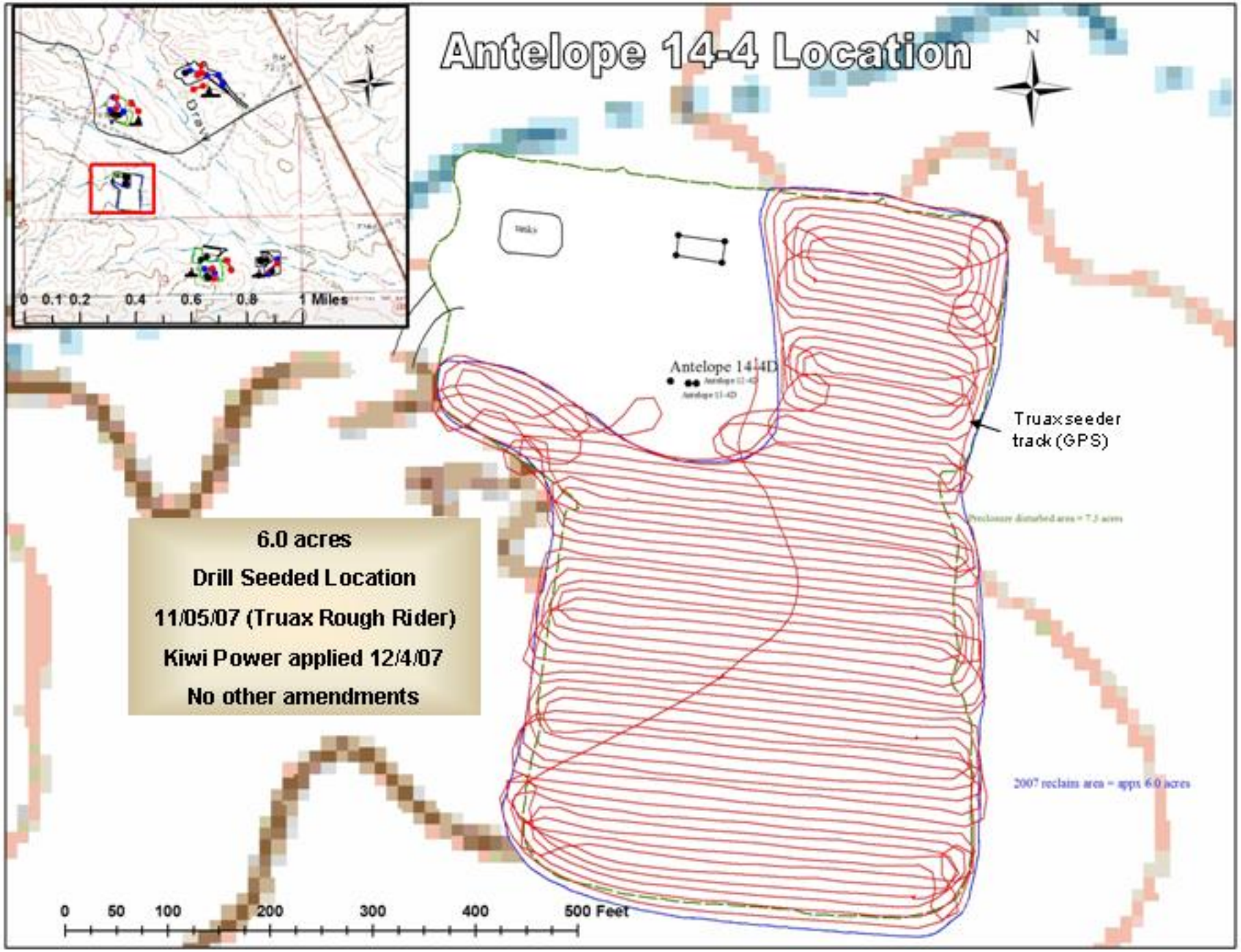
GPS EQUIPMENT



GPS EQUIPMENT




ROUGH RIDER


Antelope 14-4 Location
N
0 0.1 0.2 0.4 0.6 0.8 1 Miles
Antelope 14-4D
Truax seeder track (GPS)
6.0 acres
Drill Seeded Location
11/05/07 (Truax Rough Rider)
Kiwi Power applied 12/4/07
No other amendments
2007 reclaim area = appx 6.0 acres
0 50 100 200 300 400 500 Feet

Antelope 14-4 Location

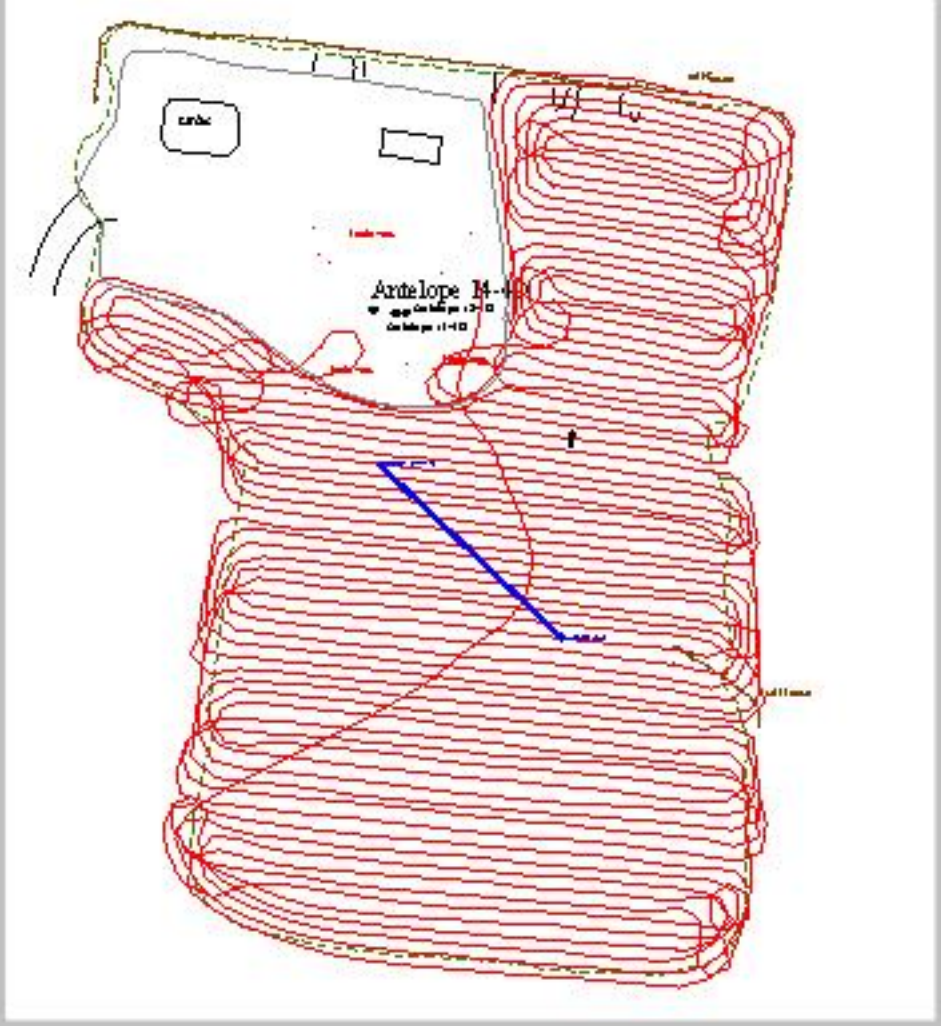
Comstock Seed (CS), Granite Seed (GS), Wind River Seed (WR)

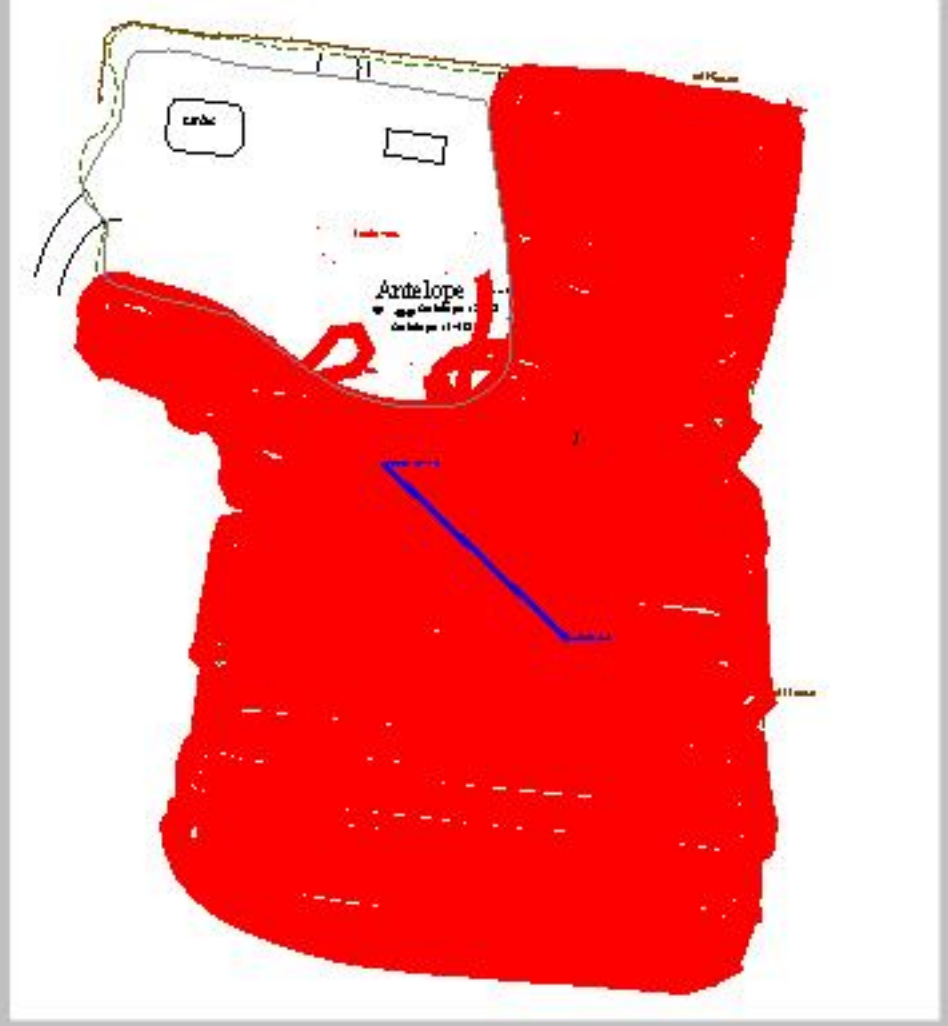
Shell Habitat Seed Mix SH07

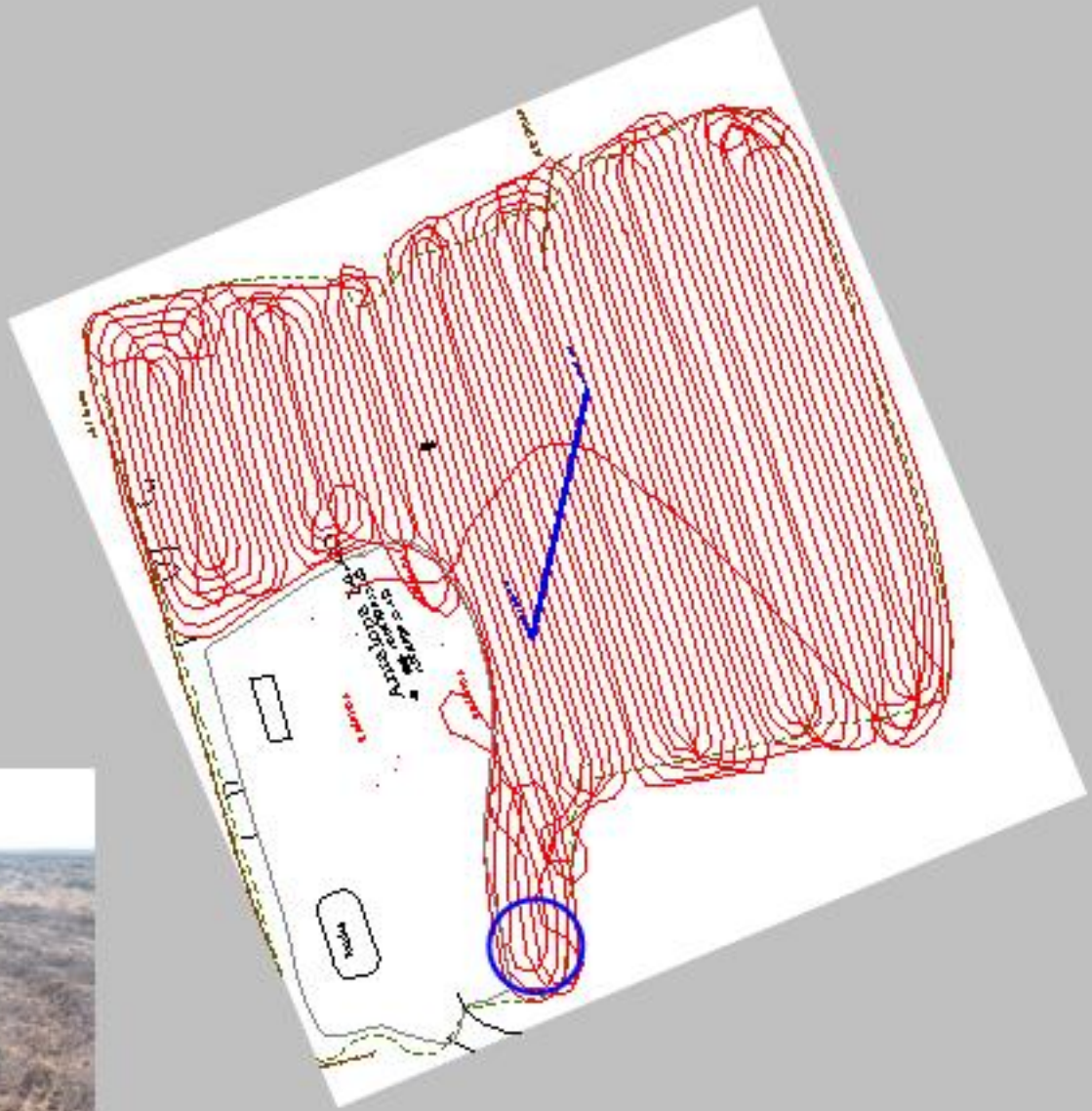
WR Need

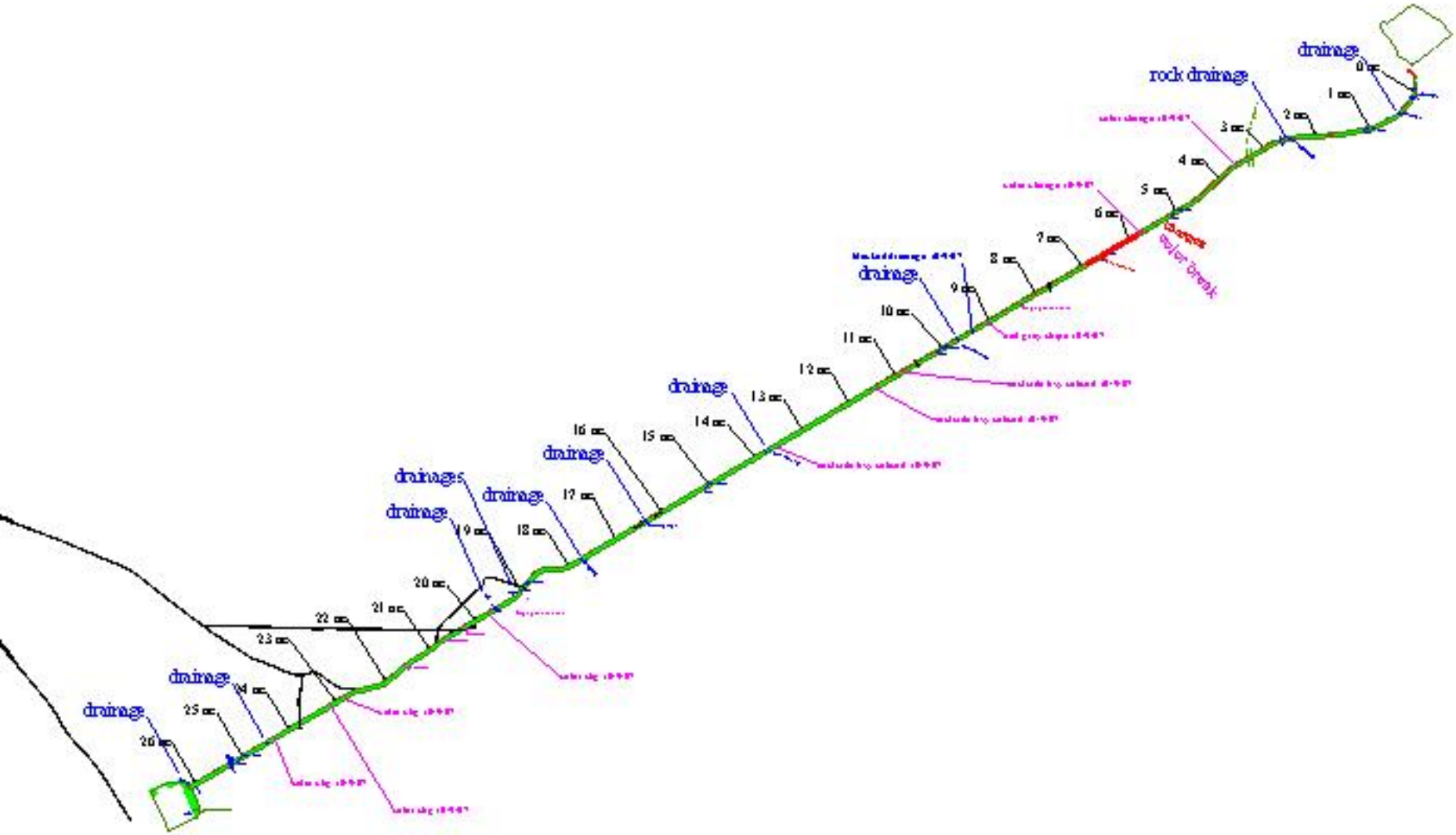
Species	# / Acre	Seeds / ft²	Seeds / ft²	% Seeds	Vendor	
Globemallow, Scarlet	0.05	500,000	0.52	0.59	CS	
Sandberg Bluegrass	1.50	925,000	21.25	22.41	WR	
Wetbrush	1.00	56,700	1.30	1.32	WR	SH07W
Yarrow, Western	0.10	2,770,000	6.36	6.47	CS	
Penstemon, palmer's (Penstemon palmeri)	0.15	951,000	1.21	1.29	WR	
Wyoming Big Sagebrush	0.50	2,500,000	28.70	29.20	WR	SH07W
Fringed Sagewort	0.10	4,598,000	10.41	10.80	WR	SH07W
Thickspike Wheatgrass, Critana	1.00	145,000	3.33	3.38	WR	SH07G
Slender Wheatgrass, Revenue	2.00	159,000	7.30	7.43	WR	SH07G
Indian Ricegrass, Nezpar	2.00	141,000	6.47	6.59	WR	SH07G
Four-winged Saltbush	0.50	52,000	0.60	0.61	WR	
Silky Lupine, Lupinus sericeus (*)	0.50	20,000	0.23	0.23	CS	
	9.40		93.28	100.00		

	Truax Range Drill (Small Seed Box = Front Box)
	Truax Range Drill Surface Seed Box (Fluffy Box = Middle Box)
	Truax Range Drill (Grass "Cool Season" Box = Back Box)


Antelope


Antelope




drainage
rock drainage
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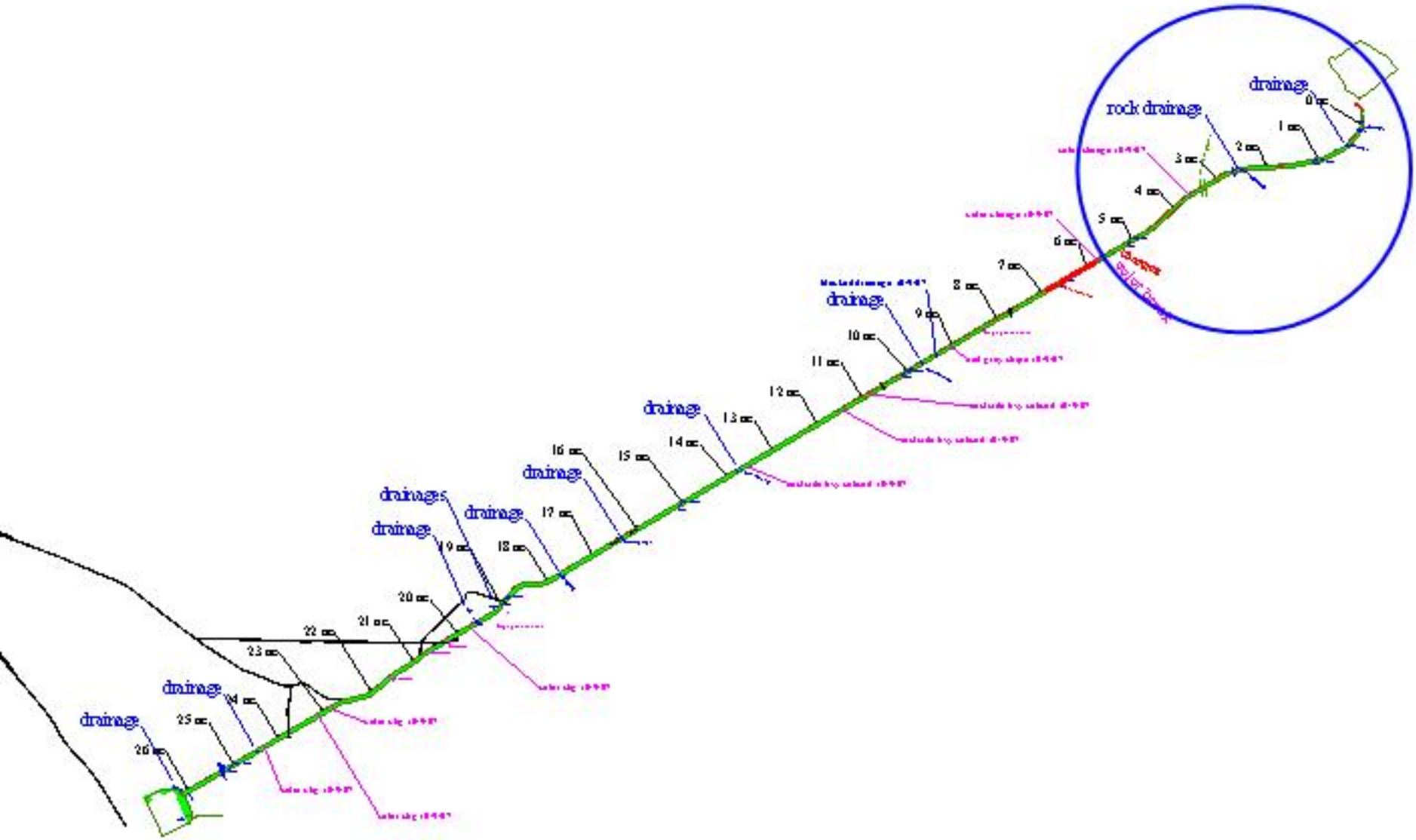
drainage
rock drainage
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drainage
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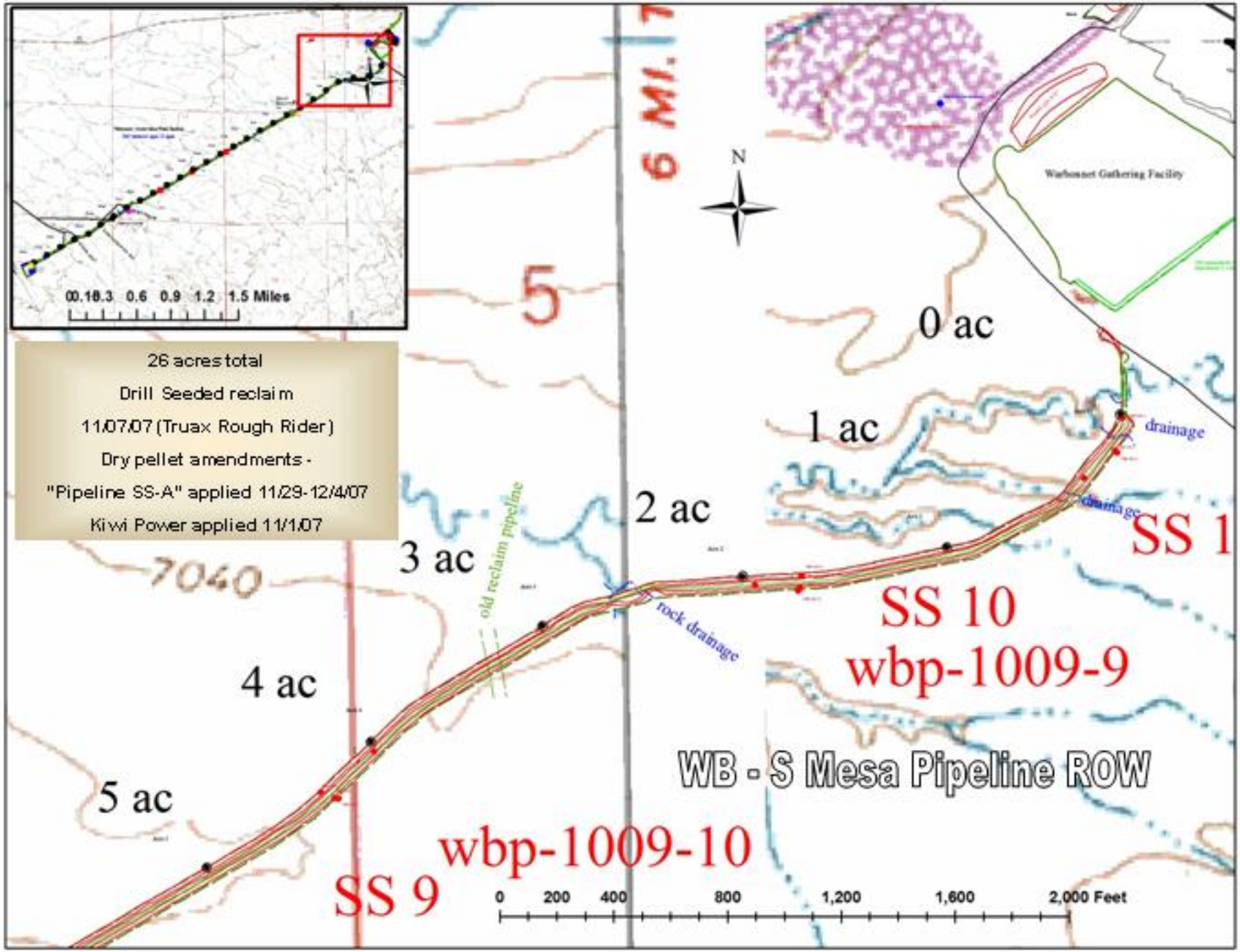
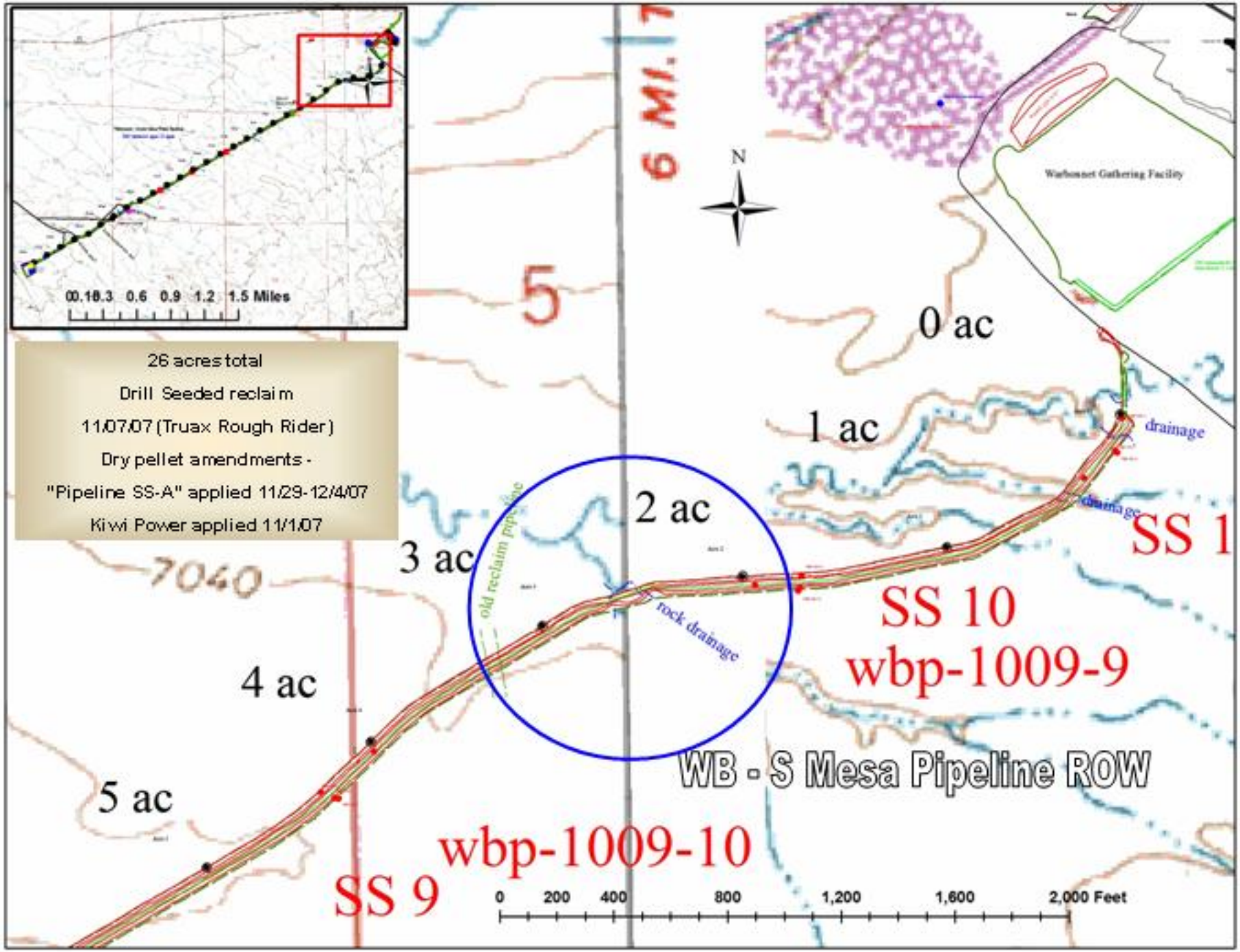

0 0.18.3 0.6 0.9 1.2 1.5 Miles
26 acres total
Drill Seeded reclaim
11/07/07 (Truax Rough Rider)
Dry pellet amendments -
"Pipeline SS-A" applied 11/29-12/4/07
Kiwi Power applied 11/1/07
6 MI.
N
Warhoont Gathering Facility
5
0 ac
1 ac
2 ac
3 ac
4 ac
5 ac
drainage
drainage
SS 1
SS 10
wbp-1009-9
old reclaim pipeline
rock drainage
7040
WB - S Mesa Pipeline ROW
wbp-1009-10
SS 9
0 200 400 800 1,200 1,600 2,000 Feet


0 0.15 0.3 0.6 0.9 1.2 1.5 Miles
26 acres total
Drill Seeded reclaim
11/07/07 (Truax Rough Rider)
Dry pellet amendments -
"Pipeline SS-A" applied 11/29-12/4/07
Kiwi Power applied 11/1/07
6 MI.
N
Warhoont Gathering Facility
5
0 ac
1 ac
2 ac
3 ac
4 ac
5 ac
7040
drainage
drainage
SS 1
old reclaim pipeline
rock drainage
SS 10
wbp-1009-9
WB - S Mesa Pipeline ROW
wbp-1009-10
SS 9
0 200 400 800 1,200 1,600 2,000 Feet

Acre 3
rock drainage
Acre 2

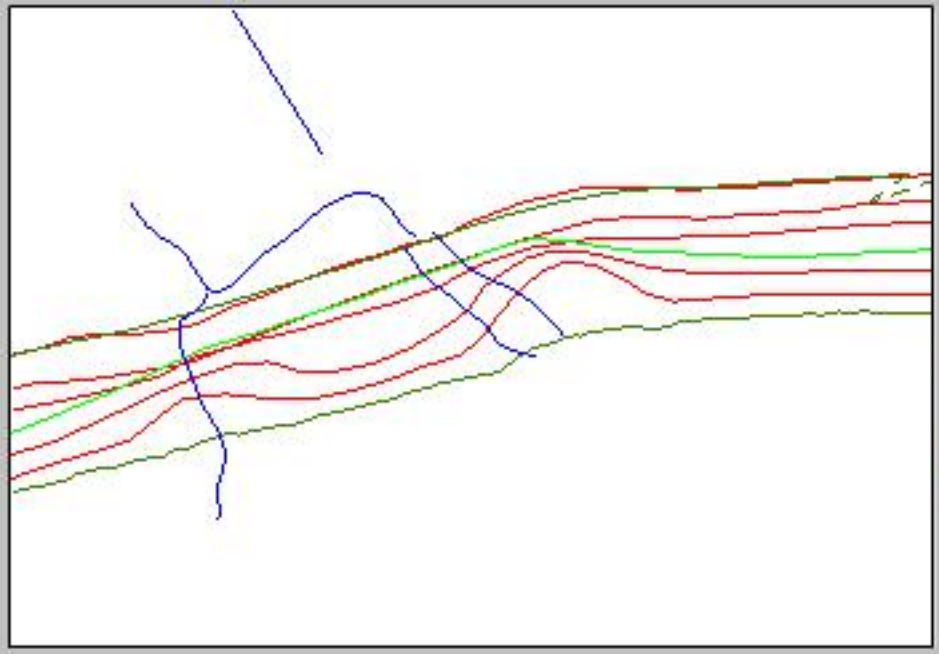
Acre 2

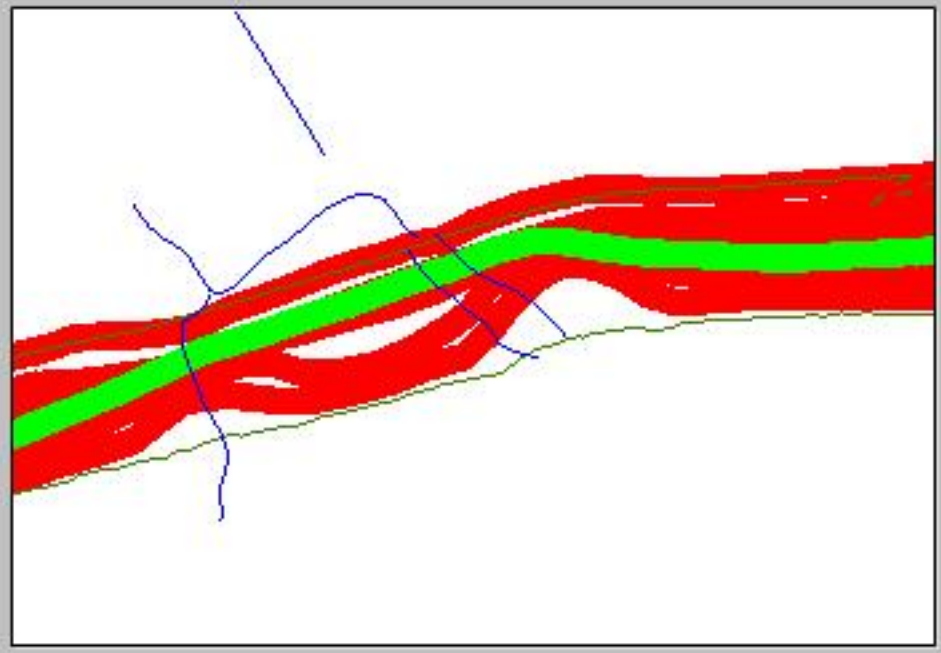
Acre 3
Rock drainage
Acre 2

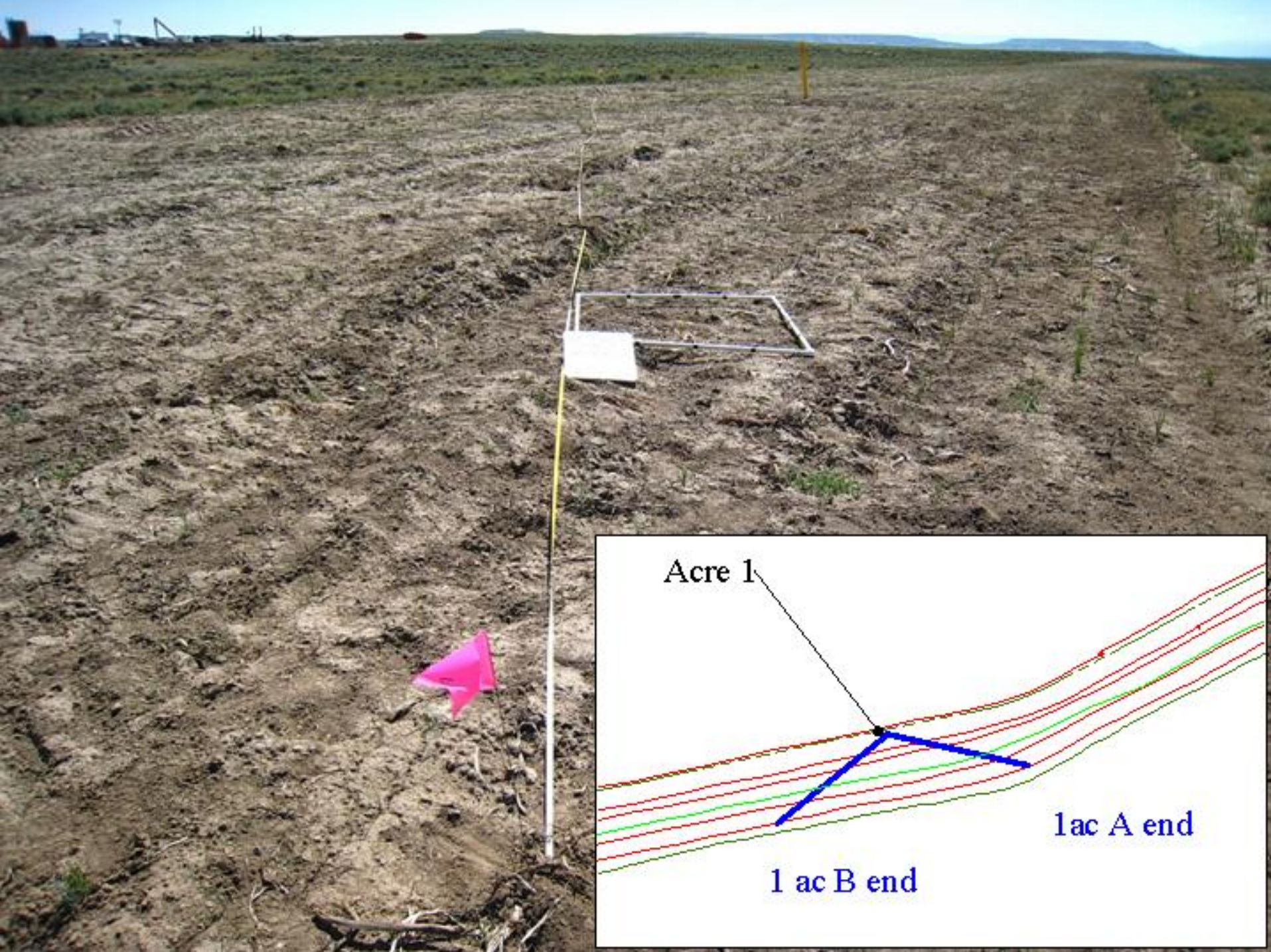
Acre 2

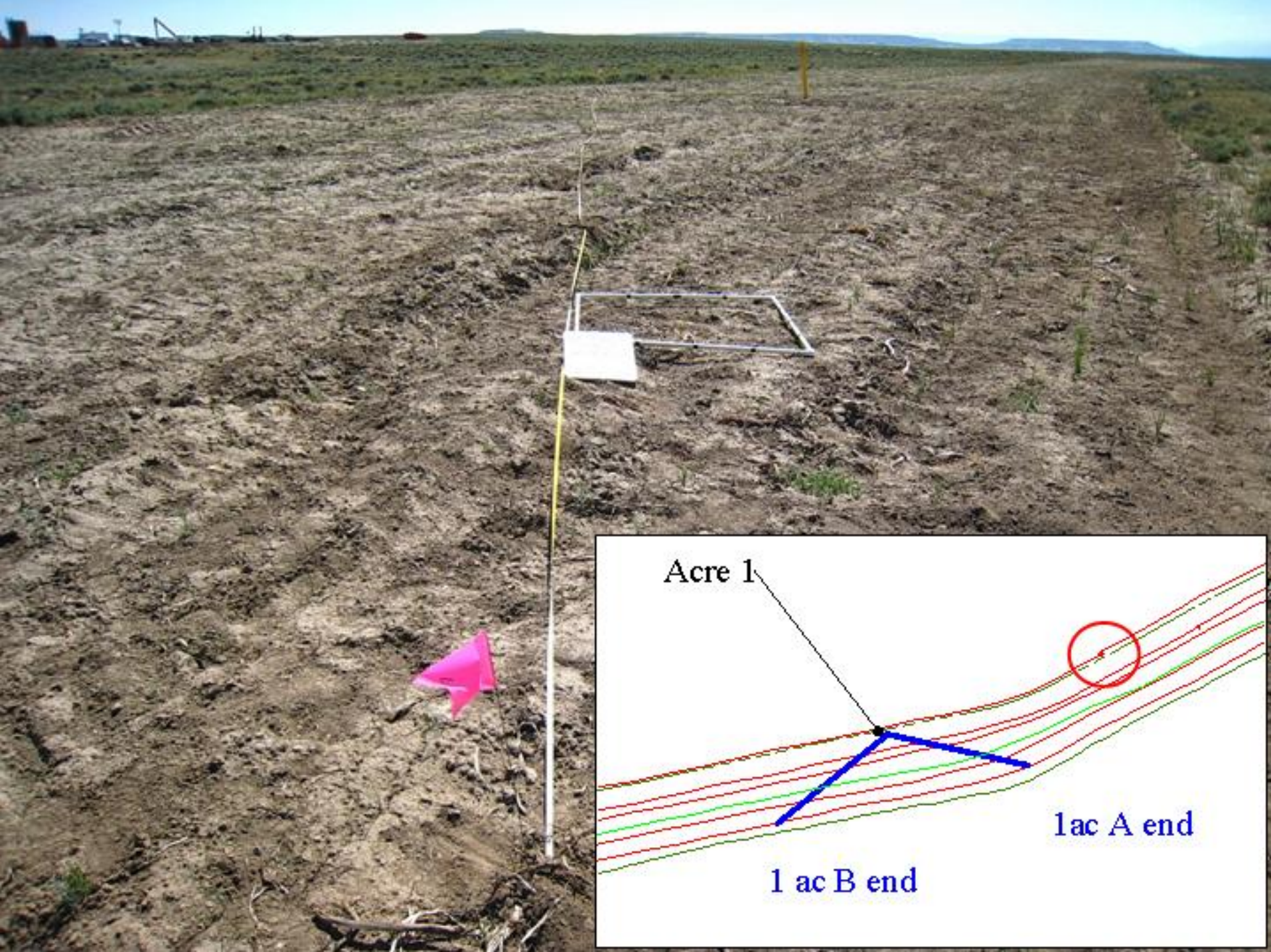
Acre 3
rock drainage
Acre 2

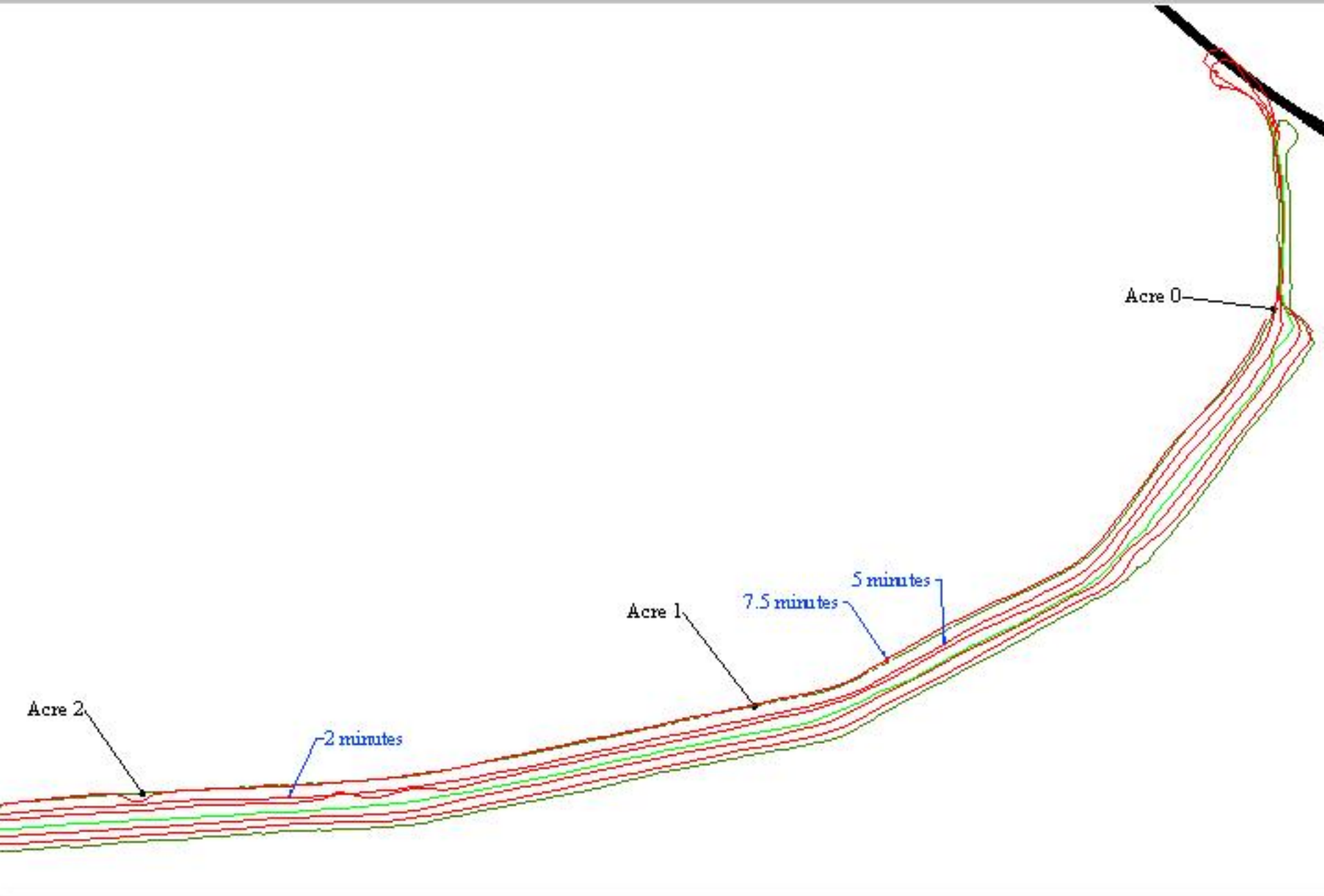
Acre 2

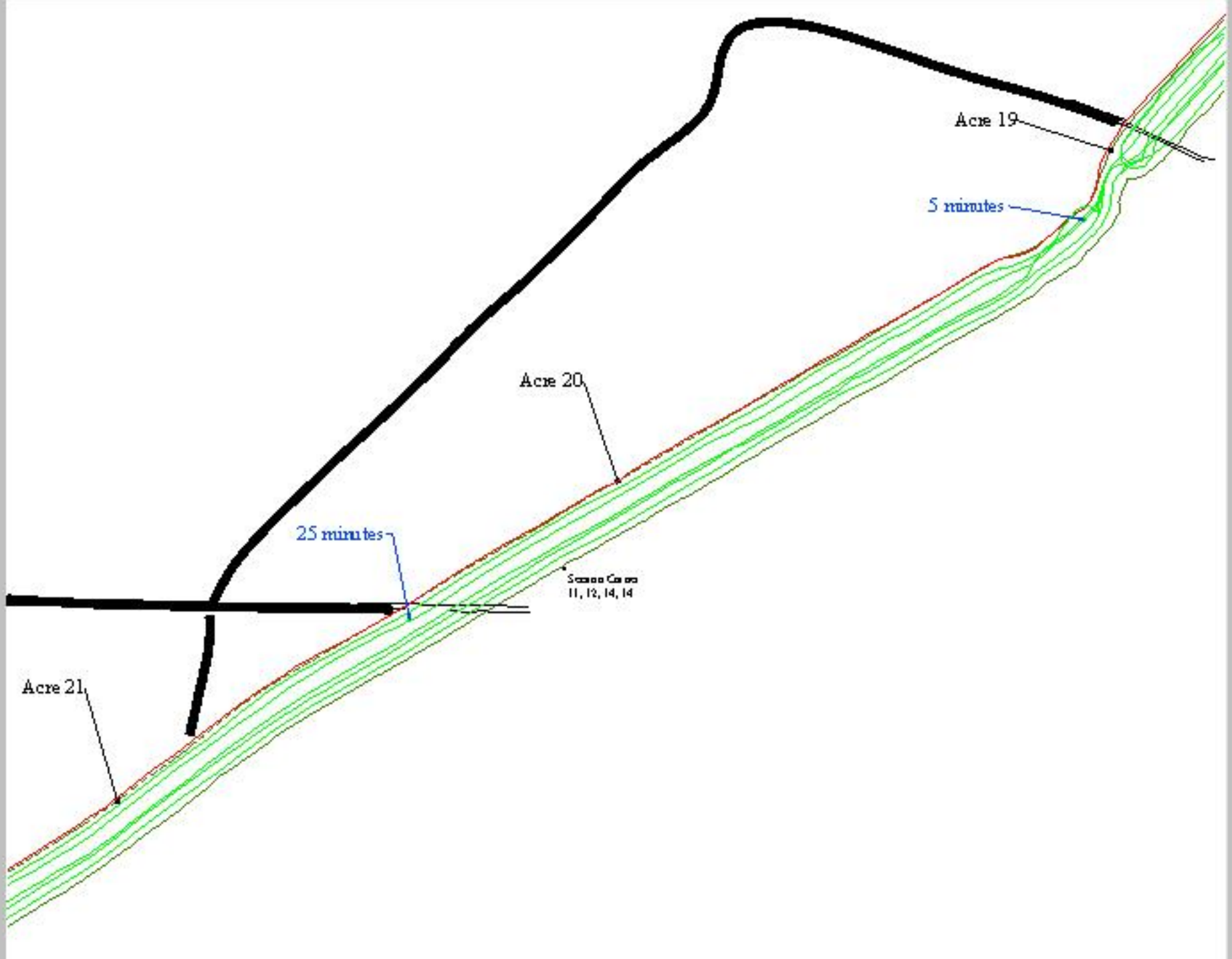


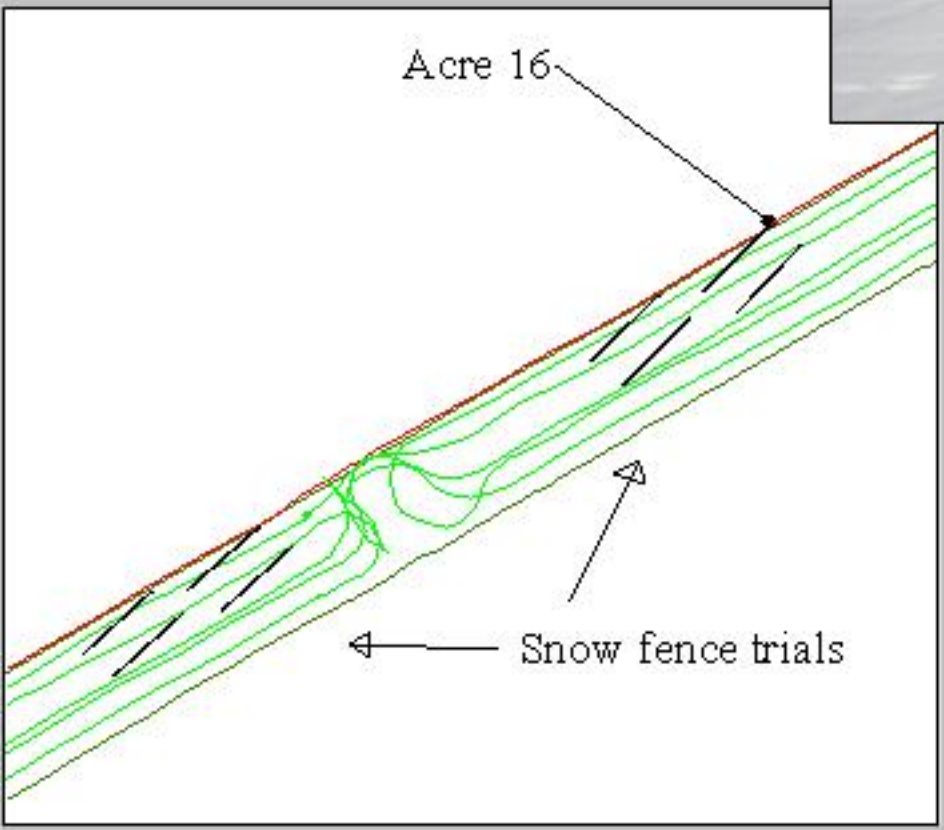


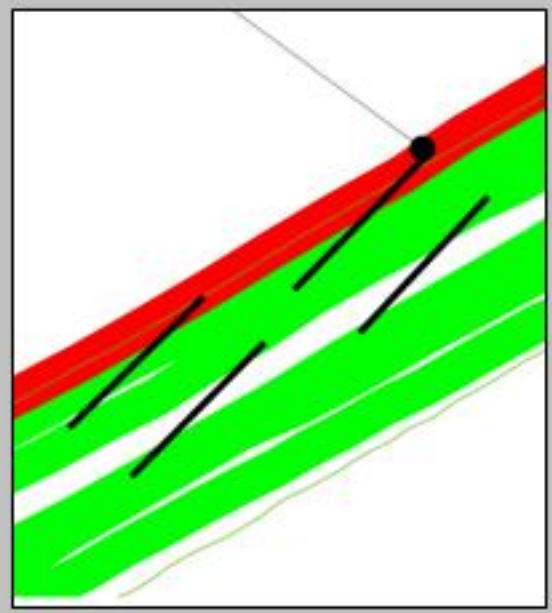

Acre 1
1ac A end
1 ac B end

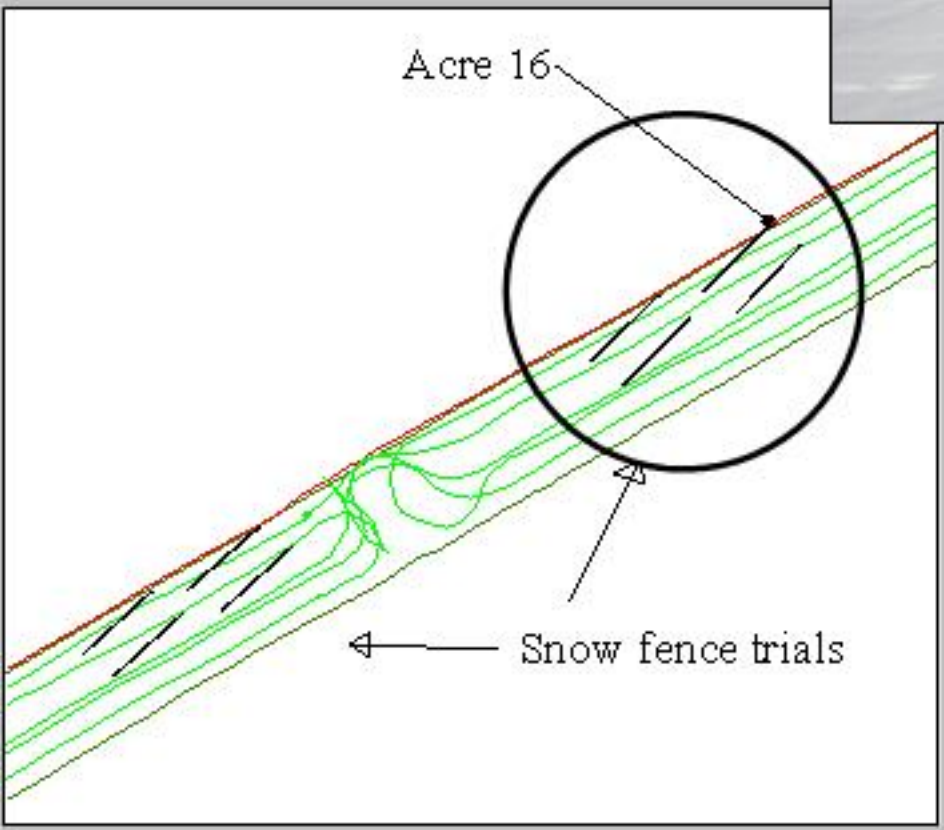

Acre 1
1ac A end
1 ac B end

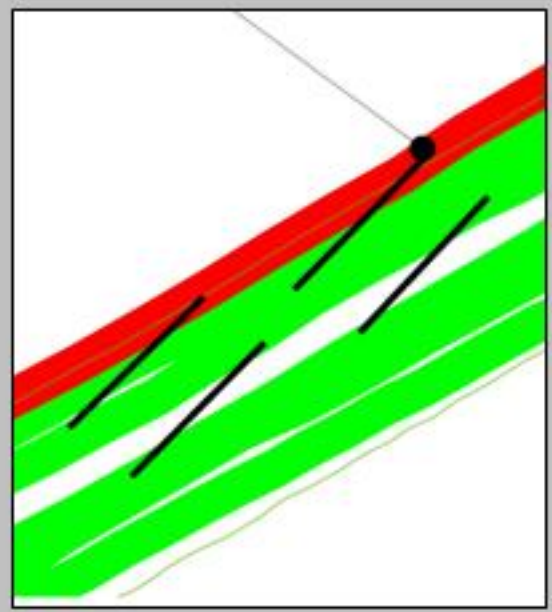

Acre 0
Acre 1
Acre 2
5 minutes
7.5 minutes
2 minutes

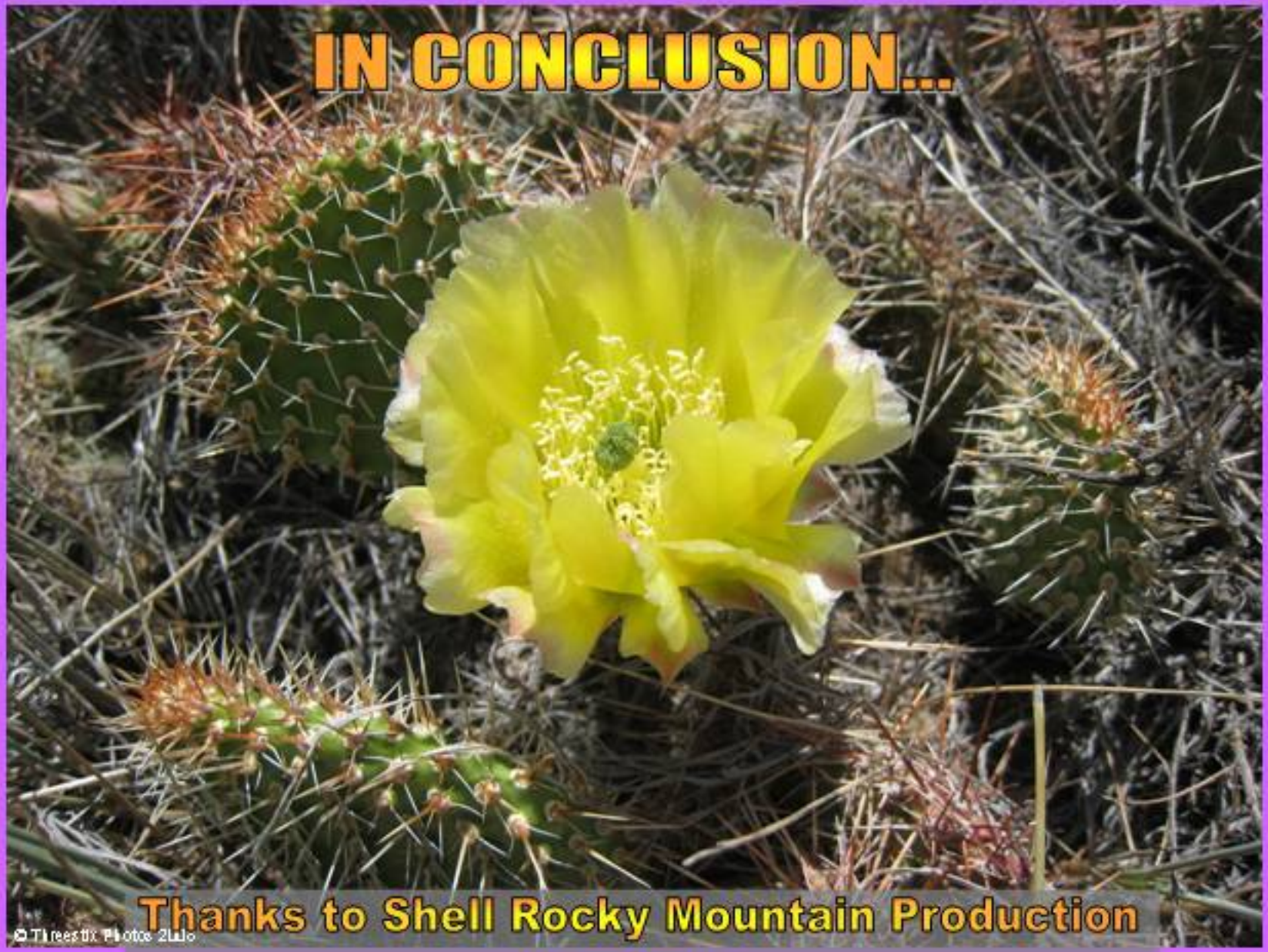

Acre 19
5 minutes
Acre 20
25 minutes
Acre 21


Acre 16
Snow fence trials




Acre 16
Snow fence trials





in particular:

Jim Sewell and Aimee Davison