

BW - _____ 35 _____

**SUBSIDENCE
MONITORING
PLAN REPORTS**



PETTIGREW
& ASSOCIATES PA

ENGINEERING | SURVEYING | TESTING
DEFINING QUALITY SINCE 1965

Darr Angell, Llano Disposal LLC
PO Box 190
Lovington, New Mexico, 88260
575-704-2777

10 April, 2017

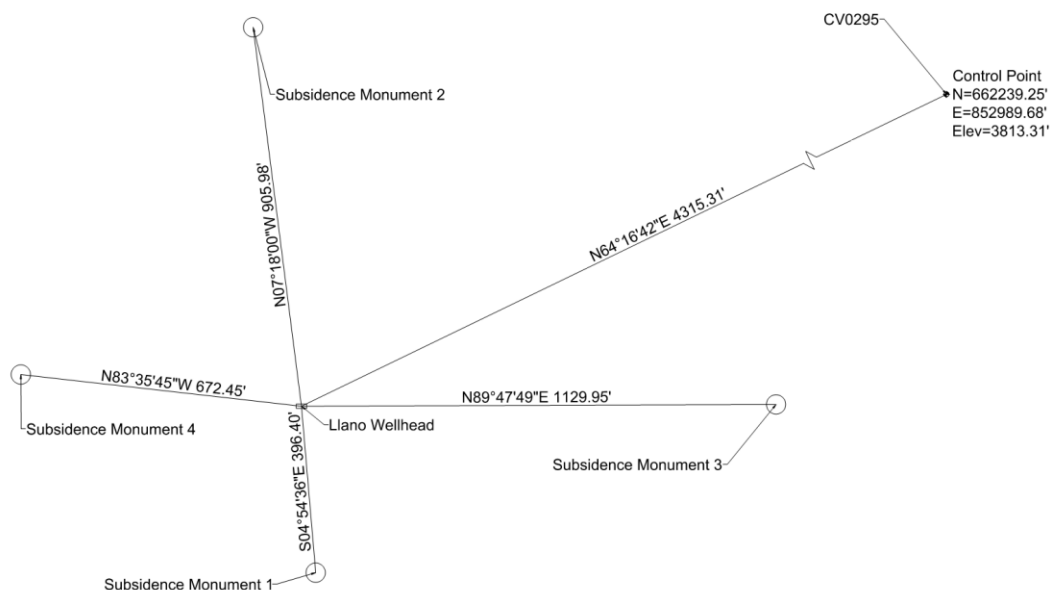
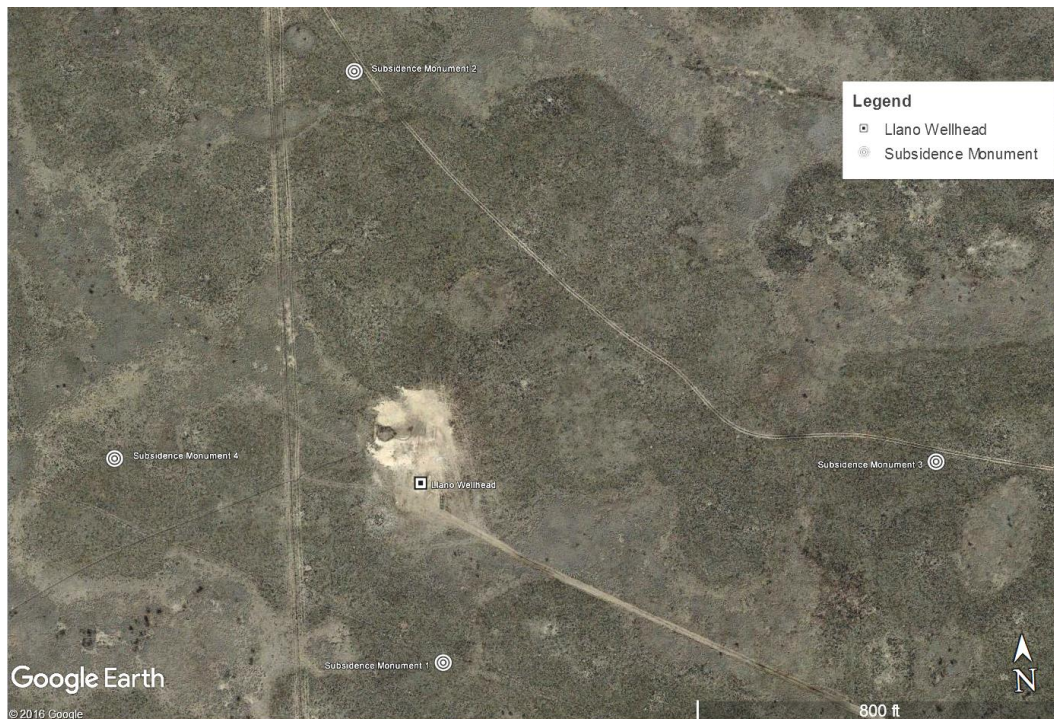
RE: Survey Report
Llano Well Subsidence Monitoring
2017.1005




SUBSIDENCE MONUMENT SURVEY

On March 9, 2017 a field survey was conducted to set and observe positions of four new subsidence monuments surrounding the Llano Wellhead located at $N32^{\circ}48'59.1''$, $W103^{\circ}19'08.02301''$. The well location and associated subsidence monuments can be accessed from NM 483 by turning East on the first road to the South of Buckeye Road, in Lea County.

The Google Earth image and the sketch below illustrate locations of the monuments.





The positions for the four set monuments were placed based on a conversation with Carl Chavez from the Energy Minerals and Natural Resources Department. The discussion was to set at least three monuments at varying distances from the well head. The distances were to be kept to a minimum of 400 feet and a maximum of 1200 feet. The four monuments were set at differing distances in the given interval and in 4 separate directions.

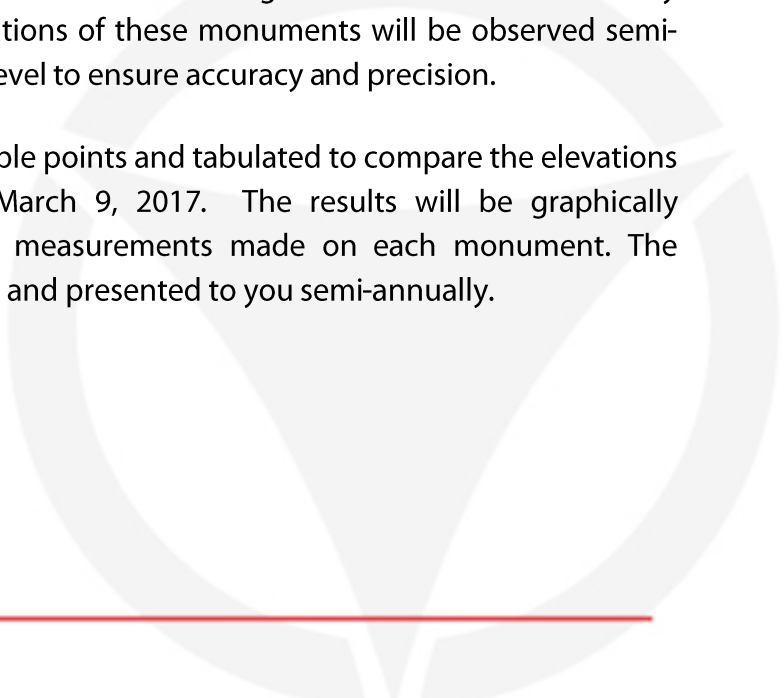
This survey was conducted using Trimble R8 GNSS Receivers and a Trimble DiNi digital level. The GNSS Receivers were used to establish the locations of the monuments and the well head through Differential GNSS observations. In an effort to tie into an existing published control point, the National Geodetic Survey website was reference to find the nearest published benchmark. Vertical Control point CV0295 is located approximately 4,300 feet northeast of the well site. Once the monument was recovered, a GNSS base was setup over the point and static data was observed for over 5 hours. The data was then submitted to an online positioning service to firmly establish the horizontal coordinates: Latitude N32°48'40.92945", Longitude W103°19'53.77433". The published elevation of 3813.31 was held.

While the published/accepted elevation for the point was used. The Trimble DiNi was then used to accurately establish the elevation of the monuments and the wellhead in relation to the NGS control point. The DiNi reads a barcode off of a special rod in order to determine difference in elevation from a known control point. The accuracy of this level helps to eliminate human reading errors. The data is stored onboard and may be transferred directly into the computer software at the office for analysis of results, ensuring greater accuracy.

SUBSIDENCE MONITORING PLAN

The NGS Control Point CV0295, with an elevation of 3813.31 feet above mean sea level (MSL), will be used as the Reference Control Point for determining the elevations of the newly placed Subsidence Monuments. The elevations of these monuments will be observed semi-annually by a level loop run with the DiNi level to ensure accuracy and precision.

Future observations will made on all available points and tabulated to compare the elevations to the base elevations established on March 9, 2017. The results will be graphically represented by trend lines representing measurements made on each monument. The continual change will be monitored by P.A. and presented to you semi-annually.



MONUMENT DESCRIPTIONS

Each of the monuments set and observed are shown below with a description and images of the point.

CV0295

NGS Control Point CV0295 is a brass U.S. Coast & Geodetic Survey Benchmark set in concrete projecting approximately one foot out of the ground. It is stamped with an X and with the year it was set as shown below, followed by the NGS datasheet:



Llano Wellhead

The existing wellhead was measured on the top of the First Flange leaving the wellhead on the horizontal plane. There is an X Filed into the metal that may fade with rust.



Subsidence Monument 1

A Berntsen three quarter inch Aluminum Top Security Sleeve Monument was set. It consists of a rod driven till refusal into a pre drilled three-foot deep hole with a twelve inch diameter. The sleeved rod is encased in six-inch PVC filled with sand, then topped with a Datum Point and an Aluminum Floating Datum Cap. It is then capped with an Access Cover that must be removed with a flathead screw driver or similar tool. The Monument is pictured below:



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STATE PLANE POINT REPORT FROM TRIMBLE BUSINESS CENTER

Project file data		Coordinate System	
Name:	Z:\2017.1005\Survey\Subsidence_Survey\Field Data\Llano Subsidence.vce	Name:	United States/State Plane 1983
Size:	66 KB	Datum:	NAD 1983 (Conus)
Modified:	3/31/2017 11:26:28 AM (UTC: -6)	Zone:	Default
Time zone:	Mountain Standard Time	Geoid:	GEOID12A (Conus)
Reference number:		Vertical datum:	
Description:			
Comment 1:			
Comment 2:			
Comment 3:			

Additional Coordinate System Details

Local Site Settings			
Project latitude:	N32°48'59.08897"	Ground scale factor:	1.00015857066738
Project longitude:	W103°19'08.02301"	False northing offset:	0.000
Project height:	3747.243	False easting offset:	0.000

Point List

ID	Northing (US survey foot)	Easting (US survey foot)	Elevation (US survey foot)	Feature Code	Combined Scale Factor	Meridian convergence angle
100	660370.412	850231.908	3826.913	SUBSIDENCE MONUMENT 3	0.9999973961	0°32'41"
101	661265.048	848986.847	3827.323	SUBSIDENCE MONUMENT 2	0.9999964984	0°32'34"
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104	660366.410	849101.963	3827.868	LLANO WELLHEAD	0.9999965526	0°32'34"
295	662239.254	852989.679	3813.310	7080 NGS CV0295	1.0000000000	0°32'59"

4/20/2017 9:09:47 AM	Z:\2017.1005\Survey\Subsidence_Survey\Field Data\Llano Subsidence.vce	Trimble Business Center
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LAT/LONG POINT REPORT FROM TRIMBLE BUSINESS CENTER

Project file data		Coordinate System	
Name:	Z:\2017.1005\Survey\Subsidence_Survey\Field Data\Llano Subsidence.vce	Name:	United States/State Plane 1983
Size:	66 KB	Datum:	NAD 1983 (Conus)
Modified:	3/31/2017 11:26:28 AM (UTC: -6)	Zone:	Default
Time zone:	Mountain Standard Time	Geoid:	GEOID12A (Conus)
Reference number:		Vertical datum:	
Description:			
Comment 1:			
Comment 2:			
Comment 3:			

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Project longitude:	W103°19'08.02301"	False northing offset:	0.000
Project height:	3747.243	False easting offset:	0.000

Point List

ID	Latitude	Longitude	Height (US survey foot)	Feature Code
100	32.811351	103.327927	3760.741	Subsidence Monument 3
101	32.813842	103.331951	3761.132	Subsidence Monument 2
102	32.811593	103.333776	3763.824	Subsidence Monument 4
103	32.810283	103.331506	3762.14	Subsidence Monument 1
104	32.811369	103.331604	3761.696	Llano Wellhead
295	32.816414	103.318895	3747.243	7080 NGS CV0295

4/27/2017 3:53 PM	Z:\2017.1005\Survey\Subsidence_Survey\Field Data\Llano Subsidence.vce	Trimble Business Center
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The NGS Data Sheet

See file [dsdata.pdf](#) for more information about the datasheet.

```
PROGRAM = datasheet95, VERSION = 8.12.1
1      National Geodetic Survey, Retrieval Date = APRIL 10, 2017
CV0295 *****
CV0295 DESIGNATION - X 151
CV0295 PID - CV0295
CV0295 STATE/COUNTY- NM/LEA
CV0295 COUNTRY - US
CV0295 USGS QUAD - LOVINGTON SE (1985)
CV0295
CV0295 *CURRENT SURVEY CONTROL
CV0295
CV0295* NAD 83(1986) POSITION- 32 48 57. (N) 103 19 08. (W) SCALED
CV0295* NAVD 88 ORTHO HEIGHT - 1163.883 (meters) 3818.51 (feet) ADJUSTED
CV0295
CV0295 GEOID HEIGHT - -21.727 (meters) GEOID12B
CV0295 DYNAMIC HEIGHT - 1162.298 (meters) 3813.31 (feet) COMP
CV0295 MODELED GRAVITY - 979,235.1 (mgal) NAVD 88
CV0295
CV0295 VERT ORDER - SECOND CLASS 0
CV0295
CV0295.The horizontal coordinates were scaled from a topographic map and have
CV0295.an estimated accuracy of +/- 6 seconds.
CV0295.
CV0295.The orthometric height was determined by differential leveling and
CV0295.adjusted by the NATIONAL GEODETIC SURVEY
CV0295.in June 1991.
CV0295
CV0295.Significant digits in the geoid height do not necessarily reflect accuracy.
CV0295.GEOID12B height accuracy estimate available here.
CV0295
CV0295.The dynamic height is computed by dividing the NAVD 88
CV0295.geopotential number by the normal gravity value computed on the
CV0295.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45
CV0295.degrees latitude (g = 980.6199 gals.).
CV0295
CV0295.The modeled gravity was interpolated from observed gravity values.
CV0295
CV0295; North East Units Estimated Accuracy
CV0295;SPC NM E - 201,790. 259,990. MT (+/- 180 meters Scaled)
CV0295
CV0295_U.S. NATIONAL GRID SPATIAL ADDRESS: 13SFS573321(NAD 83)
CV0295
CV0295 SUPERSEDED SURVEY CONTROL
CV0295
CV0295 NGVD 29 (??/??/92) 1163.479 (m) 3817.18 (f) ADJ UNCH 2 0
CV0295
CV0295.Superseded values are not recommended for survey control.
CV0295
CV0295.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
CV0295.See file dsdata.pdf to determine how the superseded data were derived.
CV0295
CV0295_MARKER: DB = BENCH MARK DISK
CV0295_SETTING: 7 = SET IN TOP OF CONCRETE MONUMENT
CV0295_STAMPING: X 151 1935
CV0295_STABILITY: C = MAY HOLD, BUT OF TYPE COMMONLY SUBJECT TO
CV0295+STABILITY: SURFACE MOTION
```



CV0295
CV0295 HISTORY - Date Condition Report By
CV0295 HISTORY - 1935 MONUMENTED CGS
CV0295 HISTORY - 1979 GOOD USGS

CV0295
CV0295 STATION DESCRIPTION
CV0295

CV0295'DESCRIBED BY COAST AND GEODETIC SURVEY 1935
CV0295'6.1 MI W FROM HUMBLE CITY.
CV0295'6.1 MI W ALONG ROADS TOWARDS BUCKEYE RANCH WEST OF HUMBLE CITY ON THE
CV0295'ROAD TO BUCKEYE RANCH, AND 15. FT. S. OF THE CENTER LINE OF THE ROAD.

CV0295
CV0295 STATION RECOVERY (1979)
CV0295

CV0295'RECOVERY NOTE BY US GEOLOGICAL SURVEY 1979
CV0295'COURT HOUSE LOVINGTON, LEA CO. NEW MEXICO 12.6 MILES SE ALONG NM 18
CV0295'THENCE 1.3 MI. SE ALONG GRAVEL RD. TO KIMBOROUGH RANCH, THENCE FOLLOW
CV0295'SECTION LINE AND FENCE WEST FOR 3.3 MILES, 620 FEET NORTH OF A FENCE,
CV0295'600 FEET EAST OF A PIPE LINE, 1500 FEET NW OF THE SE COR OF SEC. 23 T
CV0295'17S R 36 E, IN A PATCH OF MESQUITE. A STANDARD DISK STAMPED X 151
CV0295'1935 AND SET IN THE TOP OF A CONCRETE POST PROJECTING 1.0 FEET.

*** retrieval complete.
Elapsed Time = 00:00:07



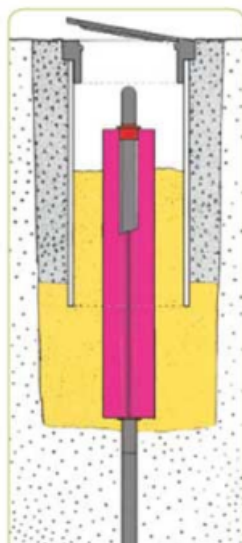
Top Security Sleeve Rod Monuments



Berntsen Sectional Rod Monument with Floating Sleeve

Berntsen's exclusive Top Security™ Sleeve 3-Dimensional Rod Monument System is specifically designed for high-precision geodetic and GPS surveys. Its patented design helps protect against excessive movements in the control monument. The Berntsen extendible rods, when driven to refusal, provide excellent vertical stability. The unique Y-shaped design of the Top Security Sleeve adds the second and third dimension to provide the most stable 3-D survey monument available.

Eliminate most common and unexpected shifts in stability by eliminating most of the direct transfer of shifts in movement from ground level or surface movement. Here's how: Rod markers (driven to refusal) have good vertical stability but can be disturbed by the natural phenomenon known as frost heave. Rod markers, installed with a greased-filled PVC pipe surrounding the upper three or four feet (900 or 1200 mm) (or more) of rod, are known to be effective in combating movement caused by frost heave but offer little protection against possible horizontal movement of surrounding earth (another major cause of differences in readings on rod markers). For the first time, Berntsen's Top Security Sleeve™ with the horizontal stability of the original Berntsen Top Security™ finned rod marker system, this is now available in a commercially available survey monument.



It's even extendible! 3' (914mm) lengths of Top Security Sleeves can also be connected together by Berntsen's exclusive End Cap Alignment Bushings and a little PVC Cement. When used in combination(s), nearly any even-foot length over six feet long (1.83m) of support for the rod marker is possible. That's innovative and flexible design at work for you.

More good news! The Top Security Sleeves' greatest advantage at installation time is speed. Simply drive standard Berntsen round rods to refusal, slip on the grease-filled finned Top Security Sleeve (recommended sleeve length greater than maximum recorded local frost depth), back-fill around the fins with sand, tamp firmly. The color coded End Cap Alignment Bushings follow Berntsen's long established universal color codes for rod marker systems and tell other surveyor's at a glance what size rod is installed - 9/16" (14 mm) Yellow; 3/4" (19 mm) Blue. We recommend NO-TOX lubricating grease to fill the Top Security Sleeve. It is specially formulated to be non-toxic and environmentally safe. It is available in an easy to use cartridge that fits a standard "grease gun". One cartridge should be used for each 36" (915mm) long Top Security Sleeve.



Chavez, Carl J, EMNRD

From: Chavez, Carl J, EMNRD
Sent: Tuesday, April 25, 2017 4:29 PM
To: 'danny@pwillc.net'
Cc: Griswold, Jim, EMNRD; Marvin Burrows; 'billy@pwillc.net'
Subject: RE: Siringo BW #1 (BW-35) Subsidence Monitoring Plan

Danny:

The New Mexico Oil Conservation Division (OCD) is in receipt of the above subject e-mail message with attached Subsidence Monitoring Report.

Could you please send OCD the NAD83 Lat./Long. Decimal Coordinates for the monument locations.

The Monument location on the Well Head should be equipped with perhaps a permanent survey marker, i.e., copper ring, to ensure the survey location remains constant over time. The plan indicates that the X mark may fade with rust over time.

Thank you.

Mr. Carl J. Chavez, CHMM (#13099)
New Mexico Oil Conservation Division
Energy Minerals and Natural Resources Department
1220 South St Francis Drive
Santa Fe, New Mexico 87505
Ph. (505) 476-3490
E-mail: CarlJ.Chavez@state.nm.us

“Why not prevent pollution, minimize waste to reduce operating costs, reuse or recycle, and move forward with the rest of the Nation?” (To see how, go to: <http://www.emnrd.state.nm.us/OCD> and see “Publications”)

From: danny@pwillc.net [mailto:danny@pwillc.net]
Sent: Monday, April 24, 2017 12:55 PM
To: Chavez, Carl J, EMNRD <CarlJ.Chavez@state.nm.us>
Cc: Griswold, Jim, EMNRD <Jim.Griswold@state.nm.us>; Marvin Burrows <burrowsmarvin@gmail.com>; 'billy@pwillc.net' <billy@pwillc.net>
Subject: RE: Siringo BW #1 (BW-35) Subsidence Monitoring Plan

Carl,
Per your request, attached is a survey and report of the ground subsidence monument installations. This is provided per SMP items 1 and 2 in your email below. We apologize for the delay in providing this information. Our monument installation contractor was delayed in providing this report.

If you have any additional questions or input concerning the SMP, please let us know.

Thank you,

Danny J. Holcomb
Pueblo West, LLC
Cell: 806-471-5628
Email: danny@pwillc.net

----- Original Message -----

Subject: Siringo BW #1 (BW-35) Cavern Characterization Plan 3/6/2017

From: "Chavez, Carl J, EMNRD" <CarlJ.Chavez@state.nm.us>

Date: Wed, March 15, 2017 5:47 pm

To: "danny@pwillc.net" <danny@pwillc.net>

Cc: "Griswold, Jim, EMNRD" <Jim.Griswold@state.nm.us>, Marvin Burrows <burrowsmarvin@gmail.com>, "billy@pwillc.net" <billy@pwillc.net>



Danny:

The New Mexico Oil Conservation Division (OCD) has completed its review of the above subject plan.

OCD comments on the Subsidence Monitoring Plan (SMP) are:

1. A map illustrating the monument locations was not provided, which would have included the well, and 3 other monument locations.
2. The max. distance of 150 ft. is too tight. Perhaps a spatial distance of at least 400 ft. between well and 3 monuments would work?
3. Annual surveying with 5-yr. annual post-closure monitoring is acceptable.

OCD comments on the Cavern Characterization Plan (CCP) are:

1. The "Loaded Cantilever Beam Model Method" was the approach to deriving the maximum 280 ft. cavern diameter within the calculated Safety Factor. This method has been documented in the scientific literature. Also mentioned was the fact that OCD's D/H equivalent was 0.14 (utilizing the H value of 2043 ft.), which is significantly below OCD's 0.5 cavern collapse ratio. OCD believes the operator's 280 ft. cavern diameter is more conservative than OCD's; thus, OCD accepts the calculation.
2. The operator did not mention how it would assess cavern morphology in the plan, i.e., sonar, production data over time, etc. Since the Permit requires monthly injection and production volumes with cumulative production volume over time (e.g., ft³ and bbl units), the operator can routinely provide estimation of cavern dissolution volumes, etc. estimates. OCD may require geophysical testing based on production data within the decade.
3. The annual reports is the mechanism to calculate cavern void space based on brine production.

Please address the SMP highlighted items above within 14 days of the date of this message.

Please contact me if you have questions. Thank you.

Mr. Carl J. Chavez, CHMM (#13099)
New Mexico Oil Conservation Division
Energy Minerals and Natural Resources Department
1220 South St Francis Drive
Santa Fe, New Mexico 87505

Ph. (505) 476-3490

E-mail: CarlJ.Chavez@state.nm.us

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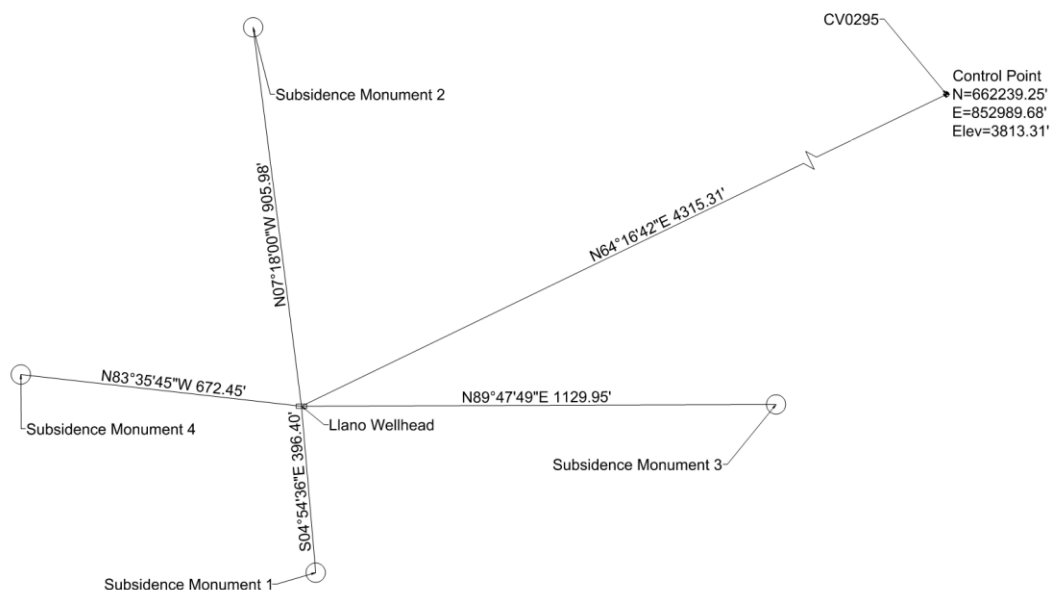
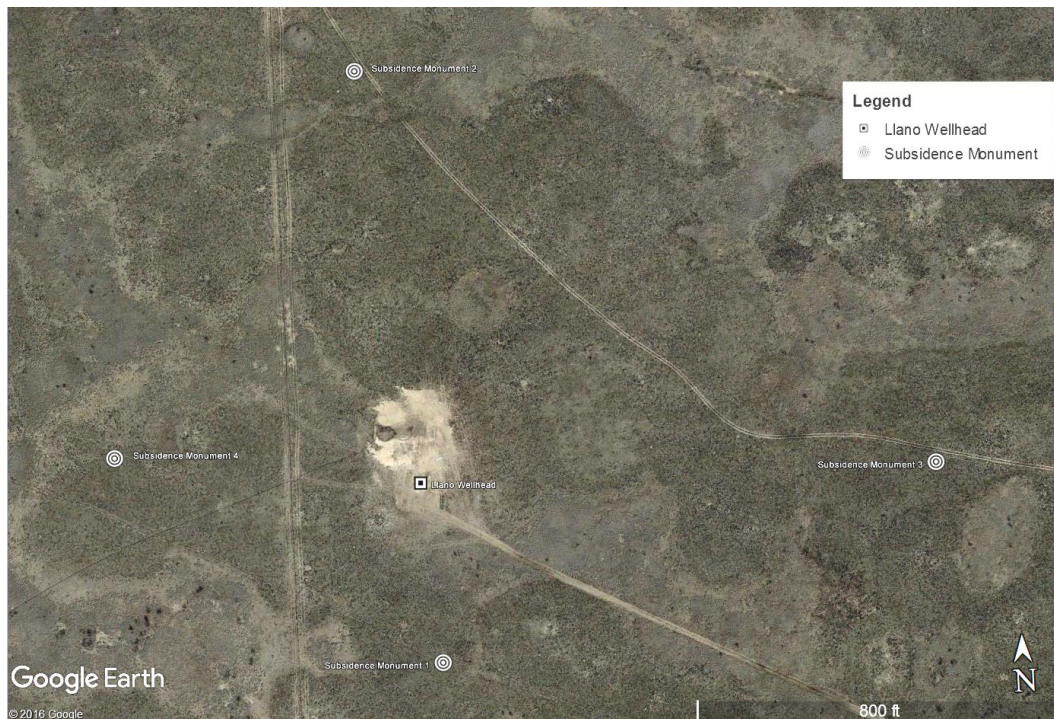
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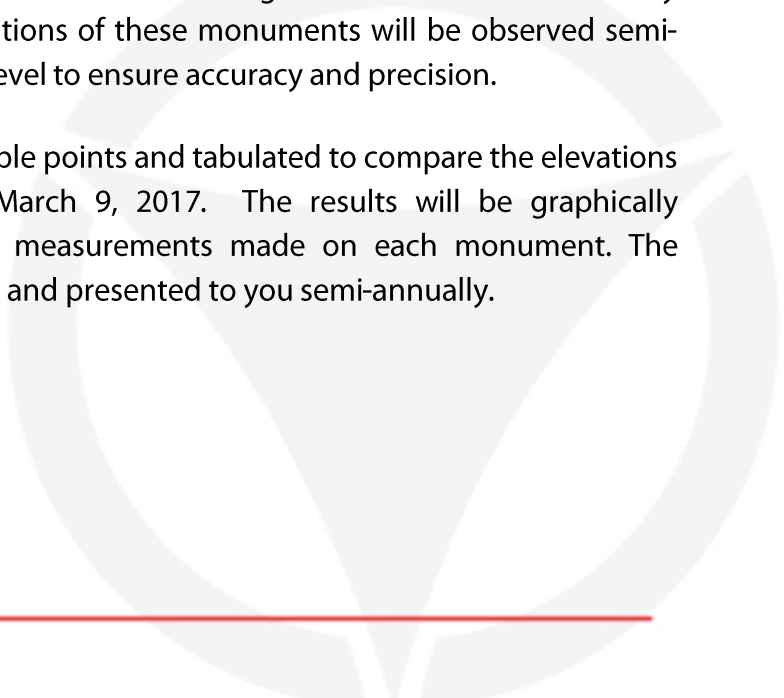
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103	659971.468	849135.891	3828.318	SUBSIDENCE MONUMENT 1	0.9999965553	0°32'34"
104	660366.410	849101.963	3827.868	LLANO WELLHEAD	0.9999965526	0°32'34"
295	662239.254	852989.679	3813.310	7080 NGS CV0295	1.0000000000	0°32'59"

4/20/2017 9:09:47 AM	Z:\2017.1005\Survey\Subsidence_Survey\Field Data\Llano Subsidence.vce	Trimble Business Center
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LAT/LONG POINT REPORT FROM TRIMBLE BUSINESS CENTER

Project file data		Coordinate System	
Name:	Z:\2017.1005\Survey\Subsidence_Survey\Field Data\Llano Subsidence.vce	Name:	United States/State Plane 1983
Size:	66 KB	Datum:	NAD 1983 (Conus)
Modified:	3/31/2017 11:26:28 AM (UTC: -6)	Zone:	Default
Time zone:	Mountain Standard Time	Geoid:	GEOID12A (Conus)
Reference number:		Vertical datum:	
Description:			
Comment 1:			
Comment 2:			
Comment 3:			

Additional Coordinate System Details

Local Site Settings			
Project latitude:	N32°48'59.08897"	Ground scale factor:	1.00015857066738
Project longitude:	W103°19'08.02301"	False northing offset:	0.000
Project height:	3747.243	False easting offset:	0.000

Point List

ID	Latitude (Global)	Longitude (Global)	Height (Global) (US survey foot)	Feature Code
100	N32°48'40.86294"	W103°19'40.53766"	3760.741	SUBSIDENCE MONUMENT 3
101	N32°48'49.82961"	W103°19'55.02310"	3761.132	SUBSIDENCE MONUMENT 2
102	N32°48'41.73398"	W103°20'01.59394"	3763.824	SUBSIDENCE MONUMENT 4
103	N32°48'37.01948"	W103°19'53.42074"	3762.140	SUBSIDENCE MONUMENT 1
104	N32°48'40.92945"	W103°19'53.77433"	3761.696	LLANO WELLHEAD
295	N32°48'59.08897"	W103°19'08.02301"	3747.243	7080 NGS CV0295

4/20/2017 10:36:29 AM	Z:\2017.1005\Survey\Subsidence_Survey\Field Data\Llano Subsidence.vce	Trimble Business Center
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The NGS Data Sheet

See file [dsdata.pdf](#) for more information about the datasheet.

```
PROGRAM = datasheet95, VERSION = 8.12.1
1      National Geodetic Survey, Retrieval Date = APRIL 10, 2017
CV0295 *****
CV0295 DESIGNATION - X 151
CV0295 PID - CV0295
CV0295 STATE/COUNTY- NM/LEA
CV0295 COUNTRY - US
CV0295 USGS QUAD - LOVINGTON SE (1985)
CV0295
CV0295 *CURRENT SURVEY CONTROL
CV0295
CV0295* NAD 83(1986) POSITION- 32 48 57. (N) 103 19 08. (W) SCALED
CV0295* NAVD 88 ORTHO HEIGHT - 1163.883 (meters) 3818.51 (feet) ADJUSTED
CV0295
CV0295 GEOID HEIGHT - -21.727 (meters) GEOID12B
CV0295 DYNAMIC HEIGHT - 1162.298 (meters) 3813.31 (feet) COMP
CV0295 MODELED GRAVITY - 979,235.1 (mgal) NAVD 88
CV0295
CV0295 VERT ORDER - SECOND CLASS 0
CV0295
CV0295.The horizontal coordinates were scaled from a topographic map and have
CV0295.an estimated accuracy of +/- 6 seconds.
CV0295.
CV0295.The orthometric height was determined by differential leveling and
CV0295.adjusted by the NATIONAL GEODETIC SURVEY
CV0295.in June 1991.
CV0295
CV0295.Significant digits in the geoid height do not necessarily reflect accuracy.
CV0295.GEOID12B height accuracy estimate available here.
CV0295
CV0295.The dynamic height is computed by dividing the NAVD 88
CV0295.geopotential number by the normal gravity value computed on the
CV0295.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45
CV0295.degrees latitude (g = 980.6199 gals.).
CV0295
CV0295.The modeled gravity was interpolated from observed gravity values.
CV0295
CV0295; North East Units Estimated Accuracy
CV0295;SPC NM E - 201,790. 259,990. MT (+/- 180 meters Scaled)
CV0295
CV0295_U.S. NATIONAL GRID SPATIAL ADDRESS: 13SFS573321(NAD 83)
CV0295
CV0295 SUPERSEDED SURVEY CONTROL
CV0295
CV0295 NGVD 29 (??/??/92) 1163.479 (m) 3817.18 (f) ADJ UNCH 2 0
CV0295
CV0295.Superseded values are not recommended for survey control.
CV0295
CV0295.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
CV0295.See file dsdata.pdf to determine how the superseded data were derived.
CV0295
CV0295_MARKER: DB = BENCH MARK DISK
CV0295_SETTING: 7 = SET IN TOP OF CONCRETE MONUMENT
CV0295_STAMPING: X 151 1935
CV0295_STABILITY: C = MAY HOLD, BUT OF TYPE COMMONLY SUBJECT TO
CV0295+STABILITY: SURFACE MOTION
```



CV0295
CV0295 HISTORY - Date Condition Report By
CV0295 HISTORY - 1935 MONUMENTED CGS
CV0295 HISTORY - 1979 GOOD USGS

CV0295
CV0295 STATION DESCRIPTION
CV0295

CV0295'DESCRIBED BY COAST AND GEODETIC SURVEY 1935
CV0295'6.1 MI W FROM HUMBLE CITY.
CV0295'6.1 MI W ALONG ROADS TOWARDS BUCKEYE RANCH WEST OF HUMBLE CITY ON THE
CV0295'ROAD TO BUCKEYE RANCH, AND 15. FT. S. OF THE CENTER LINE OF THE ROAD.

CV0295
CV0295 STATION RECOVERY (1979)
CV0295

CV0295'RECOVERY NOTE BY US GEOLOGICAL SURVEY 1979
CV0295'COURT HOUSE LOVINGTON, LEA CO. NEW MEXICO 12.6 MILES SE ALONG NM 18
CV0295'THENCE 1.3 MI. SE ALONG GRAVEL RD. TO KIMBOROUGH RANCH, THENCE FOLLOW
CV0295'SECTION LINE AND FENCE WEST FOR 3.3 MILES, 620 FEET NORTH OF A FENCE,
CV0295'600 FEET EAST OF A PIPE LINE, 1500 FEET NW OF THE SE COR OF SEC. 23 T
CV0295'17S R 36 E, IN A PATCH OF MESQUITE. A STANDARD DISK STAMPED X 151
CV0295'1935 AND SET IN THE TOP OF A CONCRETE POST PROJECTING 1.0 FEET.

*** retrieval complete.
Elapsed Time = 00:00:07



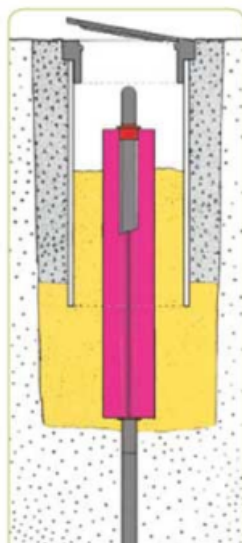
Top Security Sleeve Rod Monuments



Berntsen Sectional Rod Monument with Floating Sleeve

Berntsen's exclusive Top Security™ Sleeve 3-Dimensional Rod Monument System is specifically designed for high-precision geodetic and GPS surveys. Its patented design helps protect against excessive movements in the control monument. The Berntsen extendible rods, when driven to refusal, provide excellent vertical stability. The unique Y-shaped design of the Top Security Sleeve adds the second and third dimension to provide the most stable 3-D survey monument available.

Eliminate most common and unexpected shifts in stability by eliminating most of the direct transfer of shifts in movement from ground level or surface movement. Here's how: Rod markers (driven to refusal) have good vertical stability but can be disturbed by the natural phenomenon known as frost heave. Rod markers, installed with a greased-filled PVC pipe surrounding the upper three or four feet (900 or 1200 mm) (or more) of rod, are known to be effective in combating movement caused by frost heave but offer little protection against possible horizontal movement of surrounding earth (another major cause of differences in readings on rod markers). For the first time, Berntsen's Top Security Sleeve™ with the horizontal stability of the original Berntsen Top Security™ finned rod marker system, this is now available in a commercially available survey monument.



It's even extendible! 3' (914mm) lengths of Top Security Sleeves can also be connected together by Berntsen's exclusive End Cap Alignment Bushings and a little PVC Cement. When used in combination(s), nearly any even-foot length over six feet long (1.83m) of support for the rod marker is possible. That's innovative and flexible design at work for you.

More good news! The Top Security Sleeves' greatest advantage at installation time is speed. Simply drive standard Berntsen round rods to refusal, slip on the grease-filled finned Top Security Sleeve (recommended sleeve length greater than maximum recorded local frost depth), back-fill around the fins with sand, tamp firmly. The color coded End Cap Alignment Bushings follow Berntsen's long established universal color codes for rod marker systems and tell other surveyor's at a glance what size rod is installed - 9/16" (14 mm) Yellow; 3/4" (19 mm) Blue. We recommend NO-TOX lubricating grease to fill the Top Security Sleeve. It is specially formulated to be non-toxic and environmentally safe. It is available in an easy to use cartridge that fits a standard "grease gun". One cartridge should be used for each 36" (915mm) long Top Security Sleeve.

