OCD Artesia

14-518

TES

11-10-2014

Form 3160-3
(March 2012)

FORM APPROVED
OMB No. 1004-0137
Expires October 31, 2014

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

APPLICATION FOR PERMIT TO DRILL OR REENTER

5. Lease Serial No.
NM 92757 & NM110829

6. If Indian, Allotee or Tribe Name

1a. Type of work: ☑ DRILL ☐ REENTER

7. If Unit or CA Agreement, Name and No.

1b. Type of Well: ☑ Oil Well ☐ Gas Well ☐ Other ☑ Single Zone ☐ Multiple Zone

8. Lease Name and Well No.
PARDUE 29 FEDERAL COM 5H 313337

2. Name of Operator Legend Natural Gas III, LP 258894

9. API Well No.
30-015- 42782

3a. Address 15021 KATY FREEWAY, STE. 200
HOUSTON, TX 77094

3b. Phone No. *(include area code)*
817-872-7822

10. Field and Pool, or Exploratory
Willow Lake; Bone Spring (64450)

4. Location of Well *(Report location clearly and in accordance with any State requirements.*)*
At surface 45 FNL AND 1307 FWL
At proposed prod. zone BOTTOM HOLE - 331.2 FSL & 1509.8 FWL Non-Standard Location

11. Sec., T. R. M. or Blk. and Survey or Area
Section 29; T-24S; R-28E

14. Distance in miles and direction from nearest town or post office*
APPROX 5.0 MILES WEST/SOUTHWEST OF MALAGA, NM

12. County or Parish
Eddy

13. State
NM

15. Distance from proposed* location to nearest property or lease line, ft. (Also to nearest drig. unit line, if any)	16. No. of acres in lease	17. Spacing Unit dedicated to this well
45'	NM92757-1081.18 NM110829-560.0	160 Acres
18. Distance from proposed location* to nearest well, drilling, completed, applied for, on this lease, ft.	**19. Proposed Depth**	**20. BLM/BIA Bond No. on file**
SURFACE-30' SUB-SURFACE 85' Vert) 1130' Horiz	12704'MD; 7982'TVD	NMB000525
21. Elevations (Show whether DF, KDB, RT, GL, etc.)	**22. Approximate date work will start***	**23. Estimated duration**
3048'	04/01/2014	2 MONTHS

24. Attachments

The following, completed in accordance with the requirements of Onshore Oil and Gas Order No.1, must be attached to this form:

1. Well plat certified by a registered surveyor.
2. A Drilling Plan.
3. A Surface Use Plan (if the location is on National Forest System Lands, the SUPO must be filed with the appropriate Forest Service Office).
4. Bond to cover the operations unless covered by an existing bond on file (see Item 20 above).
5. Operator certification.
6. Such other site specific information and/or plans as may be required by the BLM.

25. Signature	Name *(Printed/Typed)*	Date
	JENNIFER MOSLEY ELROD	02/06/2014

Title
SR. REGULATORY ANALYST

Approved by *(Signature)*	Name *(Printed/Typed)*	Date
James A. Amos		OCT 31 2014
Title	**Office**	
FIELD MANAGER	CARLSBAD FIELD OFFICE	

Application approval does not warrant or certify that the applicant holds legal or equitable title to those rights in the subject lease which would entitle the applicant to conduct operations thereon.
Conditions of approval, if any, are attached.

APPROVAL FOR TWO YEARS

Title 18 U.S.C. Section 1001 and Title 43 U.S.C. Section 1212, make it a crime for any person knowingly and willfully to make to any department or agency of the United States any false, fictitious or fraudulent statements or representations as to any matter within its jurisdiction.

(Continued on page 2)

*(Instructions on page 2)

Carlsbad Controlled Water Basin

NM OIL CONSERVATION
ARTESIA DISTRICT
NOV 07 2014
RECEIVED

SEE ATTACHED FOR
CONDITIONS OF APPROVAL

Approval Subject to General Requirements
& Special Stipulations Attached

LEGEND NATURAL GAS, III L.P.
777 Main Street, Suite 900
Fort Worth, Texas 76102

Operator Certification

I hereby certify that I, or someone under my direct supervision, have inspected the drill site and access route proposed herein; that I am familiar with the conditions which currently exists; that I have full knowledge of state and Federal laws applicable to this operation; that the statements made in the APD package are, to the best of my knowledge, true and correct; and that the work associated with the operations proposed herein will be performed in conformity with this APD package and the terms and conditions under which it is approved. I also certify that I, or the company I represent, am responsible for the operations conducted under this application. These statements are subject to the provisions of 18 U.S.C. 1001 for the filing of false statements.

Executed this 7 day of February, 20 14.

Signed: _____

Name: Jennifer Mosley Elrod
Title: Sr. Regulatory Analyst
Address: 777 Main Street, Suite 900, Fort Worth, Texas 76102
Phone: (817) 872-7822

DISTRICT I
1625 N. French Dr., Hobbs, NM 88240
Phone: (575) 393-6161 Fax: (575) 393-0720
DISTRICT II
811 S. First St., Artesia, NM 88210
Phone: (575) 748-1283 Fax: (575) 748-9720
DISTRICT III
1000 Rio Brazos Road, Aztec, NM 87410
Phone: (505) 334-6178 Fax: (505) 334-6170
DISTRICT IV
1220 S. St. Francis Dr., Santa Fe, NM 87505
Phone: (505) 476-3460 Fax: (505) 476-3462

State of New Mexico
Energy, Minerals & Natural Resources Department
OIL CONSERVATION DIVISION
1220 South St. Francis Dr.
Santa Fe, New Mexico 87505

Form C-102
Revised August 1, 2011
Submit one copy to appropriate District Office

☐ AMENDED REPORT

WELL LOCATION AND ACREAGE DEDICATION PLAT

API Number	Pool Code	Pool Name
30-015-42792	64450	Willow Lake; Bone Spring
Property Code	Property Name	Well Number
313339	PARDUE 29 FEDERAL COM	5H
OGRID No.	Operator Name	Elevation
258894	LEGEND NATURAL GAS III, LP	3048'

Surface Location

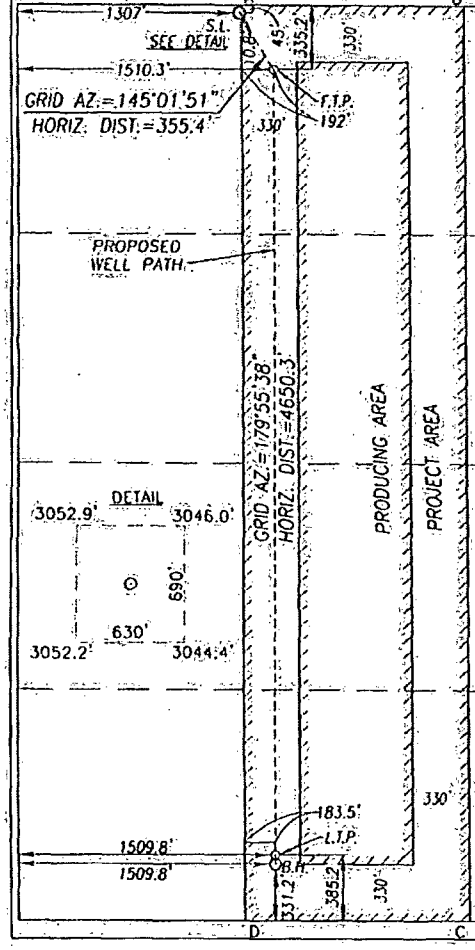
UL or lot No.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County
D	29	24-S	28-E		45	NORTH	1307	WEST	EDDY

Bottom Hole Location If Different From Surface

UL or lot No.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County
N	29	24-S	28-E		331.2	SOUTH	1509.8	WEST	EDDY

Dedicated Acres	Joint or Infill	Consolidation Code	Order No.
160			

NO ALLOWABLE WILL BE ASSIGNED TO THIS COMPLETION UNTIL ALL INTERESTS HAVE BEEN CONSOLIDATED OR A NON-STANDARD UNIT HAS BEEN APPROVED BY THE DIVISION



GEODETIC COORDINATES NAD 83 NME SURFACE LOCATION	GEODETIC COORDINATES NAD 27 NME SURFACE LOCATION
Y=435047.6 N	Y=434989.3 N
X=609187.4 E	X=568004.0 E
LAT.=32.195833° N	LAT.=32.195711° N
LONG.=104.113987° W	LONG.=104.113494° W
FIRST TAKE POINT	**FIRST TAKE POINT**
Y=434756.4 N	Y=434698.2 N
X=609391.1 E	X=568207.7 E
LAT.=32.195031° N	LAT.=32.194910° N
LONG.=104.113330° W	LONG.=104.112837° W

CORNER COORDINATES TABLE

NAD 27
A - Y=435034.3 N, X=568014.8 E
B - Y=435027.6 N, X=569332.2 E
C - Y=429678.4 N, X=569357.8 E
D - Y=429680.3 N, X=568031.2 E

NAD 83
A - Y=435092.6 N, X=609198.2 E
B - Y=435085.9 N, X=610515.6 E
C - Y=429736.6 N, X=610541.3 E
D - Y=429738.4 N, X=609214.7 E

GEODETIC COORDINATES NAD 83 NME LAST TAKE POINT	GEODETIC COORDINATES NAD 27 NME LAST TAKE POINT
Y=430123.3 N	Y=430065.1 N
X=609397.0 E	X=568213.5 E
LAT.=32.182295° N	LAT.=32.182174° N
LONG.=104.113342° W	LONG.=104.112849° W
BOTTOM HOLE LOCATION	**BOTTOM HOLE LOCATION**
Y=430069.3 N	Y=430011.1 N
X=609397.0 E	X=568213.5 E
LAT.=32.182147° N	LAT.=32.182025° N
LONG.=104.113342° W	LONG.=104.112849° W

OPERATOR CERTIFICATION

I hereby certify that the information herein is true and complete to the best of my knowledge and belief, and that this organization either owns a working interest or unleased mineral interest in the land including the proposed bottom hole location or has a right to drill this well at this location pursuant to a contract with an owner of such mineral or working interest, or to a voluntary pooling agreement or a compulsory pooling order heretofore entered by the division.

Signature 6/9/14 Date

Jennifer Elrod
Printed Name

jelrod@lng2.com
E-mail Address

SURVEYOR CERTIFICATION

I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my belief.

MAY 20, 2014
Date of Survey

Signature & Seal of Professional Surveyor:

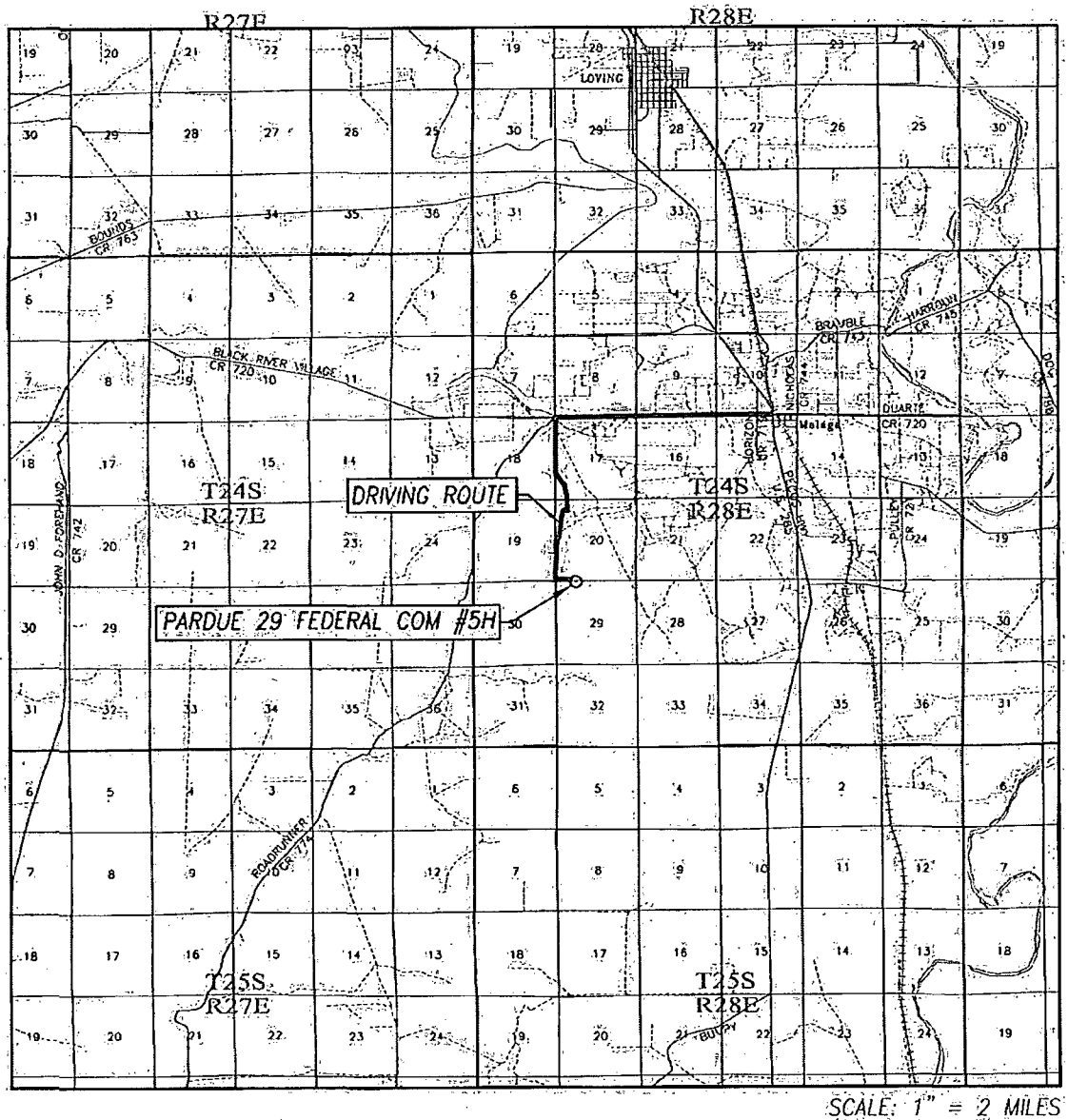
RONALD J. EIDSON NEW MEXICO 3239 REGISTERED PROFESSIONAL SURVEYOR

Ronald J. Eidson 05/05/2014

Certificate Number Gary G. Eidson 12641
Ronald J. Eidson 3239

ACK. REL. W.O.: 130358 JWSC W.O.: 14.11.0545

VICINITY MAP



SCALE: 1" = 2 MILES

DRIVING ROUTE: SEE LOCATION VERIFICATION MAP

SEC. 29 TWP. 24-S RGE. 28-E

SURVEY N.M.P.M.

COUNTY EDDY STATE NEW MEXICO

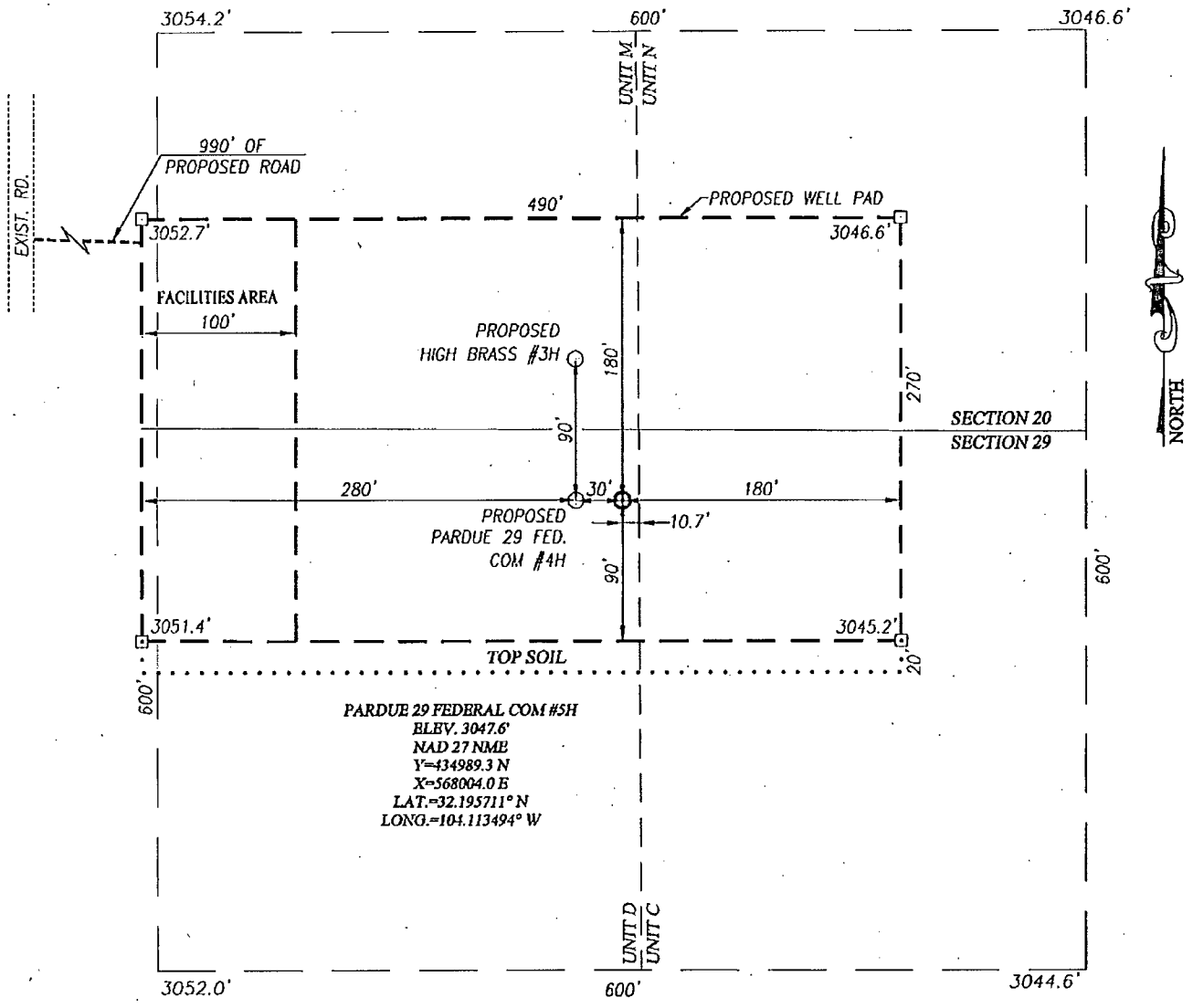
DESCRIPTION 45' FNL & 1307' FWL

ELEVATION 3048'

OPERATOR LEGEND NATURAL GAS, LLC

LEASE PARDUE 29 FEDERAL COM

PROVIDING SURVEYING SERVICES SINCE 1946
JOHN WEST SURVEYING COMPANY
412 N. DAL PASO
HOBBS, N.M. 88240
(575) 393-3117 www.jwsc.biz



DIRECTIONS TO PARDUE 29 FEDERAL COM #5H:

FROM THE INTERSECTION OF US. HIGHWAY 285 & CO. RD. 720 (BLACK RIVER RD.) GO WEST ON BLACK RIVER RD. APPROX. 2.7 MILES TO CO. RD. 774 (ROAD RUNNER RD.); TURN LEFT AND GO SOUTH ON CALICHE LEASE ROAD APPROX. 0.65 MILES. VEER LEFT AND GO SOUTHEAST APPROX. 0.2 MILES. VEER RIGHT AND GO SOUTH APPROX. 0.3 MILES. TURN RIGHT AND GO WEST APPROX. 300 FEET; TURN LEFT AND GO SOUTH APPROX. 0.5 MILES. LEASE ROAD CONTINUES WEST; FROM THIS POINT, FOLLOW A TWO-TRACK ROAD SOUTH APPROX. 0.3 MILES TO A PROPOSED ROAD SURVEY. FOLLOW ROAD SURVEY EAST 990 FEET TO THE LOCATION.

NOTE:
SEE "LOCATION VERIFICATION MAP" FOR PROPOSED ROAD LOCATION.

100 0 100 200 Feet

Scale: 1"=100'

LEGEND NATURAL GAS, LLC

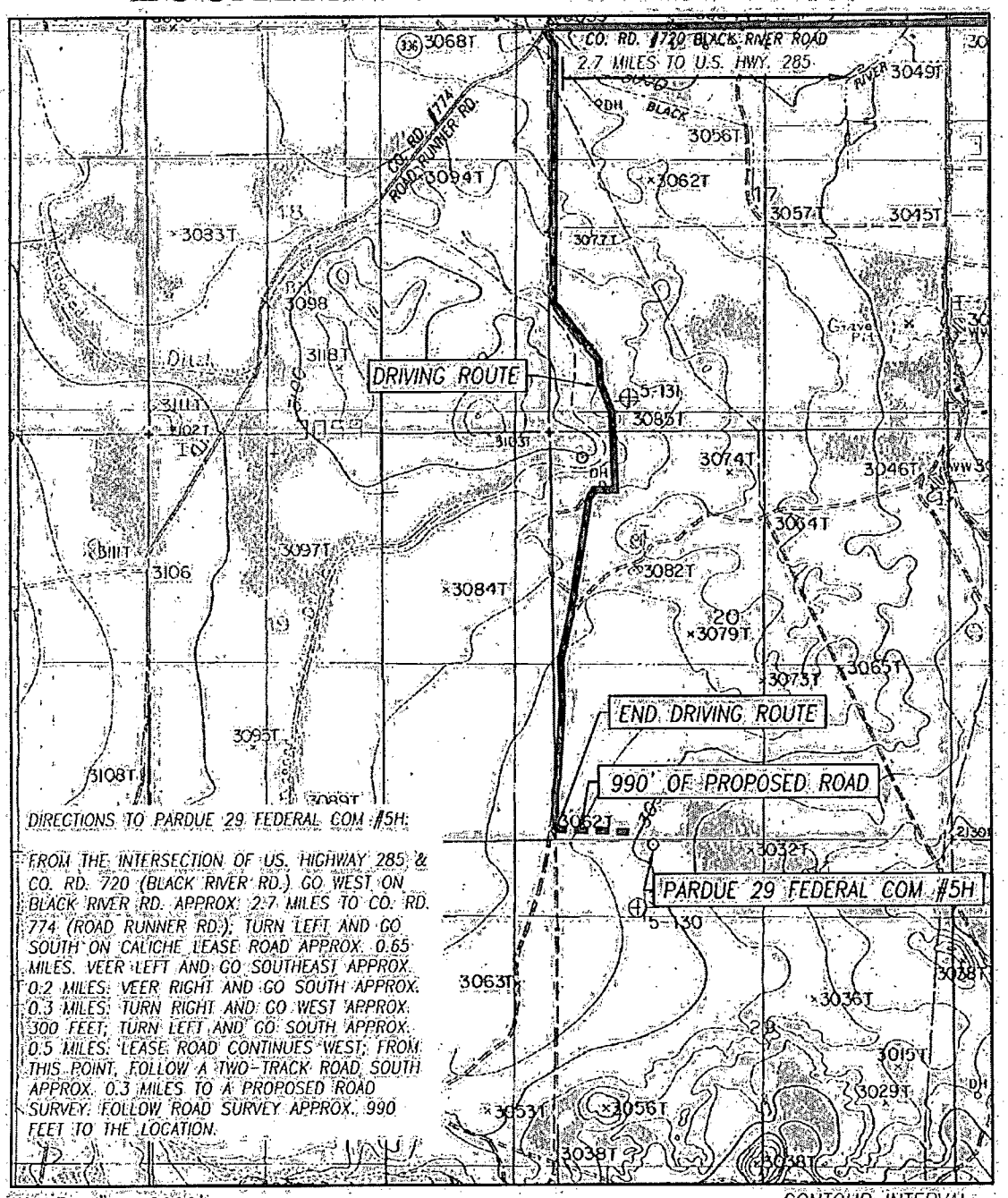
PARDUE 29 FEDERAL COM #5H WELL
LOCATED 45 FEET FROM THE NORTH LINE
AND 1307 FEET FROM THE WEST LINE OF SECTION 29,
TOWNSHIP 24 SOUTH, RANGE 28 EAST, N.M.P.M.,
EDDY COUNTY, NEW MEXICO

Survey Date: 5/20/14	CAD Date: 6/2/14	Drawn By: ACK
W.O. No.: 14110548	Rev: .	Rel. W.O.:14130258	Sheet 1 of 1

PROVIDING SURVEYING SERVICES
SINCE 1946
JOHN WEST SURVEYING COMPANY
412 N. DAL PASO
HOBBS, N.M. 88240
(575) 393-3117 www.jwsc.biz

EXHIBIT #1

LOCATION VERIFICATION MAP



DIRECTIONS TO PARDUE 29 FEDERAL COM #5H:

FROM THE INTERSECTION OF U.S. HIGHWAY 285 & CO. RD. 720 (BLACK RIVER RD.) GO WEST ON BLACK RIVER RD. APPROX. 2.7 MILES TO CO. RD. 774 (ROAD RUNNER RD.); TURN LEFT AND GO SOUTH ON CALICHE LEASE ROAD APPROX. 0.65 MILES. VEER LEFT AND GO SOUTHEAST APPROX. 0.2 MILES. VEER RIGHT AND GO SOUTH APPROX. 0.3 MILES; TURN RIGHT AND GO WEST APPROX. 300 FEET; TURN LEFT AND GO SOUTH APPROX. 0.5 MILES. LEASE ROAD CONTINUES WEST; FROM THIS POINT, FOLLOW A TWO-TRACK ROAD SOUTH APPROX. 0.3 MILES TO A PROPOSED ROAD SURVEY; FOLLOW ROAD SURVEY APPROX. 990 FEET TO THE LOCATION.

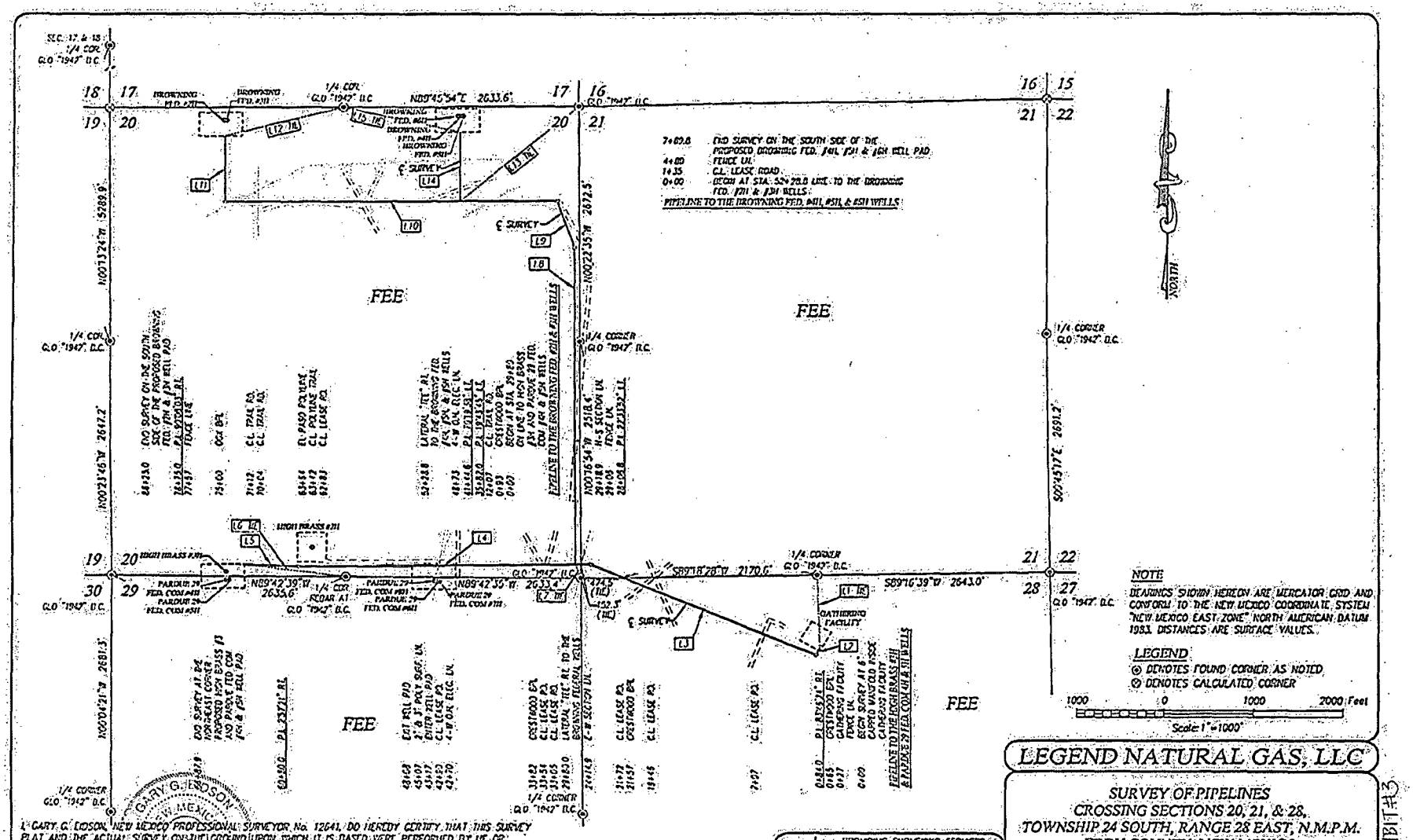
SCALE: 1" = 2000'

CONTOUR INTERVAL:
MALAGA, N.M. - 10'

SEC. 29 TWP. 24-S RGE. 28-E
SURVEY N.M.P.M.
COUNTY EDDY STATE NEW MEXICO
DESCRIPTION 45' FNL & 1307' FWL
ELEVATION 3048'
OPERATOR LEGEND NATURAL GAS, LLC
LEASE PARDUE 29 FEDERAL COM
U.S.G.S. TOPOGRAPHIC MAP
MALAGA, N.M.

PROVIDING SURVEYING SERVICES SINCE 1946
JOHN WEST SURVEYING COMPANY
412 N. DAL PASO
HOBBS, N.M. 88240
(575) 393-3117 www.jwsc.biz

EXHIBIT #2



NOTE

BEARINGS SHOWN HEREON ARE MERCATOR GRID AND CONFORM TO THE NEW MEXICO COORDINATE SYSTEM "NEW MEXICO EAST ZONE" NORTH AMERICAN DATUM 1983. DISTANCES ARE SURFACE VALUES.

LEGEND

⊙ DENOTES FOUND CORNER AS NOTED
⊗ DENOTES CALCULATED CORNER

I, GARY G. EIDSON, NEW MEXICO PROFESSIONAL SURVEYOR No. 12641, DO HEREBY CERTIFY THAT THIS SURVEY PLAT AND THE ACTUAL SURVEY ON THE GROUND UPON WHICH IT IS BASED WERE PERFORMED BY ME OR UNDER MY DIRECT SUPERVISION; THAT I AM RESPONSIBLE FOR THIS SURVEY; THAT THIS SURVEY MEETS THE MINIMUM STANDARDS FOR SURVEYING IN NEW MEXICO; AND THAT IT IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF.

GARY G. EIDSON DATE: 2/4/14

PROVIDING SURVEYING SERVICES SINCE 1946
JOHN WEST SURVEYING COMPANY
412 N. DAL PASO
HOBBS, N.M. 88240
(575) 393-3117 www.jwsc.biz

Survey Date: 1/23, 24 & 27/14	CAD Date: 2/3/14	Drawn By: ACK	
W.O. No.: 14110082	Rev.:	Rel. W.O.:	Sheet 1 of 2

DESCRIPTION TO THE HIGH BRASS #3H & PARDUE 29 FED. COM 4H & 5H WELLS

SURVEY OF A PIPELINE CROSSING SECTIONS 20, 21 & 28, TOWNSHIP 24 SOUTH, RANGE 28 EAST, N.M.P.M., EDDY COUNTY, NEW MEXICO, AND BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT A POINT IN THE NORTHEAST QUARTER OF SECTION 28, WHICH LIES S02°00'43"E 829.8 FEET FROM THE NORTH QUARTER CORNER OF SAID SECTION 28; THEN S28°19'41"W 84.0 FEET; THEN N67°53'55"W 2722.8 FEET; THEN S89°32'13"W 3273.2 FEET; THEN N87°30'26"W 607.9 FEET TO A POINT IN THE SOUTHWEST QUARTER OF SAID SECTION 20, WHICH LIES N82°58'53"W 1141.1 FEET FROM THE SOUTH QUARTER CORNER OF SAID SECTION 20.

TOTAL LENGTH EQUALS 6687.9 FEET OR 405.33 RODS.

DESCRIPTION TO THE BROWNING FED. #2H & #3H WELLS

SURVEY OF A PIPELINE CROSSING SECTION 20, TOWNSHIP 24 SOUTH, RANGE 28 EAST, N.M.P.M., EDDY COUNTY, NEW MEXICO, AND BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT A POINT IN THE SOUTHEAST CORNER OF SAID SECTION 20, WHICH LIES N22°09'58"W 163.9 FEET FROM THE SOUTHEAST CORNER OF SAID SECTION; THEN N00°11'41"W 3582.0 FEET; THEN N19°55'26"W 562.6 FEET; THEN S89°44'55"W 3730.4 FEET; THEN N00°07'01"W 750.0 FEET TO A POINT IN THE NORTHWEST QUARTER OF SAID SECTION, WHICH LIES S75°51'25"W 1375.0 FEET FROM THE NORTH QUARTER CORNER OF SAID SECTION 20.

TOTAL LENGTH EQUALS 8625.0 FEET OR 522.73 RODS.

DESCRIPTION TO THE BROWNING FED. #4H, #5H, & #6H WELLS

SURVEY OF A PIPELINE CROSSING SECTION 20, TOWNSHIP 24 SOUTH, RANGE 28 EAST, N.M.P.M., EDDY COUNTY, NEW MEXICO, AND BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT A POINT IN THE NORTHEAST QUARTER OF SAID SECTION 20, WHICH LIES S50°33'38"W 1708.2 FEET FROM THE NORTHEAST CORNER OF SAID SECTION; THEN N00°00'01"E 789.8 FEET TO A POINT IN THE NORTHEAST QUARTER OF SAID SECTION, WHICH LIES S77°46'56"E 1344.8 FEET FROM THE NORTH QUARTER CORNER OF SAID SECTION 20.

TOTAL LENGTH EQUALS 789.8 FEET OR 47.87 RODS.

SECTION 20 TOTAL LENGTH EQUALS 13183.8 FEET OR 799.02 RODS.
SECTION 21 TOTAL LENGTH EQUALS 503.9 FEET OR 30.54 RODS.
SECTION 28 TOTAL LENGTH EQUALS 2415.0 FEET OR 146.36 RODS.

TOTAL COMBINED SECTIONS 20, 21 & 28 LENGTH EQUALS 16102.7 FEET OR 975.92 RODS

PIPELINE TO THE HIGH BRASS #3H & PARDUE 29 FED. COM 4H & 5H WELLS

LINE	BEARING	DISTANCE
L1 TIE	S02°00'43"E	829.8'
L2	S28°19'41"W	84.0'
L3	N67°53'55"W	2722.8'
L4	S89°32'13"W	3273.2'
L5	N87°30'26"W	607.9'
L6 TIE	N82°58'53"W	1144.1'

PIPELINES TO THE BROWNING FED. #2H & #3H WELLS

LINE	BEARING	DISTANCE
L7 TIE	N22°09'58"W	163.9'
L8	N00°11'41"W	3582.0'
L9	N19°55'26"W	562.6'
L10	S89°44'55"W	3730.4'
L11	N00°07'01"W	750.0'
L12 TIE	S75°51'25"W	1375.0'

PIPELINE TO THE BROWNING FED. #4H, #5H, & #6H WELLS

LINE	BEARING	DISTANCE
L13 TIE	S50°33'38"W	1708.2'
L14	N00°00'01"E	789.8'
L15 TIE	S77°46'56"E	1344.8'

NORTH

NOTE

BEARINGS SHOWN HEREON ARE MERCATOR GRID AND CONFORM TO THE NEW MEXICO COORDINATE SYSTEM "NEW MEXICO EAST ZONE" NORTH AMERICAN DATUM 1983. DISTANCES ARE SURFACE VALUES.

I, GARY G. EIDSON, NEW MEXICO PROFESSIONAL SURVEYOR No. 12641, DO HEREBY CERTIFY THAT THIS SURVEY PLAT AND THE ACTUAL SURVEY ON THE GROUND UPON WHICH IT IS BASED WERE PERFORMED BY ME OR UNDER MY DIRECT SUPERVISION; THAT I AM RESPONSIBLE FOR THIS SURVEY, THAT THIS SURVEY MEETS THE MINIMUM STANDARDS FOR SURVEYING IN NEW MEXICO; AND THAT IT IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF.

GARY G. EIDSON ____________

DATE: 2/11/14

1000 0 1000 2000 FEET

Scale: 1" = 1000'

PROVIDING SURVEYING SERVICES SINCE 1946
JOHN WEST SURVEYING COMPANY
412 N. DAL PASO
HOBBS, N.M. 88240
(575) 393-3117 www.jwsc.biz

LEGEND NATURAL GAS, LLC

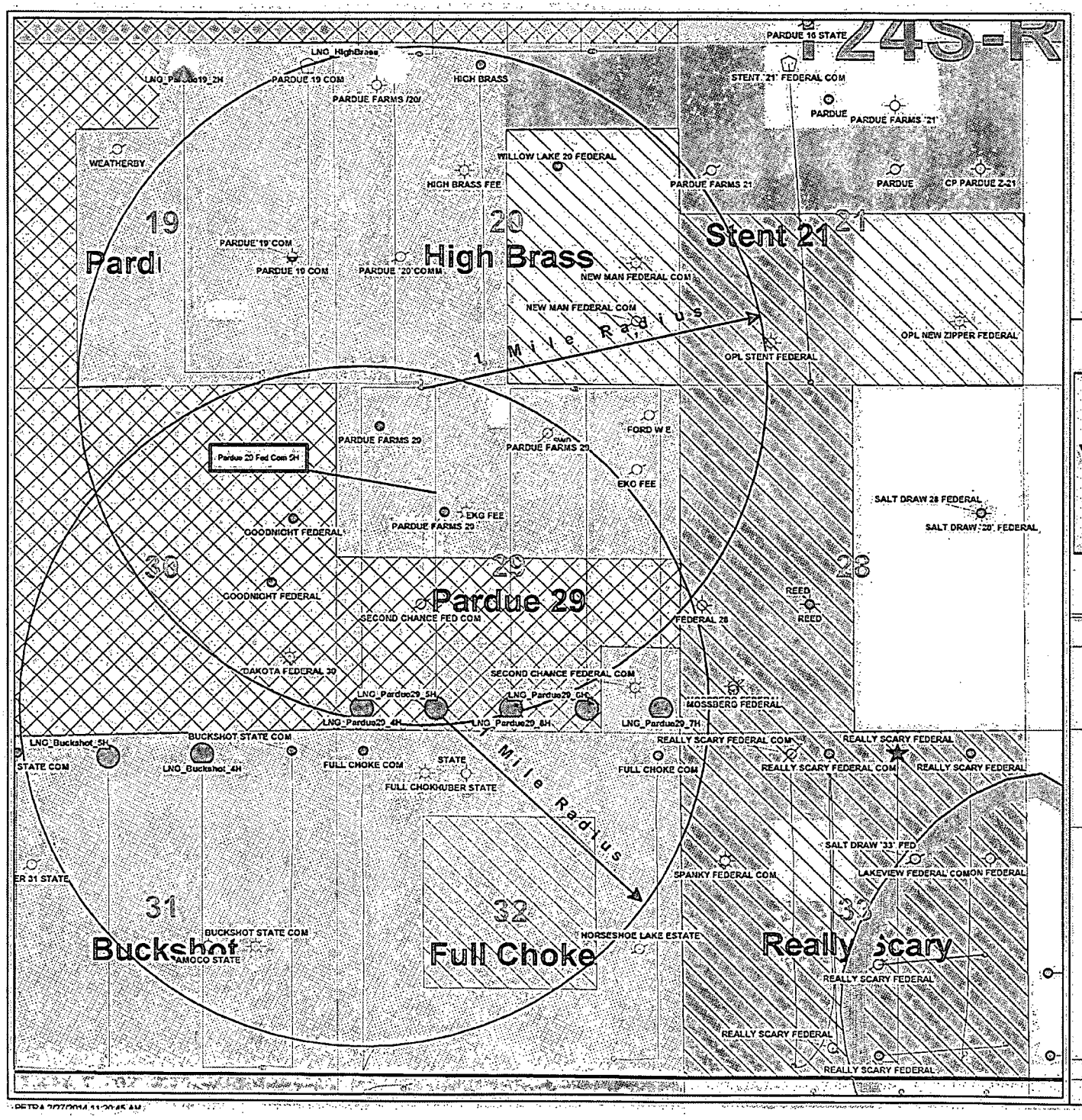
SURVEY OF PIPELINES
CROSSING SECTIONS 20, 21, & 28,
TOWNSHIP 24 SOUTH, RANGE 28 EAST, N.M.P.M.
EDDY COUNTY, NEW MEXICO

Survey Date: 1/23, 24 & 27/14	CAD Date: 2/3/14	Drawn By: ACK
W.O. No.: 14110082 Rev.	Rel. W.O.:	Sheet 2 of 2

©Angelco\2014\Legend Natural Gas, LLC\Easements\14110082 Sec 20,21,28 & 29,1245,RCE

EXHIBIT #3

EXHIBIT #4



LEGEND NATURAL GAS, LLC

Pardue 29 Fed Com 5H

0 2,129
FEET

POSTED WELL DATA

Well Label

WELL SYMBOLS
- Abandoned Well
- Dry Hole, With Show of Oil
- Dry Hole
- Gas Well
- Junked
- Oil Well
- Vernon Symbol Standards - Permit
- SWD Salt Water Disposal
- Star
- Suspended Oil Well
- NEW DRILL WELL - Injectors

By: JMG

February 27, 2014

PETRA 2/27/2014 11:20:45 AM

Legend Natural Gas, III L.P.
DRILLING AND OPERATIONS PROGRAM
Pardue 29 Federal Com 5H
SHL: 45 FNL & 1320 FWL
BHL: 330 FSL & 1510 FWL
Section 29, T-24S, R-28E
Eddy County, New Mexico

In conjunction with Form 3160-3, Application for Permit to Drill subject well, Legend Natural Gas, III L.P. submits the following eleven items of pertinent information in accordance with BLM requirements.

1. **Geological Surface Information:** Permian

2. **Formation Tops:**

The estimated tops of geologic markers and estimated depths at which anticipated water and hydrocarbons are expected to be encountered are as follows:

Rustler	0 ft	Out Cropping at Surface
Fresh Water	48 ft	
Top of Salt	690 ft	
Base of Salt / Lamar	2,316 ft	
Bell Canyon	2,560 ft	
Cherry Canyon	3,362 ft	
Brushy Canyon	4,542 ft	Oil/Gas
Bone Spring	6,093 ft	Oil/Gas
1st Bone Spring	7,013 ft	Oil/Gas
2nd Bone Spring	7,743 ft	Oil/Gas

The IHS formation tops data base has indicated that the Rustler formation on our federal acreage is out cropping at the surface. The Federal wells listed below border to the east and west of our federal acreage (Section 19 is in between the listed wells below).

Well Name	Location	Surface Casing Depth
Really Scary Federal Com 4H	Section 33 T24S R28E, Eddy County, NM	425 ft
Really Scary Federal Com 2H	Section 33 T24S R28E, Eddy County, NM	442 ft
Buckwheat 33 Federal 2H	Section 33 T24S R28E, Eddy County, NM	400 ft
Quien Sabe 25 Federal 1H	Section 25 T24S R27E, Eddy County, NM	180 ft

No other formations are expected to give up oil, gas, or fresh water in measurable quantities. Setting 11-3/4" casing at 400 ft MD/TVD and circulating cement back to surface will protect the surface fresh water sand. The Salt section will be protected by setting 8-5/8" casing at 2,500 ft MD and circulating cement back to surface. Any zones below the 8-5/8" casing shoe and above TD that contain commercial quantities of hydrocarbons will have cemented isolation. This isolation will be achieved by cementing the 5-1/2" production casing string from TD to Surface. Each cement job will have an adequate amount of Open Hole excess cement volume to ensure cement is circulated to surface (see proposed cement program for Open Hole excess volumes below). If wellbore conditions arise that require immediate action and/or a change to this

program Legend Natural Gas III L.P. personnel will always react to protect the wellbore and/or environment.

3. Proposed Casing Program:

see COA

Hole Size	Hole Interval MD	Casing Interval	Casing	Weight	Grade	Connection	Safety Factors Collapse / Burst / Tension
14-3/4"	0 - 400'	0 - 400'	11-3/4"	42#	H-40	STC	5.94 / 1.33 / 28.45
							Hole Assumes 8.4 ppg MW
10-5/8"	400' - 2,500'	0 - 2,500'	8-5/8"	32#	J-55	LTC	1.93 / 1.84 / 6.23
							Hole Assumes 10.0 ppg MW
7-7/8"	2,500' - 12,704'	0 - 12,704'	5-1/2"	17#	P-110	BTC	1.90 / 1.25 / 4.02
							Hole Assumes 9.5 ppg MW

**Note: All casing run in hole will be in NEW condition from the mill
**Note: While running all casing strings in hole, the pipe will be kept at a minimum of 1/3 full at all times to avoid approaching the collapse pressure rating of the casing

4. Proposed Cement Program:

Surface: 14-3/4" Hole, 11-3/4" Casing

Type	Interval	Density	Excess	Hole Volume w/ Excess (cubic-ft)	Yield (cu-ft/sack)	Mix Water (gal/sack)	Sacks	Cement
Lead	0 - 300'	12.9 ppg	125%	293	1.96	10.06	150	(35:65) Poz (Fly Ash): Class C Cement + 0.005 lbs/sack Static Free + 1% bwoc Calcium Chloride + 5% bwoc Sodium Chloride + 0.25 lbs/sack Cello Flake + 3 lbs/sack LCM-1 + 0.1% bwoc FL-52 + 5% bwoc MPA-5 + 6% bwoc Bentonite II + 96.5% Fresh Water
Tail	300' - 400'	14.8 ppg	100%	114	1.35	6.34	85	Class C Cement + 0.005 lbs/sack Static Free + 2% bwoc Calcium Chloride + 0.25 lbs/sack Cello Flake + 56.3% Fresh Water

Intermediate: 10-5/8" Hole, 8-5/8" Casing

Type	Interval	Density	Excess	Hole Volume w/ Excess (cubic-ft)	Yield (cu-ft/sack)	Mix Water (gal/sack)	Sacks	Cement
Lead	0 - 400'	12.9 ppg	0%	106	1.91	9.64	56	(35:65) Poz (Fly Ash): Class C Cement + 0.005 lbs/sack Static Free + 5% bwow Sodium Chloride + 0.125 lbs/sack Cello Flake + 5 lbs/sack LCM-1 + 0.2% bwoc FL-52 + 0.005 gps FP-6L + 5% bwoc MPA-5 + 4% bwoc Bentonite II + 92.4% Fresh Water
Lead	400' - 1,500'	12.9 ppg	100%	462	1.91	9.64	242	(35:65) Poz (Fly Ash): Class C Cement + 0.005 lbs/sack Static Free + 5% bwow Sodium Chloride + 0.125 lbs/sack Cello Flake + 5 lbs/sack LCM-1 + 0.2% bwoc FL-52 + 0.005 gps FP-6L + 5% bwoc MPA-5 + 4% bwoc Bentonite II + 92.4% Fresh Water
Tail	1,500' - 2,500'	14.8 ppg	100%	434	1.34	6.35	324	Class C Cement + 0.005 lbs/sack Static Free + 2% bwoc Calcium Chloride + 0.005 gps FP-6L + 56.3% Fresh Water

Production: 7-7/8" Hole, 5-1/2" Casing

Type	Interval	Density	Excess	Hole Volume w/ Excess (cubic-ft)	Yield (cu-ft/sack)	Mix Water (gal/sack)	Sacks	Cement
Lead	0 - 2,500'	12.0 ppg	0%	443	2.11	11.81	210	(60:40) Poz (Fly Ash):Class C Cement + 3% bwow Sodium Chloride + 0.3% bwoc FL-52 + 0.7% bwoc Sodium Metasilicate + 6% bwoc MPA-5 + 120.1% Fresh Water
Lead	2,500' - 4,500'	12.0 ppg	30%	451	2.11	11.81	214	(60:40) Poz (Fly Ash):Class C Cement + 3% bwow Sodium Chloride + 0.3% bwoc FL-52 + 0.7% bwoc Sodium Metasilicate + 6% bwoc MPA-5 + 120.1% Fresh Water
Tail	4,500' - 12,704'	13.2 ppg	30%	1859	1.57	7.99	1,184	(15:61:11) Poz (Fly Ash):Class C Cement:CSE-2 + 0.005% bwoc Static Free + 0.3% bwoc FL-25 + 0.4% bwoc FL-52 + 0.005 gps FP-6L + 0.5% bwoc BA-10A + 76.6% Fresh Water

See COA

- The above cement volumes could be revised pending on the amount of time the hole is open by adjusting the % excess
- The 8-5/8" Intermediate cement job is designed to circulate cement to surface
- The 5-1/2" Production cement job is designed to circulate cement to surface

5. Well Control Equipment:

See COA

The blowout preventer (BOP) equipment will consist of a double ram-type preventer and annular preventer as provided for in Onshore Order #2. The BOP will be hydraulically operated and the ram type preventers will be equipped with blind rams on top and 5" drill pipe rams on bottom. A 13-5/8" BOP will be used during the drilling of the well. A 13-5/8" permanent multi-bowl (A & B sections) casing head will be installed on the 11-3/4" Surface casing. The BOP and Multi-bowl casing head will be tested to a minimum of 5,000 psi by a third party testing service and used continuously until total depth has been reached. The 8-5/8" casing string will be run using a casing hanger landing system which is run through the 13-5/8" BOPs and landed out in the casing hanger landing profile in the Multi-bowl casing head system. The 8-5/8" pack-off will then be installed once the casing hanger has been landed out and pressure tested to 5,000 psi. Doing this allows us to not have to Nipple down the 13-5/8" BOP stack and allows us to maintain well control integrity throughout the duration. Pipe rams will be operationally checked each 24-hour period. Blind rams will be operationally checked on each trip out of the hole. These checks will be noted on the daily drilling reports. Other accessories to the BOP equipment will include the IBOP (Kelly Cock), floor safety valve, choke & kill lines, and a choke manifold rated to 5,000 psi all of which will be tested to working pressure by an independent third party tester. Anytime a component of the BOP stack or choke manifold is changed/replaced or installed the BOP equipment will be re-tested as required.

see COA

6. Proposed Mud System:

Depth (MD)	Mud Type	Weight (ppg)	Viscosity	Water Loss	pH	Chlorides (ppm)
0 - 400	SPUD	8.4 - 9.4	32 - 34	N/C	10	1 - 4K
400 - 2,500	Brine	9.5 - 10.0	28	N/C	10	186K
2,500 - 7,500	Cut-Brine	9.0 - 9.5	28	N/C	10	40 - 80K
7,500 - 8,200	Cut-Brine/polymer	9.0 - 9.5	32 - 34	N/C	10	80 - 110K
8,200 - 12,704	Cut-Brine/polymer	9.0 - 9.5	33 - 34	N/C	10	90 - 170K

Sufficient mud materials will be kept at the well site at all times to maintain mud properties, lost circulation if present, and mud weight increase requirements.

Visual or electronic mud monitoring equipment shall be in place to detect losses or gains in drilling fluid volumes.

7. Auxiliary Well Control Equipment and Monitoring Systems:

a. An IBOP (Kelly Cock) will be in the Top Drive System (TDS) at all times
b. A full opening safety valve having the appropriate connections (4-1/2" IF Connection) will be on the rig floor at all times in the ready position.
c. Hydrogen Sulfide (H_2S) detection equipment will be in operation and breathing equipment on standby upon drilling out the 11-3/4" Surface casing shoe and until the 5-1/2" casing string is cemented in place.

8. Testing, Logging, and Coring Program:

See COA

a. No open hole or cased hole wireline logs are planned during the drilling phase of the well
b. Gamma Ray will be captured from about 300 ft above KOP and throughout the curve and lateral
c. Mud logging program will consist of lagged 10 ft samples and commence at around 5,000 ft MD (about 2,500 ft above KOP) to total depth of the horizontal hole interval
d. Drill stem testing is not anticipated
e. No conventional coring operations are planned

9. Estimated Bottom Hole Pressure & Temperature:

a. BHP @ Lateral TD: 3,786 psi
b. BHT @ Lateral TD: 137°

10. Abnormal Conditions, Pressures, Temperatures, and Potential Hazards:

No abnormal pressures and temperatures are anticipated. We have determined from wells nearby in the area that any hazardous volumes of H_2S are not anticipated on being encountered. If a large volume of H_2S is encountered, the operator will comply with the provisions of Onshore Oil & Gas Order No. 6. All personnel will be familiar with all aspects of safe operation of equipment being used to drill the well.

11. Anticipated Starting Date and Duration of Operations:

Location construction will begin after the BLM has approved the APD. Anticipated spud date will be as soon as possible after BLM approval. Rig move and drilling operations is anticipated to take 20 days.

LEGEND NATURAL GAS

Project: Eddy County, NM (Nad27)
Site: Sec 29 T24S R 28E
Well: Pardue 29 Fed Com 5H
Wellbore: Wellbore #1
Design: Plan#1 012014
Rig: TBD

PHOENIX TECHNOLOGY SERVICES

Azimuths to Grid North
True North: -0.12°
Magnetic North: 7.40°

Magnetic Field
Strength: 49282.8nT
Dip Angle: 60.00°
Date: 1/20/2014
Model: IGRF2010_14

WELL DETAILS

Ground Level: 3047.00

+N/-S	+E/-W	Northing	Easting	Latitude	Longitude
0.00	0.00	434959.30	556017.10	32° 11' 44.65139 N	104° 6' 48.42534 W

Map System: US State Plane 1927 (Exact solution)
Datum: NAD 1927 (NADCON CONUS)
Ellipsoid: Clarke 1866
Zone Name: New Mexico East 3001

Local Origin: Well Pardue 29 Fed Com 5H, Grid North

Latitude: 32° 11' 44.65139 N
Longitude: 104° 6' 48.42534 W

Grid East: 556017.10
Grid North: 434959.30
Scale Factor: 1.000

Geomagnetic Model: IGRF2010_14
Sample Date: 20-Jan-14
Magnetic Declination: 7.51°
Dip Angle from Horizontal: 60.00°
Magnetic Field Strength: 49283

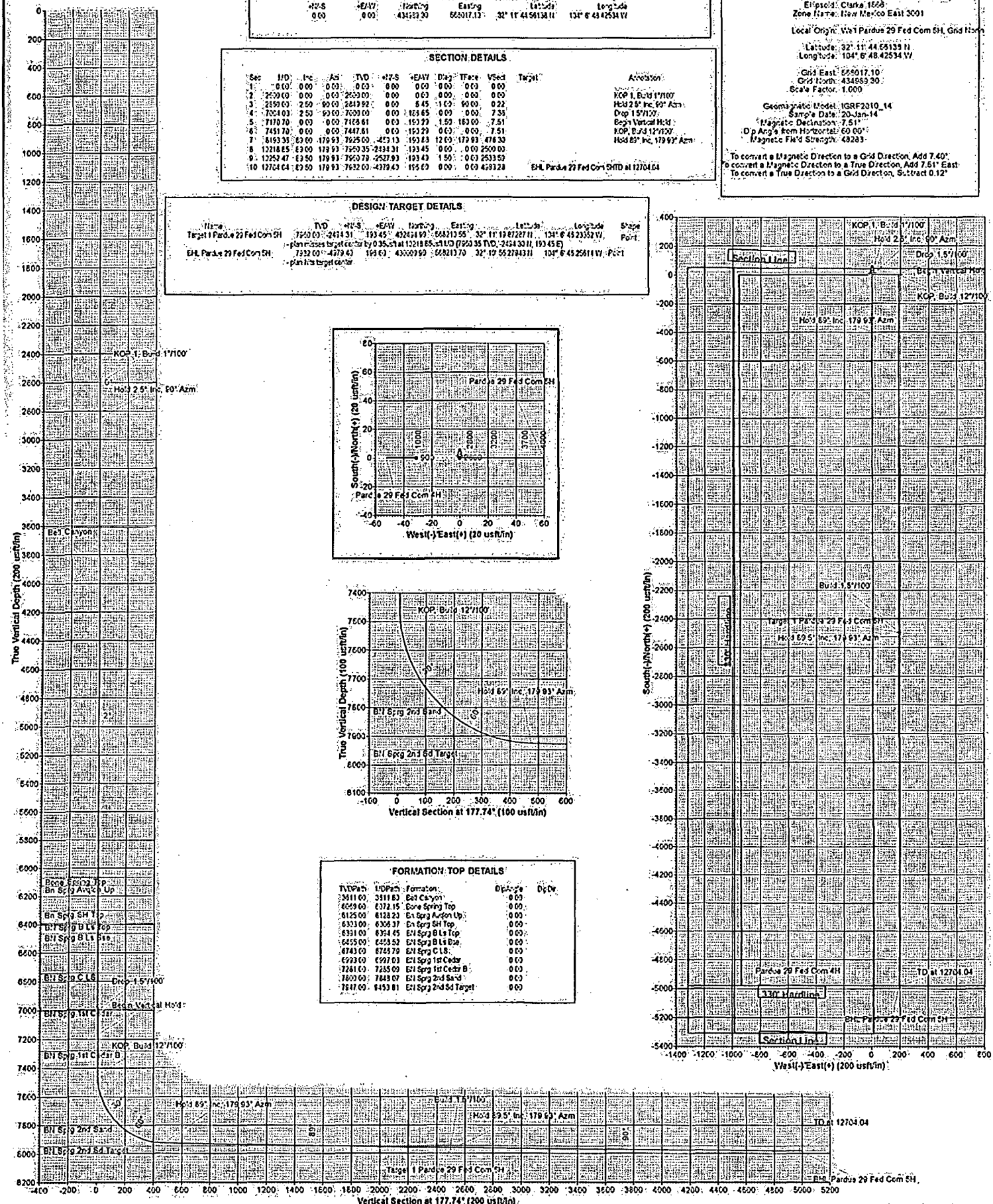
To convert a Magnetic Direction to a Grid Direction, Add 7.40°
To convert a Magnetic Direction to a True Direction, Add 7.51° East
To convert a True Direction to a Grid Direction, Subtract 0.12°

SECTION DETAILS

Sec	MD	Inc	Azi	TVD	+N/-S	+E/-W	Dleg	TFace	VSect	Target	Annotation
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
2	2500.00	0.00	0.00	2500.00	0.00	0.00	0.00	0.00	0.00		KOP 1, Build 1°/100'
3	2959.00	2.50	90.00	2958.92	0.00	5.45	1.00	90.00	0.22		Hold 2.5° Inc, 90° Azm
4	7004.03	2.50	90.00	7000.00	0.00	185.65	0.00	0.00	7.35		Drop 1.5°/100'
5	7170.70	0.00	0.00	7166.61	0.00	193.23	1.50	180.00	7.51		Begin Vertical Hold
6	7451.70	0.00	0.00	7447.61	0.00	193.23	0.00	0.00	7.51		KOP, Build 12°/100'
7	8193.35	89.00	179.93	7925.00	-471.13	193.83	12.00	179.93	476.30		Hold 89° Inc, 179.93° Azm
8	13218.65	89.00	179.93	7950.35	-4994.31	193.45	0.00	0.00	2500.00		
9	13252.47	89.50	179.93	7950.78	-5027.93	193.43	1.50	0.03	2533.83		
10	12704.04	89.50	179.93	7632.00	-4379.43	195.00	0.00	0.03	4383.28		BHL Pardue 29 Fed Com 5H TD at 12704.04

DESIGN TARGET DETAILS

Name	TVD	+N/-S	+E/-W	Northing	Easting	Latitude	Longitude	Shape
Target 1 Pardue 29 Fed Com 5H	7950.00	-4994.31	193.45	429964.99	556213.55	32° 11' 19.87287 N	104° 6' 45.23352 W	Point
plan crosses target center by 0.35usft at 13218.65usft MD (7950.35 TVD, -4994.30 N, 193.45 E)								
BHL Pardue 29 Fed Com 5H	7632.00	-4379.43	195.00	430555.90	556213.70	32° 12' 55.27943 N	104° 6' 45.25611 W	Point
plan hits target center								



FORMATION TOP DETAILS

TVDPath	MDPath	Formation	Dip Angle	Dip Dir
3511.00	3511.83	Bell Canyon	0.00	
6069.00	6072.15	Bone Spring Top	0.00	
6125.00	6128.23	Bn Spg Avalon Up	0.00	
6333.00	6336.37	Bn Spg SH Top	0.00	
6351.00	6354.45	Bn Spg B Lk Top	0.00	
6455.00	6458.52	Bn Spg B Lk Bse	0.00	
6743.00	6746.79	Bn Spg C Lk	0.00	
6923.00	6927.03	Bn Spg 1st Cedar	0.00	
7241.00	7245.09	Bn Spg 1st Cedar B	0.00	
7609.00	7613.07	Bn Spg 2nd Sand	0.00	
7947.00	8453.81	Bn Spg 2nd Sd Target	0.00	

Drawn By: Jim Vernor Date: 8:41, January 30 2014

LEGEND NATURAL GAS

Legend Natural Gas iV, LP

Eddy County, NM (Nad27)
Sec 29 T24S R 28E
Pardue 29 Fed Com 5H

Wellbore #1

Plan: Plan#1 012014

Standard Planning Report

20 January, 2014

LEGEND NATURAL GAS

Planning Report

Database:	Compass 5000 GCR DB	Local Co-ordinate Reference:	Well Pardue 29 Fed Com 5H
Company:	Legend Natural Gas IV, LP	TVD Reference:	WELL @ 3072.00usft (TBD)
Project:	Eddy County, NM (Nad27)	MD Reference:	WELL @ 3072.00usft (TBD)
Site:	Sec 29 T24S R 28E	North Reference:	Grid
Well:	Pardue 29 Fed Com 5H	Survey Calculation Method:	Minimum Curvature
Wellbore:	Wellbore #1		
Design:	Plan#1 012014		

Project Eddy County, NM (Nad27)

Map System:	US State Plane 1927 (Exact solution)	System Datum:	Mean Sea Level
Geo Datum:	NAD 1927 (NADCON CONUS)		
Map Zone:	New Mexico East 3001		

Site Sec 29 T24S R 28E

Site Position:		Northing:	434,989.30 usft	Latitude:	32° 11' 44.66138 N
From:	Map	Easting:	668,017.10 usft	Longitude:	104° 6' 48.42534 W
Position Uncertainty:	0.00 usft	Slot Radius:	13-3/16 "	Grid Convergence:	0.12 °

Well Pardue 29 Fed Com 5H

Well Position	+N/-S	0.00 usft	Northing:	434,989.30 usft	Latitude:	32° 11' 44.66138 N
	+E/-W	0.00 usft	Easting:	668,017.10 usft	Longitude:	104° 6' 48.42534 W
Position Uncertainty		0.00 usft	Wellhead Elevation:		Ground Level:	3,047.00 usft

Wellbore Wellbore #1

Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2010_14	1/20/2014	7.61	60.00	48,283

Design Plan#1 012014

Audit Notes:

Version:		Phase:	PLAN	Tie On Depth:	0.00

Vertical Section:	Depth From (TVD) (usft)	+N/-S (usft)	+E/-W (usft)	Direction (°)
	0.00	0.00	0.00	177.74

Plan Sections

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)	TFO (°)	Target
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2,600.00	0.00	0.00	2,600.00	0.00	0.00	0.00	0.00	0.00	0.00	
2,650.00	2.50	90.00	2,649.92	0.00	0.45	1.00	1.00	0.00	90.00	
7,004.03	2.50	90.00	7,000.00	0.00	186.65	0.00	0.00	0.00	0.00	
7,170.70	0.00	0.00	7,166.81	0.00	190.29	1.50	-1.50	0.00	180.00	
7,451.70	0.00	0.00	7,447.81	0.00	190.29	0.00	0.00	0.00	0.00	
8,103.38	89.00	170.93	7,925.00	-469.13	190.88	12.00	12.00	0.00	170.93	BHL Pardue 29 Fed C
10,218.65	89.00	170.93	7,960.35	-2,494.31	193.45	0.00	0.00	0.00	0.00	
10,252.47	89.50	170.93	7,960.70	-2,527.93	193.49	1.50	1.50	0.00	0.00	
12,704.04	89.50	170.93	7,982.00	-4,979.40	196.60	0.00	0.00	0.00	0.00	BHL Pardue 29 Fed C

Database:	Compass 5000 GCR DB	Local Co-ordinate Reference:	Well Pardue 29 Fed Com 5H
Company:	Legend Natural Gas IV, LP	TVD Reference:	WELL @ 3072.00usft (TBD)
Project:	Eddy County, NM (Nad27)	MD Reference:	WELL @ 3072.00usft (TBD)
Site:	Sec 29 T24S R 28E	North Reference:	Grid
Well:	Pardue 29 Fed Com 5H	Survey Calculation Method:	Minimum Curvature
Wellbore:	Wellbore #1		
Design:	Plan#1 012014		

Planned Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00
200.00	0.00	0.00	200.00	0.00	0.00	0.00	0.00	0.00	0.00
300.00	0.00	0.00	300.00	0.00	0.00	0.00	0.00	0.00	0.00
400.00	0.00	0.00	400.00	0.00	0.00	0.00	0.00	0.00	0.00
500.00	0.00	0.00	500.00	0.00	0.00	0.00	0.00	0.00	0.00
600.00	0.00	0.00	600.00	0.00	0.00	0.00	0.00	0.00	0.00
700.00	0.00	0.00	700.00	0.00	0.00	0.00	0.00	0.00	0.00
800.00	0.00	0.00	800.00	0.00	0.00	0.00	0.00	0.00	0.00
900.00	0.00	0.00	900.00	0.00	0.00	0.00	0.00	0.00	0.00
1,000.00	0.00	0.00	1,000.00	0.00	0.00	0.00	0.00	0.00	0.00
1,100.00	0.00	0.00	1,100.00	0.00	0.00	0.00	0.00	0.00	0.00
1,200.00	0.00	0.00	1,200.00	0.00	0.00	0.00	0.00	0.00	0.00
1,300.00	0.00	0.00	1,300.00	0.00	0.00	0.00	0.00	0.00	0.00
1,400.00	0.00	0.00	1,400.00	0.00	0.00	0.00	0.00	0.00	0.00
1,500.00	0.00	0.00	1,500.00	0.00	0.00	0.00	0.00	0.00	0.00
1,600.00	0.00	0.00	1,600.00	0.00	0.00	0.00	0.00	0.00	0.00
1,700.00	0.00	0.00	1,700.00	0.00	0.00	0.00	0.00	0.00	0.00
1,800.00	0.00	0.00	1,800.00	0.00	0.00	0.00	0.00	0.00	0.00
1,900.00	0.00	0.00	1,900.00	0.00	0.00	0.00	0.00	0.00	0.00
2,000.00	0.00	0.00	2,000.00	0.00	0.00	0.00	0.00	0.00	0.00
2,100.00	0.00	0.00	2,100.00	0.00	0.00	0.00	0.00	0.00	0.00
2,200.00	0.00	0.00	2,200.00	0.00	0.00	0.00	0.00	0.00	0.00
2,300.00	0.00	0.00	2,300.00	0.00	0.00	0.00	0.00	0.00	0.00
2,400.00	0.00	0.00	2,400.00	0.00	0.00	0.00	0.00	0.00	0.00
2,500.00	0.00	0.00	2,500.00	0.00	0.00	0.00	0.00	0.00	0.00
2,600.00	0.00	0.00	2,600.00	0.00	0.00	0.00	0.00	0.00	0.00
KOP 1, Build 1°/100'									
2,700.00	1.00	90.00	2,699.99	0.00	0.87	0.03	1.00	1.00	0.00
2,800.00	2.00	90.00	2,799.95	0.00	3.49	0.14	1.00	1.00	0.00
2,850.00	2.50	90.00	2,849.92	0.00	5.45	0.22	1.00	1.00	0.00
Hold 2.5° Inc, 90° Azm									
2,900.00	2.50	90.00	2,899.87	0.00	7.63	0.30	0.00	0.00	0.00
3,000.00	2.50	90.00	2,999.78	0.00	12.00	0.47	0.00	0.00	0.00
3,100.00	2.50	90.00	3,099.68	0.00	16.36	0.65	0.00	0.00	0.00
3,200.00	2.50	90.00	3,199.59	0.00	20.72	0.82	0.00	0.00	0.00
3,300.00	2.50	90.00	3,299.49	0.00	25.08	0.99	0.00	0.00	0.00
3,400.00	2.50	90.00	3,399.40	0.00	29.44	1.16	0.00	0.00	0.00
3,500.00	2.50	90.00	3,499.30	0.00	33.81	1.33	0.00	0.00	0.00
3,600.00	2.50	90.00	3,599.21	0.00	38.17	1.51	0.00	0.00	0.00
3,611.80	2.50	90.00	3,611.00	0.00	38.68	1.53	0.00	0.00	0.00
Bell Canyon									
3,700.00	2.50	90.00	3,699.11	0.00	42.53	1.68	0.00	0.00	0.00
3,800.00	2.50	90.00	3,799.02	0.00	46.89	1.85	0.00	0.00	0.00
3,900.00	2.50	90.00	3,898.92	0.00	51.25	2.02	0.00	0.00	0.00
4,000.00	2.50	90.00	3,998.83	0.00	55.62	2.19	0.00	0.00	0.00
4,100.00	2.50	90.00	4,098.73	0.00	59.98	2.37	0.00	0.00	0.00
4,200.00	2.50	90.00	4,198.64	0.00	64.34	2.54	0.00	0.00	0.00
4,300.00	2.50	90.00	4,298.54	0.00	68.70	2.71	0.00	0.00	0.00
4,400.00	2.50	90.00	4,398.45	0.00	73.06	2.88	0.00	0.00	0.00
4,500.00	2.50	90.00	4,498.35	0.00	77.43	3.05	0.00	0.00	0.00
4,600.00	2.50	90.00	4,598.26	0.00	81.79	3.23	0.00	0.00	0.00
4,700.00	2.50	90.00	4,698.16	0.00	86.15	3.40	0.00	0.00	0.00

Database:	Compass 5000 GCR DB	Local Co-ordinate Reference:	Well Pardue 29 Fed Com 5H
Company:	Legend Natural Gas IV, LP	TVD Reference:	WELL @ 3072.00usft (TBD)
Project:	Eddy County, NM (Nad27)	MD Reference:	WELL @ 3072.00usft (TBD)
Site:	Sec 29 T24S R 28E	North Reference:	Grid
Well:	Pardue 29 Fed Com 5H	Survey Calculation Method:	Minimum Curvature
Wellbore:	Wellbore #1		
Design:	Plan#1 012014		

Planned Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
4,600.00	2.50	90.00	4,798.06	0.00	90.51	3.57	0.00	0.00	0.00
4,900.00	2.50	90.00	4,897.97	0.00	94.87	3.74	0.00	0.00	0.00
5,000.00	2.50	90.00	4,997.87	0.00	99.23	3.92	0.00	0.00	0.00
5,100.00	2.50	90.00	5,097.78	0.00	103.60	4.09	0.00	0.00	0.00
5,200.00	2.50	90.00	5,197.68	0.00	107.96	4.26	0.00	0.00	0.00
5,300.00	2.50	90.00	5,297.59	0.00	112.32	4.43	0.00	0.00	0.00
5,400.00	2.50	90.00	5,397.49	0.00	116.68	4.60	0.00	0.00	0.00
5,500.00	2.50	90.00	5,497.40	0.00	121.04	4.78	0.00	0.00	0.00
5,600.00	2.50	90.00	5,597.30	0.00	125.41	4.95	0.00	0.00	0.00
5,700.00	2.50	90.00	5,697.21	0.00	129.77	5.12	0.00	0.00	0.00
5,800.00	2.50	90.00	5,797.11	0.00	134.13	5.29	0.00	0.00	0.00
5,900.00	2.50	90.00	5,897.02	0.00	138.49	5.46	0.00	0.00	0.00
6,000.00	2.50	90.00	5,996.92	0.00	142.85	5.64	0.00	0.00	0.00
6,072.15	2.50	90.00	6,069.00	0.00	146.00	5.76	0.00	0.00	0.00
Bone Spring Top									
6,100.00	2.50	90.00	6,096.83	0.00	147.22	5.81	0.00	0.00	0.00
6,128.20	2.50	90.00	6,125.00	0.00	148.45	5.86	0.00	0.00	0.00
Bn Sprg Avalon Up.									
6,200.00	2.50	90.00	6,196.73	0.00	151.58	5.98	0.00	0.00	0.00
6,300.00	2.50	90.00	6,296.64	0.00	155.94	6.15	0.00	0.00	0.00
6,306.37	2.50	90.00	6,303.00	0.00	156.22	6.16	0.00	0.00	0.00
Bn Sprg SII Top									
6,394.45	2.50	90.00	6,391.00	0.00	160.06	6.31	0.00	0.00	0.00
BN Sprg B Ls Top									
6,400.00	2.50	90.00	6,396.54	0.00	160.30	6.32	0.00	0.00	0.00
6,468.52	2.50	90.00	6,465.00	0.00	163.29	6.44	0.00	0.00	0.00
BN Sprg B Ls Bse									
6,500.00	2.50	90.00	6,496.45	0.00	164.66	6.50	0.00	0.00	0.00
6,600.00	2.50	90.00	6,596.35	0.00	169.03	6.67	0.00	0.00	0.00
6,700.00	2.50	90.00	6,696.26	0.00	173.39	6.84	0.00	0.00	0.00
6,746.79	2.50	90.00	6,743.00	0.00	175.43	6.92	0.00	0.00	0.00
BN Sprg C LS									
6,800.00	2.50	90.00	6,796.16	0.00	177.75	7.01	0.00	0.00	0.00
6,900.00	2.50	90.00	6,896.07	0.00	182.11	7.18	0.00	0.00	0.00
6,997.03	2.50	90.00	6,993.00	0.00	186.34	7.35	0.00	0.00	0.00
BN Sprg 1st Cedar									
7,000.00	2.50	90.00	6,995.97	0.00	186.47	7.36	0.00	0.00	0.00
7,004.03	2.50	90.00	7,000.00	0.00	186.65	7.36	0.00	0.00	0.00
Drop 1.5°/100'									
7,100.00	1.06	90.00	7,095.92	0.00	189.63	7.48	1.50	-1.50	0.00
7,170.70	0.00	0.00	7,166.61	0.00	190.29	7.51	1.50	-1.50	0.00
Begin Vertical Hold									
7,200.00	0.00	0.00	7,195.91	0.00	190.29	7.51	0.00	0.00	0.00
7,285.00	0.00	0.00	7,281.00	0.00	190.29	7.51	0.00	0.00	0.00
BN Sprg 1st Cedar D									
7,300.00	0.00	0.00	7,295.91	0.00	190.29	7.51	0.00	0.00	0.00
7,400.00	0.00	0.00	7,395.91	0.00	190.29	7.51	0.00	0.00	0.00
7,451.70	0.00	0.00	7,447.61	0.00	190.29	7.51	0.00	0.00	0.00
KOP, Build 12°/100'									
7,500.00	5.80	179.03	7,495.83	-2.44	190.29	9.95	12.00	12.00	0.00
7,600.00	17.80	179.03	7,593.54	-22.85	190.31	30.34	12.00	12.00	0.00
7,700.00	29.80	179.03	7,684.87	-63.12	190.37	70.58	12.00	12.00	0.00
7,800.00	41.80	179.03	7,765.83	-121.61	190.44	128.93	12.00	12.00	0.00

LEGEND NATURAL GAS

Planning Report

Database:	Compass 5000 GCR DB	Local Co-ordinate Reference:	Well Pardue 29 Fed Com 6H
Company:	Legend Natural Gas IV, LP	TVD Reference:	WELL @ 3072.00usft (TBD)
Project:	Eddy County, NM (Nad27)	MD Reference:	WELL @ 3072.00usft (TBD)
Site:	Sec 29 T24S R 28E	North Reference:	Grid
Well:	Pardue 29 Fed Com 6H	Survey Calculation Method:	Minimum Curvature
Wellbore:	Wellbore #1		
Design:	Plan#1 012014		

Planned Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
7,646.07	47.67	179.93	7,600.00	-155.29	190.48	162.69	12.00	12.00	0.00
BH Sprg 2nd Sand									
7,900.00	53.80	179.93	7,632.69	-185.45	190.53	202.81	12.00	12.00	0.00
8,000.00	65.80	179.93	7,683.10	-281.71	190.64	289.02	12.00	12.00	0.00
8,100.00	77.80	179.93	7,714.29	-376.64	190.76	383.77	12.00	12.00	0.00
8,193.36	89.00	179.93	7,725.00	-469.13	190.88	476.30	12.00	12.00	0.00
Hold 89° Inc, 179.93° Azm									
8,200.00	89.00	179.93	7,725.12	-475.77	190.89	482.93	0.00	0.00	0.00
8,300.00	89.00	179.93	7,726.86	-575.75	191.02	582.84	0.00	0.00	0.00
8,400.00	89.00	179.93	7,728.61	-675.74	191.14	682.75	0.00	0.00	0.00
8,500.00	89.00	179.93	7,730.35	-775.72	191.27	782.66	0.00	0.00	0.00
8,600.00	89.00	179.93	7,732.10	-875.71	191.40	882.58	0.00	0.00	0.00
8,700.00	89.00	179.93	7,733.84	-975.69	191.52	982.49	0.00	0.00	0.00
8,800.00	89.00	179.93	7,735.59	-1,075.68	191.65	1,082.40	0.00	0.00	0.00
8,900.00	89.00	179.93	7,737.33	-1,175.66	191.78	1,182.31	0.00	0.00	0.00
9,000.00	89.00	179.93	7,739.08	-1,275.65	191.90	1,282.22	0.00	0.00	0.00
9,100.00	89.00	179.93	7,740.83	-1,375.63	192.03	1,382.14	0.00	0.00	0.00
9,200.00	89.00	179.93	7,742.57	-1,475.61	192.16	1,482.05	0.00	0.00	0.00
9,300.00	89.00	179.93	7,744.32	-1,575.60	192.28	1,581.96	0.00	0.00	0.00
9,400.00	89.00	179.93	7,746.06	-1,675.58	192.41	1,681.87	0.00	0.00	0.00
9,453.61	89.00	179.93	7,747.00	-1,729.39	192.48	1,735.64	0.00	0.00	0.00
BH Sprg 2nd Sd Target									
9,500.00	89.00	179.93	7,747.81	-1,775.57	192.54	1,781.78	0.00	0.00	0.00
9,600.00	89.00	179.93	7,749.55	-1,875.55	192.66	1,881.69	0.00	0.00	0.00
9,700.00	89.00	179.93	7,751.30	-1,975.54	192.79	1,981.61	0.00	0.00	0.00
9,800.00	89.00	179.93	7,753.04	-2,075.52	192.92	2,081.52	0.00	0.00	0.00
9,900.00	89.00	179.93	7,754.79	-2,175.51	193.04	2,181.43	0.00	0.00	0.00
10,000.00	89.00	179.93	7,756.53	-2,275.49	193.17	2,281.34	0.00	0.00	0.00
10,100.00	89.00	179.93	7,758.28	-2,375.48	193.30	2,381.25	0.00	0.00	0.00
10,200.00	89.00	179.93	7,760.02	-2,475.46	193.42	2,481.17	0.00	0.00	0.00
10,217.06	89.00	179.93	7,760.32	-2,492.62	193.45	2,498.21	0.00	0.00	0.00
Build 1.6°/100'									
10,218.65	89.00	179.93	7,760.35	-2,494.31	193.45	2,500.00	0.00	0.00	0.00
10,250.66	89.48	179.93	7,760.77	-2,526.11	193.49	2,531.76	1.50	1.50	0.00
Hold 89.5° Inc, 179.93° Azm									
10,252.47	89.50	179.93	7,760.79	-2,527.93	193.49	2,533.59	1.50	1.50	0.00
10,300.00	89.50	179.93	7,761.20	-2,575.45	193.55	2,581.08	0.00	0.00	0.00
10,400.00	89.50	179.93	7,762.07	-2,675.45	193.68	2,681.01	0.00	0.00	0.00
10,500.00	89.50	179.93	7,762.93	-2,775.45	193.80	2,780.93	0.00	0.00	0.00
10,600.00	89.50	179.93	7,763.80	-2,875.44	193.93	2,880.85	0.00	0.00	0.00
10,700.00	89.50	179.93	7,764.66	-2,975.44	194.06	2,980.78	0.00	0.00	0.00
10,800.00	89.50	179.93	7,765.53	-3,075.43	194.19	3,080.70	0.00	0.00	0.00
10,900.00	89.50	179.93	7,766.39	-3,175.43	194.31	3,180.62	0.00	0.00	0.00
11,000.00	89.50	179.93	7,767.26	-3,275.43	194.44	3,280.55	0.00	0.00	0.00
11,100.00	89.50	179.93	7,768.12	-3,375.42	194.57	3,380.47	0.00	0.00	0.00
11,200.00	89.50	179.93	7,768.99	-3,475.42	194.69	3,480.39	0.00	0.00	0.00
11,300.00	89.50	179.93	7,769.85	-3,575.42	194.82	3,580.32	0.00	0.00	0.00
11,400.00	89.50	179.93	7,770.72	-3,675.41	194.95	3,680.24	0.00	0.00	0.00
11,500.00	89.50	179.93	7,771.58	-3,775.41	195.07	3,780.16	0.00	0.00	0.00
11,600.00	89.50	179.93	7,772.45	-3,875.40	195.20	3,880.09	0.00	0.00	0.00
11,700.00	89.50	179.93	7,773.31	-3,975.40	195.33	3,980.01	0.00	0.00	0.00
11,800.00	89.50	179.93	7,774.18	-4,075.40	195.45	4,079.93	0.00	0.00	0.00
11,900.00	89.50	179.93	7,775.04	-4,175.39	195.58	4,179.86	0.00	0.00	0.00

LEGEND NATURAL GAS

Planning Report

Database:	Compass 5000 GCR DB	Local Co-ordinate Reference:	Well Pardue 29 Fed Com 5H
Company:	Legend Natural Gas IV, LP	TVD Reference:	WELL @ 3072.00usft (TBD)
Project:	Eddy County, NM (Nad27)	MD Reference:	WELL @ 3072.00usft (TBD)
Site:	Sec 29 T24S R 28E	North Reference:	Grid
Well:	Pardue 29 Fed Com 5H	Survey Calculation Method:	Minimum Curvature
Wellbore:	Wellbore #1		
Design:	Plan#1 012014		

Planned Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
12,000.00	89.50	179.03	7,976.91	-4,276.39	195.71	4,279.76	0.00	0.00	0.00
12,100.00	89.50	179.03	7,976.77	-4,376.39	195.83	4,379.70	0.00	0.00	0.00
12,200.00	89.50	179.03	7,977.64	-4,476.38	195.96	4,479.63	0.00	0.00	0.00
12,300.00	89.50	179.03	7,978.50	-4,575.38	196.09	4,579.55	0.00	0.00	0.00
12,400.00	89.50	179.03	7,979.37	-4,675.37	196.21	4,679.47	0.00	0.00	0.00
12,500.00	89.50	179.03	7,980.23	-4,775.37	196.34	4,779.40	0.00	0.00	0.00
12,600.00	89.50	179.03	7,981.10	-4,875.37	196.47	4,879.32	0.00	0.00	0.00
12,700.00	89.50	179.03	7,981.97	-4,975.36	196.59	4,979.24	0.00	0.00	0.00
12,704.04	89.50	179.03	7,982.00	-4,979.40	196.60	4,983.28	0.00	0.00	0.00
TD at 12704.04									

Design Targets

Target Name - hit/miss target - Shape	Dip Angle (°)	Dip Dir. (°)	TVD (usft)	+N/-S (usft)	+E/-W (usft)	Northing (usft)	Easting (usft)	Latitude	Longitude
Target 1 Pardue 29 Fed - plan misses target center by 0.35usft at 10218.65usft MD (7960.35 TVD, -2494.30 N, 193.45 E) - Point	0.00	0.00	7,960.00	-2,494.31	193.45	432,494.99	668,210.65	32° 11' 19.87287 N	104° 6' 46.23352 W
BHL Pardue 29 Fed Com - plan hits target center - Point	0.00	0.00	7,982.00	-4,979.40	196.60	430,009.90	668,213.70	32° 10' 55.27943 N	104° 6' 46.25815 W

Formations

Measured Depth (usft)	Vertical Depth (usft)	Name	Lithology	Dip (°)	Dip Direction (°)
3,611.80	3,611.00	Bell Canyon		0.00	
6,072.15	6,069.00	Bone Spring Top		0.00	
6,128.20	6,125.00	Bn Sprg Avalon Up.		0.00	
6,308.37	6,305.00	Bn Sprg SH Top		0.00	
6,394.45	6,391.00	BN Sprg B Le Top		0.00	
6,468.52	6,465.00	BN Sprg B Le Bse		0.00	
6,746.79	6,743.00	BN Sprg C LS		0.00	
6,997.03	6,993.00	BN Sprg 1st Cedar		0.00	
7,285.09	7,281.00	BN Sprg 1st Cedar B		0.00	
7,848.07	7,800.00	BN Sprg 2nd Sand		0.00	
0,453.81	7,947.00	BN Sprg 2nd Sd Target		0.00	

Database:	Compass 5000 GCR DB	Local Co-ordinate Reference:	Well Perdue 29 Fed Com 5H
Company:	Legend Natural Gas IV, LP	TVD Reference:	WELL @ 3072.00usft (TBD)
Project:	Eddy County, NM (Nad27)	MD Reference:	WELL @ 3072.00usft (TBD)
Site:	Sec 29 T24S R 28E	North Reference:	Grid
Well:	Perdue 29 Fed Com 5H	Survey Calculation Method:	Minimum Curvature
Wellbore:	Wellbore #1		
Design:	Plan#1 012014		

Plan Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates +N/-S (usft)	+E/-W (usft)	Comment
2,600.00	2,600.00	0.00	0.00	KOP 1, Build 1°/100'
2,650.00	2,649.92	0.00	0.45	Hold 2.6° Inc, 90° Azm
7,004.03	7,000.00	0.00	186.65	Drop 1.5°/100'
7,170.70	7,166.61	0.00	190.29	Begin Vertical Hold
7,451.70	7,447.61	0.00	190.29	KOP, Build 12°/100'
8,193.36	7,925.00	-469.13	190.66	Hold 89° Inc, 179.93° Azm
10,217.06	7,960.32	-2,492.62	193.45	Build 1.5°/100'
10,250.66	7,960.77	-2,526.11	193.49	Hold 89.5° Inc, 179.93° Azm
12,704.04	7,982.00	-4,979.40	196.60	TD at 12704.04

LEGEND NATURAL GAS

Legend Natural Gas iV, LP

Eddy County, NM (Nad27)
Sec 29 T24S R 28E
Pardue 29 Fed Com 5H

Wellbore #1
Plan#1 012014

Anticollision Report

20 January, 2014

LEGEND NATURAL GAS

Anticollision Report

Company:	Legend Natural Gas IV, LP	**Local Co-ordinate Reference:**	Well Pardue 29 Fed Com 5H
Project:	Eddy County, NM (Nad27)	**TVD Reference:**	WELL @ 3072.00usft (TBD)
Reference Site:	Sec 29 T24S R 28E	**MD Reference:**	WELL @ 3072.00usft (TBD)
Site Error:	0.00 usft	**North Reference:**	Grid
Reference Well:	Pardue 29 Fed Com 5H	**Survey Calculation Method:**	Minimum Curvature
Well Error:	0.00 usft	**Output errors are at**	2.00 sigma
Reference Wellbore	Wellbore #1	**Database:**	Compass 5000 GCR DB
Reference Design:	Plan#1 012014	**Offset TVD Reference:**	Reference Datum

Reference Plan#1 012014

Filter type:	NO GLOBAL FILTER: Using user defined selection & filtering criteria		
Interpolation Method:	MD Interval 50.00usft	**Error Model:**	ISCWSA
Depth Range:	Unlimited	**Scan Method:**	Closest Approach 3D
Results Limited by:	Maximum center-center distance of 10,000.00 usft	**Error Surface:**	Elliptical Conic
Warning Levels Evaluated at:	2.00 **Sigma**	**Casing Method:**	Not applied

Survey Tool Program **Date** 1/20/2014

From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description
0.00	12,704.04	Plan#1 012014 (Wellbore #1)	MWD	MWD - Standard

Summary

Site Name / Offset Well - Wellbore - Design	Reference Measured Depth (usft)	Offset Measured Depth (usft)	Distance Between Centres (usft)	Distance Between Ellipses (usft)	Separation Factor	Warning
Sec 29 T24S R 28E						
Pardue 29 Fed Com 4H - Wellbore #1 - Plan#1 012014	900.00	900.00	31.10	27.34	8.261	CC, ES
Pardue 29 Fed Com 4H - Wellbore #1 - Plan#1 012014	12,704.04	12,747.47	1,129.75	944.52	6.099	SF

Offset Design Sec 29 T24S R 28E - Pardue 29 Fed Com 4H - Wellbore #1 - Plan#1 012014 — **Offset Site Error:** 0.00 usft

Survey Program: 0-MWD — **Offset Well Error:** 0.00 usft

Reference Measured Depth (usft)	Reference Vertical Depth (usft)	Offset Measured Depth (usft)	Offset Vertical Depth (usft)	Semi Major Axis Reference (usft)	Semi Major Axis Offset (usft)	Azimuth from North (°)	Offset Wellbore Centre +N/-S (usft)	Offset Wellbore Centre +E/-W (usft)	Distance Between Centres (usft)	Distance Between Ellipses (usft)	Minimum Separation (usft)	Separation Factor	Warning
0.00	0.00	0.00	0.00	0.00	0.00	-89.82	0.10	-31.10	31.10				
50.00	50.00	50.00	50.00	0.03	0.04	-89.82	0.10	-31.10	31.10	31.03	0.07	442.773	
100.00	100.00	100.00	100.00	0.08	0.08	-89.82	0.10	-31.10	31.10	30.93	0.17	184.489	
150.00	150.00	150.00	150.00	0.20	0.20	-89.82	0.10	-31.10	31.10	30.71	0.39	79.067	
200.00	200.00	200.00	200.00	0.31	0.31	-89.82	0.10	-31.10	31.10	30.48	0.62	50.315	
250.00	250.00	250.00	250.00	0.42	0.42	-89.82	0.10	-31.10	31.10	30.26	0.84	36.898	
300.00	300.00	300.00	300.00	0.53	0.53	-89.82	0.10	-31.10	31.10	30.03	1.07	29.130	
350.00	350.00	350.00	350.00	0.65	0.65	-89.82	0.10	-31.10	31.10	29.81	1.29	24.064	
400.00	400.00	400.00	400.00	0.76	0.76	-89.82	0.10	-31.10	31.10	29.58	1.52	20.499	
450.00	450.00	450.00	450.00	0.87	0.87	-89.82	0.10	-31.10	31.10	29.36	1.74	17.854	
500.00	500.00	500.00	500.00	0.98	0.98	-89.82	0.10	-31.10	31.10	29.13	1.97	15.813	
550.00	550.00	550.00	550.00	1.10	1.10	-89.82	0.10	-31.10	31.10	28.91	2.19	14.191	
600.00	600.00	600.00	600.00	1.21	1.21	-89.82	0.10	-31.10	31.10	28.68	2.42	12.871	
650.00	650.00	650.00	650.00	1.32	1.32	-89.82	0.10	-31.10	31.10	28.46	2.64	11.776	
700.00	700.00	700.00	700.00	1.43	1.43	-89.82	0.10	-31.10	31.10	28.23	2.87	10.852	
750.00	750.00	750.00	750.00	1.55	1.55	-89.82	0.10	-31.10	31.10	28.01	3.09	10.063	
800.00	800.00	800.00	800.00	1.66	1.66	-89.82	0.10	-31.10	31.10	27.78	3.32	9.381	
850.00	850.00	850.00	850.00	1.77	1.77	-89.82	0.10	-31.10	31.10	27.56	3.54	8.785	
900.00	900.00	900.00	900.00	1.88	1.88	-89.82	0.10	-31.10	31.10	27.34	3.76	8.261	CC, ES
950.00	950.00	949.59	949.59	1.99	1.99	-89.82	0.10	-31.42	31.42	27.44	3.98	7.892	
1,000.00	1,000.00	999.17	999.16	2.11	2.09	-89.82	0.10	-32.39	32.40	28.20	4.20	7.715	
1,050.00	1,050.00	1,048.71	1,048.68	2.22	2.19	-89.83	0.10	-33.99	34.02	29.61	4.41	7.710	
1,100.00	1,100.00	1,098.21	1,098.12	2.33	2.29	-89.84	0.10	-36.24	36.29	31.66	4.63	7.845	
1,150.00	1,150.00	1,147.63	1,147.46	2.44	2.40	-89.85	0.10	-39.12	39.21	34.36	4.84	8.094	
1,200.00	1,200.00	1,196.98	1,196.68	2.56	2.51	-89.87	0.10	-42.64	42.77	37.71	5.06	8.449	

CC - Min centre to center distance or covergent point, SF - min separation factor, ES - min ellipse separation

Company:	Legend Natural Gas IV, LP	**Local Co-ordinate Reference:**	Well Pardue 29 Fed Com 5H
Project:	Eddy County, NM (Nad27)	**TVD Reference:**	WELL @ 3072.00usft (TBD)
Reference Site:	Sec 29 T24S R 28E	**MD Reference:**	WELL @ 3072.00usft (TBD)
Site Error:	0.00 usft	**North Reference:**	Grid
Reference Well:	Pardue 29 Fed Com 5H	**Survey Calculation Method:**	Minimum Curvature
Well Error:	0.00 usft	**Output errors are at**	2.00 sigma
Reference Wellbore	Wellbore #1	**Database:**	Compass 5000 GCR DB
Reference Design:	Plan#1 012014	**Offset TVD Reference:**	Reference Datum

Offset Design Sec 29 T24S R 28E - Pardue 29 Fed Com 4H - Wellbore #1 - Plan#1 012014 — Offset Site Error: 0.00 usft

Survey Program: 0-MWD — Offset Well Error: 0.00 usft

Reference Measured Depth (usft)	Reference Vertical Depth (usft)	Offset Measured Depth (usft)	Offset Vertical Depth (usft)	Semi Major Axis Reference (usft)	Semi Major Axis Offset (usft)	Azimuth from North (°)	Offset Wellbore Centre +N/-S (usft)	Offset Wellbore Centre +E/-W (usft)	Distance Between Centres (usft)	Distance Between Ellipses (usft)	Minimum Separation (usft)	Separation Factor	Warning
1,250.00	1,250.00	1,246.22	1,245.75	2.67	2.62	-89.88	0.10	-46.78	46.97	41.69	5.29	8.886	
1,300.00	1,300.00	1,295.35	1,294.65	2.78	2.73	-89.89	0.10	-51.54	51.82	46.31	5.51	9.404	
1,350.00	1,350.00	1,344.35	1,343.35	2.89	2.85	-89.90	0.10	-56.92	57.30	51.56	5.74	9.979	
1,400.00	1,400.00	1,393.20	1,391.83	3.01	2.97	-89.91	0.10	-62.90	63.43	57.45	5.97	10.615	
1,450.00	1,450.00	1,441.89	1,440.08	3.12	3.10	-89.92	0.10	-69.47	70.18	63.96	6.22	11.290	
1,500.00	1,500.00	1,490.55	1,488.20	3.23	3.23	-89.93	0.10	-76.65	77.56	71.10	6.46	12.007	
1,550.00	1,550.00	1,539.97	1,537.04	3.34	3.37	-89.93	0.10	-84.17	85.16	78.45	6.71	12.686	
1,600.00	1,600.00	1,589.39	1,585.89	3.46	3.51	-89.94	0.10	-91.69	92.77	85.80	6.97	13.314	
1,650.00	1,650.00	1,638.80	1,634.73	3.57	3.66	-89.94	0.10	-99.21	100.37	93.15	7.23	13.888	
1,700.00	1,700.00	1,688.22	1,683.57	3.68	3.81	-89.95	0.10	-106.72	107.98	100.49	7.49	14.421	
1,750.00	1,750.00	1,737.64	1,732.42	3.79	3.96	-89.95	0.10	-114.24	115.59	107.84	7.75	14.911	
1,800.00	1,800.00	1,787.06	1,781.26	3.91	4.11	-89.95	0.10	-121.76	123.19	115.18	8.02	15.366	
1,850.00	1,850.00	1,836.48	1,830.10	4.02	4.27	-89.96	0.10	-129.28	130.80	122.51	8.28	15.788	
1,900.00	1,900.00	1,885.90	1,878.95	4.13	4.42	-89.96	0.10	-136.79	138.41	129.85	8.55	16.181	
1,950.00	1,950.00	1,935.31	1,927.79	4.24	4.58	-89.96	0.10	-144.31	146.01	137.19	8.82	16.546	
2,000.00	2,000.00	1,984.73	1,976.63	4.35	4.74	-89.96	0.10	-151.83	153.62	144.52	9.10	16.889	
2,050.00	2,050.00	2,034.15	2,025.47	4.47	4.90	-89.96	0.10	-159.35	161.22	151.85	9.37	17.208	
2,100.00	2,100.00	2,083.57	2,074.32	4.58	5.06	-89.97	0.10	-166.87	168.83	159.19	9.64	17.508	
2,150.00	2,150.00	2,132.99	2,123.16	4.69	5.23	-89.97	0.10	-174.38	176.44	166.52	9.92	17.789	
2,200.00	2,200.00	2,182.40	2,172.00	4.80	5.39	-89.97	0.10	-181.90	184.04	173.85	10.19	18.053	
2,250.00	2,250.00	2,231.82	2,220.85	4.92	5.56	-89.97	0.10	-189.42	191.65	181.18	10.47	18.302	
2,300.00	2,300.00	2,281.24	2,269.69	5.03	5.72	-89.97	0.10	-196.94	199.26	188.51	10.75	18.537	
2,350.00	2,350.00	2,330.66	2,318.53	5.14	5.89	-89.97	0.10	-204.45	206.86	195.83	11.03	18.759	
2,400.00	2,400.00	2,380.08	2,367.37	5.25	6.05	-89.97	0.10	-211.97	214.47	203.16	11.31	18.969	
2,450.00	2,450.00	2,429.49	2,416.22	5.37	6.22	-89.97	0.10	-219.49	222.07	210.49	11.59	19.168	
2,500.00	2,500.00	2,478.91	2,465.06	5.48	6.39	-89.97	0.10	-227.01	229.68	217.81	11.87	19.357	
2,550.00	2,550.00	2,528.33	2,513.90	5.59	6.56	-89.98	0.10	-234.52	237.29	225.14	12.15	19.536	
2,600.00	2,600.00	2,577.75	2,562.75	5.70	6.72	-89.98	0.10	-242.04	244.89	232.46	12.43	19.706	
2,650.00	2,650.00	2,627.13	2,611.56	5.81	6.89	-89.98	0.10	-249.55	252.71	241.14	11.57	21.839	
2,700.00	2,699.99	2,676.45	2,660.30	5.91	7.06	-89.98	0.10	-257.06	260.97	249.18	11.79	22.134	
2,750.00	2,749.98	2,725.69	2,708.96	6.01	7.23	-89.98	0.10	-264.55	269.65	257.65	12.00	22.469	
2,800.00	2,799.96	2,774.85	2,757.55	6.11	7.40	-89.98	0.10	-272.03	278.76	266.55	12.21	22.829	
2,850.00	2,849.92	2,823.93	2,806.06	6.21	7.57	-89.98	0.10	-279.49	288.30	275.88	12.42	23.214	
2,900.00	2,899.87	2,872.97	2,854.53	6.31	7.74	-89.98	0.10	-286.95	298.06	285.42	12.64	23.588	
2,950.00	2,949.83	2,922.01	2,903.00	6.42	7.91	-89.98	0.10	-294.41	307.81	294.96	12.85	23.948	
3,000.00	2,999.78	2,971.05	2,951.47	6.52	8.08	-89.98	0.10	-301.87	317.56	304.49	13.07	24.296	
3,050.00	3,049.73	3,020.09	2,999.94	6.62	8.25	-89.98	0.10	-309.33	327.32	314.03	13.29	24.631	
3,100.00	3,099.68	3,069.13	3,048.41	6.73	8.42	-89.98	0.10	-316.79	337.07	323.57	13.51	24.954	
3,150.00	3,149.64	3,118.17	3,096.87	6.83	8.59	-89.98	0.10	-324.25	346.83	333.10	13.73	25.266	
3,200.00	3,199.59	3,167.21	3,145.34	6.93	8.76	-89.98	0.10	-331.71	356.58	342.64	13.95	25.568	
3,250.00	3,249.54	3,216.24	3,193.81	7.04	8.93	-89.98	0.10	-339.17	366.34	352.17	14.17	25.859	
3,300.00	3,299.49	3,265.28	3,242.28	7.14	9.10	-89.98	0.10	-346.63	376.09	361.70	14.39	26.141	
3,350.00	3,349.44	3,314.32	3,290.75	7.25	9.27	-89.98	0.10	-354.09	385.85	371.24	14.61	26.413	
3,400.00	3,399.40	3,363.36	3,339.22	7.36	9.45	-89.99	0.10	-361.55	395.60	380.77	14.83	26.677	
3,450.00	3,449.35	3,412.40	3,387.69	7.46	9.62	-89.99	0.10	-369.01	405.35	390.30	15.05	26.932	
3,500.00	3,499.30	3,461.44	3,436.15	7.57	9.79	-89.99	0.10	-376.47	415.11	399.84	15.27	27.179	
3,550.00	3,549.25	3,510.48	3,484.62	7.68	9.96	-89.99	0.10	-383.93	424.86	409.37	15.50	27.418	
3,600.00	3,599.21	3,559.52	3,533.09	7.79	10.13	-89.99	0.10	-391.39	434.62	418.90	15.72	27.651	
3,650.00	3,649.16	3,608.56	3,581.56	7.89	10.31	-89.99	0.10	-398.85	444.37	428.43	15.94	27.876	
3,700.00	3,699.11	3,657.60	3,630.03	8.00	10.48	-89.99	0.10	-406.31	454.13	437.96	16.16	28.094	
3,750.00	3,749.06	3,706.64	3,678.50	8.11	10.65	-89.99	0.10	-413.77	463.88	447.49	16.39	28.306	
3,800.00	3,799.02	3,755.68	3,726.97	8.22	10.82	-89.99	0.10	-421.23	473.64	457.02	16.61	28.511	

CC - Min centre to center distance or covergent point, SF - min separation factor, ES - min ellipse separation

Company:	Legend Natural Gas IV, LP	**Local Co-ordinate Reference:**	Well Pardue 29 Fed Com 5H
Project:	Eddy County, NM (Nad27)	**TVD Reference:**	WELL @ 3072.00usft (TBD)
Reference Site:	Sec 29 T24S R 28E	**MD Reference:**	WELL @ 3072.00usft (TBD)
Site Error:	0.00 usft	**North Reference:**	Grid
Reference Well:	Pardue 29 Fed Com 5H	**Survey Calculation Method:**	Minimum Curvature
Well Error:	0.00 usft	**Output errors are at**	2.00 sigma
Reference Wellbore	Wellbore #1	**Database:**	Compass 5000 GCR DB
Reference Design:	Plan#1 012014	**Offset TVD Reference:**	Reference Datum

Offset Design — Sec 29 T24S R 28E - Pardue 29 Fed Com 4H - Wellbore #1 - Plan#1 012014 — Offset Site Error: 0.00 usft

Survey Program: 0-MWD — Offset Well Error: 0.00 usft

Reference Measured Depth (usft)	Reference Vertical Depth (usft)	Offset Measured Depth (usft)	Offset Vertical Depth (usft)	Semi Major Axis Reference (usft)	Semi Major Axis Offset (usft)	Azimuth from North (°)	Offset Wellbore Centre +N/-S (usft)	Offset Wellbore Centre +E/-W (usft)	Distance Between Centres (usft)	Distance Between Ellipses (usft)	Minimum Separation (usft)	Separation Factor	Warning
3,850.00	3,848.97	3,804.72	3,775.43	8.33	11.00	-89.99	0.10	-428.69	483.39	466.55	16.84	28.711	
3,900.00	3,898.92	3,853.76	3,823.90	8.44	11.17	-89.99	0.10	-436.15	493.15	476.08	17.06	28.905	
3,950.00	3,948.87	3,902.79	3,872.37	8.55	11.34	-89.99	0.10	-443.61	502.90	485.61	17.29	29.094	
4,000.00	3,998.83	3,951.83	3,920.84	8.66	11.51	-89.99	0.10	-451.07	512.65	495.14	17.51	29.277	
4,050.00	4,048.78	4,000.87	3,969.31	8.77	11.69	-89.99	0.10	-458.53	522.41	504.67	17.74	29.455	
4,100.00	4,098.73	4,049.91	4,017.78	8.88	11.86	-89.99	0.10	-465.99	532.16	514.20	17.96	29.629	
4,150.00	4,148.68	4,098.95	4,066.25	8.99	12.03	-89.99	0.10	-473.45	541.92	523.73	18.19	29.797	
4,200.00	4,198.64	4,147.99	4,114.71	9.10	12.21	-89.99	0.10	-480.91	551.67	533.26	18.41	29.962	
4,250.00	4,248.59	4,197.03	4,163.18	9.21	12.38	-89.99	0.10	-488.37	561.43	542.79	18.64	30.121	
4,300.00	4,298.54	4,246.07	4,211.65	9.32	12.55	-89.99	0.10	-495.83	571.18	552.32	18.86	30.277	
4,350.00	4,348.49	4,295.11	4,260.12	9.43	12.73	-89.99	0.10	-503.29	580.94	561.84	19.09	30.429	
4,400.00	4,398.45	4,344.15	4,308.59	9.55	12.90	-89.99	0.10	-510.75	590.69	571.37	19.32	30.577	
4,450.00	4,448.40	4,393.19	4,357.06	9.66	13.07	-89.99	0.10	-518.21	600.45	580.90	19.54	30.721	
4,500.00	4,498.35	4,442.23	4,405.52	9.77	13.25	-89.99	0.10	-525.67	610.20	590.43	19.77	30.862	
4,550.00	4,548.30	4,491.27	4,453.99	9.88	13.42	-89.99	0.10	-533.13	619.95	599.96	20.00	30.999	
4,600.00	4,598.26	4,540.31	4,502.46	9.99	13.59	-89.99	0.10	-540.59	629.71	609.48	20.23	31.133	
4,650.00	4,648.21	4,589.34	4,550.93	10.11	13.77	-89.99	0.10	-548.05	639.46	619.01	20.45	31.264	
4,700.00	4,698.16	4,638.38	4,599.40	10.22	13.94	-89.99	0.10	-555.51	649.22	628.54	20.68	31.391	
4,750.00	4,748.11	4,687.42	4,647.87	10.33	14.12	-89.99	0.10	-562.97	658.97	638.06	20.91	31.516	
4,800.00	4,798.06	4,736.46	4,696.34	10.44	14.29	-89.99	0.10	-570.43	668.73	647.59	21.14	31.638	
4,850.00	4,848.02	4,785.50	4,744.80	10.56	14.46	-89.99	0.10	-577.89	678.48	657.12	21.37	31.756	
4,900.00	4,897.97	4,834.54	4,793.27	10.67	14.64	-89.99	0.10	-585.35	688.24	666.64	21.59	31.873	
4,950.00	4,947.92	4,883.58	4,841.74	10.78	14.81	-89.99	0.10	-592.81	697.99	676.17	21.82	31.986	
5,000.00	4,997.87	4,932.62	4,890.21	10.90	14.98	-89.99	0.10	-600.27	707.74	685.69	22.05	32.097	
5,050.00	5,047.83	4,981.66	4,938.68	11.01	15.16	-89.99	0.10	-607.73	717.50	695.22	22.28	32.206	
5,100.00	5,097.78	5,030.70	4,987.15	11.12	15.33	-89.99	0.10	-615.19	727.25	704.75	22.51	32.312	
5,150.00	5,147.73	5,079.74	5,035.62	11.24	15.51	-89.99	0.10	-622.65	737.01	714.27	22.74	32.416	
5,200.00	5,197.68	5,128.78	5,084.08	11.35	15.68	-89.99	0.10	-630.11	746.76	723.80	22.97	32.517	
5,250.00	5,247.64	5,177.82	5,132.55	11.47	15.86	-89.99	0.10	-637.57	756.52	733.32	23.19	32.617	
5,300.00	5,297.59	5,226.85	5,181.02	11.58	16.03	-89.99	0.10	-645.03	766.27	742.85	23.42	32.714	
5,350.00	5,347.54	5,275.89	5,229.49	11.69	16.20	-89.99	0.10	-652.49	776.03	752.37	23.65	32.809	
5,400.00	5,397.49	5,324.93	5,277.96	11.81	16.38	-89.99	0.10	-659.95	785.78	761.90	23.88	32.903	
5,450.00	5,447.45	5,373.97	5,326.43	11.92	16.55	-89.99	0.10	-667.41	795.54	771.42	24.11	32.994	
5,500.00	5,497.40	5,423.01	5,374.90	12.04	16.73	-89.99	0.10	-674.87	805.29	780.95	24.34	33.084	
5,550.00	5,547.35	5,472.05	5,423.36	12.15	16.90	-89.99	0.10	-682.33	815.04	790.47	24.57	33.171	
5,600.00	5,597.30	5,521.09	5,471.83	12.27	17.08	-89.99	0.10	-689.79	824.80	800.00	24.80	33.257	
5,650.00	5,647.26	5,570.13	5,520.30	12.38	17.25	-89.99	0.10	-697.25	834.55	809.52	25.03	33.342	
5,700.00	5,697.21	5,619.17	5,568.77	12.49	17.42	-89.99	0.10	-704.71	844.31	819.05	25.26	33.424	
5,750.00	5,747.16	5,668.21	5,617.24	12.61	17.60	-89.99	0.10	-712.17	854.06	828.57	25.49	33.505	
5,800.00	5,797.11	5,717.25	5,665.71	12.72	17.77	-89.99	0.10	-719.63	863.82	838.10	25.72	33.585	
5,850.00	5,847.07	5,766.29	5,714.17	12.84	17.95	-89.99	0.10	-727.09	873.57	847.62	25.95	33.663	
5,900.00	5,897.02	5,815.33	5,762.64	12.95	18.12	-89.99	0.10	-734.55	883.33	857.15	26.18	33.739	
5,950.00	5,946.97	5,864.37	5,811.11	13.07	18.30	-89.99	0.10	-742.01	893.08	866.67	26.41	33.814	
6,000.00	5,996.92	5,913.40	5,859.58	13.18	18.47	-89.99	0.10	-749.47	902.84	876.19	26.64	33.888	
6,050.00	6,046.88	5,962.44	5,908.05	13.30	18.65	-89.99	0.10	-756.93	912.59	885.72	26.87	33.960	
6,100.00	6,096.83	6,011.48	5,956.52	13.42	18.82	-89.99	0.10	-764.39	922.34	895.24	27.10	34.031	
6,150.00	6,146.78	6,060.52	6,004.99	13.53	19.00	-89.99	0.10	-771.85	932.10	904.77	27.33	34.101	
6,200.00	6,196.73	6,109.56	6,053.45	13.65	19.17	-89.99	0.10	-779.31	941.85	914.29	27.56	34.170	
6,250.00	6,246.68	6,158.60	6,101.92	13.76	19.34	-89.99	0.10	-786.77	951.61	923.81	27.79	34.237	
6,300.00	6,296.64	6,207.64	6,150.39	13.88	19.52	-89.99	0.10	-794.23	961.36	933.34	28.03	34.303	
6,350.00	6,346.59	6,256.68	6,198.86	13.99	19.69	-89.99	0.10	-801.69	971.12	942.86	28.26	34.368	
6,400.00	6,396.54	6,305.72	6,247.33	14.11	19.87	-89.99	0.10	-809.15	980.87	952.38	28.49	34.431	

Company:	Legend Natural Gas IV, LP	**Local Co-ordinate Reference:**	Well Pardue 29 Fed Com 5H
Project:	Eddy County, NM (Nad27)	**TVD Reference:**	WELL @ 3072.00usft (TBD)
Reference Site:	Sec 29 T24S R 28E	**MD Reference:**	WELL @ 3072.00usft (TBD)
Site Error:	0.00 usft	**North Reference:**	Grid
Reference Well:	Pardue 29 Fed Com 5H	**Survey Calculation Method:**	Minimum Curvature
Well Error:	0.00 usft	**Output errors are at**	2.00 sigma
Reference Wellbore	Wellbore #1	**Database:**	Compass 5000 GCR DB
Reference Design:	Plan#1 012014	**Offset TVD Reference:**	Reference Datum

Offset Design Sec 29 T24S R 28E - Pardue 29 Fed Com 4H - Wellbore #1 - Plan#1 012014 — Offset Site Error: 0.00 usft

Survey Program: 0-MWD — Offset Well Error: 0.00 usft

Reference Measured Depth (usft)	Reference Vertical Depth (usft)	Offset Measured Depth (usft)	Offset Vertical Depth (usft)	Semi Major Axis Reference (usft)	Semi Major Axis Offset (usft)	Azimuth from North (°)	Offset Wellbore Centre +N/-S (usft)	Offset Wellbore Centre +E/-W (usft)	Distance Between Centres (usft)	Distance Between Ellipses (usft)	Minimum Separation (usft)	Separation Factor	Warning
6,450.00	6,446.49	6,354.76	6,295.80	14.22	20.04	-89.99	0.10	-816.61	990.63	961.91	28.72	34.494	
6,500.00	6,496.45	6,403.80	6,344.27	14.34	20.22	-89.99	0.10	-824.07	1,000.38	971.43	28.95	34.555	
6,550.00	6,546.40	6,452.84	6,392.73	14.46	20.39	-89.99	0.10	-831.53	1,010.13	980.95	29.18	34.616	
6,600.00	6,596.35	6,501.88	6,441.20	14.57	20.57	-89.99	0.10	-838.99	1,019.89	990.48	29.41	34.675	
6,650.00	6,646.30	6,550.91	6,489.67	14.69	20.74	-89.99	0.10	-846.45	1,029.64	1,000.00	29.64	34.734	
6,700.00	6,696.26	6,599.95	6,538.14	14.80	20.92	-89.99	0.10	-853.91	1,039.40	1,009.52	29.88	34.791	
6,750.00	6,746.21	6,648.99	6,586.61	14.92	21.09	-89.99	0.10	-861.37	1,049.15	1,019.05	30.11	34.848	
6,800.00	6,796.16	6,698.03	6,635.08	15.03	21.27	-89.99	0.10	-868.83	1,058.91	1,028.57	30.34	34.903	
6,850.00	6,846.11	6,747.07	6,683.55	15.15	21.44	-89.99	0.10	-876.29	1,068.66	1,038.09	30.57	34.958	
6,900.00	6,896.07	6,796.11	6,732.01	15.27	21.62	-89.99	0.10	-883.75	1,078.42	1,047.62	30.80	35.012	
6,950.00	6,946.02	6,845.15	6,780.48	15.38	21.79	-89.99	0.10	-891.21	1,088.17	1,057.14	31.03	35.065	
7,000.00	6,995.97	6,894.19	6,828.95	15.50	21.97	-89.99	0.10	-898.67	1,097.93	1,066.66	31.26	35.117	
7,050.00	7,045.93	6,943.28	6,877.47	15.60	22.14	-89.99	0.10	-906.14	1,107.41	1,075.89	31.52	35.139	
7,100.00	7,095.92	6,992.49	6,926.11	15.71	22.32	-89.99	0.10	-913.63	1,116.25	1,084.49	31.76	35.142	
7,150.00	7,145.91	7,041.82	6,974.86	15.80	22.49	-89.99	0.10	-921.13	1,124.45	1,092.45	32.00	35.138	
7,200.00	7,195.91	7,110.41	7,042.71	15.90	22.71	-89.99	0.10	-931.20	1,131.91	1,099.64	32.26	35.085	
7,250.00	7,245.91	7,199.98	7,131.65	16.00	22.93	-89.99	0.10	-941.76	1,137.80	1,105.26	32.54	34.966	
7,300.00	7,295.91	7,290.20	7,221.55	16.11	23.11	-89.99	0.10	-949.23	1,141.94	1,109.13	32.81	34.804	
7,350.00	7,345.91	7,380.83	7,312.07	16.21	23.26	-89.99	0.10	-953.52	1,144.31	1,111.24	33.07	34.599	
7,400.00	7,395.91	7,464.68	7,395.91	16.31	23.38	-89.99	0.10	-954.64	1,144.92	1,111.60	33.33	34.355	
7,450.00	7,445.91	7,514.86	7,446.10	16.42	23.45	-90.01	-0.26	-954.64	1,144.92	1,111.40	33.52	34.152	
7,500.00	7,495.83	7,565.20	7,496.20	16.52	23.52	-90.12	-4.85	-954.62	1,144.91	1,111.20	33.71	33.962	
7,550.00	7,545.22	7,615.31	7,545.33	16.62	23.59	-90.23	-14.63	-954.57	1,144.88	1,110.99	33.89	33.777	
7,600.00	7,593.54	7,665.20	7,592.94	16.72	23.66	-90.33	-29.42	-954.51	1,144.84	1,110.76	34.08	33.592	
7,650.00	7,640.26	7,714.86	7,638.56	16.82	23.73	-90.42	-49.01	-954.43	1,144.79	1,110.52	34.27	33.402	
7,700.00	7,684.87	7,764.31	7,681.71	16.93	23.81	-90.50	-73.11	-954.32	1,144.73	1,110.25	34.48	33.198	
7,750.00	7,726.88	7,813.55	7,721.98	17.05	23.90	-90.56	-101.41	-954.20	1,144.66	1,109.95	34.71	32.973	
7,800.00	7,765.83	7,862.60	7,758.98	17.18	23.99	-90.60	-133.57	-954.06	1,144.58	1,109.60	34.98	32.718	
7,850.00	7,801.30	7,911.46	7,792.37	17.33	24.10	-90.63	-169.22	-953.91	1,144.49	1,109.20	35.30	32.425	
7,900.00	7,832.89	7,960.15	7,821.84	17.51	24.22	-90.63	-207.95	-953.74	1,144.39	1,108.73	35.67	32.087	
7,950.00	7,860.26	8,008.69	7,847.15	17.71	24.35	-90.60	-249.34	-953.56	1,144.28	1,108.19	36.10	31.701	
8,000.00	7,883.10	8,057.09	7,868.07	17.95	24.51	-90.56	-292.96	-953.37	1,144.17	1,107.57	36.60	31.265	
8,050.00	7,901.18	8,105.36	7,884.43	18.24	24.69	-90.50	-338.35	-953.17	1,144.04	1,106.87	37.17	30.781	
8,100.00	7,914.29	8,153.53	7,896.11	18.56	24.89	-90.43	-385.07	-952.97	1,143.91	1,106.10	37.81	30.255	
8,150.00	7,922.28	8,201.61	7,903.01	18.91	25.13	-90.34	-432.63	-952.77	1,143.77	1,105.26	38.52	29.695	
8,200.00	7,925.12	8,250.19	7,905.30	19.30	25.39	-90.27	-481.14	-952.56	1,143.63	1,104.34	39.29	29.105	
8,250.00	7,925.99	8,300.19	7,906.38	19.73	25.69	-90.27	-531.13	-952.34	1,143.47	1,103.33	40.14	28.484	
8,300.00	7,926.86	8,350.19	7,907.45	20.17	26.01	-90.27	-581.12	-952.12	1,143.32	1,102.27	41.05	27.855	
8,350.00	7,927.74	8,400.19	7,908.52	20.67	26.37	-90.27	-631.10	-951.91	1,143.16	1,101.15	42.01	27.213	
8,400.00	7,928.61	8,450.19	7,909.60	21.17	26.76	-90.27	-681.09	-951.69	1,143.00	1,099.98	43.03	26.565	
8,450.00	7,929.48	8,500.19	7,910.67	21.72	27.17	-90.27	-731.08	-951.47	1,142.85	1,098.75	44.10	25.916	
8,500.00	7,930.35	8,550.19	7,911.74	22.27	27.61	-90.27	-781.06	-951.26	1,142.69	1,097.47	45.22	25.271	
8,550.00	7,931.23	8,600.19	7,912.82	22.87	28.07	-90.27	-831.05	-951.04	1,142.53	1,096.15	46.38	24.634	
8,600.00	7,932.10	8,650.19	7,913.89	23.47	28.56	-90.27	-881.04	-950.83	1,142.38	1,094.79	47.59	24.006	
8,650.00	7,932.97	8,700.19	7,914.96	24.10	29.06	-90.27	-931.03	-950.61	1,142.22	1,093.39	48.83	23.391	
8,700.00	7,933.84	8,750.19	7,916.04	24.74	29.59	-90.27	-981.01	-950.39	1,142.07	1,091.95	50.11	22.790	
8,750.00	7,934.72	8,800.19	7,917.11	25.40	30.14	-90.27	-1,031.00	-950.18	1,141.91	1,090.48	51.43	22.205	
8,800.00	7,935.59	8,850.19	7,918.18	26.07	30.71	-90.27	-1,080.99	-949.96	1,141.75	1,088.98	52.77	21.636	
8,850.00	7,936.46	8,900.18	7,919.26	26.77	31.29	-90.27	-1,130.98	-949.74	1,141.60	1,087.46	54.14	21.085	
8,900.00	7,937.33	8,950.18	7,920.33	27.47	31.89	-90.27	-1,180.96	-949.53	1,141.44	1,085.90	55.54	20.551	
8,950.00	7,938.21	9,000.18	7,921.40	28.19	32.50	-90.27	-1,230.95	-949.31	1,141.29	1,084.32	56.97	20.035	
9,000.00	7,939.08	9,050.18	7,922.48	28.91	33.13	-90.27	-1,280.94	-949.10	1,141.13	1,082.72	58.41	19.536	

CC - Min centre to center distance or covergent point, SF - min separation factor, ES - min ellipse separation

Company:	Legend Natural Gas iV, LP	**Local Co-ordinate Reference:**	Well Pardue 29 Fed Com 5H
Project:	Eddy County, NM (Nad27)	**TVD Reference:**	WELL @ 3072.00usft (TBD)
Reference Site:	Sec 29 T24S R28E	**MD Reference:**	WELL @ 3072.00usft (TBD)
Site Error:	0.00 usft	**North Reference:**	Grid
Reference Well:	Pardue 29 Fed Com 5H	**Survey Calculation Method:**	Minimum Curvature
Well Error:	0.00 usft	**Output errors are at**	2.00 sigma
Reference Wellbore	Wellbore #1	**Database:**	Compass 5000 GCR DB
Reference Design:	Plan#1 012014	**Offset TVD Reference:**	Reference Datum

Offset Design Sec 29 T24S R 28E - Pardue 29 Fed Com 4H - Wellbore #1 - Plan#1 012014 — Offset Site Error: 0.00 usft

Survey Program: 0-MWD — Offset Well Error: 0.00 usft

Reference Measured Depth (usft)	Reference Vertical Depth (usft)	Offset Measured Depth (usft)	Offset Vertical Depth (usft)	Semi Major Axis Reference (usft)	Semi Major Axis Offset (usft)	Azimuth from North (°)	Offset Wellbore Centre +N/-S (usft)	Offset Wellbore Centre +E/-W (usft)	Distance Between Centres (usft)	Distance Between Ellipses (usft)	Minimum Separation (usft)	Separation Factor	Warning
9,050.00	7,939.95	9,100.18	7,923.55	29.65	33.78	-90.27	-1,330.93	-948.88	1,140.98	1,081.10	59.88	19.055	
9,100.00	7,940.83	9,150.18	7,924.62	30.39	34.43	-90.27	-1,380.91	-948.66	1,140.82	1,079.46	61.36	18.591	
9,150.00	7,941.70	9,200.18	7,925.70	31.15	35.10	-90.27	-1,430.90	-948.45	1,140.66	1,077.80	62.87	18.144	
9,200.00	7,942.57	9,250.18	7,926.77	31.91	35.78	-90.26	-1,480.89	-948.23	1,140.51	1,076.12	64.39	17.713	
9,250.00	7,943.44	9,300.18	7,927.84	32.69	36.47	-90.26	-1,530.88	-948.01	1,140.35	1,074.43	65.92	17.298	
9,300.00	7,944.32	9,350.18	7,928.92	33.46	37.17	-90.26	-1,580.86	-947.80	1,140.20	1,072.72	67.48	16.898	
9,350.00	7,945.19	9,400.18	7,929.99	34.25	37.88	-90.26	-1,630.85	-947.58	1,140.04	1,071.00	69.04	16.513	
9,400.00	7,946.06	9,450.18	7,931.06	35.04	38.60	-90.26	-1,680.84	-947.36	1,139.89	1,069.27	70.62	16.142	
9,450.00	7,946.93	9,500.18	7,932.14	35.84	39.33	-90.26	-1,730.83	-947.15	1,139.73	1,067.52	72.21	15.784	
9,500.00	7,947.81	9,550.18	7,933.21	36.64	40.06	-90.26	-1,780.81	-946.93	1,139.57	1,065.77	73.81	15.440	
9,550.00	7,948.68	9,600.18	7,934.28	37.45	40.80	-90.26	-1,830.80	-946.72	1,139.42	1,064.00	75.42	15.108	
9,600.00	7,949.55	9,650.18	7,935.36	38.26	41.55	-90.26	-1,880.79	-946.50	1,139.26	1,062.23	77.04	14.789	
9,650.00	7,950.42	9,700.17	7,936.43	39.08	42.31	-90.26	-1,930.77	-946.28	1,139.11	1,060.44	78.67	14.480	
9,700.00	7,951.30	9,750.17	7,937.50	39.90	43.07	-90.26	-1,980.76	-946.07	1,138.95	1,058.65	80.30	14.183	
9,750.00	7,952.17	9,800.17	7,938.57	40.73	43.84	-90.26	-2,030.75	-945.85	1,138.80	1,056.85	81.95	13.896	
9,800.00	7,953.04	9,850.17	7,939.65	41.56	44.61	-90.26	-2,080.74	-945.63	1,138.64	1,055.04	83.60	13.620	
9,850.00	7,953.91	9,900.17	7,940.72	42.39	45.39	-90.26	-2,130.72	-945.42	1,138.49	1,053.22	85.26	13.353	
9,900.00	7,954.79	9,950.17	7,941.79	43.22	46.17	-90.26	-2,180.71	-945.20	1,138.33	1,051.40	86.93	13.095	
9,950.00	7,955.66	10,000.17	7,942.87	44.06	46.96	-90.26	-2,230.70	-944.99	1,138.18	1,049.57	88.60	12.846	
10,000.00	7,956.53	10,050.17	7,943.94	44.90	47.76	-90.26	-2,280.69	-944.77	1,138.02	1,047.74	90.28	12.605	
10,050.00	7,957.41	10,100.17	7,945.01	45.75	48.55	-90.26	-2,330.67	-944.55	1,137.87	1,045.90	91.97	12.372	
10,100.00	7,958.28	10,150.17	7,946.09	46.60	49.36	-90.26	-2,380.66	-944.34	1,137.71	1,044.05	93.66	12.147	
10,150.00	7,959.15	10,200.17	7,947.16	47.45	50.16	-90.26	-2,430.65	-944.12	1,137.56	1,042.20	95.35	11.930	
10,200.00	7,960.02	10,250.17	7,948.23	48.30	50.97	-90.26	-2,480.64	-943.90	1,137.40	1,040.35	97.05	11.719	
10,250.00	7,960.77	10,300.03	7,949.00	49.15	51.78	-90.25	-2,530.49	-943.69	1,137.25	1,038.49	98.76	11.516	
10,300.00	7,961.20	10,350.03	7,949.47	50.01	52.60	-90.25	-2,580.48	-943.47	1,137.10	1,036.63	100.47	11.318	
10,350.00	7,961.63	10,400.02	7,949.94	50.87	53.42	-90.25	-2,630.48	-943.26	1,136.94	1,034.76	102.18	11.127	
10,400.00	7,962.07	10,450.02	7,950.41	51.73	54.24	-90.25	-2,680.48	-943.04	1,136.79	1,032.89	103.90	10.941	
10,450.00	7,962.50	10,500.02	7,950.88	52.59	55.07	-90.25	-2,730.48	-942.82	1,136.64	1,031.02	105.62	10.762	
10,500.00	7,962.93	10,550.02	7,951.35	53.45	55.89	-90.25	-2,780.47	-942.61	1,136.48	1,029.14	107.34	10.587	
10,550.00	7,963.36	10,600.02	7,951.82	54.32	56.72	-90.25	-2,830.47	-942.39	1,136.33	1,027.26	109.07	10.418	
10,600.00	7,963.80	10,650.02	7,952.29	55.18	57.56	-90.25	-2,880.47	-942.17	1,136.18	1,025.37	110.80	10.254	
10,650.00	7,964.23	10,700.02	7,952.76	56.05	58.39	-90.25	-2,930.46	-941.96	1,136.02	1,023.49	112.54	10.095	
10,700.00	7,964.66	10,750.02	7,953.23	56.92	59.23	-90.25	-2,980.46	-941.74	1,135.87	1,021.60	114.27	9.940	
10,750.00	7,965.10	10,800.02	7,953.70	57.79	60.07	-90.25	-3,030.46	-941.53	1,135.72	1,019.70	116.01	9.790	
10,800.00	7,965.53	10,850.02	7,954.17	58.67	60.92	-90.25	-3,080.45	-941.31	1,135.56	1,017.81	117.75	9.643	
10,850.00	7,965.96	10,900.02	7,954.64	59.54	61.76	-90.25	-3,130.45	-941.09	1,135.41	1,015.91	119.50	9.501	
10,900.00	7,966.39	10,950.02	7,955.11	60.41	62.61	-90.25	-3,180.45	-940.88	1,135.26	1,014.01	121.25	9.363	
10,950.00	7,966.83	11,000.02	7,955.58	61.29	63.46	-90.25	-3,230.45	-940.66	1,135.10	1,012.11	123.00	9.229	
11,000.00	7,967.26	11,050.02	7,956.05	62.17	64.31	-90.25	-3,280.44	-940.44	1,134.95	1,010.20	124.75	9.098	
11,050.00	7,967.69	11,100.02	7,956.52	63.05	65.16	-90.25	-3,330.44	-940.23	1,134.80	1,008.29	126.50	8.970	
11,100.00	7,968.12	11,150.02	7,956.99	63.93	66.01	-90.25	-3,380.44	-940.01	1,134.64	1,006.38	128.26	8.846	
11,150.00	7,968.56	11,200.02	7,957.46	64.81	66.87	-90.25	-3,430.43	-939.79	1,134.49	1,004.47	130.02	8.726	
11,200.00	7,968.99	11,250.02	7,957.93	65.69	67.72	-90.25	-3,480.43	-939.58	1,134.34	1,002.56	131.78	8.608	
11,250.00	7,969.42	11,300.02	7,958.40	66.57	68.58	-90.25	-3,530.43	-939.36	1,134.18	1,000.64	133.54	8.493	
11,300.00	7,969.85	11,350.02	7,958.87	67.45	69.44	-90.25	-3,580.43	-939.15	1,134.03	998.73	135.30	8.381	
11,350.00	7,970.29	11,400.02	7,959.34	68.33	70.30	-90.25	-3,630.42	-938.93	1,133.88	996.81	137.07	8.272	
11,400.00	7,970.72	11,450.02	7,959.81	69.22	71.17	-90.25	-3,680.42	-938.71	1,133.72	994.89	138.84	8.166	
11,450.00	7,971.15	11,500.02	7,960.28	70.10	72.03	-90.25	-3,730.42	-938.50	1,133.57	992.97	140.60	8.062	
11,500.00	7,971.58	11,550.02	7,960.75	70.99	72.90	-90.25	-3,780.41	-938.28	1,133.42	991.04	142.38	7.961	
11,550.00	7,972.02	11,600.02	7,961.22	71.88	73.76	-90.25	-3,830.41	-938.06	1,133.26	989.12	144.15	7.862	
11,600.00	7,972.45	11,650.02	7,961.69	72.76	74.63	-90.25	-3,880.41	-937.85	1,133.11	987.19	145.92	7.765	

CC - Min centre to center distance or covergent point, SF - min separation factor, ES - min ellipse separation

Company:	Legend Natural Gas IV, LP	**Local Co-ordinate Reference:**	Well Pardue 29 Fed Com 5H
Project:	Eddy County, NM (Nad27)	**TVD Reference:**	WELL @ 3072.00usft (TBD)
Reference Site:	Sec 29 T24S R 28E	**MD Reference:**	WELL @ 3072.00usft (TBD)
Site Error:	0.00 usft	**North Reference:**	Grid
Reference Well:	Pardue 29 Fed Com 5H	**Survey Calculation Method:**	Minimum Curvature
Well Error:	0.00 usft	**Output errors are at**	2.00 sigma
Reference Wellbore	Wellbore #1	**Database:**	Compass 5000 GCR DB
Reference Design:	Plan#1 012014	**Offset TVD Reference:**	Reference Datum

Offset Design Sec 29 T24S R 28E - Pardue 29 Fed Com 4H - Wellbore #1 - Plan#1 012014 — Offset Site Error: 0.00 usft

Survey Program: 0-MWD — Offset Well Error: 0.00 usft

Reference Measured Depth (usft)	Reference Vertical Depth (usft)	Offset Measured Depth (usft)	Offset Vertical Depth (usft)	Semi Major Axis Reference (usft)	Semi Major Axis Offset (usft)	Azimuth from North (°)	Offset Wellbore Centre +N/-S (usft)	Offset Wellbore Centre +E/-W (usft)	Distance Between Centres (usft)	Distance Between Ellipses (usft)	Minimum Separation (usft)	Separation Factor	Warning
11,650.00	7,972.88	11,700.02	7,962.16	73.65	75.50	-90.25	-3,930.40	-937.63	1,132.96	985.26	147.69	7.671	
11,700.00	7,973.31	11,750.02	7,962.63	74.54	76.37	-90.25	-3,980.40	-937.42	1,132.80	983.33	149.47	7.579	
11,750.00	7,973.75	11,800.02	7,963.10	75.43	77.24	-90.25	-4,030.40	-937.20	1,132.65	981.40	151.25	7.489	
11,800.00	7,974.18	11,850.02	7,963.57	76.32	78.11	-90.25	-4,080.40	-936.98	1,132.50	979.47	153.02	7.401	
11,850.00	7,974.61	11,900.02	7,964.04	77.21	78.98	-90.25	-4,130.39	-936.77	1,132.34	977.54	154.80	7.315	
11,900.00	7,975.04	11,950.02	7,964.51	78.10	79.86	-90.25	-4,180.39	-936.55	1,132.19	975.61	156.58	7.231	
11,950.00	7,975.48	12,000.02	7,964.98	78.99	80.73	-90.25	-4,230.39	-936.33	1,132.04	973.67	158.37	7.148	
12,000.00	7,975.91	12,050.02	7,965.45	79.88	81.61	-90.25	-4,280.38	-936.12	1,131.88	971.74	160.15	7.068	
12,050.00	7,976.34	12,100.02	7,965.92	80.78	82.48	-90.25	-4,330.38	-935.90	1,131.73	969.80	161.93	6.989	
12,100.00	7,976.77	12,150.02	7,966.39	81.67	83.36	-90.25	-4,380.38	-935.68	1,131.58	967.86	163.72	6.912	
12,150.00	7,977.21	12,200.02	7,966.86	82.56	84.24	-90.25	-4,430.38	-935.47	1,131.42	965.92	165.50	6.836	
12,200.00	7,977.64	12,250.02	7,967.32	83.46	85.12	-90.25	-4,480.37	-935.25	1,131.27	963.98	167.29	6.762	
12,250.00	7,978.07	12,300.02	7,967.79	84.35	85.99	-90.25	-4,530.37	-935.04	1,131.12	962.04	169.08	6.690	
12,300.00	7,978.50	12,350.02	7,968.26	85.24	86.88	-90.25	-4,580.37	-934.82	1,130.96	960.10	170.86	6.619	
12,350.00	7,978.94	12,400.02	7,968.73	86.14	87.76	-90.25	-4,630.36	-934.60	1,130.81	958.16	172.65	6.550	
12,400.00	7,979.37	12,450.01	7,969.20	87.03	88.64	-90.25	-4,680.36	-934.39	1,130.66	956.21	174.44	6.482	
12,450.00	7,979.80	12,500.01	7,969.67	87.93	89.52	-90.25	-4,730.36	-934.17	1,130.50	954.27	176.23	6.415	
12,500.00	7,980.23	12,550.01	7,970.14	88.83	90.40	-90.25	-4,780.36	-933.95	1,130.35	952.33	178.03	6.349	
12,550.00	7,980.67	12,600.01	7,970.61	89.72	91.29	-90.25	-4,830.35	-933.74	1,130.20	950.38	179.82	6.285	
12,600.00	7,981.10	12,650.01	7,971.08	90.62	92.17	-90.25	-4,880.35	-933.52	1,130.05	948.43	181.61	6.222	
12,650.00	7,981.53	12,700.01	7,971.55	91.52	93.05	-90.25	-4,930.35	-933.31	1,129.89	946.49	183.40	6.161	
12,700.00	7,981.97	12,747.47	7,972.00	92.41	93.89	-90.12	-4,977.80	-933.10	1,129.74	944.59	185.15	6.102	
12,700.92	7,981.97	12,747.47	7,972.00	92.43	93.89	-90.08	-4,977.80	-933.10	1,129.74	944.57	185.17	6.101	
12,704.04	7,982.00	12,747.47	7,972.00	92.49	93.89	-89.92	-4,977.80	-933.10	1,129.75	944.52	185.22	6.099	SF

Company:	Legend Natural Gas IV LP	**Local Co-ordinate Reference:**	Well Pardue 29 Fed Com 5H
Project:	Eddy County, NM (Nad27)	**TVD Reference:**	WELL @ 3072.00usft (TBD)
Reference Site:	Sec 29 T24S R28E	**MD Reference:**	WELL @ 3072.00usft (TBD)
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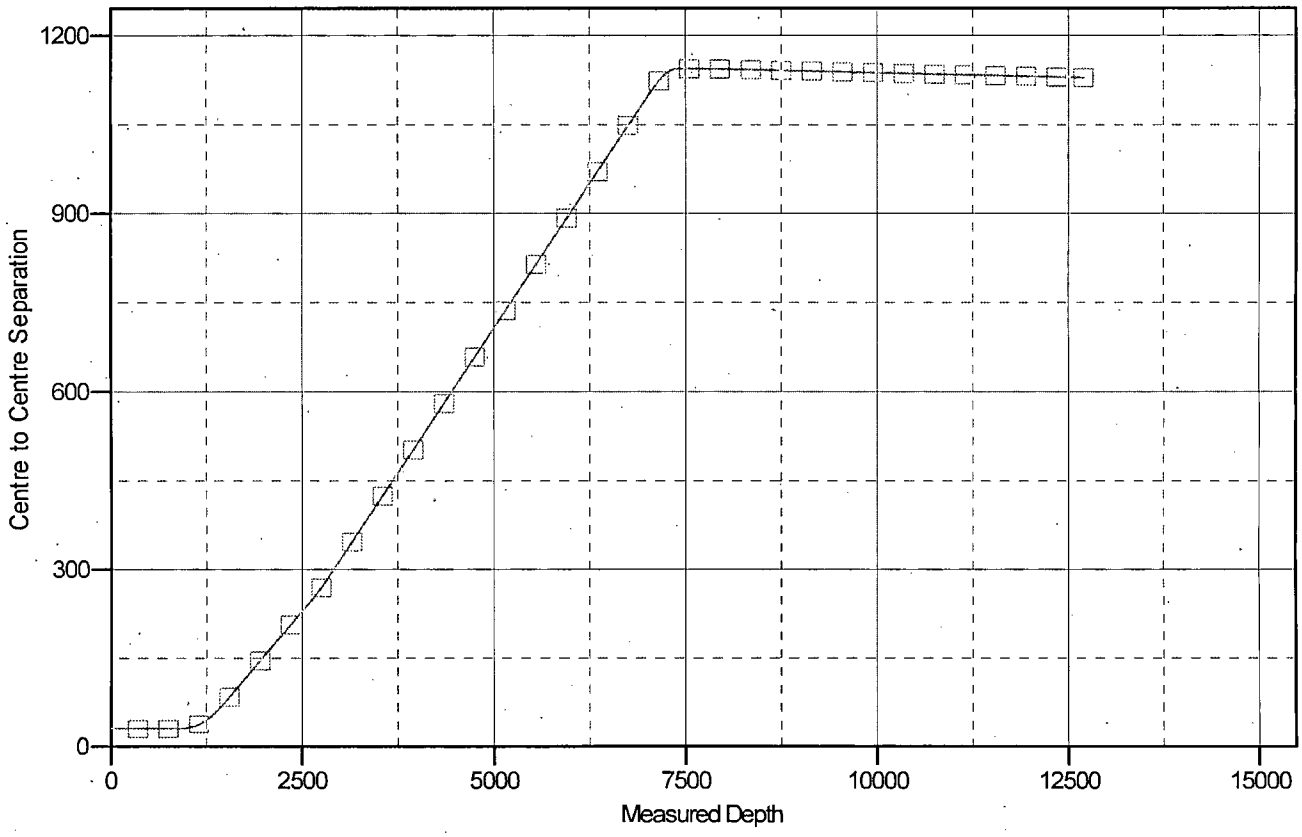
Reference Well:	Pardue 29 Fed Com 5H	**Survey Calculation Method:**	Minimum Curvature
Well Error:	0.00 usft	**Output errors are at**	2.00 sigma
Reference Wellbore	Wellbore #1	**Database:**	Compass 5000 GCR DB
Reference Design:	Plan#1 012014	**Offset TVD Reference:**	Reference Datum

Reference Depths are relative to WELL @ 3072.00usft (TBD)
Offset Depths are relative to Offset Datum
Central Meridian is 104° 19' 60.00000 W

Coordinates are relative to: Pardue 29 Fed Com 5H
Coordinate System is US State Plane 1927 (Exact solution), New Mexico East 30
Grid Convergence at Surface is: 0.12°

Ladder Plot



LEGEND

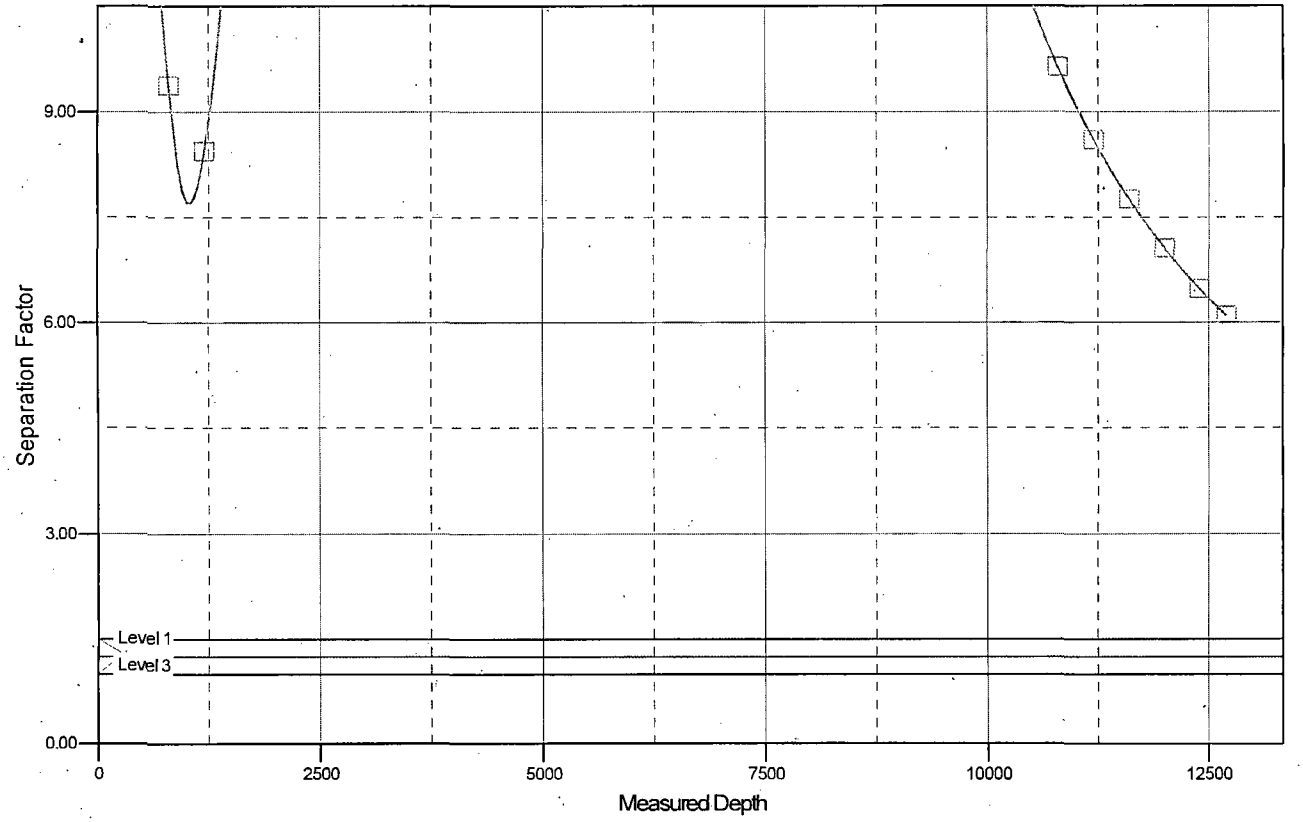
due 29 Fed Com 4H, Wellbore #1, Plan#1 012014 V0

Company:	Legend Natural Gas IV, LP	**Local Co-ordinate Reference:**	Well Pardue 29 Fed Com 5H
Project:	Eddy County, NM (Nad27)	**TVD Reference:**	WELL @ 3072.00usft (TBD)
Reference Site:	Sec 29 T24S R 28E	**MD Reference:**	WELL @ 3072.00usft (TBD)
Site Error:	0.00 usft	**North Reference:**	Grid
Reference Well:	Pardue 29 Fed Com 5H	**Survey Calculation Method:**	Minimum Curvature
Well Error:	0.00 usft	**Output errors are at**	2.00 sigma
Reference Wellbore	Wellbore #1	**Database:**	Compass 5000 GCR DB
Reference Design:	Plan#1 012014	**Offset TVD Reference:**	Reference Datum

Reference Depths are relative to WELL @ 3072.00usft (TBD)
Offset Depths are relative to Offset Datum
Central Meridian is 104° 19' 60.00000 W

Coordinates are relative to: Pardue 29 Fed Com 5H
Coordinate System is US State Plane 1927 (Exact solution), New Mexico East 30
Grid Convergence at Surface is: 0.12°

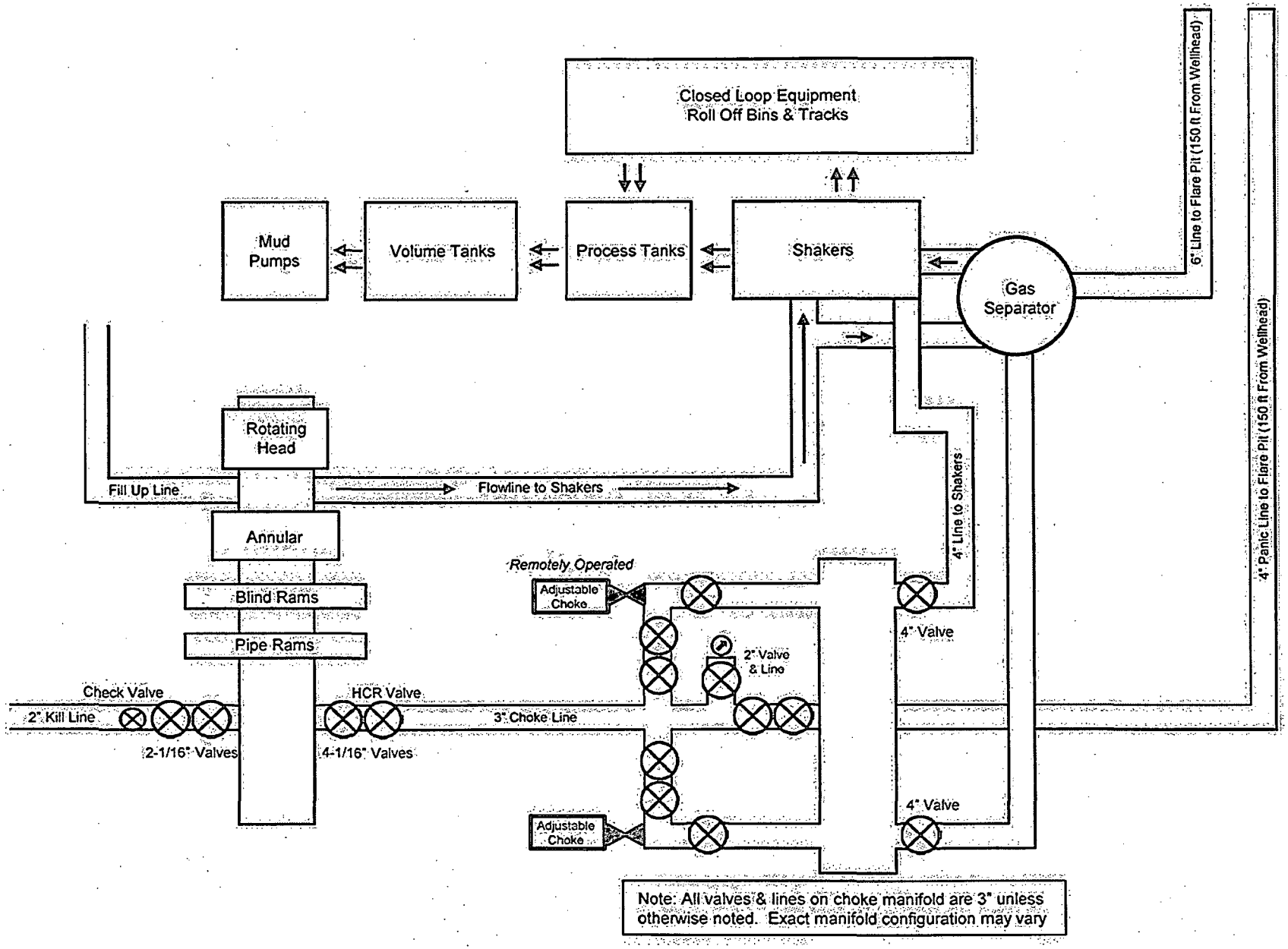
Separation Factor Plot



LEGEND

due 29 Fed Com 4H, Wellbore #1, Plan#1 012014 V0

13-5/8" 5M BOPE & Closed Loop Equipment Schematic



Notes Regarding Blowout Preventers

Legend Natural Gas, III LP
Pardue 29 Fed Com 5H

1. The drilling nipple will be constructed so it can be removed mechanically without the aid of a welder. The minimum internal diameter will equal BOP bore.
2. Wear ring will be properly installed in head.
3. Blowout preventer and all associated fittings will be in operable condition to withstand 5,000 psi working pressure.
4. A full bore safety valve tested to a minimum of 5,000 psi working pressure with proper thread connections will be on the rig floor at all times.
5. All choke lines will be anchored to prevent movement.
6. Hand wheels and extensions will be properly installed and tested
7. Hydraulic BOP control panel will be located as near in proximity to drillers controls as possible
8. All BOP equipment will meet Onshore Order #2 regulations and requirements.

Design Plan
Operating and Maintenance Plan
Closure Plan

Pardue 29 Federal Com 5H
SHL: 45 FNL & 1320 FWL
BHL: 330 FSL & 1510 FWL
Section 29, T-24S, R-28E
Eddy County, New Mexico

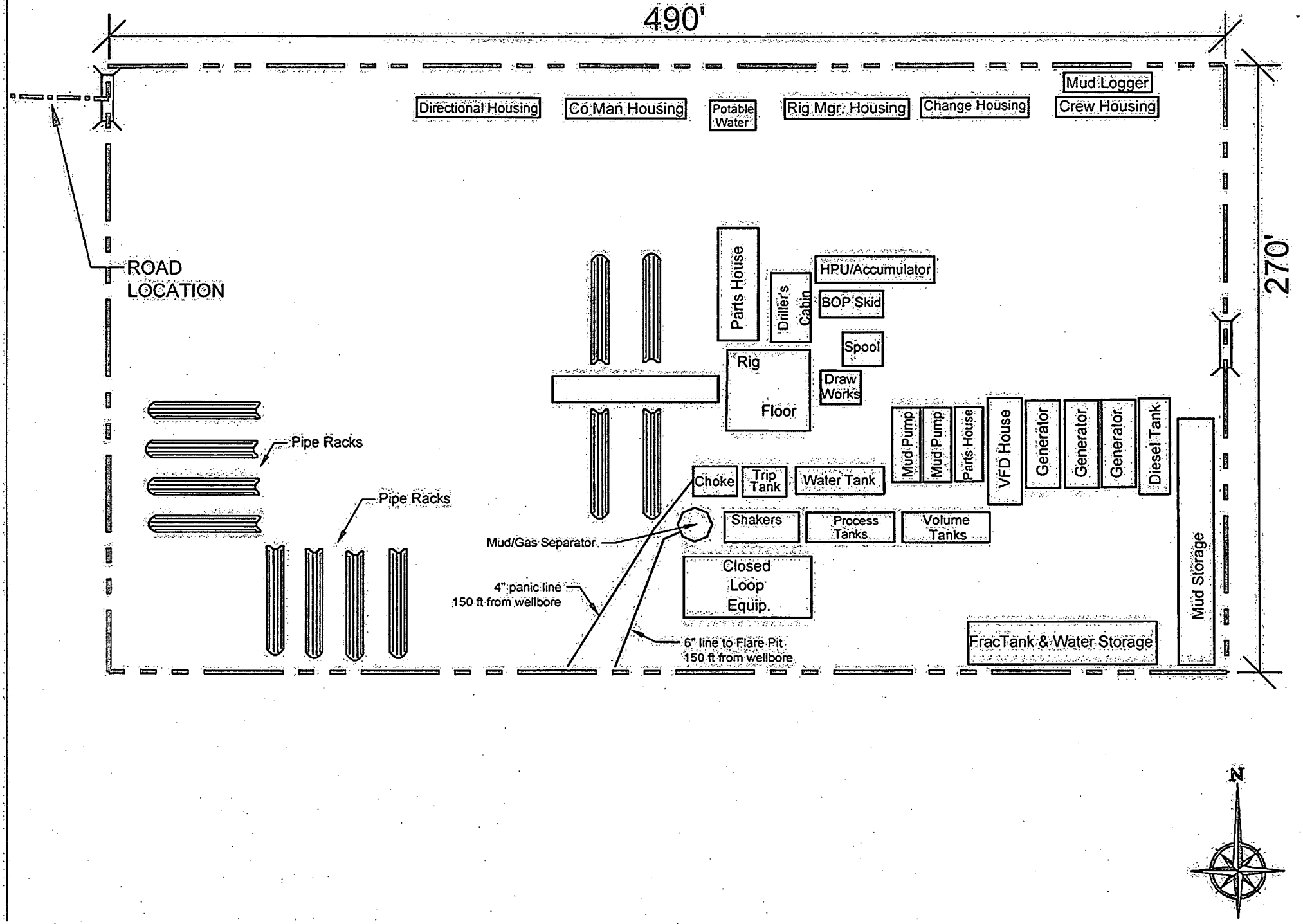
Legend Natural Gas, III L.P. will be using all above ground steel pits for fluid and cuttings while drilling. If a tank develops a leak we will have immediate visual discovery, we would then transfer the fluid to another tank then remove any contaminated soil and dispose of it in the cuttings bins for transportation. All leaks should be kept to less than 5 barrels. Rig crews will monitor the tanks at all times.

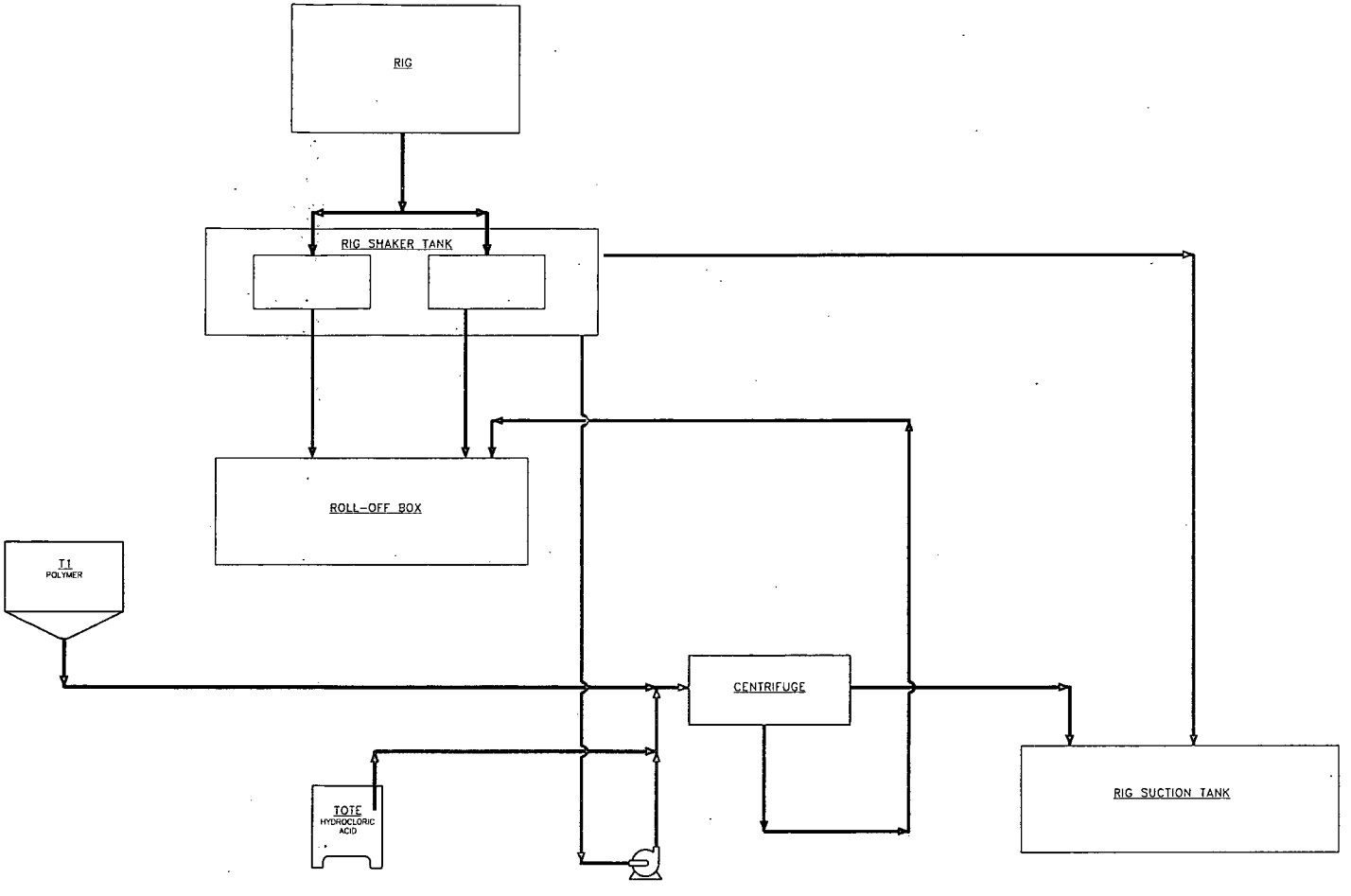
Equipment List:
2- Shale Shakers
1- 5500 Centrifuge
3-Roll Off Bins w/ Tracks
1-Rig steel pits (1,000 bbl capacity)
2-500 bbl Frac Tanks

During drilling operations all drilling fluids waste and cuttings will be hauled off via CRI (Controlled Recovery Inc.) Permit R-9166.

Dewatering Process:
CRS Reprocessing Services dewatering process will include the use of the H&H 5500 centrifuge that has a 16" x 56" rotating assembly. Mud will be pulled from the sand trap on the rig pits and pumped to the centrifuge using a 2x3 centrifugal pump. We will introduce our coagulant for the flocculation process on the downstream side of the 2x3 centrifugal pump. For this application we will be using hydrochloric acid as our coagulant. The acid will be located in the same area as our equipment and will be in a 300 gallon chemical tote. We will inject the acid into the mud using an LMI chemical injection pump. This pump has a max processing rate of 10 gallons per hour. After the acid has been introduced we will inject polymer mixture using an electrical positive displacement pump. The polymer we will use is packaged in 55# bags stored on a pallet located next to our operating area. We will mix the polymer in a 5 to 6 bbls tank using fresh water on the first batch. Once the dewatering process starts we will recycle our effluent from the centrifuge to build new batches of polymer. Once the acid and polymer are injected into the mud on the downstream side of the 2x3 centrifugal pump the mud will then enter the centrifuge. The flocculation process will occur by the hydrochloric acid clinging to the solids suspended in the fluid and the polymer causing the solids to clump together. This process plus the g-force of the centrifuge strips the fluid of all suspended solids and returns a clear clean effluent to the active pits. The solids are discharged down the centrifuge discharge slide into the roll off bin and the effluent is returned through a 6" pvc pipe to the rig suction tank.

See CRS Dewatering Process Diagram


490'
270'
Directional Housing
Co Man Housing
Potable Water
Rig Mgr. Housing
Change Housing
Mud Logger
Crew Housing
ROAD LOCATION
Parts House
Driller's Cabin
HPU/Accumulator
BOP Skid
Spool
Draw Works
Rig Floor
Pipe Racks
Pipe Racks
Choke
Trip Tank
Water Tank
Mud Pump
Mud Pump
Parts House
VFD House
Generator
Generator
Generator
Diesel Tank
Shakers
Process Tanks
Volume Tanks
Mud/Gas Separator
Closed Loop Equip.
4" panic line 150 ft from wellbore
6" line to Flare Pit 150 ft from wellbore
FracTank & Water Storage
Mud Storage
N



LEGEND

- DIRTY WATER
- POLYMER
- HYDROCLORIC ACID
- CLEAN WATER
- WASTE/SOLIDS
- EFFLUENT

REV	DESCRIPTION	BY	DATE
A	ISSUE FOR REVIEW	KC	1/17/14

CRS
REPROCESSING SERVICES
13551 TRITON PARK BLVD., SUITE 1200, LOUISVILLE, KENTUCKY 40223

CHECK BY	DATE	APPRVD BY	DATE

DRAWN BY	DATE	SCALE
KC	1/17/14	NTS

TITLE

DEWATERING DIAGRAM USING ROLL-OFF BOX

CUST:

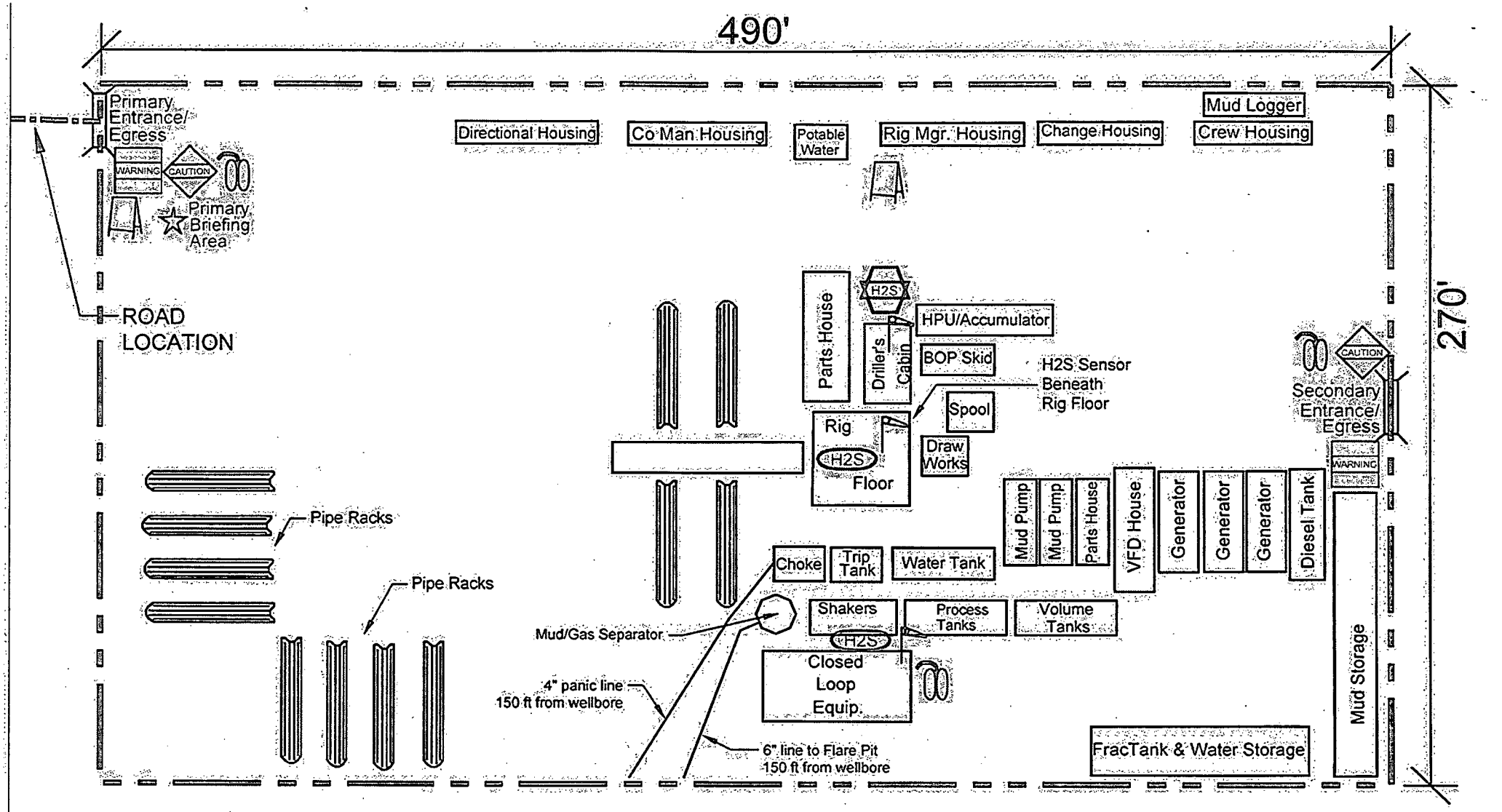
SITE:

CAPX:

REV A

DRAWING NUMBER

THW-XX-XXX-201



LEGEND NATURAL GAS
Rig Location Layout
Safety Equipment Location

Location Dimensions:
490 ft x 270 ft

- Wind indicators
- Location entrance warning sign used to control location in event of an emergency
- Caution (H2S Gas, May Be Fatal)
- Site briefing area
- Self-contained breathing apparatus (SCBA)
- H2S sensors located around the rig
- H2S monitor control/alarm box

Prevailing Wind Direction, S/SW

N

Legend Natural Gas III, LP

777 Main Street
Suite 900
Fort Worth, TX 76102
Legal's:
PARDUE 29 FEDERAL COM WELL 5H
Eddy County NM
Lat 32.195711°N
Long 104.113452°W

H_2S

"Contingency Plan"

Escape
Crews shall escape upwind of escaping gas in the event of an emergency release of gas. Escape can be facilitated from the location entrance road. Crews should then block entrance to the location from the lease road so as not to allow anyone traversing into a hazardous area. The blockade should be at a safe distance outside of the ROE. There are no homes or buildings in or near the ROE.

Assumed 100 ppm ROE= 3000'
100 ppm H2S concentration shall trigger activation of this plan.

Emergency Procedures

In the event of a release of gas containing H2S, the first responder(s) must

- Isolate the area and prevent entry by other persons into the 100 ppm ROE.
- Evacuate my public places encompassed by the 100 ppm ROE.
- Be equipped with H2S monitors and air packs in order to control the release.
- Use the "buddy system" to ensure no injuries occur during the response
- Take precautions to avoid personal injury during this operation.
- Contact operator and for local officials to aid in operation. See list of phone numbers attached.
- Have received training in the
  - Detection of H2S, and
  - Measures for protection against the gas,
  - Equipment used for protection and emergency response.

Ignition of Gas Source
Should control of the well be considered lost and ignition considered, take care to protect against exposure to Sulfur Dioxide (S02). Intentional ignition must be coordinated with the NMOCD and local officials. Additionally the NM State Police may become involved. NM State Police shall be the Incident Command on scene of any major release. Take care to protect downwind whenever there is an ignition of the gas

Characteristics of H2S and S02

Common Name	Chemical Formula	Specific Gravity	Threshold Limit	Hazardous Limit	Lethal Concentration
Hydrogen Sulfide	H2S	1.189 Air = 1	10ppm	100 ppm/hr	600 ppm
Sulfur Dioxide	SO2	2.21 Air = 1	2ppm	N/A	1000ppm

Contacting Authorities

Legend Natural Gas III, LP personnel must liaison with local and state agencies to ensure a proper response to a major release. Additionally, the OCD must be notified of the release as soon as possible but no later than 4 hours. Agencies will ask for information such as type and volume of release, wind direction, location of release, etc. Be prepared with all information available. The following call list of essential and potential responders has been prepared for use during a release. Legend Natural Gas III, LP response must be in coordination with the State of New Mexico's 'Hazardous Materials Emergency Response Plan' (HMER)

Hydrogen Sulfide Drilling Operation Plan

I. HYDROGEN SULFIDE (H2S) TRAINING

All personnel, whether regularly assigned, contracted, or employed on an unscheduled basis, will receive training from a qualified instructor in the following areas prior to commencing drilling operations on this well:

1. The hazards and characteristics of hydrogen sulfide (H2S)

2. The proper use and maintenance of personal protective equipment and life support systems.

3. The proper use of H_2S detectors, alarms, warning systems, briefing areas, evacuation procedures, and prevailing winds.

4. The proper techniques for first aid and rescue procedures.

In addition, supervisory personnel will be trained in the following areas:

1. The effects of H2S metal components. If high tensile tubular are to be used, personnel will be trained in their special maintenance requirements.

2. Corrective action and shut-in procedures when drilling or reworking a well and blowout prevention and well control procedures.

3. The contents and requirements of the H_2S Drilling Operations Plan and Public Protection Plan.

There will be an initial training session just prior to encountering a known or probable H_2S zone (within 3 days or 500 feet) and weekly H_2S and well control drills for all personnel in each crew. The initial training session shall include a review of the site specific H_2S Drilling Operations Plan and the Public Protection Plan.

II. HYDROGEN SULFIDE TRAINING

Note: All H_2S safety equipment and systems will be installed, tested, and operational when drilling reaches a depth of 500 feet above, or three days prior to penetrating the first zone containing or reasonable expected to contain H2S.

1. Well Control Equipment

A. Flare line

B. Choke manifold -With Remotely Operated Choke

C. Blind rams and pipe rams to accommodate all pipe sizes with properly sized closing unit

D. Auxiliary equipment may include if applicable: annular preventer and rotating head.

E. Mud/Gas Separator

2. Protective equipment for essential personnel:

A. 30-minute SCBA units located in the doghouse and at briefing areas, as indicated on well site diagram. As it may be difficult to communicate audibly while wearing these units, hand signals shall be utilized.

3. H_2S detection and monitoring equipment:

A. Portable H2S monitors positioned on location for best coverage and response. These unites have warning lights and audible sirens when H2S levels of 20 PPM are reached. These units are usually capable of detecting S02 , which is a byproduct of burning H2S.

4. Visual warning systems:

A. Wind direction indicators as shown on well site diagram

B. Caution/ Danger signs shall be posted on roads providing direct access to locations. Signs will be painted a high visibility yellow with black lettering of sufficient size to be reasonable distance from the immediate location. Bilingual signs will be used when appropriate.

5. Mud program:

A. The mud program has been designed to minimize the volume of H2S circulated to surface. Proper mud weight, safe drilling practices and the use of H2S scavengers will minimize hazards when penetrating H2S bearing zones.

6. Metallurgy:

A. Blowout preventer, drilling spool, kill lines, choke manifold lines, and valves shall be H2S trim.

B. All elastomers used for packing and seals shall be H2S trim.

7. Communication:

A. Radio communications in company vehicles including cellular telephones and 2-way radio

B. Land line (telephone) communications at Office

8. Well testing:

A. Drill stem testing will be performed with a minimum number of personnel in the immediate vicinity, which are necessary to safety and adequately conduct the test. The drill stem testing will be conducted during daylight hours and formation fluids will not be flowed to the surface. All drill-stem-testing operations conducted in an H_2S environment will use the closed chamber method of testing.

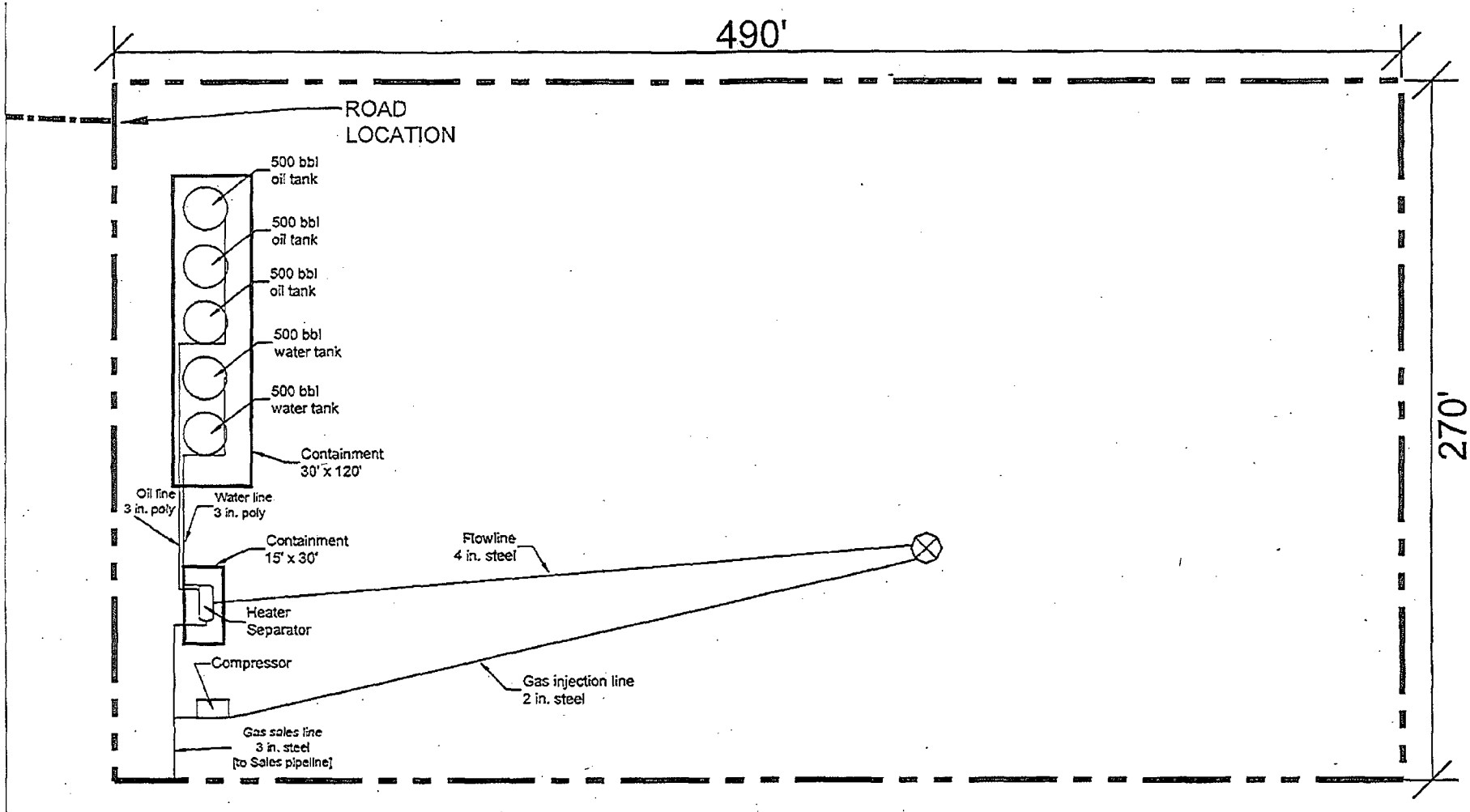
B. There will be no drill stem testing.

Emergency Assistance Telephone List

PUBLIC SAFETY:			**911 or**
Eddy County Sheriff's Department		Number:	(575)887-7551
Fire Department:			
	Loco Hills	Number:	(575)677-2349
	Artesia	Number:	(575)746-5051
	Carlsbad	Number:	(575)885-3125
	Happy Valley Carlsbad	Number:	(575)887-6353
	Loving	Number:	(575)745-3600
	Hope	Number:	(575)484-3222
Ambulance:	Artesia	Number:	(575)746-5050
	Carlsbad	Number:	(575)885-2111
	Careplus	Number:	(575)887-5969
	Loving	Number:	(575)887-1191
Hospitals:	Artesia General Hospital	Number:	(575)748-3333
AirMed:	Medevac	Number:	(888)303-9112
Dept. of Public Safety		Number:	(575)887-7551
New Mexico Oil Conservation		Number:	(575)476-3440
U.S. Dept. of Labor		Number:	(866)487-2365
Highway Department		Number:	(575)885-3281

Legend Natural Gas, Inc.

LEGEND NATURAL GAS			Office:	(817)-872-7808
Company Drilling Consultants:				
Name:			Number:	
Name:			Number:	
EHS Coordinator 24hr. Emergency Contact				
Name:	Jody Fontenot	jfontenot@LNG2.com	Number:	(940)-210-0430
Drilling Manager				
Name:	David Dunn	ddunn@LNG2.com	Number:	(817)944-1023
Drilling Superintendent				
Name:	Scott Zacharie	szacharie@LNG2.com	Number:	(214)906-8365
Drilling Company				
Name:			Number:	
Name:			Number:	
Tool Pusher:				
Name:			Number:	
Name:			Number:	
Safety Consultants				
Cliff Strasner			Cell	(432) 894-9789
Craig Strasner			Cell	(432) 894-0341



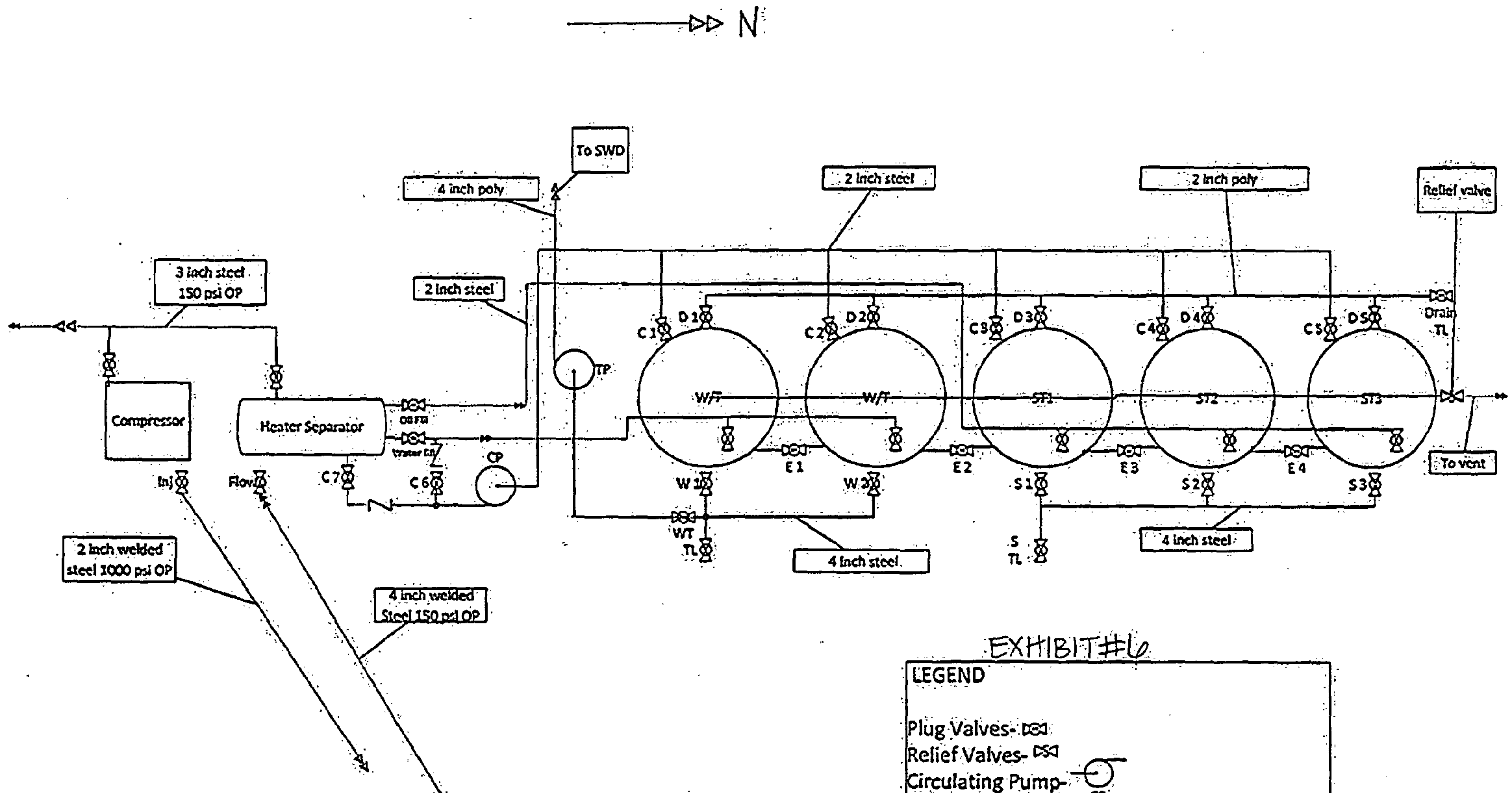
PARDUE 29 FEDERAL COM #5H

ELEV. 3,048'
NAD 27 NME
Y = 434989.3 N
X = 568004.0 E
LAT. = 32.195711 DEG. N
LONG. = 104.113494 DEG. W

EXHIBIT #5

Final Pad = 270' x 490'

N



EXHIBIT#6

LEGEND

Plug Valves-
Relief Valves-
Circulating Pump-
Water Transfer pump-
Lines Connected-
Lines Crossing-

Legend Natural Gas III, LP
Multi-Point Surface Use Plan of Operations

Pardue 29 Federal Com 5H
SHL: 45 FNL & 1307 FWL
BHL: 331.2 FSL & 1509.8 FWL
Section 29, T-24S, R-28E
Eddy County, New Mexico

The plan is submitted with Form 3160-3, Application for Permit to Drill, covering the above described well: The purpose of this plan is to describe the location of the proposed well, the proposed construction activities and operations plan, the magnitude of the surface disturbance involved and the procedures to be followed in rehabilitating the surface after completion of the operations so that a complete appraisal can be made of the environmental effect associated with the operations.

1. **Existing Roads:**
   a. The well site and elevation plat for the proposed well are reflected on the well site layout Form C-102. The well was staked by John West Surveying Company.
   b. **Exhibit #2** is a portion of a topographic map showing the well and roads in the vicinity of the location. The well site is indicated on **Exhibit #2**
   c. Routine grading and maintenance of existing roads will be conducted as necessary to maintain their condition as long as any operations continue with this lease.

   Directions:
   From the Intersection of US Highway 285 & County Rd. 720 (Black River) go west on Black River rd. approximately 2.7 miles to CR 774 (Road Runner Rd.); turn left and go South on caliche lease road approximately 0.70 miles. Veer left and go southeast approximately 0.2 miles, veer right and go south approximately 0.3 miles. Turn right and go west approximately 300 feet; turn left and go south approximately 0.5 miles. Lease road continues west; from this point, follow a two-track road south approximately 0.3 miles to a proposed road survey. Follow road survey east approximately 1003 feet to the northwest corner of the proposed well pad. This location stake is southeast approximately 325 feet. This location is approximately 5.0 miles west/southwest of Malaga, NM.

2. **Planned Access Road:**
   Legend Natural Gas III, LP will be using existing caliche road and will have to construct an 1003' of caliche road in order to access the Pardue 29 Federal Com 5H well site. Width of the road is 14' wide with a crown design. The maximum with of surface disturbance needed to construct the road is 25 feet. The road is crowned and ditched with a 2% slope from the tip of the crown to the edge of the driving surface. The ditches are 3 feet wide with 3:1 slopes.

3. **Location of Existing Facilities: (Exhibit #4)**
   Wells within a mile radius of proposed surface-hole location include:
   - Pardue 29 Federal Com 4H (proposed; Legend Natural Gas III, LP, permitted 01/2014)
   - Pardue 29 Federal Com 5H (proposed; Legend Natural Gas III, LP, permitted 01/2014)
   - Pardue 29 Federal Com 6H (proposed; Legend Natural Gas III, LP, permitted 01/2014)
   - Pardue 29 Federal Com 7H (proposed; Legend Natural Gas III, LP, permitted 01/2014)
   - Pardue Farms 29 #3
   - Pardue Farms 29 #2
   - Pardue Farms 29 SWD #1
   - EKG Fee #1
   - High Brass Fee #1
   - High Brass 3H (proposed; Legend Natural Gas III, LP, permit has not been submitted)
   - High Brass 2H
   - New Man Federal Com #1
   - OPL Stent Federal #1
   - Federal 28 #1
   - Reed #1
   - Mossberg 28 Federal #1Y
   - Mossberg Federal #1
   - Second Chance Fed #1
   - Really Scary Federal Com #2H
   - Really Scary Federal Com #3H
   - Realy Scary Federal Com #5H
   - Spanky Federal Com #1
   - Full Choke Com 3H
   - Full Choke #1
   - Full Choke Com 2H
   - Buckshot State Com #2H
   - Pardue Farms 20 #1
   - Pardue 19 Com 3H (permitted ENMRD; API-30-015-41405)
   - Pardue 19 Com #1
   - Pardue 19 Federal Com 2H
   - Dakota Federal 30 #1
   - Goodnight Federal #1
   - Goodnight Federal #2

4. **Location of Existing and/or Proposed Facilities:**
   a. In the event the well is found productive, a tank battery and other surface facilities will be constructed onsite **(See Exhibit C-102 & Exhibit #5 & #6)**
   b. **Exhibit #3** shows the proposed pipeline route to the Pardue 29 Federal Com 4H facility. The proposed route is 6687.9' in length, and will include: 1-6" steel, buried gas sales line with a working PSI of 150; and 1-4" poly waterline on surface with an operating PSI of 120 or less. The 6" steel gas pipeline is to parallel the southern portion of section 20 W/E, crossing into section 21 for 607.9' running S/E to section 28 tying into existing pipeline at Legend Natural Gas III,LP, central gathering facility, being more particularly described in **Exhibit #3**
   c. A buried flow line from the well head to the separator is proposed and will be 150' of 4" welded steel line carrying oil, gas, and water with less than 150 psi.
   d. All flow lines will adhere to API Standards
   e. An Onsite Inspection was conducted with BLM representative, Indra Dahal on **December 11, 2013** with no issues being found during the inspection.

5. **Location and Types of Water Supply:**
   This well will be drilled using a combination of water mud systems (outlined in the Drilling Program). The water will be obtained from commercial water stations in the area and hauled to a location by transport truck using the existing and proposed roads shown in **Exhibit #2**. On occasion, water will be obtained from a pre-existing water well, running a pump directly to the drill rig. In these cases where a poly pipeline is used to transport water for drilling purposes, the existing and proposed road shown in **Exhibit #2** will be utilized.

6. **Construction Materials**
   All caliche utilized for the drilling pad and proposed access road will be obtained from an existing pit or from prevailing deposits found under the location. All roads will be constructed of 6" rolled and compacted caliche. Where BLM recommends use of extra caliche, will obtain from other locations close by for roads, if available.

7. **Methods of Handling Waste Material:**
   a. All trash, junk, and other waste material will be removed from the well site within 30 days after finishing drilling and/or completion operations. All waste material will be contained in trash cages or trash bins to prevent scattering. When the job is completed, all contents will be removed and disposed of in an approved sanitary landfill.
   b. The supplier will pick up slats, including broken sacks, remaining after the completion of the well.
   c. A port-o-john will be provided for the rig crews. This equipment will be properly maintained during the drilling and completion operations and will be removed when all operations are complete.

d. Disposal of fluids to be transported by an approved disposal company.

8. **Ancillary Facilities:**
   No campsite or other facilities will be constructed as a result of this well

9. **Well Site Layout:**
   a. **Exhibit #1** shows the proposed well site layout with dimensions of the pad layout.
   b. Mud pits in the active circulating system will be steel pits and a closed loop system will be utilized.

10. **Plans for Surface Reclamation:**
    Surface is privately owned; per discussion with the landowner we will keep the pad the same size for future drilling and completion operations off this same pad to minimize the footprint.

11. **Surface Ownership:**
    The surface is owned by Pardue Limited. PO Box 2018 (126 N. Canyon), Carlsbad, New Mexico 88220. Phone number is 575-887-9525. A Surface Use Agreement between Pardue Limited and Legend Natural Gas III, LP has been executed. A copy of the Multi-Point Surface Use and Operations Plan has been mailed to Pardue Limited.

12. **Other Information**
    a. The area surrounding the well site is grassland. The vegetation is moderately sparse with native prairie grass and mesquite bushes. No wildlife was observed but is likely that deer, rabbits, coyotes, and rodents traverse the area.
    b. There is no permanent or live water in the general proximity of the location.
    c. Topsoil will be stockpiled 30' wide on the SOUTH SIDE of the location until it is needed for interim reclamation.
    d. NSL (Non-Standard Location) Permits will be filed with the State of New Mexico Oil Conservation Division
    e. This pad location is designated for the Pardue 29 Federal Com 4H and the Pardue 29 Federal Com 5H

13. **Operator's Representatives:**
    Drilling: David Dunn: 817-872-7805
    Drilling: Scott Zacharie: 817-872-7806
    Operations: Jason Vining: 817-872-7845
    Operations: Ron Dahle: 817-872-7811
    Land: John McCauley: 281-644-5972
    Geology: Dan Emmers: 817-872-7853
    Regulatory: Jennifer Elrod: 817-872-7822
    Environmental: Brad Bingham: 817-872-7808
    HSE- Jody Fontenot: 817-872-7809

Jennifer Elrod

From: McMillan, Michael, EMNRD <Michael.McMillan@state.nm.us>
Sent: Tuesday, June 10, 2014 4:44 PM
To: Jennifer Elrod
Cc: Lisa Lemon ; Joseph Galluzzi ; Dade, Randy, EMNRD; Shapard, Craig, EMNRD; Ezeanyim, Richard, EMNRD; Goetze, Phillip, EMNRD
Subject: Pardue 29 Federal Well No. 5H, 6H, and 8H NSL and NSP Eddy Co. N.M.

The following permit has been issued and will soon be scanned along with the application and will be available on the Division's web site.

NSL-7103 Legend Natural Gas III, Limited Partnership Pardue 29 Federal Com Well No. 5H (Unit D Sec. 29 24S 28E) Eddy Co. 30-015-pending
NSL-7102 Legend Natural Gas III, Limited Partnership Pardue 29 Federal Com Well No. 6H (Unit B Sec. 29 24S 28E) Eddy Co. 30-015-pending
NSL-7104 and NSP 1991 Legend Natural Gas III, Limited Partnership Pardue 29 Federal Com Well No. 8H (Unit B Sec. 29 24S 28E) Eddy Co. 30-015-pending

Michael A. McMillan
Engineering and Geological Services Bureau, Oil Conservation Division
1220 South St. Francis Dr., Santa Fe NM 87505
O: 505.476.3448 F. 505.476.3462

MEMORANDUM OF SURFACE USE AND OCCUPANCY AGREEMENT

THE STATE OF NEW MEXICO §
KNOW ALL MEN BY THESE PRESENTS:
COUNTY OF EDDY §

A Surface Use and Occupancy Agreement has been made and entered on the 26th day of September, 2013, by and between Pardue Limited Company, whose address is P.O. Box 2018, Carlsbad, New Mexico 88220, hereinafter called "GRANTOR" and Legend Natural Gas III, LP whose address is 15021 Katy Freeway, Suite 200, Houston, Texas 77094, hereinafter called "GRANTEE"

WITNESSETH:

Grantor and Grantee have entered into a Surface Use and Occupancy Agreement for Entry, Roadway, Well Location and other Associated Surface Disturbing Activities (the "Agreement") for a term of five (5) years from the 26th day of September, 2013, upon and subject to the terms and conditions therein stated, for the use of the Grantor's surface to access, develop, operate and produce under applicable oil, gas and mineral leases within Grantor's ranch, more particularly described on Exhibit "A", attached hereto and made a part hereof.

A copy of the executed Surface Use and Occupancy Agreement herein referred to is located at the office of Grantee at its address as listed first above.

In Witness whereof, the parties hereto have executed this Instrument on the 9th day October, 2013, to evidence of record in the Official Public Records of the County Clerk of Eddy County, New Mexico, the existence of said Surface Use and Occupancy Agreement and for all other purposes.

PARDUE LIMITED COMPANY

By: Marvin N. Van Soest

Marvin N. Van Soest
Printed Name

CO-Manager
Printed Title

LEGEND NATURAL GAS III, LP

By: _____

Aaron Thesman
Vice President-Land

LEGEND NATURAL GAS III LP
ATTN JOHN MCCAULEY
15021 KATY FREEWAY STE 200
HOUSTON TX 77094

ACKNOWLEDGMENTS

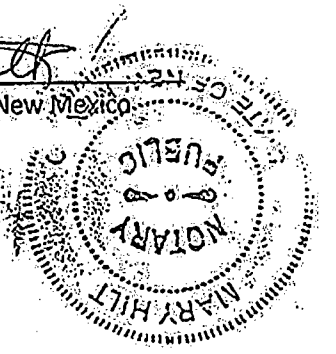
STATE OF NEW MEXICO §
§
COUNTY OF EDDY §

The foregoing instrument was acknowledged before me on the 15th day of October, 2013, by MARVIN N. VANSOEST, as CO-MANAGER of Pardue Limited Company, a New Mexico limited liability company, on behalf of said limited liability company.

My commission expires:

05/05/2014

Mary Hilt
Notary Public, State of New Mexico



STATE OF TEXAS §
§
COUNTY OF HARRIS §

This instrument was acknowledged before me on this 8th day of October, 2013, by Aaron Thesman, Vice President-Land of Legend Natural Gas III, LP, a Delaware limited partnership, on behalf of said limited partnership.

My commission expires:

1-14-2017

Carolyn Ann Turner
Notary Public, State of Texas

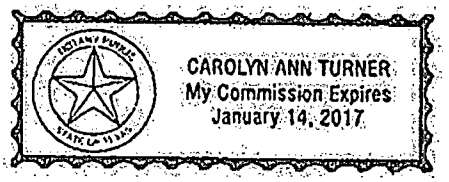


Exhibit "A"

Attached to and made a part of that certain Memorandum of Surface Use and Occupancy Agreement by and between Pardue Limited Company and Legend Natural Gas III, LP dated October ____, 2013.

TOTAL ACRES	OUR NET ACRES	SEC.	TWP.	RGE.	DESCRIPTION
65	65	18	24S	28E	N/2S/2NE/4, SW/4SE/4NE/4, SE/4SW/4NE/4, E/2SW/4SW/4NE/4
360	360	19	24S	28E	N/2NE/4NE/4, N/2SE/4NE/4NE/4, SW/4NE/4NE/4, E/2SE/4NE/4, SW/4SE/4NE/4, S/2NW/4SE/4NE/4, N/2NE/4SW/4NE/4, S/2SW/4NE/4, NW/4SW/4NE/4, S/2NE/4NE/4SE/4, N/2SE/4NE/4SE/4, W/2NE/4SE/4, N/2NE/4SE/4SE/4, SE/4SE/4SE/4, W/2SE/4SE/4, N/2SW/4SE/4, SE/4SW/4SE/4, S/2SW/4SW/4SE/4, N/2NW/4SE/4, S/2SE/4NW/4SE/4, SW/4NW/4SE/4, SE/4NE/4SW/4, W/2NE/4SW/4, NE/4SE/4SW/4, S/2SE/4SE/4SW/4,W/2SE/4SW/4, SE/4NW/4, NE/4NE/4SW/4, N/2SE/4SE/4SW/4
610	603.33	20	24S	28E	E/2NE/4SW/4, SW/4NE/4SW/4, E/2NE/4SE/4SW/4, S/2SE/4SW/4, NW/4SE/4SW/4, SW/4SW/4, N/2NW/4SW/4, SE/4NW/4SW/4, W/2SW/4NW/4SW/4, W/2NE/4NE/4NW/4, SE/4NE/4NW/4, W/2NE/4NW/4, E/2SE/4NW/4, SW/4SE/4NW/4, NE/4SW/4NW/4, E/2SE/4SW/4NW/4, W/2SW/4NW/4, NW/4NW/4, NW/4SE/4NW/4 (1/3 interest), E/2
320	320	21	24S	28E	S/2
640	640	28	24S	28E	All
275	275	29	24S	28E	W/2NE/4, SE/4SE/4, NE/4NW/4, N/2SE/4NW/4, E/2S/2SE/4NW/4, E/2W/2S/2SE/4NW/4,W/2NW/4
120	120	32	24S	28E	E/2NE/4, NW/4NE/4
640	640	33	24S	28E	All

RECEPTION NO: 1311737 STATE OF NEW MEXICO, COUNTY OF EDDY
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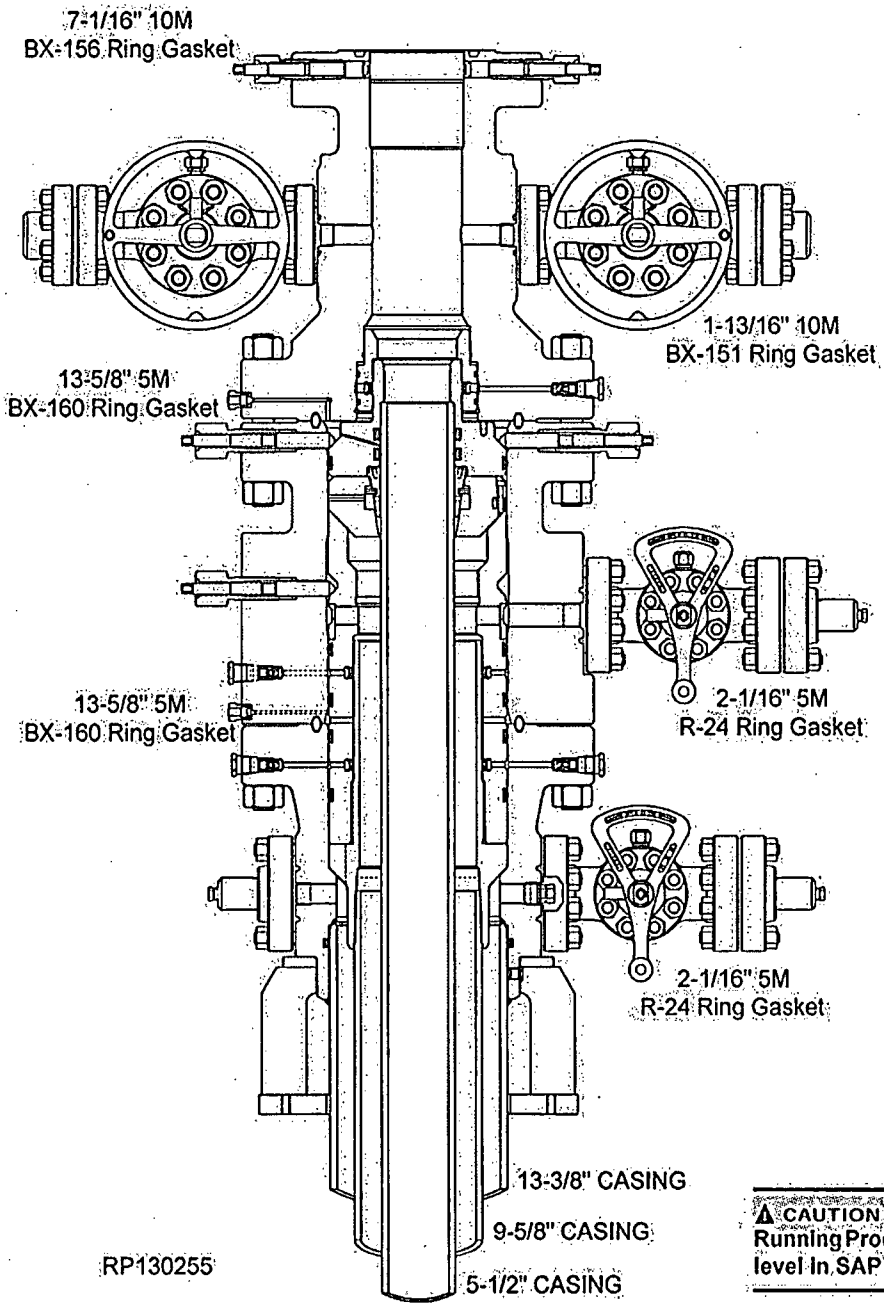
DARLENE ROSPRIM, COUNTY CLERK

RUNNING PROCEDURE

Legend Natural Gas



RP130255

⚠ CAUTION Must verify Running Procedure Revision level in SAP prior to usage.

Surface Systems Publication

CAMERON	13-5/8" 5M MBS System 13-3/8" x 9-5/8" x 5-1/2"	RP-002748 Rev 01

Safety Hazard Indicators

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury

Indicates a hazardous situation which, if not avoided, could result in death or serious injury

Indicates a hazardous situation which, if not avoided, will result in death or serious injury

Preferred to address practices not related to personal injury

ES-000175-02

This document alone does not qualify an individual to Install/Run the Equipment. This document is created and provided as a reference for Qualified Cameron Service Personnel and does not cover all scenarios that may occur.

Table of Contents

RUNNING PROCEDURE GENERAL WARNING

READ AND UNDERSTAND ALL INSTRUCTIONS. Failure to follow may result in serious personal injury and damage not only to the equipment but also the environment.

1. Safety is a combination of staying alert, common sense, and experience with the oil field equipment and environment. Read this Running Procedure prior to operating and installing the equipment. Be familiar with the operation terminologies of oil field equipment.

2. This document includes basic installation guidance. **The field service personnel shall be fully trained in all aspects of handling pressure control equipment as well as of the job that they are going to perform.** If any of the procedures and policies listed in this procedure cannot be followed, contact a Cameron Representative for the best course of action.

3. Proper **Personal Protective Equipment (PPE)** shall be utilized according to Company policies. Always use proper tools when servicing the equipment.

4. A **Job Hazard Analysis (JHA)** must be performed prior to beginning any service on a well location. A JHA review meeting will be held with all affected rig personnel PRIOR to the commencement of work to review the results of the JHA, evacuation routes, emergency contacts, etc. All meeting attendees and a Company Representative will sign-off on the JHA to acknowledge this meeting has taken place.

5. **Be aware of unexpected circumstances** that may arise when operating or servicing the equipment. Utilize the **Step Back 5X5 Process** in order to assess the hazards posed before, during, and after the servicing of equipment under pressure or with the potential of hazardous chemicals present. Be familiar with the company's and facility's Lockout/Tagout program in order to ensure all sources of energy (i.e. electrical, pneumatic, pressure) are isolated and/or de-energized prior to beginning work.

6. All **governmental or Company safety requirements** shall be met before working on the equipment. **Requirements of fully tested pressure barriers prior to servicing the equipment shall be observed. Cameron recommends that two mechanical pressure barriers is the preferred practice.** Additional precautions should be taken to ensure that the mechanical pressure barriers are functioning correctly prior to any work being carried out on this particular equipment.

7. Always check for any **trapped pressure** before servicing the equipment. All valves downstream of the pressure barriers must be cycled several times to release any trapped pressure.

8. Ensure the chemical and physical properties of the fluid flow product inside the equipment are known. Obtain applicable **Material Safety Data Sheets (MSDS)** for commonly encountered chemicals such as hydrogen sulfide, cements, etc. in order to identify appropriate PPE to use, emergencies, procedures, and methods or exposure control.

9. Always use **correct lifting devices** and follow safety rules in handling heavy products. The actual weight can vary for the system configurations. Never attempt to lift the equipment by hand.

10. Cameron manufactures a variety of oil field equipment with different features and operating requirements. Be certain of the equipment model and refer to the appropriate procedure, before attempting any operation or service on the equipment. ***This procedure is to assist field personnel in the operation and installation of the equipment that is listed in this document. Different procedures are available for other oil field products.***

SD-045055-01 Rev 01 - RP General Warning M.Contreras 25/OCT/2010

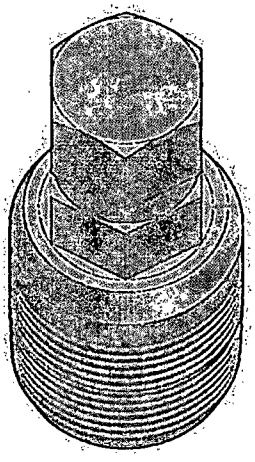
Valve Removal Plugs

For Installation and Removal of

Valve Removal Plugs refer to:

Publication: RP-001558

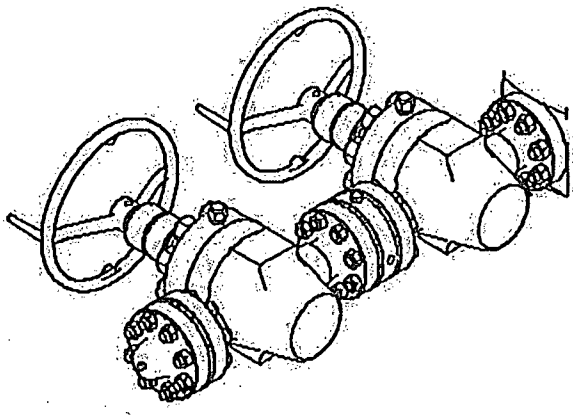
(Assembly Procedure for VR Plugs and Recommended Torque Values)



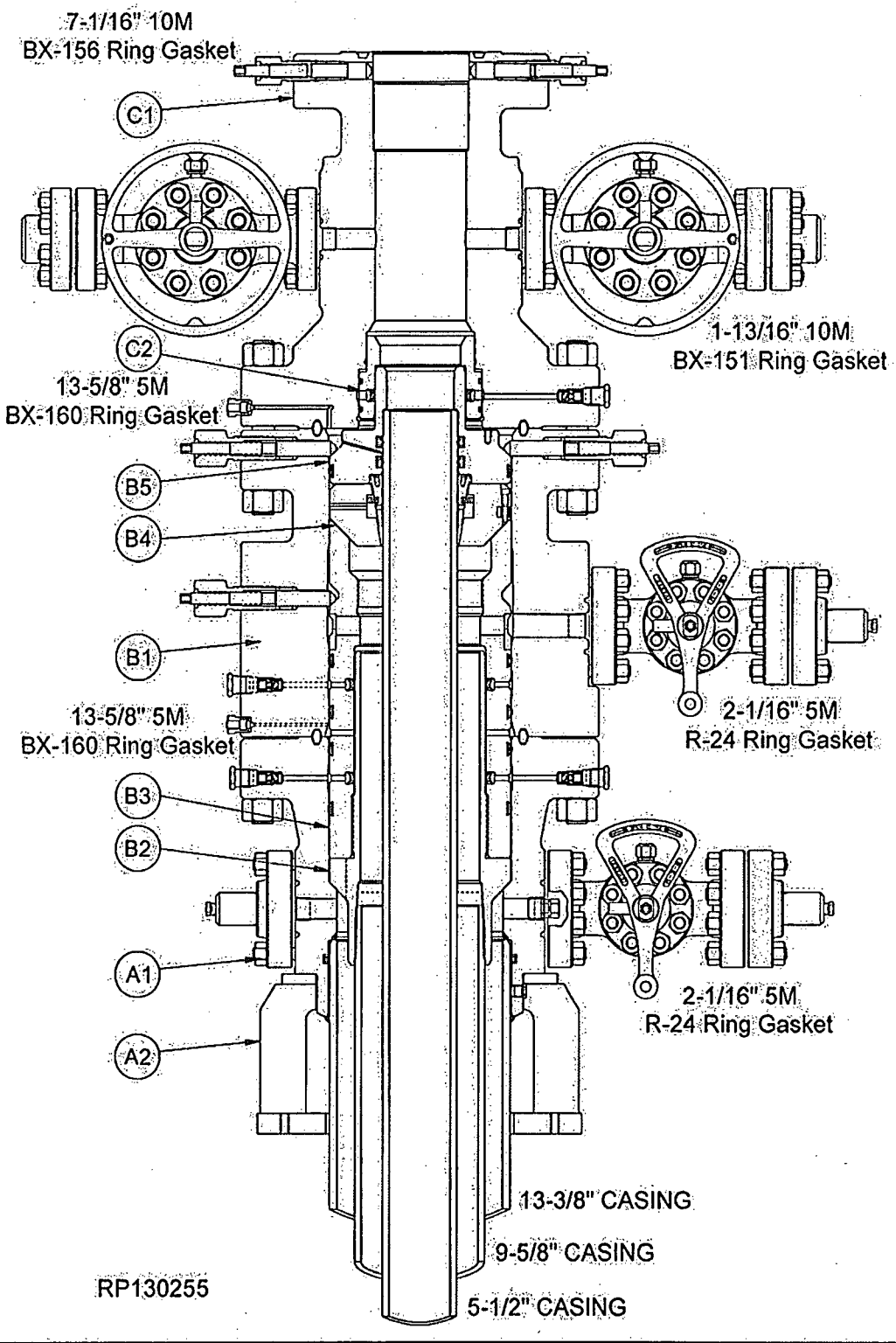
Make-up Requirements for API Flange Connections

Refer to:

Publication: RP-002153



System Drawing



Bill of Materials

NOTE Contact your Cameron representative for replacement part inquiries. Cameron personnel can check the latest revision of the assembly bill-of-material to obtain the appropriate and current replacement part number.

LOWER MULTI BOWL ASSEMBLY

Item	Qty	Description
A1	1	Casing Head, MB-S Lower, 13-5/8" 5M x 13-3/8" SOW w/ two 2-1/16" 5M SSOs Part# 2253955-01-01
A2	1	CR Landing Base f/ 13-5/8" flange, 24" OD base plate Part# 2057661-02-01

UPPER MULTI BOWL ASSEMBLY

Item	Qty	Description
B1	1	Spool, MBS-L Upper, 13-5/8" 5M x 13-5/8"5M, w/ two 2-1/16" 5M SSOs Part# 2161751-02-03
B2	1	Casing Hanger, Mandrel, MBS, 13-5/8" x 9-5/8" LCSG btm x 10.000-4 Stub Acme lh running thrd top, slick neck Part# 2161673-03-01
B3	1	Packoff Support Bushing MBS, 13-5/8" for mandre 9-5/8" 3M thru 10M Service Part# 2161673-03-01
B4	1	Casing Hanger IC-1, 13-5/8" x 5-1/2" casing Part# 2236815-03-04
B5	1	Packoff for IC-1 Hanger, 13-5/8" 10M x 5-1/2" OD double 'T' seal prep, w/ 6-5/8" extended neck and 5" BPV thrd Part# 2330172-04-01

TUBING SPOOL ASSEMBLY

Item	Qty	Description
C1	1	Tubing Spool, Type 'C', 13-5/8" 5M x 7-1/16" 10M, w/ two 1-13/16" 10M SSOs and 11" nom 'NX' prep btm Part# 2161751-02-03
C2	1	'NX' Bushing, 11" nom x 6-5/8" OD casing, w/ integral bit guide Part# 2161829-06-01

RECOMMENDED SERVICE TOOLS

Item	Qty	Description
ST1	1	Test Plug, Type 'C', 13-5/8" nom, 4-1/2" IF box top x pin bottom Part # 2247044-01-01
ST2	1	Wear Bushing, MBS, 13-5/8" Nom x 12.31 Bore, 33.28" long with J-slots Part# Y29100-72300411
ST3	1	Wear Bushing, IC-2 & IC-9 13-5/8" Nom x 10-3/4 Bore 14" long with J-slots Part# Y29106-03000021
ST4	1	Wear Bushing Running and Retrieving Tool, IC-2, 13-5/8" Nom, 4-1/2" IF box btm x top Part# 2301310-02
ST5	1	MBS Casing Hanger R/T, 10"-4 stub acme lh btm x 9-5/8" 8rd LC top Part# 2161757-11-01
ST6	1	Running Tool for MBS Support Bushing, 13-5/8" nom, 9.25"-4 stub acme lh, w/ 4-1/2" pin btm x 4-1/2" IF box top Part # Y29000-77800171
ST7	1	Jetting tool, 13-5/8" Nom Type MBS, 4-1/2" IF box top Part # 2247778-01

Stage 1.0 — 13-3/8" Casing

SAFETY NOTE: Always wear proper PPE (Personal Protective Equipment) such as safety shoes, safety glasses, hard hat, gloves, etc. to handle, install and operate the equipment.

⚠ CAUTION Threaded Devices should *NEVER* be routinely tightened under pressure. This includes: Flange Bolting, Pipe Plugs, Bull Plugs, Union Nuts, Tie-down/Lockscrew Glands.

1.0 Install the MBS Assembly

1.1.1. Run the 13-3/8" Casing and cement as required.

1.1.2. Examine the *MBS System (Item A1 & B1)*. Verify the following:

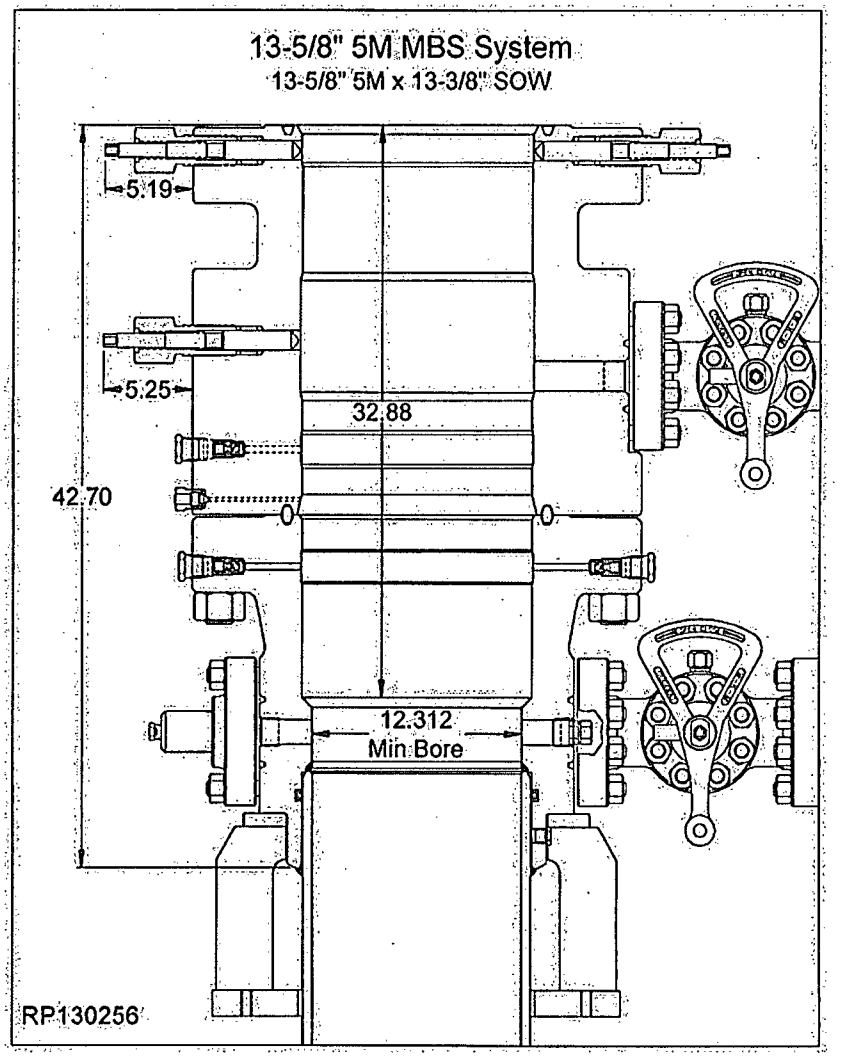
- bore is clean and free of debris
- all threads are clean and undamaged
- o-ring is properly installed and undamaged
- orient the System as illustrated.
- all lower and upper lockscrews are retracted from the bore

⚠WARNING All Lockscrews *MUST* achieve positions as indicated. Otherwise contact Surface Engineering for guidance.

1.1.3. Determine the correct elevation for the top of the MBS System and cut 13-3/8 casing at the appropriate elevation.

1.1.4. Grind a 3/8" x 3/16" bevel on the OD of the casing stub. This will allow the stub to pass by the o-ring in the bottom prep of the Casing Head.

NOTE It is advisable to grind the ID of the casing to allow the drill pipe and casing collars to be run smoothly.



Stage 1.0 — 13-3/8" Casing

1.1.5. Align and level the MBS System above the casing stub, orienting the outlets so they will be compatible with the drilling equipment.

1.1.6. Slowly and carefully lower the Assembly onto the casing stub.

1.1.7. Remove the 1/2" npt test fitting prior to welding.

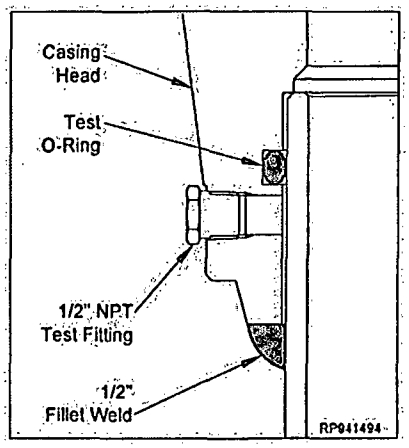
1.1.8. Weld and test as required.

NOTE **The weld should be a fillet-type weld with legs no less than the wall of the casing. Legs of 1/2" to 5/8" are adequate for most jobs.**

NOTE **Do Not use HOT HEADS, or similar methods of preheating, as it may damage seals and packing.**

NOTE **Refer to the *Recommended Procedure for Field Welding Pipe to Wellhead Parts for Pressure Seal* found in the back of this manual for details of the welding and testing procedure.**

1.1.9. Reinstall the fitting.



Stage 2.0 — 9-5/8" Casing

2.1 Test the BOP Stack

NOTE Previously used BOP Test Plugs must be inspected for damage due to wear. Where warranted such as highly deviated wells the Tester must be checked periodically to insure integrity.

WARNING Immediately after making up the BOP stack and periodically during the drilling of the hole for the next casing string, the BOP stack (connections and rams) must be tested.

2.1.1. Make up the BOP stack to the Spool using a spare ring gasket.

2.1.2. Examine the *Test Plug (Item ST1)*. Verify the following:

- seal is in place and undamaged
- 1/2" pipe plug is installed, if required
- all threads are in good condition

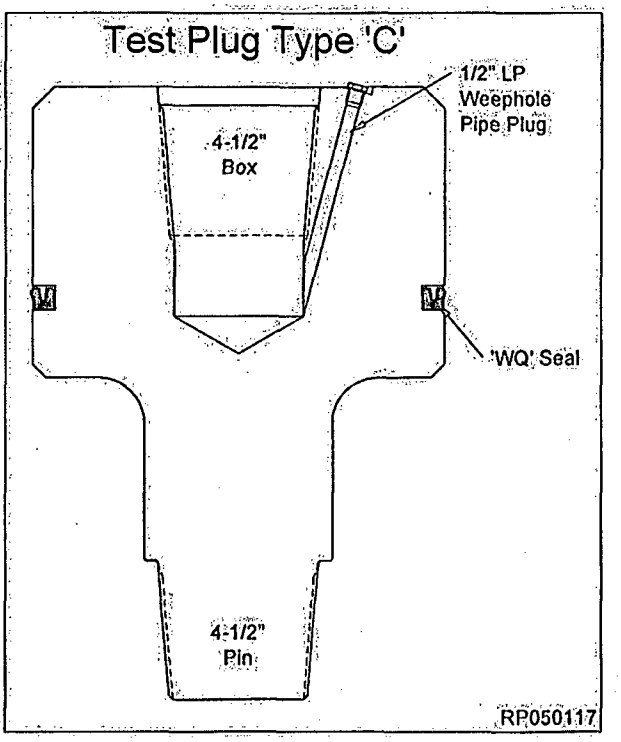
2.1.3. Orient the Tool as illustrated.

2.1.4. Make up a joint of drill pipe to the top of the Tool.

2.1.5. Make up a joint of drill pipe to the bottom of the Tool.

WARNING A minimum of one joint of Drill Pipe is required on the bottom of the BOP Test Plug to ensure BOP Test plug remains centralized.

2.1.6. Wipe the seal of the Tool with a coat of light oil.



Stage 2 — 9-5/8" Casing

2.1.7 Ensure *all upper and lower lockscrews of the MBS System* are retracted from the bore.

⚠WARNING All Lockscrews *MUST* achieve positions as indicated. Otherwise contact Surface Engineering for guidance.

2.1.8. Open the annulus valve of the Lower Housing or Casing Head.

2.1.9. Slowly lower the Test Plug through the BOP until it lands on the load shoulder in the Lower Housing or Casing Head.

2.1.10. Close the BOP rams on the drill pipe and test to *5,000 psi maximum.*

2.1.11. Monitor the annulus valve for signs of pressure.

2.1.12. After a satisfactory test is achieved, release pressure, close the outlet valve and open the rams.

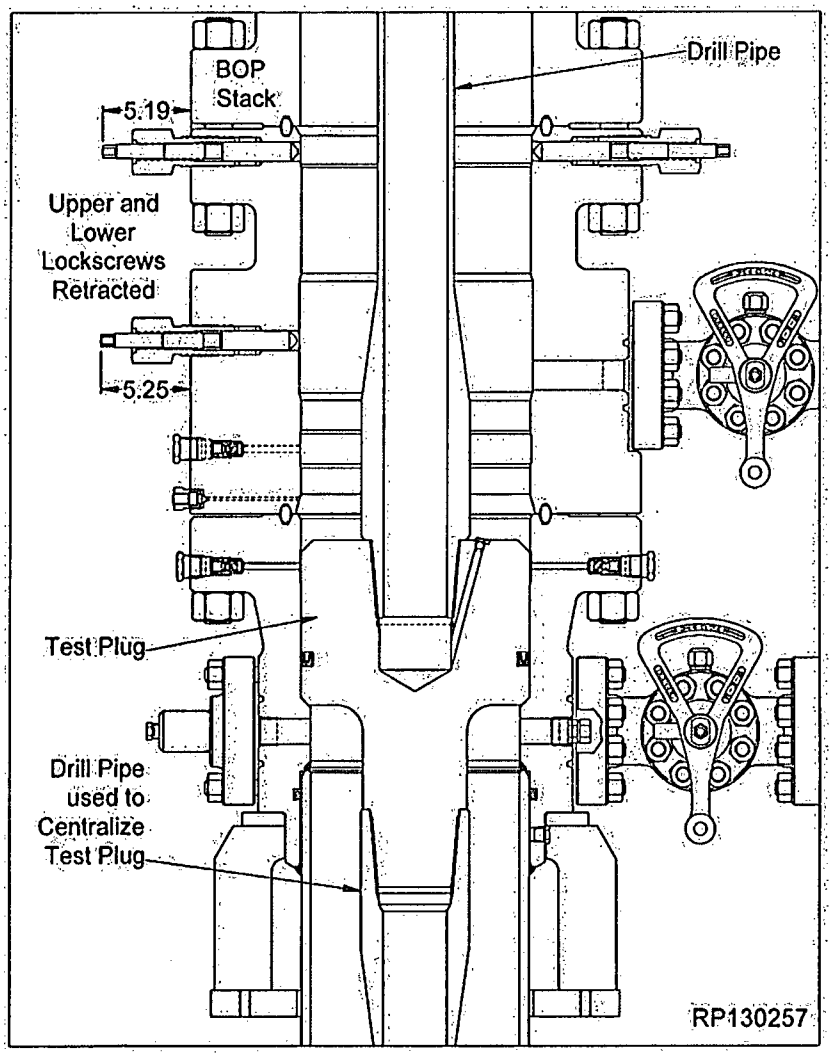
2.1.13. Remove as much fluid from the BOP stack as possible.

2.1.14. Retrieve the Test Plug slowly to avoid damage to the seal.

NOTE It may be necessary to open the annulus valve when starting to retrieve the Test Plug to relieve and vacuum that may occur.

2.1.15. Clean, grease and store the Tool as required.

2.1.16. Repeat this procedure as required during drilling operations.



Stage 2 — 9-5/8" Casing

2.2 Run the Wear Bushing Before Drilling

NOTE Previously used wear bushings must be inspected for damage and significant reduction in wall thickness due to wear. Where warranted such as highly deviated wells the wear bushing must be checked periodically to insure integrity.

⚠WARNING Always use a Wear Bushing while drilling to protect the load shoulders from damage by the drill bit or rotating drill pipe. The Wear Bushing must be retrieved prior to running the casing.

2.2.1. Examine the ***Wear Bushing Running Tool (Item ST4)***. Verify the following:

- bore is clean and free of debris
- lift lugs are intact and undamaged
- all threads are clean and free of debris

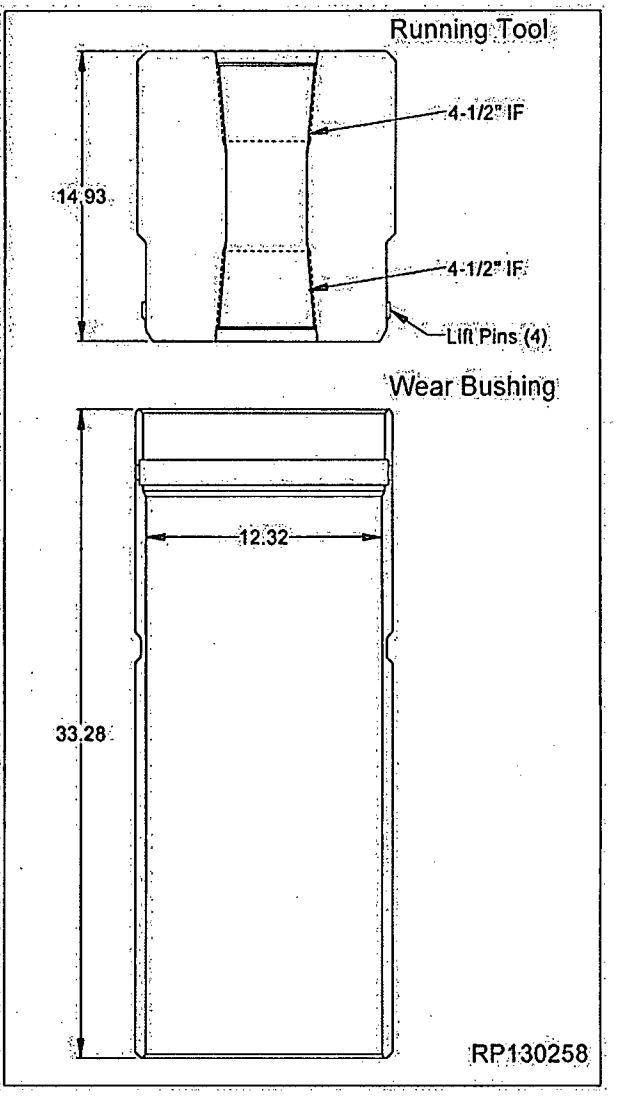
2.2.2. Orient the Tool with the lift lugs down.

2.2.3. Make up a joint of drill pipe to the top of the Tool.

2.2.4. Examine the ***Wear Bushing (Item ST2)***. Verify the following:

- bore is clean and free of debris
- stop lugs are secure
- J-slots are clean and free of debris

2.2.5. Lower the Test Plug into the Wear Bushing and rotate the Plug 1/4 turn clockwise.



Stage 2.0 — 9-5/8" Casing

2.2.6. Verify all *upper and lower lockscrews of the MBS System* are retracted from the bore as indicated.

⚠WARNING All Lockscrews *MUST* achieve positions as indicated. Otherwise contact Surface Engineering for guidance.

2.2.7. Slowly lower the Tool/Bushing Assembly through the BOP stack and into the MBS System, until it lands on the load shoulder in the Casing Head.

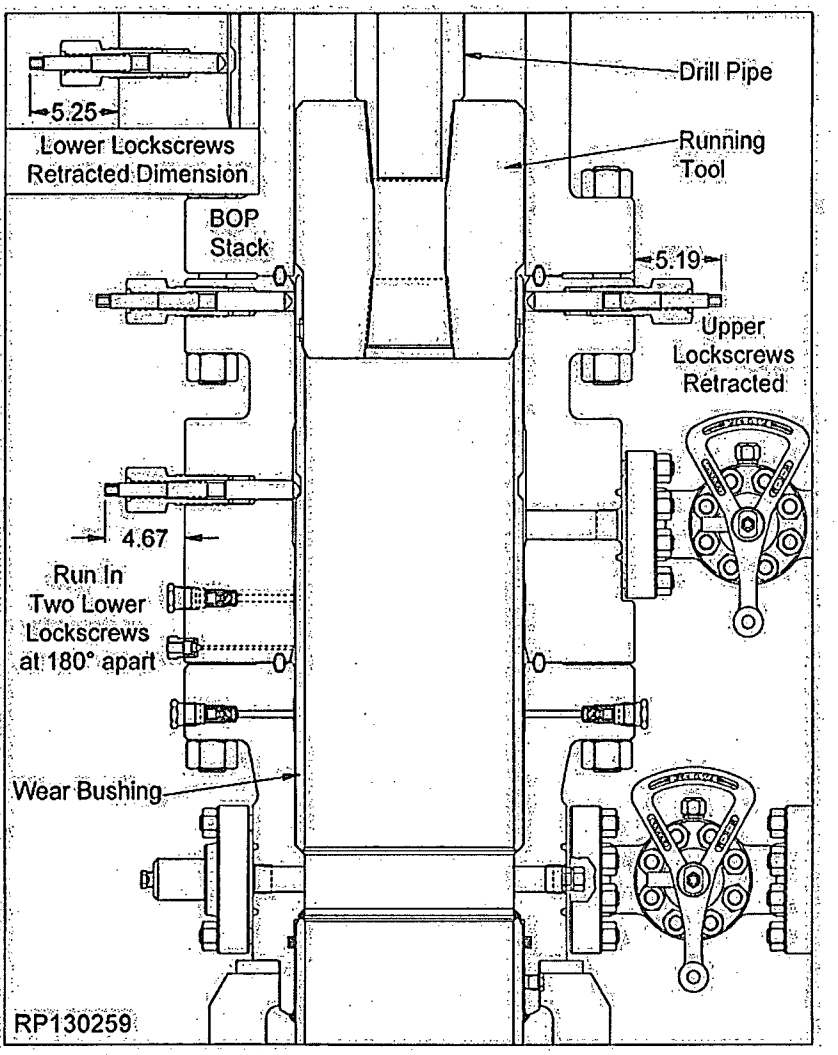
2.2.8. Run in only two *lowermost lockscrews of the MBS Upper Spool*, 180° apart snug tight.

⚠WARNING Do Not overtighten the lockscrews.

⚠WARNING All Lockscrews *MUST* achieve positions as indicated. Otherwise contact Surface Engineering for guidance.

2.2.9. Remove the Tool from the Wear Bushing by rotating the drill pipe counterclockwise 1/4 turn and lifting straight up.

2.2.10. Drill as required.



Stage 2.0 — 9-5/8" Casing

2.3 Retrieving the Wear Bushing After Drilling

2.3.1. Make up a joint drill pipe to the Tool. Ensure the lift lugs are down.

2.3.2. Slowly lower the Tool into the Wear Bushing.

2.3.3. Rotate the Tool clockwise until the drill pipe drops approximately 2". This indicates the lugs have aligned with the J-slots of the Wear Bushing.

2.3.4. Slack off all weight to make sure the Tool is down.

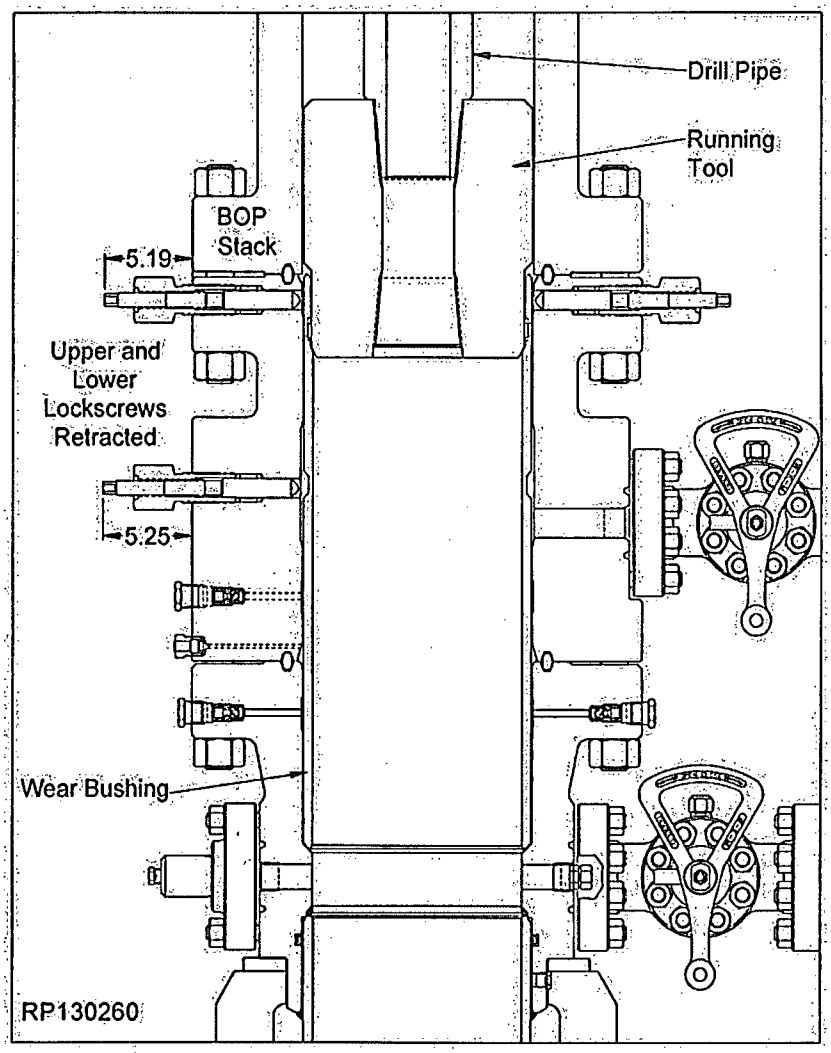
2.3.5. Rotate the Tool clockwise 1/4 turn to fully engage the lugs in the Wear Bushing.

2.3.6. Retract ***lowermost lockscrews of the MBS Upper Spool*** and retrieve the Wear Bushing.

⚠WARNING All Lockscrews *MUST* achieve positions as indicated. Otherwise contact Surface Engineering for guidance.

2.3.7. Remove the Bushing and the Tool from the drill string.

2.3.8. Clean, grease and store tools as required.



Stage 2.0 — 9-5/8" Casing

Landing of Mandrel Hangers

Cameron service personnel must verify that the mandrel hanger is landed properly on the load shoulder in the wellhead. This can be accomplished by one of two methods.

- Calculate the distance from the rig floor to the landing shoulder and confirm that the hanger has traveled the required distance.
- Or the preferred method: Conduct a dry run and mark the dedicated landing joint prior to running the casing or tubing.

2.4 Hang off the Casing

2.4.1. Run the 9-5/8" casing and space out as required.

2.4.2. Examine the ***Casing Hanger Running Tool (Item ST5)***. Verify the following:

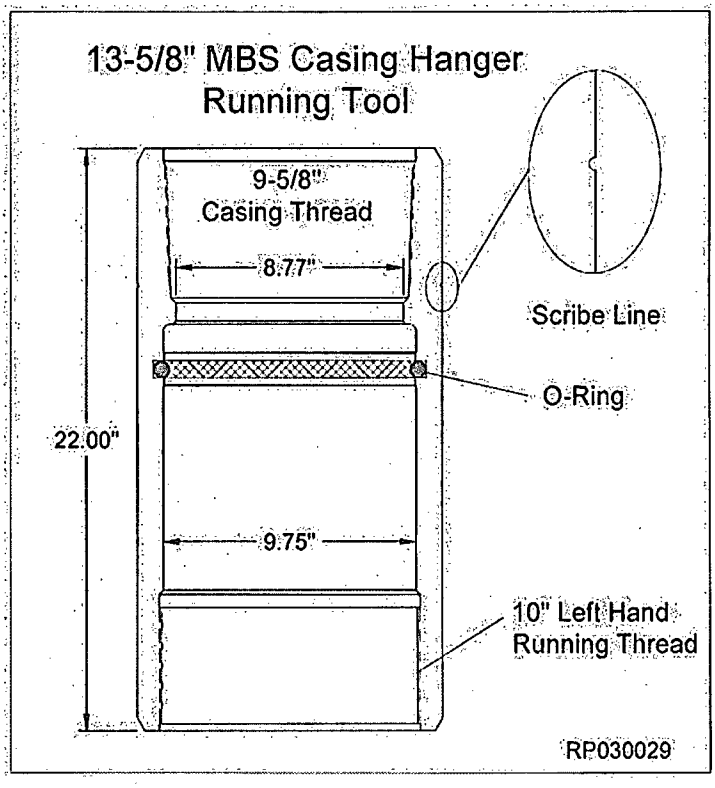
- bore is clean and free of debris
- all threads are clean and undamaged
- o-ring is clean and undamaged
- scribe line is clearly identifiable

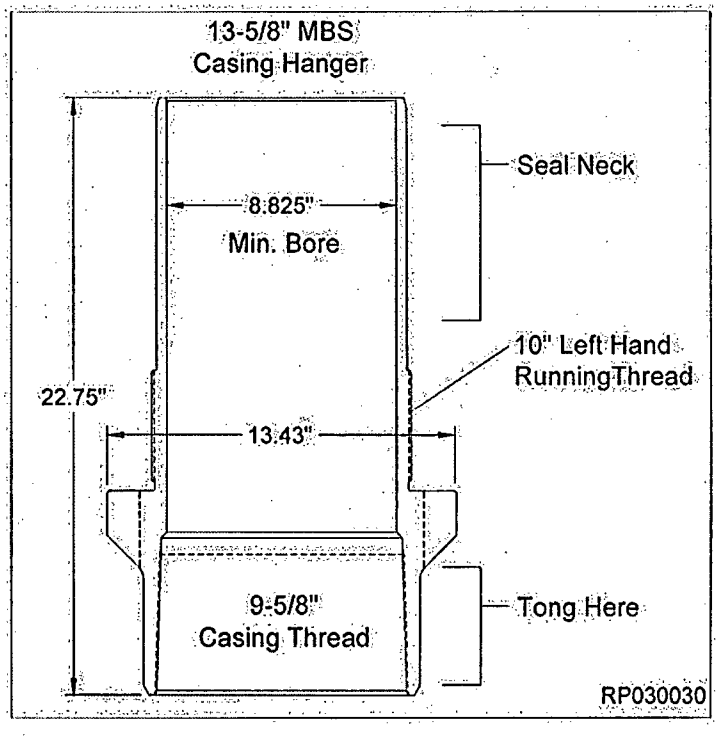
2.4.3. Orient the Tool with the casing threads up.

2.4.4. Examine the ***Mandrel Casing Hanger (Item B2)***. Verify the following:

- bore is clean and free of debris
- all threads are clean and undamaged
- neck seal area is clean and undamaged

2.4.5. Orient the Hanger with the casing threads down.





Stage 2.0 — 9-5/8" Casing

2.4.6. Make up a landing joint to the top of the Tool.

2.4.7. Wipe the OD of the Hanger neck and the Running Tool o-ring and running threads with a light coat of oil or grease.

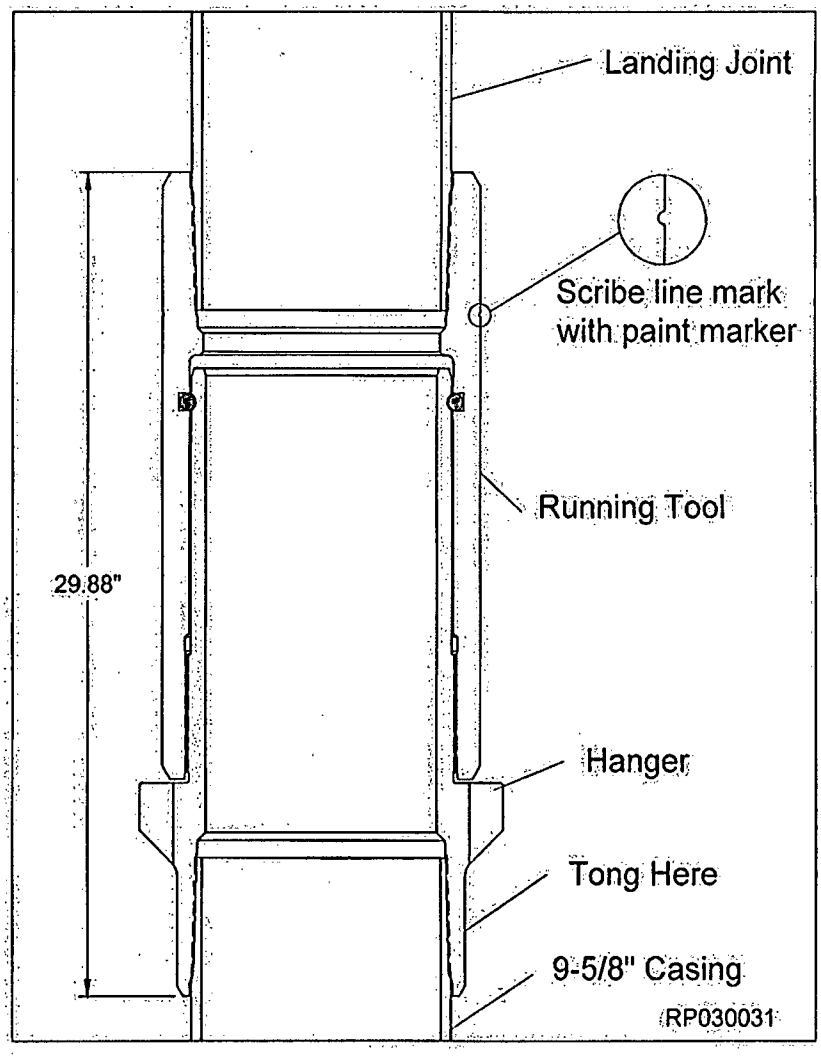
⚠WARNING Excessive oil or grease may prevent a positive seal from forming.

2.4.8. Make up the Tool onto the Hanger with left hand rotation to approximately 15 to 16 turns until it bottoms out on the Hanger body.

⚠WARNING Do Not torque the Hanger/Tool connection.

2.4.9. Back off the Tool 1/2 a turn allowing 1/8" gap between the Tool and the Hanger.

2.4.10. Lower the Hanger onto the last joint of casing run and make up the connection to the thread manufacturers recommended optimum torque.



Stage 2.0 — 9-5/8" Casing

2.4.11. Verify ***all upper and lower lockscrews*** are retracted from the bore as indicated.

⚠WARNING All Lockscrews *MUST* achieve positions as indicated. Otherwise contact Surface Engineering for guidance.

2.4.12. Slowly and carefully lower the Hanger through the BOP and land it in the Lower MBS Casing Spool.

2.4.13. Slack off all weight on the casing.

2.4.14. Verify the well is safe and under control.

2.4.15. Carefully open the outlet valve on the Casing Spool.

2.4.16. Visually verify the scribe line is in the center of the outlet indicating the Hanger is properly landed.

2.4.17. Close the outlet.

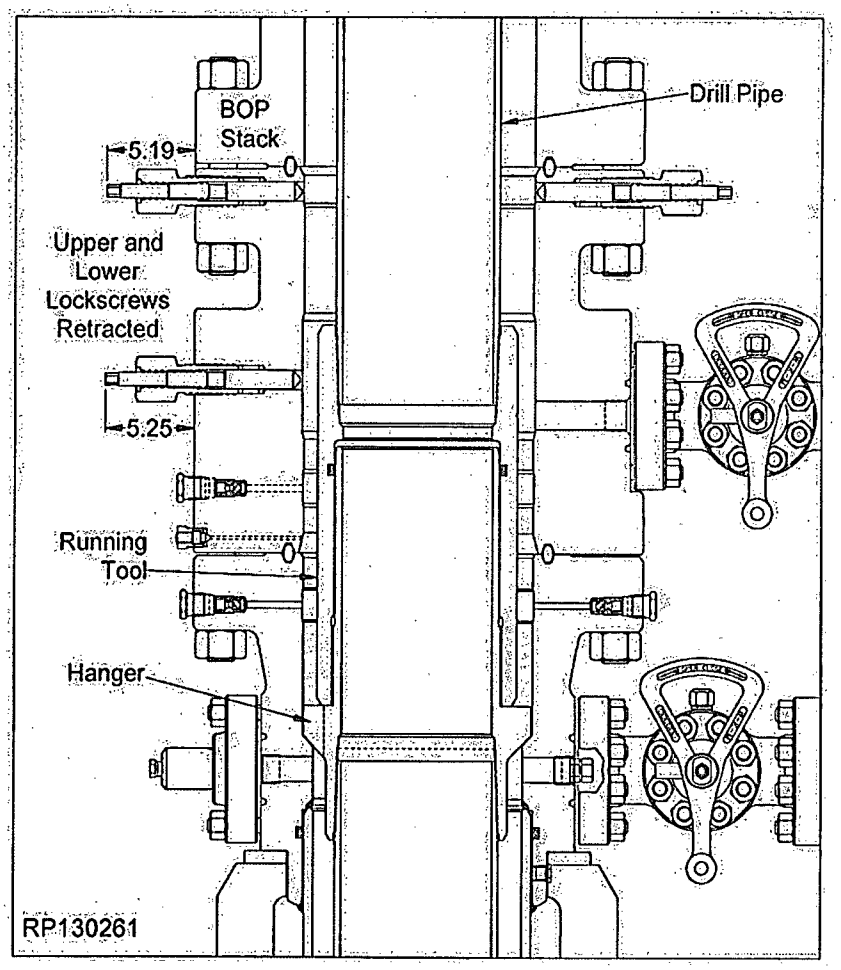
2.4.18. Cement the casing as required.

NOTE Cement returns may be taken through the flutes of the Hanger and out of the BOP or out of the side outlets on the Casing Spool.

2.4.19. Rotate the landing joint and Running tool to the right until the thread jump can be felt.

2.4.20. Retrieve the Landing Joint and Running Tool to the rig floor.

2.4.21. Clean, grease and store the Tool as required.



Stage 2.0 — 9-5/8" Casing

2.5 Washout for the Packoff Support Bushing (Option)

2.5.1. Examine the ***Washout Tool (Item ST7)***. Verify the following:

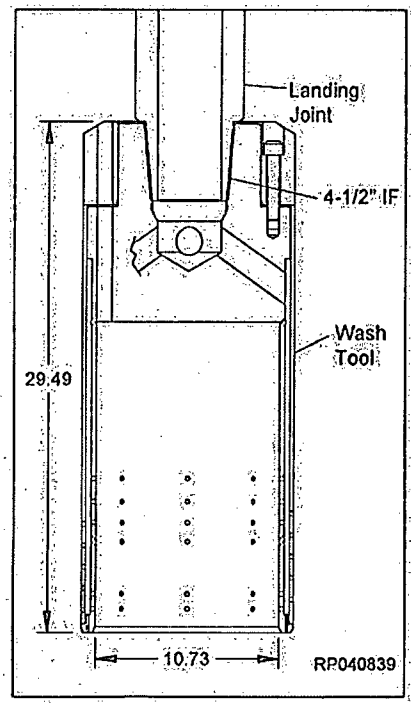
- bore is clean and free of debris
- all threads are clean and undamaged

2.5.2. Orient the Tool as illustrated.

2.5.3. Make up a joint of drill pipe to the top of the wash tool.

2.5.4. Verify all upper and lower lockscrews are retracted from the bore.

⚠WARNING All Lockscrews *MUST* achieve positions as indicated. Otherwise contact Surface Engineering for guidance.



2.5.5. Open the lowermost outlet valve on the MBS system.

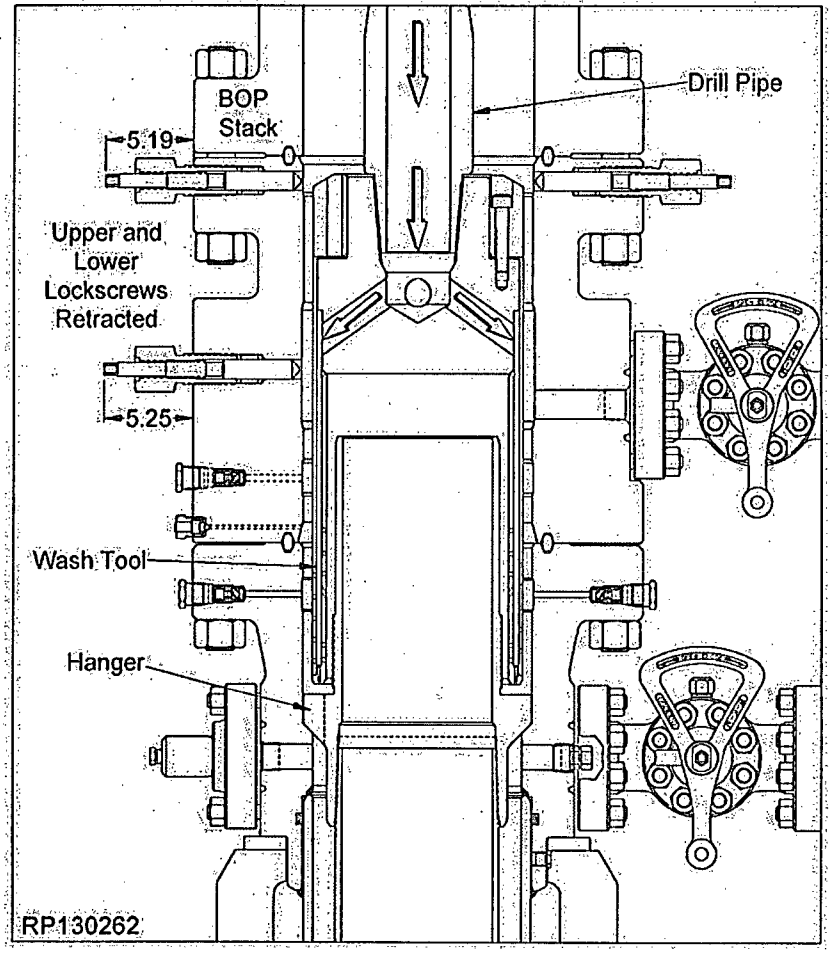
2.5.6. Carefully lower the wash tool through the BOP.

2.5.7. Slow the rate of decent until the tool lands out on top of the Casing Hanger.

2.5.8. Wash out the MBS profile carefully raising and lowering the tool while the flowing through the tool.

2.5.9. Take returns through the open outlet valve, and wash until clean returns are taken.

2.5.10. Retrieve the wash tool, clean, grease, and store the tool.



Stage 2.0 — 9-5/8" Casing

2.6 Installing the Packoff Support Bushing

NOTE The following steps detail the installation of the MBS Packoff Support Bushing if the casing has been run normally and is hung off with the Mandrel Casing Hanger

2.6.1. Thoroughly washout the System. Ensure all mud and debris are removed from the top of the Hanger and ID of the Spool.

2.6.2. Examine the ***Packoff Support Bushing Running Tool (Item ST6)***. Verify the following:

- bore is clean and free of debris
- all threads are clean and undamaged

2.6.3. Orient the Tool as illustrated.

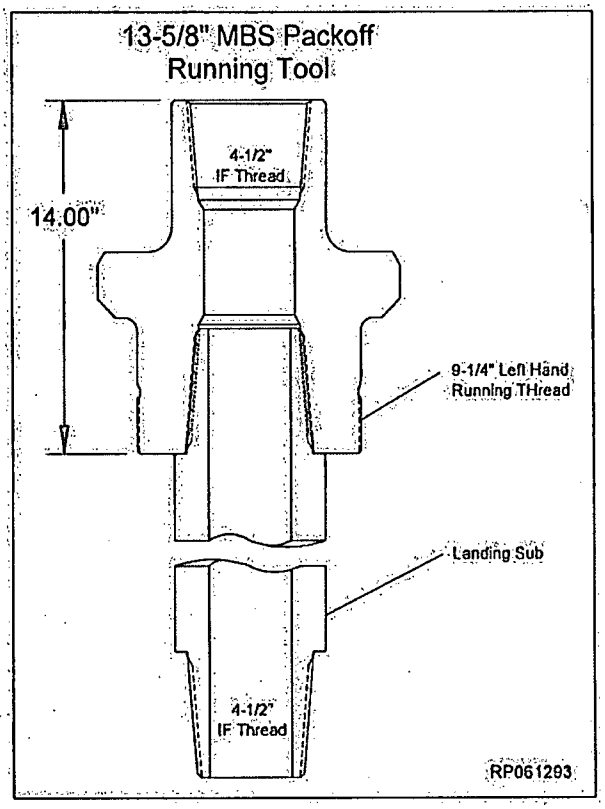
2.6.4. Examine the ***Packoff Support Bushing (Item B3)***. Verify the following:

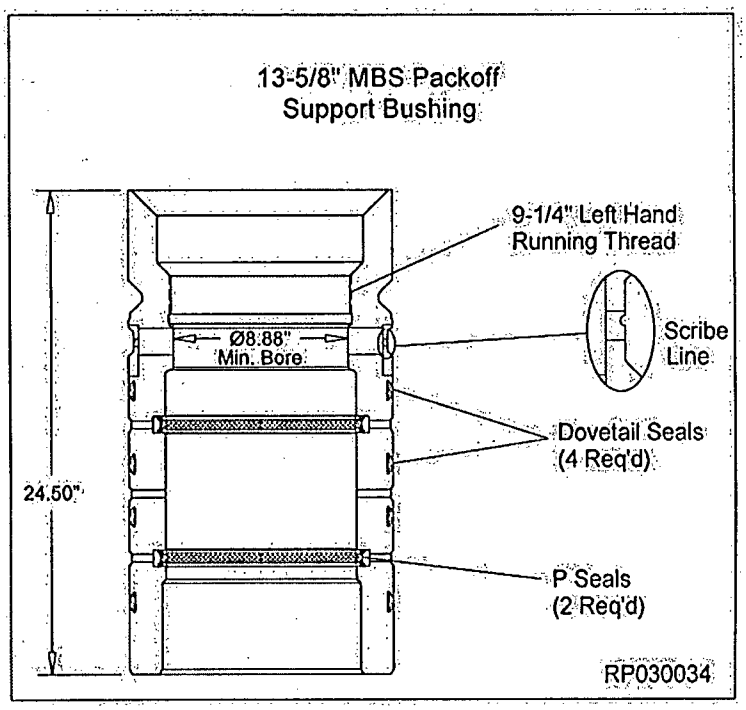
- bore is clean and free of debris
- all elastomer seals are in place and undamaged
- all threads are clean and undamaged

2.6.5. Orient the Bushing as illustrated.

2.6.6. Lubricate the ID of the 'T' seals and the OD of the dovetail seals liberally with a light oil or grease.

2.6.7. Mark the scribe line on the OD of the Bushing with a paint marker the entire length of the line.





Stage 2.0 — 9-5/8" Casing

2.6.8. Run drill pipe or heavy weight collars through the rotary table and hang off in the floor slips.

NOTE Heavy weight drill pipe or drill collars are used to aid in landing the Support Bushing. Weight required to pull the support bushing into the Head is approximately 1500 lbs per Dovetail seal.

2.6.9. Make up a landing joint to the top of the Running Tool.

2.6.10. Wipe the running threads of the Packoff and the mating threads of the running tool with a light coat of oil or grease.

2.7.11. Lower the Tool onto the Packoff until the mating threads make contact.

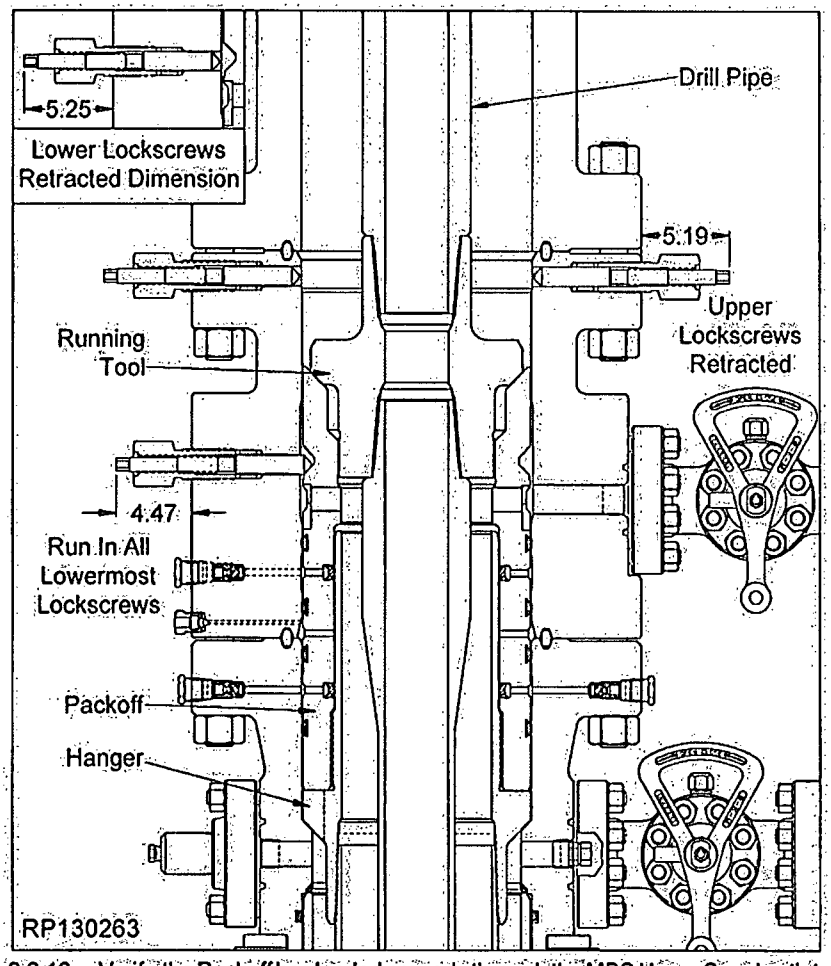
2.6.12. While balancing the weigh, rotate the tool to the right until thread jump can be felt then to the left approximately 6 turns. **Do not tighten.**

2.6.13. Make up the lowermost pin connection of the Running Tool to the box connection of the drill pipe hung off in the rig floor.

2.6.14. Verify all lower and upper lockscrews of the MBS System are retracted from the bore as indicated.

2.6.15. Slowly lower the assembly through the BOP stack and MBS System until the Support Bushing lands on the Casing Hanger.

NOTE When landing the Support Bushing on the Hanger the scribe line will be visible in the middle of the outlet of the MBS Spool.



2.6.16. Verify the Packoff has landed properly through the MBS Upper Spool outlet:

- ensure no pressure build up has occurred
- remove outlet equipment and set aside
- visually verify the scribe line is visible in the center of the outlet
- reinstall the outlet equipment

2.6.17. Fully run in the ***lowermost lockscrews of the Upper MBS Spool*** in an alternating cross pattern to refusal.

⚠WARNING **All Lockscrews *MUST* achieve positions as indicated. Otherwise contact Surface Engineering for guidance.**

Stage 2.0 — 9-5/8" Casing

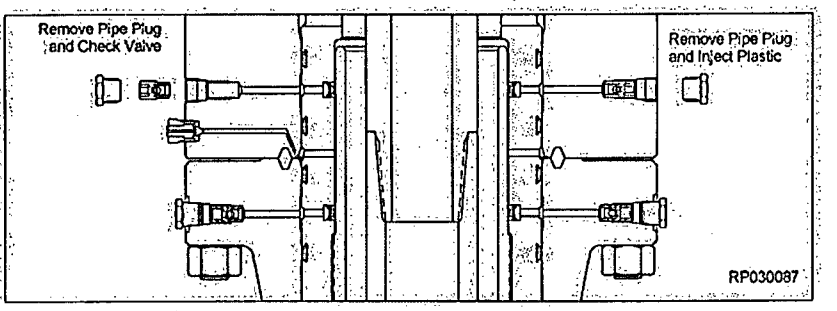
2.7 Energize the Upper Seal of the Packoff

2.7.1. Locate the ports on the lower portion of the MBS Spool for injecting plastic packing into the upper P seal and remove the pipe plug from each port.

2.7.2. Remove the check valve from one port only.

2.7.3. Install a plastic packing gun with a test pump into the port which still contains the check valve and inject plastic until a continuous stream flows from the empty port.

2.7.4. Replace the check valve and pipe plug into the empty port and continue to inject plastic packing to ***5,000 psi maximum.***



NOTE **If the 9-5/8" Emergency Packoff is used do not exceed 80% of casing collapse.**

NOTE **Contact the Drilling Supervisor to determine the collapse pressure of the specific grade and weight of the casing used.**

2.7.5. Hold and monitor the injection pressure until it has stabilized.

2.7.6. Once the pressure has stabilized carefully bleed the injection pressure back into the test pump.

2.7.7. Replace the pipe plug.

NOTE **For proper injection gun operation procedure refer to the back of this manual.**

2.8 Energize the Lower Seal of the Packoff

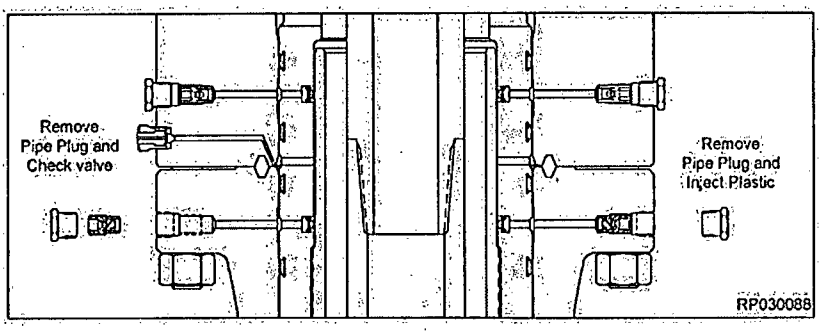
2.8.1. Locate the ports on the flange of the Casing Head for injecting plastic packing into the lower P seal and remove the dust cap from each fitting.

2.8.2. Install a plastic packing gun with a test pump onto one fitting and a bleeder tool onto the opposite fitting.

2.8.3. Open the bleeder tool to vent to the atmosphere.

2.8.4. Inject plastic packing until a continuous stream flows from the bleeder tool.

2.8.5. Close the bleeder tool and continue to inject plastic packing to ***5,000 psi maximum.***



NOTE **If the 9-5/8" Emergency Packoff is used do not exceed 80% of casing collapse.**

NOTE **Contact the Drilling Supervisor to determine the collapse pressure of the specific grade and weight of the casing used.**

2.8.6. Hold and monitor the injection pressure until it has stabilized.

2.8.7. Once the pressure has stabilized carefully bleed the injection pressure back into the test pump.

2.8.8. Remove the bleeder tool and injection gun.

2.8.9. Replace the dust caps.

NOTE **For proper injection gun operation procedure refer to the back of this manual.**

Stage 2.0 — 9-5/8" Casing

2.9 Test the Connection

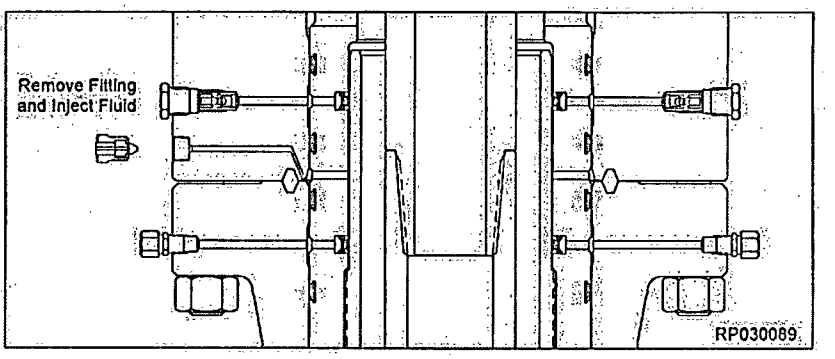
2.9.1. Locate the port on the lower portion of the MBS Spool for testing the connection and remove the fitting.

2.9.2. Install a test pump into the open port and inject test fluid to ***5,000 psi maximum.***

NOTE **If the 9-5/8" Emergency Packoff is used do not exceed 80% of casing collapse.**

NOTE **Contact the Drilling Supervisor to determine the collapse pressure of the specific grade and weight of the casing used.**

2.9.3. Hold and monitor the test pressure for 15 minutes or as instructed by the Drilling Supervisor.



2.9.4. Once a satisfactory test has been achieved carefully bleed off all test pressure and remove the test pump.

2.9.5. Replace the fitting.

2.9.6. Balancing the string weight, rotate the Tool to the right 6 full turns to the right until the threads of the Packoff and the Tool disengage and retrieve the Tool to the rig floor.

Stage 3.0 — 5-1/2" Casing

3.1 Test the BOP Stack

NOTE Previously used BOP Test Plugs must be inspected for damage due to wear. Where warranted such as highly deviated wells the Tester must be checked periodically to insure integrity.

⚠WARNING Immediately after making up the BOP stack and periodically during the drilling of the hole for the next casing string, the BOP stack (connections and rams) must be tested.

3.1.1. Make up the BOP stack to the Spool using a spare ring gasket.

3.1.2. Examine the ***Test Plug (Item ST1).*** Verify the following:

- seal is in place and undamaged
- 1/2" pipe plug is installed, if required
- all threads are in good condition

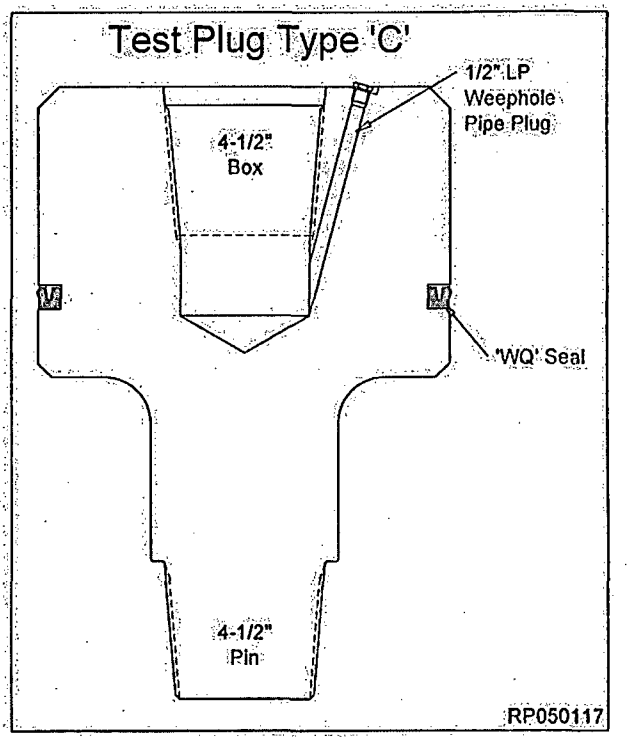
3.1.3. Orient the Tool as illustrated.

3.1.4. Make up a joint of drill pipe to the top of the Tool.

3.1.5. Make up a joint of drill pipe to the bottom of the Tool.

⚠WARNING A minimum of one joint of Drill Pipe is required on the bottom of the BOP Test Plug to ensure BOP Test plug remains centralized.

3.1.6. Wipe the seal of the Tool with a coat of light oil.



Stage 3.0 — 5-1/2" Casing

3.1.7 Ensure *all upper and lower lockscrews of the MBS System* are retracted from the bore.

⚠WARNING All Lockscrews *MUST* achieve positions as indicated. Otherwise contact Surface Engineering for guidance.

3.1.8. Open the annulus valve of the MBS Spool.

3.1.9. Slowly lower the Test Plug through the BOP until it lands on the Packoff Support Bushing.

3.1.10. Close the BOP rams on the drill pipe and test to *5,000 psi maximum.*

3.1.11. Monitor the annulus valve for signs of pressure.

3.1.12. After a satisfactory test is achieved, release pressure, close the outlet valve and open the rams.

3.1.13. Remove as much fluid from the BOP stack as possible.

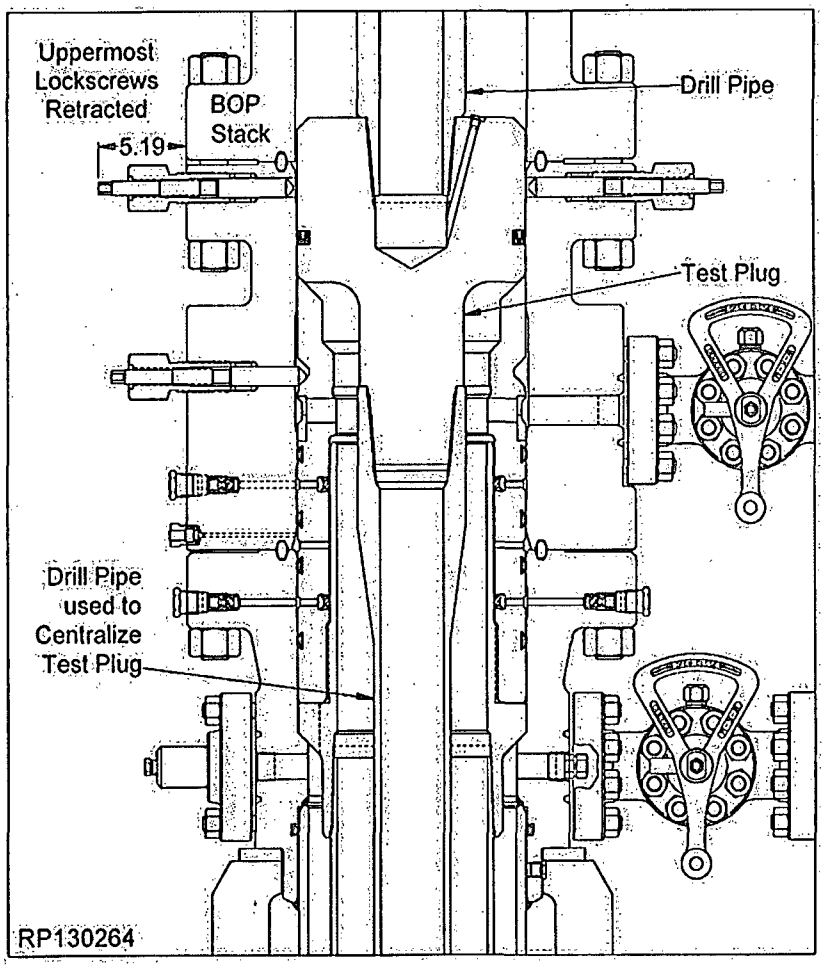
3.1.14. Retrieve the Test Plug slowly to avoid damage to the seal.

NOTE It may be necessary to open the annulus valve when starting to retrieve the Test Plug to relieve and vacuum that may occur.

3.1.15. Close the valve.

3.1.16. Clean, grease and store the Tool as required.

3.1.17. Repeat this procedure as required during drilling operations.



Stage 3.0 — 5-1/2" Casing

3.2 Run the Wear Bushing Before Drilling

NOTE Previously used wear bushings must be inspected for damage and significant reduction in wall thickness due to wear. Where warranted such as highly deviated wells the wear bushing must be checked periodically to insure integrity.

WARNING Always use a Wear Bushing while drilling to protect the load shoulders from damage by the drill bit or rotating drill pipe. The Wear Bushing must be retrieved prior to running the casing.

3.2.1. Examine the ***Wear Bushing Running Tool (Item ST4)***. Verify the following:

- bore is clean and free of debris
- lift lugs are intact and undamaged
- all threads are clean and free of debris

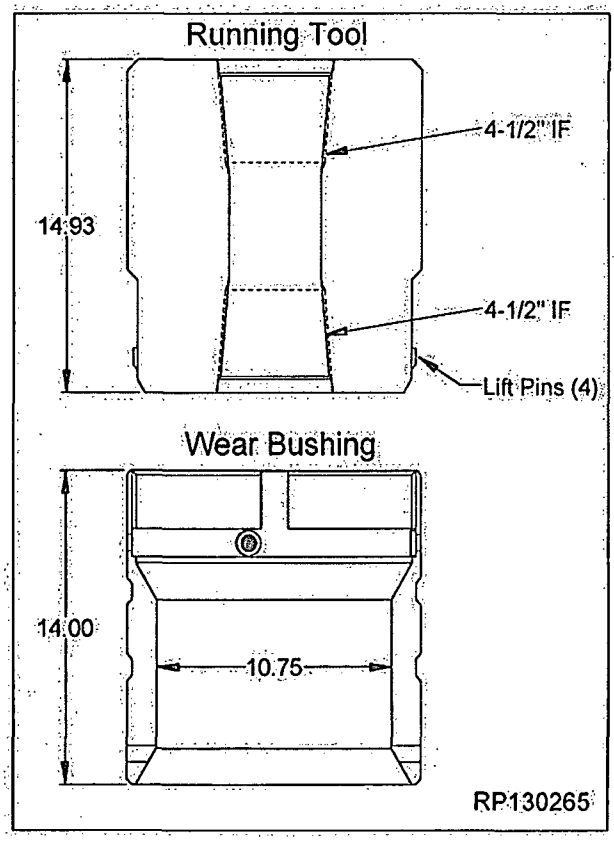
3.2.2. Orient the Tool with the lift lugs down.

3.2.3. Make up a joint of drill pipe to the top of the Tool.

3.2.4. Examine the ***Wear Bushing (Item ST3)***. Verify the following:

- bore is clean and free of debris
- stop lugs are secure
- J-slots are clean and free of debris

3.2.5. Lower the Test Plug into the Wear Bushing and rotate the Plug 1/4 turn clockwise.



Stage 3.0 — 5-1/2" Casing

3.2.6. Verify all *lower lockscrews of the MBS System* are retracted from the bore as indicated.

⚠WARNING All Lockscrews *MUST* achieve positions as indicated. Otherwise contact Surface Engineering for guidance.

3.2.6. Slowly lower the Wear Bushing Assembly through the BOP stack and land it on the Packoff Support Bushing.

3.2.7. Disengage the Tool from the Wear Bushing by rotating the drill pipe counterclockwise 1/4 turn and lifting straight up.

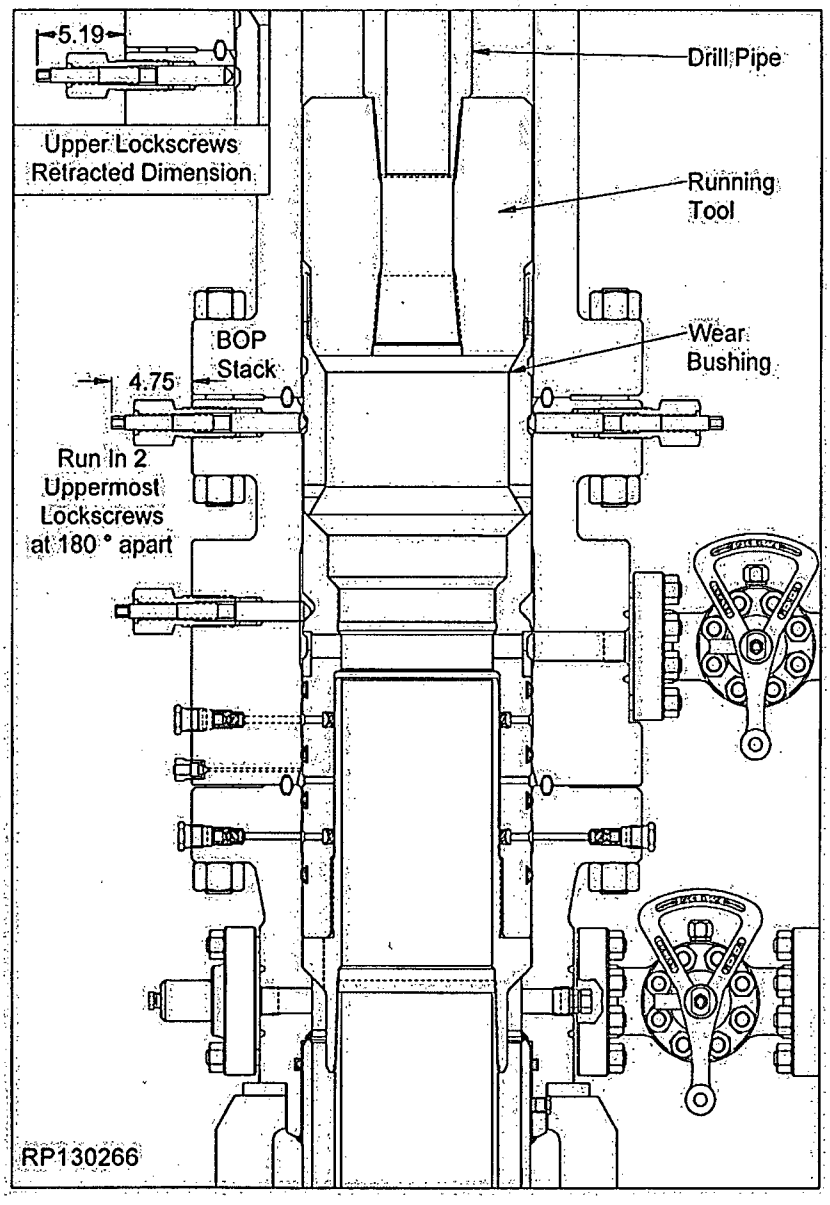
3.2.8. Run in two uppermost MBS Spool Lockscrews 180° apart to hold the wear bushing in place.

⚠WARNING All Lockscrews *MUST* achieve positions as indicated. Otherwise contact Surface Engineering for guidance.

3.2.9. Retrieve the Tool to the rig floor.

3.2.10. Carefully remove the tool from the drill string.

3.2.11. Drill as required.



Stage 3.0 — 5-1/2" Casing

3.3 Retrieve the Wear Bushing After Drilling

3.3.1. Make up a joint of drill pipe to the Running Tool ensuring the lift lugs are down and the elastomer is up.

3.3.2. Slowly lower the Tool through the BOP stack until it lands on the Wear Bushing.

3.3.3. Rotate the Tool clockwise until the drill pipe drops approximately 2". This indicates the lugs have aligned with the Wear Bushing slots.

3.3.4. Slack off all weight to make sure the Tool is down.

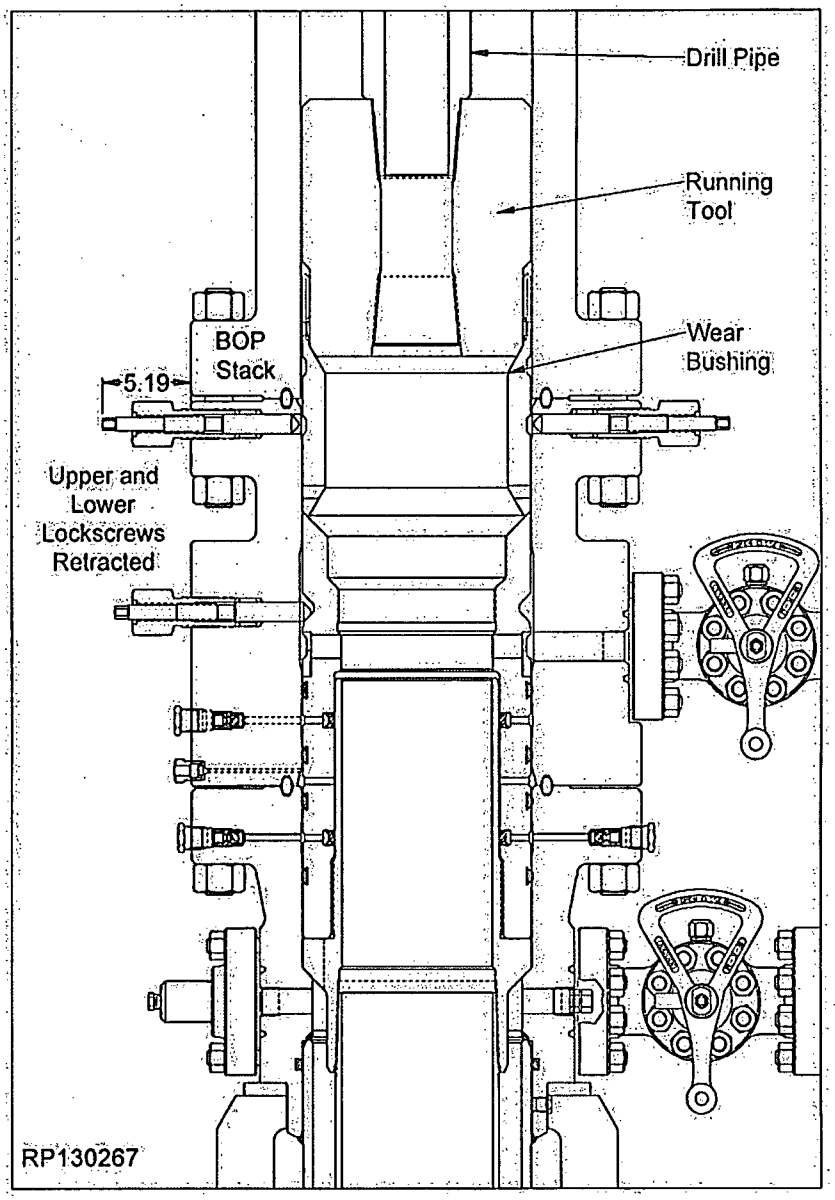
3.3.5. Rotate the Tool clockwise 1/4 turn to fully engage the lugs in the Wear Bushing.

3.3.6. Retract the ***uppermost MBS Spool Lockscrews*** as indicated.

⚠WARNING All Lockscrews *MUST* achieve positions as indicated. Otherwise contact Surface Engineering for guidance.

3.3.7. Slowly retrieve the Wear Bushing and remove it and the Tool from the drill string.

3.3.8. Clean, grease and store the Tool and Wear Bushing.



Stage 3.0 — 5-1/2" Casing

SAFETY NOTE: **Always wear proper PPE (Personal Protective Equipment) especially gloves to handle and install the slip type casing hanger.**

NOTE

1. **Re-confirm the Casing OD and grade. Remove and clean loose scale from Casing OD.**

2. **Verify Slip Bowl taper is smooth, clean with no corrosion and damage free.**

3. **Disassembly of the Hanger to re-orient the split is not required**

3.4 Hang Off the Casing

3.4.1. Run the casing and cement as required.

NOTE **Ensure that the casing is centralized. Hanger clearances are small and centering must be accurate.**

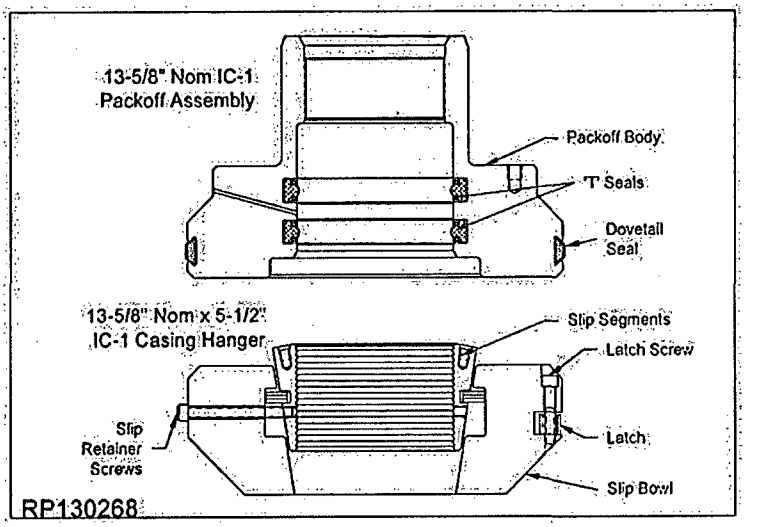
3.4.2. Drain the BOP and MBS Spool bowl through the Spool side outlet. Leave the valve open until the Casing Hanger is set.

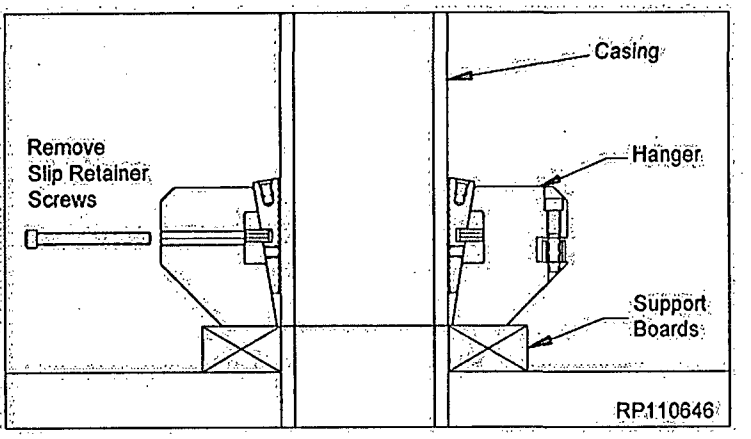
3.4.3. There are two methods used to install the Casing Hanger:

- from the rig floor through a full opening BOP stack, provided no casing collars are between the rig floor and the Head/Spool.
- underneath the BOP stack, provided the well is safe and under control. This option allows the Hanger bowl to be inspected and thoroughly washed prior to the Hanger installation.

3.4.4. Examine the *Casing Hanger (Item B4)* Verify the following:

- all screws are in place and intact
- slips are intact, clean, undamaged





3.4.5. Remove the latch screw and separate the Hanger halves.

3.4.6. Place two boards against the casing to support the Hanger.

3.4.7. Wrap the Hanger around the casing and replace the latch screw.

3.4.8. Remove the (4) slip retainer screws on the OD of the slip bowl. These screws hold the slips in retracted position. Slips will NOT set unless these screws are removed before Hanger is placed in the Spool.

3.4.9. Grease the Casing Hanger body.

Stage 3.0 — 5-1/2" Casing

3.4.10. Ensure all uppermost lockscrews of the MBS Spool are retracted from the bore.

⚠WARNING All Lockscrews *MUST* achieve positions as indicated. Otherwise contact Surface Engineering for guidance.

3.4.11. Remove the support boards and lower the Hanger into the Packoff, using a cat-line to center the casing, if necessary.

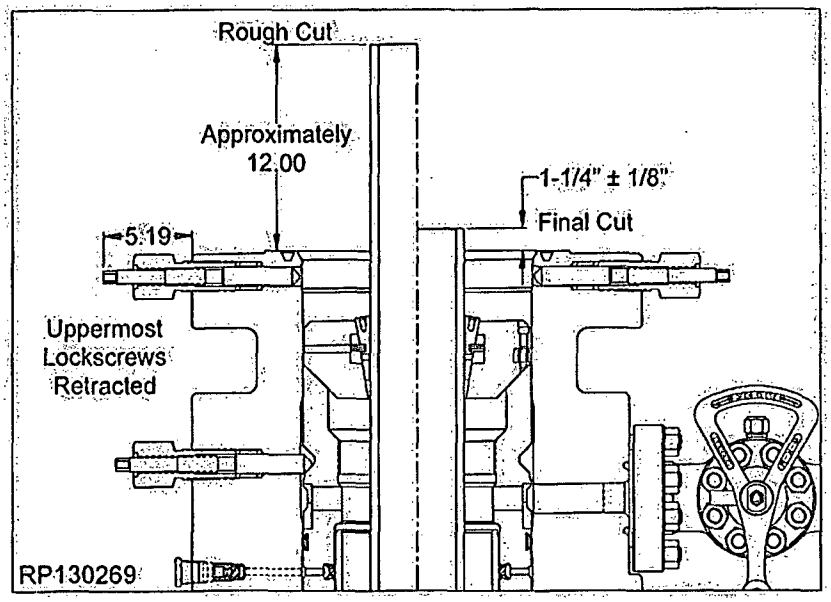
3.4.12. Pull tension on the casing to the desired hanging weight (no minimum weight is required).

3.4.13. Slack off on the casing. A sharp decrease on the weight indicator will signify that the Hanger has taken weight and is supporting the casing.

⚠WARNING Protect the MBS Spool bowl from casing cut debris

3.4.14. Rough cut the casing approximately 12" above the top of the MBS Spool and move the excess casing and BOP out of the way.

NOTE Always physically measure the bottom prep of the next component to be installed prior to making the final casing cut.



3.4.15. Final cut the casing at 1-1/4" ±1/8" above the top of the MBS Spool flange. Place a 3/8" x 3/16" bevel on the casing stub and remove all burrs and sharp edges.

NOTE There must not be any rough edges on the casing or the 'T' seal of the Packoff will be damaged

⚠WARNING The ID edge of the casing may be ground slightly to allow drill pipe and casing collars to pass smoothly.

⚠WARNING DO Not run in lockscrews. Do Not Fill the void above the hanger.

Stage 3.0 — 5-1/2" Casing

3.4.16. Examine the ***Emergency Packoff (Item B5).*** Verify the following:

- 'T' seal is properly installed, clean and undamaged
- Dovetail seal is properly installed, clean and undamaged
- bore is clean and free of debris

3.4.17. Wipe the ID of the 'T' Seal, OD of the Dovetail seal and OD of the casing stub with a light coat of oil or grease.

⚠WARNING Excessive oil or grease will prevent a positive seal from forming.

3.4.18. Ensure the spool bore is clean and free of debris.

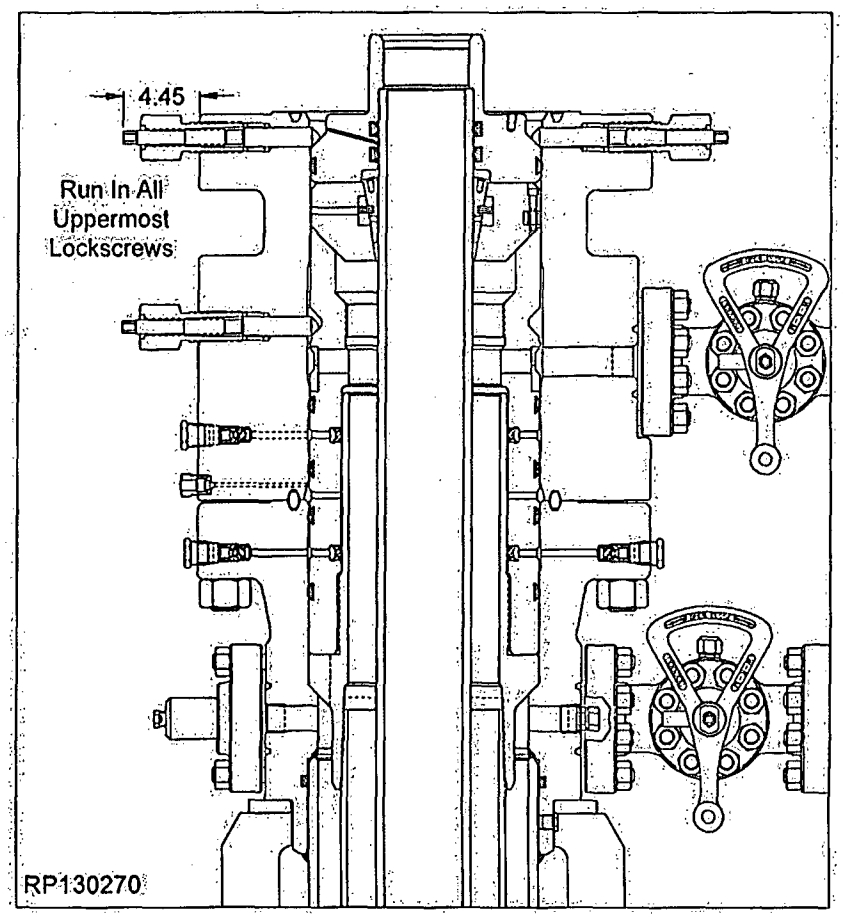
3.4.19. Lift and suspend the Packoff and carefully lower the packoff over the casing stub onto the Spool and land on top of the Casing Hanger.

⚠WARNING DO NOT damage the T seals or their sealing ability will be impaired!

3.4.20. Run in the uppermost lockscrews of the MBS Spool in an alternating cross fashion to the torque referenced in the chart in the back of this procedure.

3.4.21. Fill the void above the Packoff with clean oil to the top of the Spool.

⚠WARNING DO NOT overfill the void. Oil that becomes trapped under the ring gasket will prevent formation of a positive seal.



Stage 3.0 — 5-1/2" Casing

3.5 Install the Tubing Spool

3.5.1. Examine the ***Tubing Spool (Item C1)***. Verify the following:

- bore is clean and free of debris
- ***'NX' Bushing (Item C2)*** is installed, P seal is properly installed and undamaged.
- ring grooves and seal areas are clean and undamaged
- peripheral equipment is intact and undamaged
- ensure the lockscrews of the tubing spool are retracted from the bore as indicated

⚠WARNING All Lockscrews *MUST* achieve positions as indicated. Otherwise contact Surface Engineering for guidance.

3.5.2. Lubricate the ID of the P seal and the OD of the casing hanger/casing stub with light oil or grease.

NOTE Excessive oil or grease may prevent a positive seal from forming.

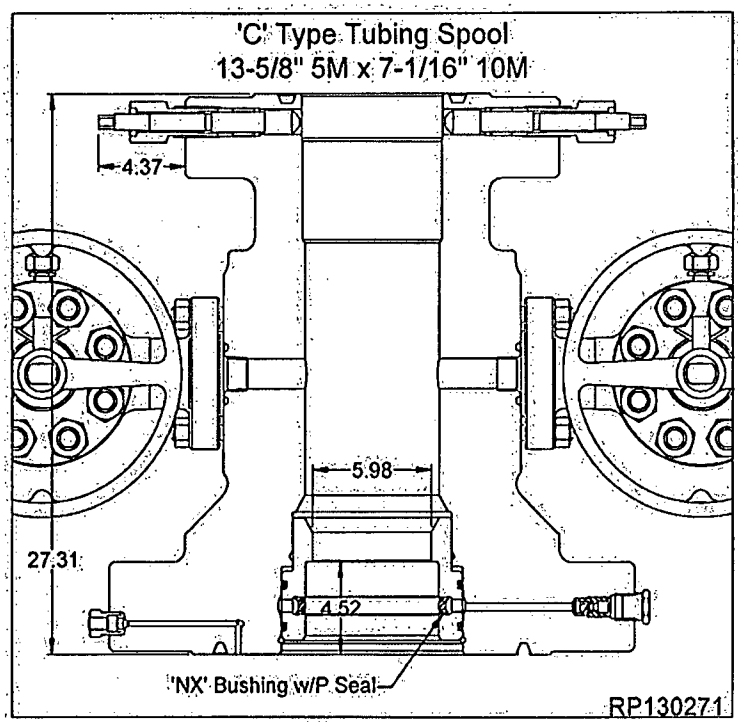
3.5.3. Install a new ***Ring Gasket BX-160*** into the ring groove of the MBS Spool Flange.

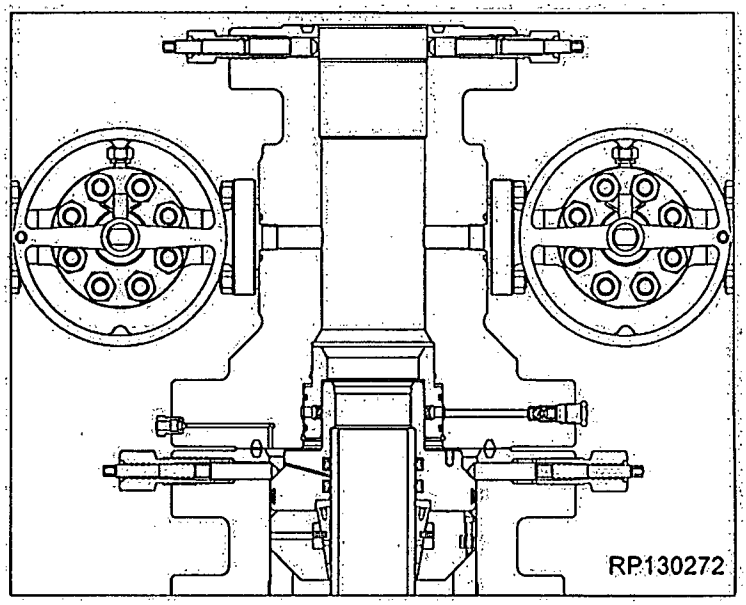
3.5.4. Lift and suspend the Tubing Spool over the Casing Packoff neck, ensuring it is level.

3.5.5. Orient the Tubing Spool outlets as required and carefully lower the Tubing Spool over the Casing Packoff neck until it lands on the ring gasket.

⚠WARNING Do Not damage the 'P' seal or its sealing ability will be impaired.

3.5.6. Make up the connection using the ***Studs and Nuts*** in an alternating cross fashion to the torque referenced in the chart in the back of this manual.





Stage 3.0 — 5-1/2" Casing

3.6 Energize the P Seal

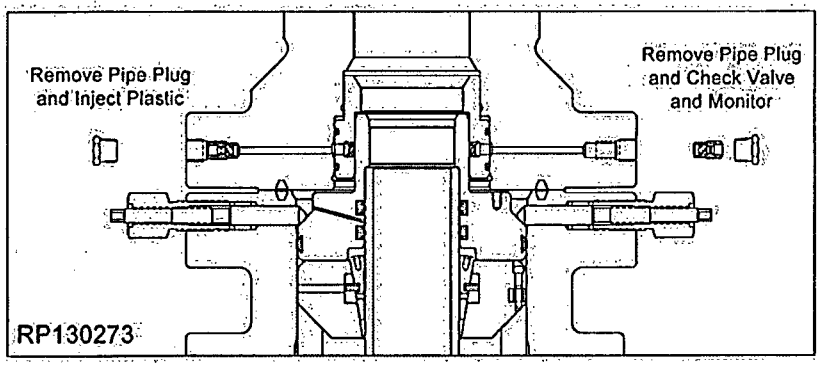
3.6.1. Locate the ports on the bottom flange of the Tubing Spool for injecting plastic packing into the P seal and remove the pipe plugs.

3.6.2. Remove the check valve from one port only.

3.6.3. Install a plastic pacing gun into the port which still contains the check valve and inject plastic until a continuous stream flows from the empty port.

3.6.4. Replace the check valve and pipe plug into the empty port and continue to inject plastic to *10,000 psi.*

NOTE *If emergency hanger was installed do not exceed 80% of casing collapse.*



3.6.5. Hold and monitor injection pressure until it has stabilized.

3.6.6. Once the injection pressure has stabilized, carefully bleed off injection pressure and remove injection gun.

3.6.7. Replace the pipe plug into the open port.

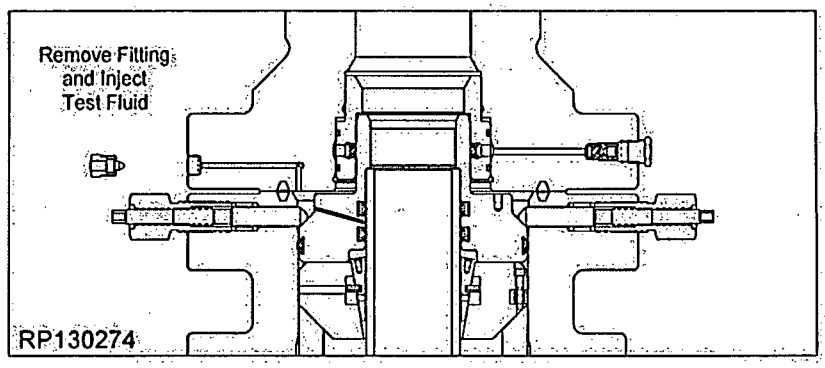
NOTE **For proper injection gun preparation, refer to the page in the back of this manual labeled "Injection Gun Preparation".**

3.7 Test the Connection

3.7.1. Locate the port on the bottom flange of the Tubing Spool for testing the connection and remove the fitting.

3.7.2. Install a test pump to the open port and inject test fluid to *5,000 psi maximum.*

NOTE *If emergency hanger was installed do not exceed 80% of casing collapse.*



3.7.3. Hold and monitor test pressure for fifteen minutes or as required by Drilling Supervisor.

3.7.4. Once a satisfactory test is achieved, carefully bleed off test pressure and remove the test pump.

3.7.5. Reinstall the fitting.

Recommended Procedure for Field Welding Pipe to Wellhead Parts for Pressure Seal

The following procedure is a direct extraction (except for the numeric footnote designators) from the Fourteenth Edition of API 6A[1]. Editorial footnotes have been added to provide additional information that may be of benefit when developing procedures for specific field welding applications. The recommended procedure and footnotes are for general information purposes and it should be mentioned that Cameron is not responsible for determining or administering any field welding practices. The organization performing the welding should qualify their welding procedure(s) and welder(s) in accordance with applicable codes and standards[2]. The success of any field weld should be verified by subsequent hydrostatic test at the direction of the customer.

B.1 Introduction and Scope. - The following recommended procedure has been prepared with particular regard to attaining pressure-tight welds when attaching casing heads, flanges, etc., to casing. Although most of the high strength casing used (such as P-110) is not normally considered field weldable, some success may be obtained by using the following or similar procedures[3].

⚠CAUTION In some wellheads, the seal weld is also a structural weld and can be subjected to high tensile stresses. Consideration must therefore be given by competent authority to the mechanical properties of the weld and its heat affected zone.

1. The steels used in wellhead parts and in casing are high strength steels that are susceptible to cracking when welded. It is imperative that the finished weld and adjacent metal be free from cracks. The heat from welding also affects the mechanical properties. This is especially serious if the weld is subjected to service tension stresses.
2. This procedure is offered only as a recommendation. The responsibility for welding lies with the user and results are largely governed by the welder's skill. Weldability of the several makes and grades of casing varies widely, thus placing added responsibility on the welder. Transporting a qualified welder to the job, rather than using a less-skilled man who may be at hand, will, in most cases, prove economical. The responsible operating representative should ascertain the welder's qualifications and if necessary, assure himself by instruction or demonstration, that the welder is able to perform the work satisfactorily.

B.2 Welding conditions. - Unfavorable welding conditions must be avoided or minimized in every way possible, as even the most skilled welder cannot successfully weld steels that are susceptible to cracking under adverse working conditions, or when the work is rushed. Work above the welder on the drilling floor should be avoided. The weld should be protected from dripping mud, water, and oil and from wind, rain, or other adverse weather conditions. The drilling mud, water, or other fluids must be lowered in the casing and kept at a low level until the weld has properly cooled. It is the responsibility of the user to provide supervision that will assure favorable working conditions, adequate time, and the necessary cooperation of the rig personnel.

B.3 Welding. - The welding should be done by the shielded metal-arc[4] or other approved process.

B.4 Filler Metal. - After the root pass, low hydrogen electrodes or filler wires of a yield strength equal to the casing yield strength should be used[5]. The low hydrogen electrodes include classes EXX15, EXX16, EXX18, EXX28 of AWS A5.1 (latest edition): *Mild Steel Covered Arc-Welding Electrodes*[4] and AWS A5.5 (latest edition): *Low Alloy Steel Covered Arc-Welding Electrodes*[4]. Low hydrogen electrodes should not be exposed to the atmosphere until ready for use. Electrodes exposed to atmosphere should be dried 1 to 2 hours at 500 to 600°F *(260 to 316°C)* just before use[6].

[4]Available from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pa. 19103.

B.5 Preparation of Base Metal. - The area to be welded should be dry and free of any paint, grease, scale, rust or dirt.

B.6 Preheating. - Both the casing and the wellhead member should be preheated to 250-400°F *(121 to 204°C)* for a distance of at least 3 inches *(76.2 mm)* on either side of the weld location, using a suitable preheating torch. Before applying preheat, the fluid should be bailed out of the casing to a point several inches *(mm)* below the weld location. The preheat temperature should be checked by the use of heat sensitive crayons. Special attention must be given to preheating the thick sections of wellhead parts to be welded, to insure uniform heating and expansion with respect to the relatively thin casing[7].

NOTE Preheating may have to modified because of the effect of temperature on adjacent packing elements which may be damaged by exposure to temperatures 200°F *(93°C)* and higher. Temperature limitations of the packing materials should be determined before the application of preheat.

⚠WARNING If Casing Head is designed with an internal o-ring bottom prep and the internal o-ring is installed, ensure the o-ring preheat temperature does not exceed 300°F.

Recommended Procedure for Field Welding Pipe to Wellhead Parts for Pressure Seal

B7. Welding technique. - Use a 1/8 or 5/32 inch *(3.2 or 4.0 mm)* E6010 electrode[8] and step weld the first bead (root pass); that is, weld approximately 2 to 4 inches *(50 to 100 mm)* and then move diametrically opposite this point and weld 2 to 4 inches (50 to 100 mm). Then weld 2 to 4 inches *(50 to 100 mm)* halfway between the first two welds, move diametrically opposite this weld, and so on until the first pass is completed. The second pass should be made with a 5/32 *(4.0 mm)* low hydrogen electrode of the proper strength and may be continuous. The balance of the welding groove may then be filled with continuous passes without back stepping or lacing, using a 3/16-inch *(4.8 mm)* low hydrogen electrode. All beads should be stringer beads with good penetration, and each bead after the root pass should be thoroughly peened before applying the next bead. There should be no undercutting and welds shall be workmanlike in appearance.

NOTE *E7018 RODS HAVE BEEN SUCCESSFULLY USED FOR ROOT PASS.*

1. Test ports should be open when welding is per formed to prevent pressure build-up within the test cavity.
2. During welding the temperature of the base metal on either side of the weld should be maintained at 250°F *(121°C)* minimum.
3. Care should be taken to insure that the welding cable is properly grounded to the casing, but ground wire should not be welded to the casing or the wellhead. Ground wire should be firmly clamped to the casing, the wellhead, or fixed in position between pipe slips. Bad contact may cause sparking, with resultant hard spots beneath which incipient cracks may develop. The welding cable should not be grounded to the steel derrick, nor to the rotary-table base.

B.8 Cleaning. - All slag or flux remaining on any welding bead should be removed before laying the next bead. This also applies to the completed weld.

B.9 Defects. - Any cracks or blow holes that appear on any bead should be removed to sound metal by chipping or grinding before depositing the next bead.

B.10 Postheating. - For the removal of all brittle areas on high strength steel casing, a post heat temperature of 1050-1100°F *(566 to 593°C)*[9] is desirable. It is recognized, however, that this temperature is difficult or impossible to obtain in the field, and that the mechanical properties of the wellhead parts and the pipe may be considerably reduced by these temperatures. As a practical matter, the temperature range of 500-900°F *(260 to 482°C)* has been used with satisfactory results.

B.11 Cooling. - Rapid cooling must be avoided. To assure slow cooling, welds should be protected from extreme weather conditions (cold, rain, high winds, etc.) By the use of a blanket of asbestos[10] or other suitable insulating material. Particular attention should be given to maintaining uniform cooling of the thick sections of the wellhead parts and the relatively thin casing, as the relatively thin casing will pull away from the head or hanger if allowed to cool more rapidly. The welds should cool in air to 250°F *(121°C)* (measured with a heat sensitive crayon) prior to permitting the mud to rise in the casing.

NOTE **The above procedure is presented for the convenience of our customers. Please Contact Cameron's Land Wellhead engineering Group in Houston, Texas if any additional assistance is required.**

Recommended Procedure for Field Welding Pipe to Wellhead Parts for Pressure Seal

[1]API SPECIFICATION 6A - Fourteenth Edition, March 1983, Appendix B, Page 109

[2]ASME Section IX is one such code that provides guidelines for the qualification of welding procedures and welders. It specifically assigns the responsibility of qualification of welding procedures and welders to the organization with "responsible operational control" over the production welding.

[3]Many of the high strength casing grades are weldable but weldability will vary from one casing manufacturer to another even within a given casing grade. The weldability of any base metal is determined largely by its chemical composition. Casing materials, even within a given grade vary widely in their chemical makeup. This necessitates the qualification of welding procedures, not just for a particular grade but also for each different chemical makeup. When qualifying welding procedures intended for field application, it is recommended that field welding conditions be simulated as much as is possible. It is very important that the welding parameters and techniques qualified are duplicated in the field.

[4]American Welding Society designation SMAW (Shielded Metal Arc Welding), commonly referred to as "stick welding."

[5]Finding filler metals that will match the strength of the high strength casings will be very difficult if not impossible to do. For instance, E12018M is the highest strength electrode classified by AWS A5.5. It has a minimum specified yield strength of 108 ksi. That does not meet the minimum specified yield strength for P-110 or Q-125 casing. When joining carbon and low alloy materials of different strengths, it is standard practice to use a carbon steel or low alloy filler metal that will match, as a minimum, the strength of the weaker of the two materials being joined. When dealing with the high strength casings such as N-80, P-110 and Q-125, the material to which any one of these is to be joined will probably be the weaker of the two. In such cases, filler metals should be selected based on the minimum specified strength of the weaker material. It is the responsibility of the user to specify the size of weld required based on anticipated loads and strength of weld metal being used.

[6]The reason for maintaining low moisture in the electrodes is to minimize the amount of hydrogen that is liberated at the arc during welding. When welding high strength low alloy steels, hydrogen can promote delayed cold cracking in hardened weld metals and heat affected zones. One of the ways to reduce the chance of cold cracking is to minimize the hydrogen potential of the electrodes through moisture control.

[7]Internal preheaters for preheating the casing and wellhead member from the inside are available from Cameron and are highly recommended.

[8]E6010 electrodes contain high levels of moisture in their coating. Hydrogen which is liberated from moisture under the intense heat of the electric arc, migrates into the weld metal and heat affected zone and can promote hydrogen induced cold cracking as the weld cools down. For this reason, some companies elect not to use E6010 electrodes for the first pass, even though there are benefits from the standpoint of operator appeal and penetration. If they are used, precautions must be taken to get rid of the diffusible hydrogen before the weld cools from preheating temperatures. Given enough time at elevated temperatures, the hydrogen will diffuse out of the metal. The rate of diffusion is time and temperature dependant. Therefore, the diffusion process can be promoted through the use of high preheats, post weld stress relief, post weld soaks at or above preheat temperatures and slow cooling.

NOTE *E7018 RODS HAVE BEEN SUCCESSFULLY USED FOR ROOT PASS.*

[9]Low alloy welds that are required to meet NACE MR0175 specification must be stress relieved at 1150°F *(621°C)* minimum.

[10]For health reasons, Cameron strongly recommends against the use of asbestos insulating blankets . There are many good non-asbestos materials that can be used as an acceptable substitute.

Torque Chart

Recommended Makeup Torques for Flange Bolting Ft·Lbf Per API 6A: preload = .50Sy				
Bolt Size, Nom OD - TPI	B7M, L7M (Sy=80 ksi)		B7, L7, 660 (Sy=105 ksi)	
	cf=0.07	cf=0.13	cf=0.07	cf=0.13
.500-13	27	45	35	59
.625-11	52	88	68	115
.750-10	90	153	118	200
.875-9	143	243	188	319
1.000-8	213	361	279	474
1.125-8	305	523	401	686
1.250-8	421	726	553	953
1.375-8	563	976	739	1280
1.500-8	733	1280	962	1680
1.625-8	934	1640	1230	2150
1.750-8	1170	2050	1530	2700
1.875-8	1440	2540	1890	3330
2.000-8	1750	3090	2300	4060
2.250-8	2500	4440	3280	5820
2.500-8	3430	6120	4500	8030
2.625-8	3970	7100	4720	8430
2.750-8	4570	8180	5420	9700
3.000-8	5930	10700	7050	12700
3.250-8	7550	13600	8970	16100
3.500-8	9430	17000	11200	20200
3.750-8	11600	21000	13800	24900
3.875-8	12800	23200	15200	27500
4.000-8	14100	25500	16700	30300

NOTE

- The information in this table is based on API-6A's recommended torque for a given bolt size. The information is presented for the convenience of the user and is based on assumptions of certain coefficients of friction (cf). The coefficients of friction are based on approximations of the friction between the studs and nuts, as well as the nuts and flange face. A coefficient friction of 0.13 assumes the threads and nut bearing surfaces are bare metal and are well lubricated with thread compound. A coefficient of friction of 0.07 assumes the thread and nuts are coated with a fluoropolymer material.

- Lubrication

  It is essential that threads and nut faces be well lubricated with an appropriate grease prior to assembly. Cameron clamps and fast clamps require lubrication on the hub-clamp contact area. Acceptable lubricants include thread joint compounds which meet the formulation, evaluation and testing requirements specified in API Recommended Practice 5A3/ISO13678. (Reference - Jet Lube Grease, 1 lb can PN: 2737980-02).

  Studs and nuts coated with Xylan/PTFE compound in accordance with a Cameron procedure do not require lubrication. However, a light coat of API Recommended Practice 5A3/ISO13678 thread compound is recommended for Xyland-coated bolting as an aid to assembly.

  Material gaskets should be lightly coated with lubricant prior to assembly. Acceptable lubricants include motor oil or Cameron gate valve greases.

IC Test Plug Load Chart

IC Test Plug Maximum Load							
Bowl		Maximum Hanging Load (In 1000s lbs) at Test Pressure					
Size	Pressure	0 psi	2,000 psi	3,000 psi	5,000 psi	10,000 psi	15,000 psi
7-1/16"	2,000 to 5,000 psi	213	135	96	19	N/A	N/A
	10,000 psi	253	175	136	59	0	N/A
	15,000 psi	477	399	360	282	88	0
9"	2,000 to 10,000 psi	600	479	419	299	0	N/A
	15,000 psi	751	630	570	450	149	0
11"	2,000 to 10,000 psi	1277	1091	998	812	348	N/A
	15,000 psi	1596	1410	1317	1131	667	202
13-5/8"	2,000 to 10,000 psi	1713	1426	1283	997	281	N/A
	15,000 psi	2142	1855	1712	1426	710	5
16-3/4"	2,000 to 5,000 psi	3076	2641	2424	1990	N/A	N/A
20"	2,000 to 5,000 psi	2733	2096	1778	1142	N/A	N/A

Minimum Casing Load Chart for IC Type Hangers

Minimum Casing Load for IC-2 & IC-6 Casing Hangers		
Hanger Nominal Size	Casing Size	Load (Pounds)
11"	4-1/2"	78,000
	5"	74,000
	5-1/2"	70,000
	6-5/8"	59,000
	7"	55,000
	7-5/8"	48,000
13-5/8"	5-1/2"	120,000
	7"	106,000
	7-5/8"	99,000
	8-5/8"	86,000
	9-5/8"	72,000
	10-3/4"	54,000

Minimum Casing Load for IC-2 & IC-6 Casing Hangers		
Hanger Nominal Size	Casing Size	Load (Pounds)
16-3/4"	9-5/8"	146,000
	10-3/4"	128,000
	11-3/4"	110,000
	11-7/8"	109,000
	13-3/8"	79,000
20-3/4" 21-1/4"	10-3/4"	228,000
	13-3/8"	180,000
	13-5/8"	175,000
	16"	120,000

'N' Style Lockscrew Charts

Operational Sequence

1. Ensure the well is safe and under control and the area of the lockscrew is free of pressure.
2. Loosen the Gland Nut only minimum amount.

CAUTION **Well bore pressure may exist inboard of lock screw packing. Therefore, it is imperative to only relieve the gland the minimum amount required to permit rotation of the locksrew for prevention pressure release escape of well bore.**

3. Retighten the Gland Nut to approximately 50 ft/lbs
4. Run in and tighten all lockscrews in an alternating cross manner to the required torque listed in the *Lockscrew torque charts.*
5. Retighten the packing gland to the required torque listed in the *Recommended Gland Nut Torque for 'N' Style Lockscrew chart.*

Recommended Gland Nut Torque for N style Lockscrews	
Pressure Rating	Required Torque
2,000 psi	400 to 500 ft lbs
3,000 psi	400 to 500 ft lbs
5,000 psi	500 to 600 ft lbs
10,000 psi	600 to 700 ft lbs
15,000 psi	800 to 1000 ft lbs
20,000 psi	1000 to 1300 ft lbs

N Style Lockscrew Torque Values for Elastomer Hangers			
Flange Size	Pressure Rating (psi)	Recommended Torque Value Ft-Lbs (N.M.)	Maximum Torque Value Ft-Lbs (N.M.)
4-1/16"	10,000	150 (200)	300 (400)
	15,000		
7-1/16"	2000	150 (200)	250 (340)
	3000		
	5000		
	10,000		450 (610)
	15,000		
	20,000		550 (750)
9"	2000	200 (270)	300 (400)
	3000		
	5000	175 (240)	450 (610)
	10,000	150 (200)	
	15,000		550 (750)
	20,000		1350 (1830)
11"	2000	200 (270)	300 (400)
	3000		
	5000	175 (240)	450 (610)
	10,000	150 (200)	
	15,000		
	20,000		1350 (1830)

X-2708-12-01 Rev01

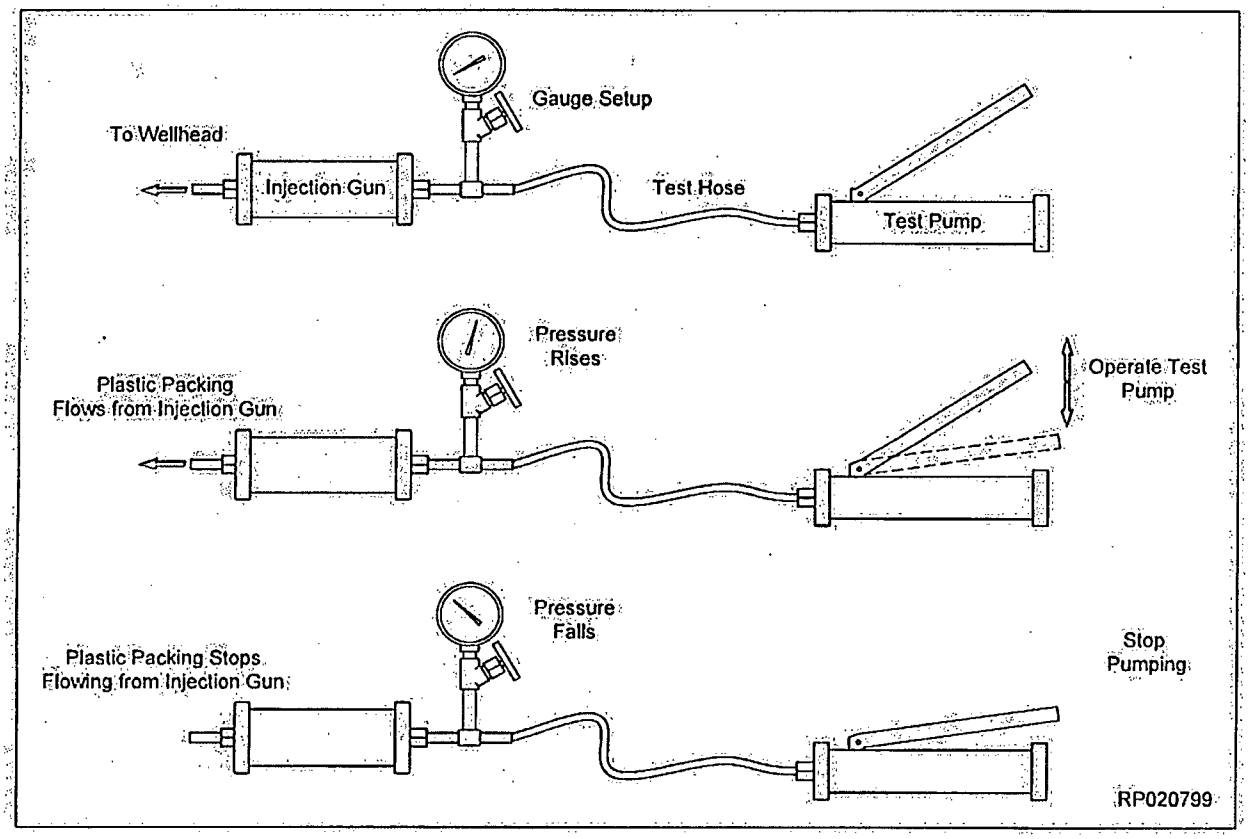
Injection Gun Preparation

1. Maintaining the Injection Gun at ambient temperatures, prepare Test Pump and Injection Gun for injecting P seals.
2. Operate Test Pump to inject fluid into Injection gun.
3. Monitor open end of Injection Gun for signs of plastic packing.
4. After plastic packing begins to flow from open end of Injection Gun continue to inject fluid from Test Pump increasing pressure an additional 200 to 400 psi.
5. Stop pumping Test Pump and monitor plastic packing movement and pressure on the pressure gauge.
6. Once packing has stopped flowing and the pressure gauge has stabilized observe the reading on gauge and record the pressure.

NOTE The pressure recorded will become "0". This is the pressure required to move the plastic packing and is not included in the actual injection pressure.

EXAMPLE If the plastic packing begins to flow at 900 psi and the fluid pressure from the Test Pump is increased to 1200 psi, after allowing the pressure to fall the plastic packing and needle on the pressure gauge cease to move at 850 psi, then 850 psi becomes "0". If the flange rating is 5000 psi and 80% of casing collapse exceeds 5000 psi then the final gauge reading when the P seal is fully energized will be 5850 psi.

NOTE The amount of pressure required to force plastic packing to flow from the Injection Gun is dependent on several factors including outside temperature and the plastic injection gun itself. The example given above is for illustration purposes only.



Review History

Review History			
Description	Prepared by:	Released by:	Date Released:
Initial Release per ZS 301267343 Houston Surface Systems Engineering	E. Nguyen	Dennis Nguyen	January 28, 2013

PECOS DISTRICT
CONDITIONS OF APPROVAL

OPERATOR'S NAME:	Legend Natural Gas III Limited Partnership
LEASE NO.:	NM110829
WELL NAME & NO.:	5H-Pardue 29 Federal Com
SURFACE HOLE FOOTAGE:	45'/N & 1320'/W
BOTTOM HOLE FOOTAGE	330'/S & 1510'/W
LOCATION:	Section 29, T.24 S., R. 28 E., NMPM
COUNTY:	Eddy County, New Mexico

TABLE OF CONTENTS

Standard Conditions of Approval (COA) apply to this APD. If any deviations to these standards exist or special COAs are required, the section with the deviation or requirement will be checked below.

I. GENERAL PROVISIONS

The approval of the Application For Permit To Drill (APD) is in compliance with all applicable laws and regulations: 43 Code of Federal Regulations 3160, the lease terms, Onshore Oil and Gas Orders, Notices To Lessees, New Mexico Oil Conservation Division (NMOCD) Rules, National Historical Preservation Act As Amended, and instructions and orders of the Authorized Officer. Any request for a variance shall be submitted to the Authorized Officer on Form 3160-5, Sundry Notices and Report on Wells.

II. PERMIT EXPIRATION

If the permit terminates prior to drilling and drilling cannot be commenced within 60 days after expiration, an operator is required to submit Form 3160-5, Sundry Notices and Reports on Wells, requesting surface reclamation requirements for any surface disturbance. However, if the operator will be able to initiate drilling within 60 days after the expiration of the permit, the operator must have set the conductor pipe in order to allow for an extension of 60 days beyond the expiration date of the APD. (Filing of a Sundry Notice is required for this 60 day extension.)

III. ARCHAEOLOGICAL, PALEONTOLOGY & HISTORICAL SITES

Any cultural and/or paleontological resource discovered by the operator or by any person working on the operator's behalf shall immediately report such findings to the Authorized Officer. The operator is fully accountable for the actions of their contractors and subcontractors. The operator shall suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the Authorized Officer. An evaluation of the discovery shall be made by the Authorized Officer to determine the appropriate actions that shall be required to prevent the loss of significant cultural or scientific values of the discovery. The operator shall be held responsible for the cost of the proper mitigation measures that the Authorized Officer assesses after consultation with the operator on the evaluation and decisions of the discovery. Any unauthorized collection or disturbance of cultural or paleontological resources may result in a shutdown order by the Authorized Officer.

IV. NOXIOUS WEEDS

The operator shall be held responsible if noxious weeds become established within the areas of operations. Weed control shall be required on the disturbed land where noxious weeds exist, which includes the roads, pads, associated pipeline corridor, and adjacent land affected by the establishment of weeds due to this action. The operator shall consult with the Authorized Officer for acceptable weed control methods, which include following EPA and BLM requirements and policies.

V. SPECIAL REQUIREMENT(S)

Cave and Karst

** Depending on location, additional Drilling, Casing, and Cementing procedures may be required by engineering to protect critical karst groundwater recharge areas.

Cave/Karst Surface Mitigation

The following stipulations will be applied to minimize impacts during construction, drilling and production.

Construction:
In the advent that any underground voids are opened up during construction activities, construction activities will be halted and the BLM will be notified immediately.

No Blasting:
No blasting will be utilized for pad construction. The pad will be constructed and leveled by adding the necessary fill and caliche.

Pad Berming:
The entire perimeter of the well pad will be bermed to prevent oil, salt, and other chemical contaminants from leaving the well pad.

- The compacted berm shall be constructed at a minimum of 12 inches high with impermeable mineral material (e.g. caliche).
- No water flow from the uphill side(s) of the pad shall be allowed to enter the well pad.
- The topsoil stockpile shall be located outside the bermed well pad.
- Topsoil, either from the well pad or surrounding area, shall not be used to construct the berm.
- No storm drains, tubing or openings shall be placed in the berm.
- If fluid collects within the bermed area, the fluid must be vacuumed into a safe container and disposed of properly at a state approved facility.
- The integrity of the berm shall be maintained around the surfaced pad throughout the life of the well and around the downsized pad after interim reclamation has been completed.
- Any access road entering the well pad shall be constructed so that the integrity of the berm height surrounding the well pad is not compromised. (Any access road crossing the berm cannot be lower than the berm height.)

Tank Battery Liners and Berms:
Tank battery locations will be lined and bermed. A 20 mil permanent liner will be installed with a 4 oz. felt backing to prevent tears or punctures. Tank battery berms must be large enough to contain 1 ½ times the content of the largest tank.

Leak Detection System:
A method of detecting leaks is required. The method could incorporate gauges to measure loss, situating values and lines so they can be visually inspected, or installing electronic sensors to alarm when a leak is present. Leak detection plan will be submitted to BLM for approval.

Automatic Shut-off Systems:
Automatic shut off, check values, or similar systems will be installed for pipelines and tanks to minimize the effects of catastrophic line failures used in production or drilling.

Cave/Karst Subsurface Mitigation

The following stipulations will be applied to protect cave/karst and ground water concerns:

Rotary Drilling with Fresh Water:
Fresh water will be used as a circulating medium in zones where caves or karst features are expected. SEE ALSO: Drilling COAs for this well.

Directional Drilling:
Kick off for directional drilling will occur at least 100 feet below the bottom of the cave occurrence zone. SEE ALSO: Drilling COAs for this well.

Lost Circulation:
ALL lost circulation zones from the surface to the base of the cave occurrence zone will be logged and reported in the drilling report.

Regardless of the type of drilling machinery used, if a void of four feet or more and circulation losses greater than 70 percent occur simultaneously while drilling in any cave-bearing zone, the BLM will be notified immediately by the operator. The BLM will assess the situation and work with the operator on corrective actions to resolve the problem.

Abandonment Cementing:
Upon well abandonment in high cave karst areas additional plugging conditions of approval may be required. The BLM will assess the situation and work with the operator to ensure proper plugging of the wellbore.

Pressure Testing:
Annual pressure monitoring will be performed by the operator on all casing annuli and reported in a sundry notice. If the test results indicated a casing failure has occurred, remedial action will be undertaken to correct the problem to the BLM's approval.

Drilling:

Communitization Agreement

A Communitization Agreement covering the acreage dedicated to this well must be filed for approval with the BLM. The effective date of the agreement shall be prior to any sales. In addition, the well sign shall include the surface and bottom hole lease numbers. If the Communitization Agreement number is known, it shall also be on the sign. If not, it shall be placed on the sign when the sign is replaced.

VI. CONSTRUCTION

A. NOTIFICATION

The BLM shall administer compliance and monitor construction of the access road and well pad. Notify the Carlsbad Field Office at (575) 234-5909 at least 3 working days prior to commencing construction of the access road and/or well pad.

When construction operations are being conducted on this well, the operator shall have the approved APD and Conditions of Approval (COA) on the well site and they shall be made available upon request by the Authorized Officer.

B. TOPSOIL

The operator shall strip the top portion of the soil (root zone) from the entire well pad area and stockpile the topsoil along the edge of the well pad as depicted in the APD. The root zone is typically six (6) inches in depth. All the stockpiled topsoil will be redistributed over the interim reclamation areas. Topsoil shall not be used for berming the pad or facilities. For final reclamation, the topsoil shall be spread over the entire pad area for seeding preparation.

Other subsoil (below six inches) stockpiles must be completely segregated from the topsoil stockpile. Large rocks or subsoil clods (not evident in the surrounding terrain) must be buried within the approved area for interim and final reclamation.

C. CLOSED LOOP SYSTEM

Tanks are required for drilling operations: No Pits.

The operator shall properly dispose of drilling contents at an authorized disposal site.

D. FEDERAL MINERAL MATERIALS PIT

Payment shall be made to the BLM prior to removal of any federal mineral materials. Call the Carlsbad Field Office at (575) 234-5972.

E. WELL PAD SURFACING

Surfacing of the well pad is not required.

If the operator elects to surface the well pad, the surfacing material may be required to be removed at the time of reclamation.The well pad shall be constructed in a manner which creates the smallest possible surface disturbance, consistent with safety and operational needs.

F. EXCLOSURE FENCING (CELLARS & PITS)

Exclosure Fencing
The operator will install and maintain exclosure fencing for all open well cellars to prevent access to public, livestock, and large forms of wildlife before and after drilling operations until the pit is free of fluids and the operator initiates backfilling. (For examples of exclosure fencing design, refer to BLM's Oil and Gas Gold Book, Exclosure Fence Illustrations, Figure 1, Page 18.)

G. ON LEASE ACCESS ROADS

Road Width
The access road shall have a driving surface that creates the smallest possible surface disturbance and does not exceed fourteen (14) feet in width. The maximum width of surface disturbance, when constructing the access road, shall not exceed twenty-five (25) feet.

Surfacing
Surfacing material is not required on the new access road driving surface. If the operator elects to surface the new access road or pad, the surfacing material may be required to be removed at the time of reclamation.

Where possible, no improvements should be made on the unsurfaced access road other than to remove vegetation as necessary, road irregularities, safety issues, or to fill low areas that may sustain standing water.

The Authorized Officer reserves the right to require surfacing of any portion of the access road at any time deemed necessary. Surfacing may be required in the event the road deteriorates, erodes, road traffic increases, or it is determined to be beneficial for future field development. The surfacing depth and type of material will be determined at the time of notification.

Crowning
Crowning shall be done on the access road driving surface. The road crown shall have a grade of approximately 2% (i.e., a 1" crown on a 14' wide road). The road shall conform to Figure 1; cross section and plans for typical road construction.

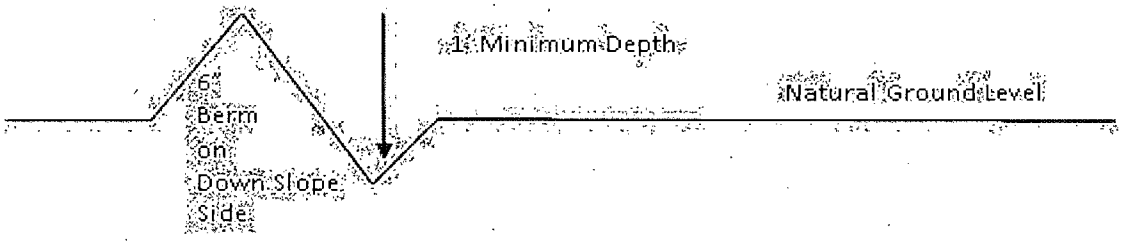
Ditching
Ditching shall be required on both sides of the road.

Turnouts
Vehicle turnouts shall be constructed on the road. Turnouts shall be intervisible with interval spacing distance less than 1000 feet. Turnouts shall conform to Figure 1; cross section and plans for typical road construction.

Drainage
Drainage control systems shall be constructed on the entire length of road (e.g. ditches, sidehill outsloping and insloping, lead-off ditches, culvert installation, and low water crossings).

A typical lead-off ditch has a minimum depth of 1 foot below and a berm of 6 inches above natural ground level. The berm shall be on the down-slope side of the lead-off ditch.

Cross Section of a Typical Lead-off Ditch



All lead-off ditches shall be graded to drain water with a 1 percent minimum to 3 percent maximum ditch slope. The spacing interval are variable for lead-off ditches and shall be determined according to the formula for spacing intervals of lead-off ditches, but may be amended depending upon existing soil types and centerline road slope (in %);

Formula for Spacing Interval of Lead-off Ditches

Example - On a 4% road slope that is 400 feet long, the water flow shall drain water into a lead-off ditch. Spacing interval shall be determined by the following formula:

400 foot road with 4% road slope: $\frac{400'}{4\%} + 100' = 200'$ lead-off ditch interval

Cattleguards
An appropriately sized cattleguard sufficient to carry out the project shall be installed and maintained at fence/road crossings. Any existing cattleguards on the access road route shall be repaired or replaced if they are damaged or have deteriorated beyond practical use. The operator shall be responsible for the condition of the existing cattleguards that are in place and are utilized during lease operations.

Fence Requirement
Where entry is granted across a fence line, the fence shall be braced and tied off on both sides of the passageway prior to cutting. The operator shall notify the private surface landowner or the grazing allotment holder prior to crossing any fences.

Public Access

Public access on this road shall not be restricted by the operator without specific written approval granted by the Authorized Officer.

Construction Steps

1. Salvage topsoil
2. Construct road
3. Redistribute topsoil
4. Revegetate slopes

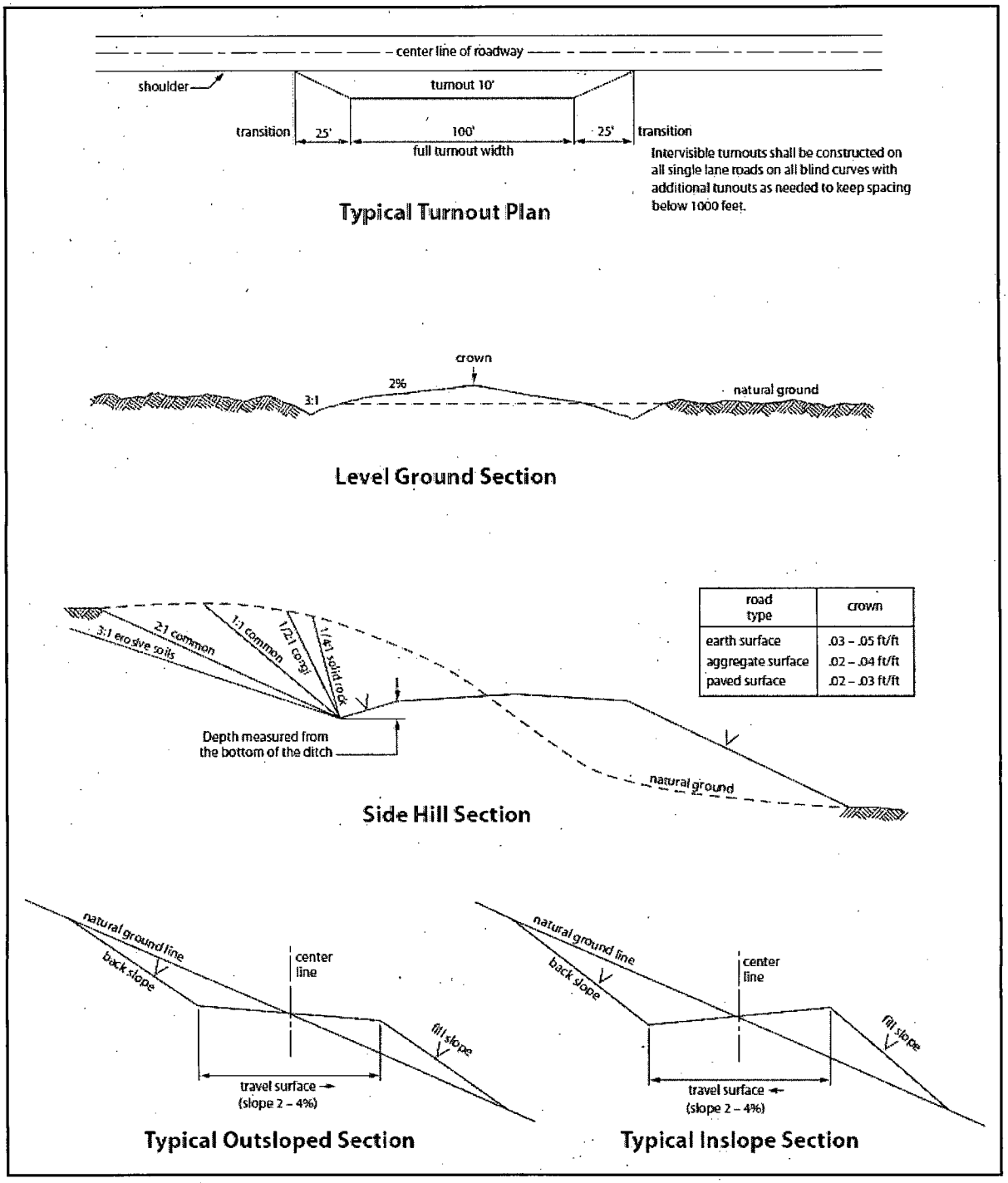


Figure 1. Cross-sections and plans for typical road sections representative of BLM resource or FS local and higher-class roads.

VII. DRILLING

A. DRILLING OPERATIONS REQUIREMENTS

The BLM is to be notified in advance for a representative to witness:

a. Spudding well (minimum of 24 hours)
b. Setting and/or Cementing of all casing strings (minimum of 4 hours)
c. BOPE tests (minimum of 4 hours)

☒ **Eddy County**
Call the Carlsbad Field Office, 620 East Greene St., Carlsbad, NM 88220, (575) 361-2822

1. **Although Hydrogen Sulfide has not been reported in the area, it is always a potential hazard. If Hydrogen Sulfide is encountered, report measured amounts and formations to the BLM. Operator has stated that they will have monitoring equipment in place prior to drilling out of the surface shoe.**

2. Unless the production casing has been run and cemented or the well has been properly plugged, the drilling rig shall not be removed from over the hole without prior approval. **If the drilling rig is removed without approval – an Incident of Non-Compliance will be written and will be a "Major" violation.**

3. Floor controls are required for 3M or Greater systems. These controls will be on the rig floor, unobstructed, readily accessible to the driller and will be operational at all times during drilling and/or completion activities. Rig floor is defined as the area immediately around the rotary table; the area immediately above the substructure on which the draw works is located, this does not include the dog house or stairway area.

4. **The record of the drilling rate along with the GR/N well log run from TD to surface (horizontal well – vertical portion of hole) shall be submitted to the BLM office as well as all other logs run on the borehole 30 days from completion. If available, a digital copy of the logs is to be submitted in addition to the paper copies. The Rustler top and top and bottom of Salt are to be recorded on the Completion Report.**

B. CASING

Changes to the approved APD casing program need prior approval if the items substituted are of lesser grade or different casing size or are Non-API. The Operator can exchange the components of the proposal with that of superior strength (i.e. changing from J-55 to N-80, or from 36# to 40#). Changes to the approved cement program need prior approval if the altered cement plan has less volume or strength or if the changes are substantial (i.e. Multistage tool, ECP, etc.).

The initial wellhead installed on the well will remain on the well with spools used as needed

Centralizers required on surface casing per Onshore Order 2.III.B.1.f.

Wait on cement (WOC) time prior to drilling out for a primary cement job will be a minimum 18 hours for a water basin, 24 hours in the potash area, or 500 pounds compressive strength, whichever is greater for all casing strings. DURING THIS WOC TIME, NO DRILL PIPE, ETC. SHALL BE RUN IN THE HOLE. Provide compressive strengths including hours to reach required 500 pounds compressive strength prior to cementing each casing string. IF OPERATOR DOES NOT HAVE THE WELL SPECIFIC CEMENT DETAILS ONSITE PRIOR TO PUMPING THE CEMENT FOR EACH CASING STRING, THE WOC WILL BE 30 HOURS. See individual casing strings for details regarding lead cement slurry requirements.

No pea gravel permitted for remedial or fall back remedial without prior authorization from the BLM engineer.

Possibility of water flows in the Salado and Castile.
Possibility of lost circulation in the Rustler, Salado, and Delaware.

A MINIMUM OF TWO CASING STRINGS CEMENTED TO SURFACE IS REQUIRED IN HIGH CAVE/KARST AREAS. THE CEMENT MUST BE IN A SOLID SHEATH. THEREFORE, ONE INCH OPERATIONS ARE NOT SUFFICIENT TO PROTECT CAVE KARST RESOURCES. A CASING DESIGN THAT HAS A ONE INCH JOB PERFORMED DOES NOT COUNT AS A SOLID SHEATH.

1. The **11-3/4** inch surface casing shall be set at approximately **200 feet** (a minimum of 25 feet into the Rustler Anhydrite and above the salt) and cemented to the surface. **If salt is encountered, set casing at least 25 feet above the salt.**

    a. If cement does not circulate to the surface, the appropriate BLM office shall be notified and a temperature survey utilizing an electronic type temperature survey with surface log readout will be used or a cement bond log shall be run to verify the top of the cement. Temperature survey will be run a minimum of six hours after pumping cement and ideally between 8-10 hours after completing the cement job.

    b. Wait on cement (WOC) time for a primary cement job is to include the lead cement slurry.

    c. Wait on cement (WOC) time for a remedial job will be a minimum of 4 hours after bringing cement to surface or 500 pounds compressive strength, whichever is greater.

d. If cement falls back, remedial cementing will be done prior to drilling out that string.

Formation below the 11-3/4" shoe to be tested according to Onshore Order 2.III.B.1.i. Test to be done as a mud equivalency test using the mud weight necessary for the pore pressure of the formation below the shoe and the mud weight for the bottom of the hole. Report results to BLM office.

2. The minimum required fill of cement behind the **8-5/8** inch intermediate casing set at **2450 feet** is:

   ☒ Cement to surface. If cement does not circulate see B.1.a, c-d above. **Wait on cement (WOC) time for a primary cement job is to include the lead cement slurry due to cave/karst.**

Formation below the 8-5/8" shoe to be tested according to Onshore Order 2.III.B.1.i. Test to be done as a mud equivalency test using the mud weight necessary for the pore pressure of the formation below the shoe (not the mud weight required to prevent dissolving the salt formation) and the mud weight for the bottom of the hole. Report results to BLM office.

Centralizers required on horizontal leg, must be type for horizontal service and a minimum of one every other joint.

3. The minimum required fill of cement behind the **5-1/2** inch production casing is:

   ☒ Cement to surface. If cement does not circulate, contact the appropriate BLM office.

4. If hardband drill pipe is rotated inside casing, returns will be monitored for metal. If metal is found in samples, drill pipe will be pulled and rubber protectors which have a larger diameter than the tool joints of the drill pipe will be installed prior to continuing drilling operations.

C. PRESSURE CONTROL

1. All blowout preventer (BOP) and related equipment (BOPE) shall comply with well control requirements as described in Onshore Oil and Gas Order No. 2 and API RP 53 Sec. 17.

2. **Operator has proposed a multi-bowl wellhead assembly. This assembly will only be tested when installed on the surface casing. Minimum working pressure of the blowout preventer (BOP) and related equipment (BOPE) required for drilling below the surface casing shoe shall be 5000 (5M) psi.**

    a. **Wellhead shall be installed by manufacturer's representatives, submit documentation with subsequent sundry.**
    b. **If the welding is performed by a third party, the manufacturer's representative shall monitor the temperature to verify that it does not exceed the maximum temperature of the seal.**
    c. **Manufacturer representative shall install the test plug for the initial BOP test.**
    d. **Operator shall perform the intermediate casing integrity test to 70% of the casing burst. This will test the multi-bowl seals.**
    e. **If the cement does not circulate and one inch operations would have been possible with a standard wellhead, the well head shall be cut off, cementing operations performed and another wellhead installed.**

5M system requires an HCR valve, remote kill line and annular to match. The remote kill line is to be installed prior to testing the system and tested to stack pressure.

3. The appropriate BLM office shall be notified a minimum of 4 hours in advance for a representative to witness the tests.

    a. In a water basin, for all casing strings utilizing slips, these are to be set as soon as the crew and rig are ready and any fallback cement remediation has been done. The casing cut-off and BOP installation can be initiated four hours after installing the slips, which will be approximately six hours after bumping the plug. For those casing strings not using slips, the minimum wait time before cut-off is eight hours after bumping the plug. BOP/BOPE testing can begin after cut-off or once cement reaches 500 psi compressive strength (including lead when specified), whichever is greater. However, if the float does not hold, cut-off cannot be initiated until cement reaches 500 psi compressive strength (including lead when specified).

    a. The tests shall be done by an independent service company utilizing a test plug **not a cup or J-packer**.

    b. The test shall be run on a 5000 psi chart for a 2-3M BOP/BOP, on a 10000 psi chart for a 5M BOP/BOPE and on a 15000 psi chart for a 10M BOP/BOPE. If a linear chart is used, it shall be a one hour chart. A circular chart shall have a maximum 2 hour clock. If a twelve hour or twenty-four hour chart is used, tester shall make a notation that it is run with a two hour clock.

    c. The results of the test shall be reported to the appropriate BLM office.

d. All tests are required to be recorded on a calibrated test chart. **A copy of the BOP/BOPE test chart and a copy of independent service company test will be submitted to the appropriate BLM office.**

e. The BOP/BOPE test shall include a low pressure test from 250 to 300 psi. The test will be held for a minimum of 10 minutes if test is done with a test plug and 30 minutes without a test plug. This test shall be performed prior to the test at full stack pressure.

D. DRILL STEM TEST

If drill stem tests are performed, Onshore Order 2.III.D shall be followed.

E. WASTE MATERIAL AND FLUIDS

All waste (i.e. drilling fluids, trash, salts, chemicals, sewage, gray water, etc.) created as a result of drilling operations and completion operations shall be safely contained and disposed of properly at a waste disposal facility. No waste material or fluid shall be disposed of on the well location or surrounding area.

Porto-johns and trash containers will be on-location during fracturing operations or any other crew-intensive operations.

EGF 103014

VIII. PRODUCTION (POST DRILLING)

A. WELL STRUCTURES & FACILITIES

Placement of Production Facilities
Production facilities should be placed on the well pad to allow for maximum interim recontouring and revegetation of the well location.

Exclosure Netting (Open-top Tanks)
Immediately following active drilling or completion operations, the operator will take actions necessary to prevent wildlife and livestock access, including avian wildlife, to all open-topped tanks that contain or have the potential to contain salinity sufficient to cause harm to wildlife or livestock, hydrocarbons, or Resource Conservation and Recovery Act of 1976-exempt hazardous substances. At a minimum, the operator will net, screen, or cover open-topped tanks to exclude wildlife and livestock and prevent mortality. If the operator uses netting, the operator will cover and secure the open portion of the tank to prevent wildlife entry. The operator will net, screen, or cover the tanks until the operator removes the tanks from the location or the tanks no longer contain substances that could be harmful to wildlife or livestock. Use a maximum netting mesh size of 1 ½ inches. The netting must not be in contact with fluids and must not have holes or gaps.

Chemical and Fuel Secondary Containment and Exclosure Screening
The operator will prevent all hazardous, poisonous, flammable, and toxic substances from coming into contact with soil and water. At a minimum, the operator will install and maintain an impervious secondary containment system for any tank or barrel containing hazardous, poisonous, flammable, or toxic substances sufficient to contain the contents of the tank or barrel and any drips, leaks, and anticipated precipitation. The operator will dispose of fluids within the containment system that do not meet applicable state or U. S. Environmental Protection Agency livestock water standards in accordance with state law; the operator must not drain the fluids to the soil or ground. The operator will design, construct, and maintain all secondary containment systems to prevent wildlife and livestock exposure to harmful substances. At a minimum, the operator will install effective wildlife and livestock exclosure systems such as fencing, netting, expanded metal mesh, lids, and grate covers. Use a maximum netting mesh size of 1 ½ inches.

Open-Vent Exhaust Stack Exclosures
The operator will construct, modify, equip, and maintain all open-vent exhaust stacks on production equipment to prevent birds and bats from entering, and to discourage perching, roosting, and nesting. (*Recommended exclosure structures on open-vent exhaust stacks are in the shape of a cone.*) Production equipment includes, but may not be limited to, tanks, heater-treaters, separators, dehydrators, flare stacks, in-line units, and compressor mufflers.

Containment Structures
Proposed production facilities such as storage tanks and other vessels will have a secondary containment structure that is constructed to hold the capacity of 1.5 times the

largest tank, plus freeboard to account for precipitation, unless more stringent protective requirements are deemed necessary.

Painting Requirement
All above-ground structures including meter housing that are not subject to safety requirements shall be painted a flat non-reflective paint color, **Shale Green** from the BLM Standard Environmental Color Chart (CC-001: June 2008).

A. PIPELINES

BURIED PIPELINE STIPULATIONS

A copy of the application (Grant, APD, or Sundry Notice) and attachments, including conditions of approval, survey plat and/or map, will be on location during construction. BLM personnel may request to you a copy of your permit during construction to ensure compliance with all stipulations.

Holder agrees to comply with the following stipulations to the satisfaction of the Authorized Officer:

1. The Holder shall indemnify the United States against any liability for damage to life or property arising from the occupancy or use of public lands under this grant.

2. The Holder shall comply with all applicable Federal laws and regulations existing or hereafter enacted or promulgated. In any event, the holder shall comply with the Toxic Substances Control Act of 1976 as amended, 15 USC 2601 et seq. (1982) with regards to any toxic substances that are used, generated by or stored on the right-of-way or on facilities authorized under this right-of-way grant. (See 40 CFR Part 702-799 and especially, provisions on polychlorinated biphenyls, 40 CFR 761.1-761.193.) Additionally, any release of toxic substances (leaks, spills, etc.) in excess of the reportable quantity established by 40 CFR Part 117 shall be reported as required by the Comprehensive Environmental Response, Compensation, and Liability Act, section 102b. A copy of any report required or requested by any Federal agency or State government as a result of a reportable release or spill of any toxic substances shall be furnished to the authorized officer concurrent with the filing of the reports to the involved Federal agency or State government.

3. The holder agrees to indemnify the United States against any liability arising from the release of any hazardous substance or hazardous waste (as these terms are defined in the Comprehensive Environmental Response, Compensation and Liability Act of 1980, 42 U.S.C. 9601, et seq. or the Resource Conservation and Recovery Act, 42 U.S.C.6901, et seq.) on the Right-of-Way (unless the release or threatened release is wholly unrelated to the Right-of-Way holder's activity on the Right-of-Way), or resulting from the activity of the Right-of-Way holder on the Right-of-Way. This agreement applies without regard to whether a release is caused by the holder, its agent, or unrelated third parties.

4. If, during any phase of the construction, operation, maintenance, or termination of the pipeline, any oil or other pollutant should be discharged from the pipeline system, impacting Federal lands, the control and total removal, disposal, and cleaning up of such oil or other pollutant, wherever found, shall be the responsibility of holder, regardless of fault. Upon failure of holder to control, dispose of, or clean up such discharge on or affecting Federal lands, or to repair all damages resulting therefrom, on the Federal lands, the Authorized Officer may take

such measures as he deems necessary to control and clean up the discharge and restore the area, including where appropriate, the aquatic environment and fish and wildlife habitats, at the full expense of the holder. Such action by the Authorized Officer shall not relieve holder of any responsibility as provided herein.

5. All construction and maintenance activity will be confined to the authorized right-of-way.

6. The pipeline will be buried with a minimum cover of **36** inches between the top of the pipe and ground level.

7. The maximum allowable disturbance for construction in this right-of-way will be **30** feet:

- Blading of vegetation within the right-of-way will be allowed: maximum width of blading operations will not exceed **20** feet. The trench is included in this area. (*Blading is defined as the complete removal of brush and ground vegetation.*)

- Clearing of brush species within the right-of-way will be allowed: maximum width of clearing operations will not exceed **30** feet. The trench and bladed area are included in this area. (*Clearing is defined as the removal of brush while leaving ground vegetation (grasses, weeds, etc.) intact. Clearing is best accomplished by holding the blade 4 to 6 inches above the ground surface.*)

- The remaining area of the right-of-way (if any) shall only be disturbed by compressing the vegetation. (*Compressing can be caused by vehicle tires, placement of equipment, etc.*)

8. The holder shall stockpile an adequate amount of topsoil where blading is allowed. The topsoil to be stripped is approximately 6 inches in depth. The topsoil will be segregated from other spoil piles from trench construction. The topsoil will be evenly distributed over the bladed area for the preparation of seeding.

9. The holder shall minimize disturbance to existing fences and other improvements on public lands. The holder is required to promptly repair improvements to at least their former state. Functional use of these improvements will be maintained at all times. The holder will contact the owner of any improvements prior to disturbing them. When necessary to pass through a fence line, the fence shall be braced on both sides of the passageway prior to cutting of the fence. No permanent gates will be allowed unless approved by the Authorized Officer.

10. Vegetation, soil, and rocks left as a result of construction or maintenance activity will be randomly scattered on this right-of-way and will not be left in rows, piles, or berms, unless otherwise approved by the Authorized Officer. The entire right-of-way shall be recontoured to match the surrounding landscape. The backfilled soil shall be compacted and a 6 inch berm will be left over the ditch line to allow for settling back to grade.

11. In those areas where erosion control structures are required to stabilize soil conditions, the holder will install such structures as are suitable for the specific soil conditions being encountered and which are in accordance with sound resource management practices.

12. The holder will reseed all disturbed areas. Seeding will be done according to the attached seeding requirements, using the following seed mix.

(X) seed mixture 1	( ) seed mixture 3
( ) seed mixture 2	( ) seed mixture 4
( ) seed mixture 2/LPC	( ) Aplomado Falcon Mixture

13. All above-ground structures not subject to safety requirements shall be painted by the holder to blend with the natural color of the landscape. The paint used shall be color which simulates "Standard Environmental Colors" – **Shale Green**, Munsell Soil Color No. 5Y 4/2.

14. The pipeline will be identified by signs at the point of origin and completion of the right-of-way and at all road crossings. At a minimum, signs will state the holder's name, BLM serial number, and the product being transported. All signs and information thereon will be posted in a permanent, conspicuous manner, and will be maintained in a legible condition for the life of the pipeline.

15. The holder shall not use the pipeline route as a road for purposes other than routine maintenance as determined necessary by the Authorized Officer in consultation with the holder before maintenance begins. The holder will take whatever steps are necessary to ensure that the pipeline route is not used as a roadway. As determined necessary during the life of the pipeline, the Authorized Officer may ask the holder to construct temporary deterrence structures.

16. Any cultural and/or paleontological resources (historic or prehistoric site or object) discovered by the holder, or any person working on his behalf, on public or Federal land shall be immediately reported to the Authorized Officer. Holder shall suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the Authorized Officer. An evaluation of the discovery will be made by the Authorized Officer to determine appropriate actions to prevent the loss of significant cultural or scientific values. The holder will be responsible for the cost of evaluation and any decision as to proper mitigation measures will be made by the Authorized Officer after consulting with the holder.

17. The operator shall be held responsible if noxious weeds become established within the areas of operations. Weed control shall be required on the disturbed land where noxious weeds exist, which includes associated roads, pipeline corridor and adjacent land affected by the establishment of weeds due to this action. The operator shall consult with the Authorized Officer for acceptable weed control methods, which include following EPA and BLM requirements and policies.

18. Escape Ramps - The operator will construct and maintain pipeline/utility trenches that are not otherwise fenced, screened, or netted to prevent livestock, wildlife, and humans from becoming entrapped. At a minimum, the operator will construct and maintain escape ramps, ladders, or other methods of avian and terrestrial wildlife escape in the trenches according to the following criteria:

a. Any trench left open for eight (8) hours or less is not required to have escape ramps; however, before the trench is backfilled, the contractor/operator shall inspect the trench for wildlife, remove all trapped wildlife, and release them at least 100 yards from the trench.
b. For trenches left open for eight (8) hours or more, earthen escape ramps (built at no more than a 30 degree slope and spaced no more than 500 feet apart) shall be placed in the trench.

STANDARD STIPULATIONS FOR SURFACE INSTALLED PIPELINES

A copy of the application (Grant, Sundry Notice, APD) and attachments, including stipulations, survey plat and/or map, will be on location during construction. BLM personnel may request to you a copy of your permit during construction to ensure compliance with all stipulations.

Holder agrees to comply with the following stipulations to the satisfaction of the Authorized Officer:

1. The holder shall indemnify the United States against any liability for damage to life or property arising from the occupancy or use of public lands under this grant.

2. The holder shall comply with all applicable Federal laws and regulations existing or hereafter enacted or promulgated. In any event, the holder shall comply with the Toxic Substances Control Act of 1976 as amended, 15 USC 2601 et seq. (1982) with regards to any toxic substances that are used, generated by or stored on the right-of-way or on facilities authorized under this right-of-way grant. (See 40 CFR, Part 702-799 and especially, provisions on polychlorinated biphenyls, 40 CFR 761.1-761.193.) Additionally, any release of toxic substances (leaks, spills, etc.) in excess of the reportable quantity established by 40 CFR, Part 117 shall be reported as required by the Comprehensive Environmental Response, Compensation, and Liability Act, section 102b. A copy of any report required or requested by any Federal agency or State government as a result of a reportable release or spill of any toxic substances shall be furnished to the authorized officer concurrent with the filing of the reports to the involved Federal agency or State government.

3. The holder agrees to indemnify the United States against any liability arising from the release of any hazardous substance or hazardous waste (as these terms are defined in the Comprehensive Environmental Response, Compensation and Liability Act of 1980, 42 U.S.C. 9601, et seq. or the Resource Conservation and Recovery Act, 42 U.S.C. 6901, et seq.) on the Right-of-Way (unless the release or threatened release is wholly unrelated to activity of the Right-of-Way holder's activity on the Right-of-Way), or resulting from the activity of the Right-of-Way holder on the Right-of-Way. This agreement applies without regard to whether a release is caused by the holder, its agent, or unrelated third parties.

4. The holder shall be liable for damage or injury to the United States to the extent provided by 43 CFR Sec. 2883.1-4. The holder shall be held to a standard of strict liability for damage or injury to the United States resulting from pipe rupture, fire, or spills caused or substantially aggravated by any of the following within the right-of-way or permit area:

a. Activities of the holder including, but not limited to construction, operation, maintenance, and termination of the facility.
b. Activities of other parties including, but not limited to:
    (1) Land clearing.

(2) Earth-disturbing and earth-moving work.
(3) Blasting.
(4) Vandalism and sabotage.

c. Acts of God.

The maximum limitation for such strict liability damages shall not exceed one million dollars ($1,000,000) for any one event, and any liability in excess of such amount shall be determined by the ordinary rules of negligence of the jurisdiction in which the damage or injury occurred.

This section shall not impose strict liability for damage or injury resulting primarily from an act of war or from the negligent acts or omissions of the United States.

5. If, during any phase of the construction, operation, maintenance, or termination of the pipeline, any oil, salt water, or other pollutant should be discharged from the pipeline system, impacting Federal lands, the control and total removal, disposal, and cleaning up of such oil, salt water, or other pollutant, wherever found, shall be the responsibility of the holder, regardless of fault. Upon failure of the holder to control, dispose of, or clean up such discharge on or affecting Federal lands, or to repair all damages resulting therefrom, on the Federal lands, the Authorized Officer may take such measures as he deems necessary to control and clean up the discharge and restore the area, including, where appropriate, the aquatic environment and fish and wildlife habitats, at the full expense of the holder. Such action by the Authorized Officer shall not relieve the holder of any responsibility as provided herein.

6. All construction and maintenance activity will be confined to the authorized right-of-way width of **20** feet. If the pipeline route follows an existing road or buried pipeline right-of-way, the surface pipeline must be installed no farther than 10 feet from the edge of the road or buried pipeline right-of-way. If existing surface pipelines prevent this distance, the proposed surface pipeline must be installed immediately adjacent to the outer surface pipeline. All construction and maintenance activity will be confined to existing roads or right-of-ways.

7. No blading or clearing of any vegetation will be allowed unless approved in writing by the Authorized Officer.

8. The holder shall install the pipeline on the surface in such a manner that will minimize suspension of the pipeline across low areas in the terrain. In hummocky of duney areas, the pipeline will be "snaked" around hummocks and dunes rather then suspended across these features.

9. The pipeline shall be buried with a minimum of **24** inches under all roads, "two-tracks," and trails. Burial of the pipe will continue for 20 feet on each side of each crossing. The condition of the road, upon completion of construction, shall be returned to at least its former state with no bumps or dips remaining in the road surface.

10. The holder shall minimize disturbance to existing fences and other improvements on public lands. The holder is required to promptly repair improvements to at least their former state. Functional use of these improvements will be maintained at all times. The holder will contact the owner of any improvements prior to disturbing them. When necessary to pass through a fence line, the fence shall be braced on both sides of the passageway prior to cutting of the fence. No permanent gates will be allowed unless approved by the Authorized Officer.

11. In those areas where erosion control structures are required to stabilize soil conditions, the holder will install such structures as are suitable for the specific soil conditions being encountered and which are in accordance with sound resource management practices.

12. Excluding the pipe, all above-ground structures not subject to safety requirement shall be painted by the holder to blend with the natural color of the landscape. The paint used shall be a color which simulates "Standard Environmental Colors" – **Shale Green**, Munsell Soil Color No. 5Y 4/2; designated by the Rocky Mountain Five State Interagency Committee.

13. The pipeline will be identified by signs at the point of origin and completion of the right-of-way and at all road crossings. At a minimum, signs will state the holder's name, BLM serial number, and the product being transported. Signs will be maintained in a legible condition for the life of the pipeline.

14. The holder shall not use the pipeline route as a road for purposes other than routine maintenance as determined necessary by the Authorized Officer in consultation with the holder. The holder will take whatever steps are necessary to ensure that the pipeline route is not used as a roadway.

15. Any cultural and/or paleontological resource (historic or prehistoric site or object) discovered by the holder, or any person working on his behalf, on public or Federal land shall be immediately reported to the authorized officer. Holder shall suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the authorized officer. An evaluation of the discovery will be made by the authorized officer to determine appropriate cultural or scientific values. The holder will be responsible for the cost of evaluation and any decision as to proper mitigation measures will be made by the authorized officer after consulting with the holder.

16. The operator shall be held responsible if noxious weeds become established within the areas of operations. Weed control shall be required on the disturbed land where noxious weeds exist, which includes the roads, powerline corridor, and adjacent land affected by the establishment of weeds due to this action. The operator shall consult with the Authorized Officer for acceptable weed control methods, which include following EPA and BLM requirements and policies.

17. Surface pipelines must be less than or equal to 4 inches and a working pressure below 125 psi.

IX. INTERIM RECLAMATION

During the life of the development, all disturbed areas not needed for active support of production operations should undergo interim reclamation in order to minimize the environmental impacts of development on other resources and uses.

Within six (6) months of well completion, operators should work with BLM surface management specialists (Jim Amos: 575-234-5909) to devise the best strategies to reduce the size of the location. Interim reclamation should allow for remedial well operations, as well as safe and efficient removal of oil and gas.

During reclamation, the removal of caliche is important to increasing the success of revegetating the site. Removed caliche that is free of contaminants may be used for road repairs, fire walls or for building other roads and locations. In order to operate the well or complete workover operations, it may be necessary to drive, park and operate on restored interim vegetation within the previously disturbed area. Disturbing revegetated areas for production or workover operations will be allowed. If there is significant disturbance and loss of vegetation, the area will need to be revegetated. Communicate with the appropriate BLM office for any exceptions/exemptions if needed.

All disturbed areas after they have been satisfactorily prepared need to be reseeded with the seed mixture provided below.

Upon completion of interim reclamation, the operator shall submit a Sundry Notices and Reports on Wells, Subsequent Report of Reclamation (Form 3160-5).

X. FINAL ABANDONMENT & RECLAMATION

At final abandonment, well locations, production facilities, and access roads must undergo "final" reclamation so that the character and productivity of the land are restored.

Earthwork for final reclamation must be completed within six (6) months of well plugging. All pads, pits, facility locations and roads must be reclaimed to a satisfactory revegetated, safe, and stable condition, unless an agreement is made with the landowner or BLM to keep the road and/or pad intact.

After all disturbed areas have been satisfactorily prepared, these areas need to be revegetated with the seed mixture provided below. Seeding should be accomplished by drilling on the contour whenever practical or by other approved methods. Seeding may need to be repeated until revegetation is successful, as determined by the BLM.

Operators shall contact a BLM surface protection specialist prior to surface abandonment operations for site specific objectives (Jim Amos: 575-234-5909).

(Insert Seed Mixture Here)

Seed Mixture 1, for Loamy Sites

The holder shall seed all disturbed areas with the seed mixture listed below. The seed mixture shall be planted in the amounts specified in pounds of pure live seed (PLS)* per acre. There shall be no primary or secondary noxious weeds in the seed mixture. Seed will be tested and the viability testing of seed will be done in accordance with State law(s) and within nine (9) months prior to purchase. Commercial seed will be either certified or registered seed. The seed container will be tagged in accordance with State law(s) and available for inspection by the authorized officer.

Seed will be planted using a drill equipped with a depth regulator to ensure proper depth regulator to ensure proper depth of planting where drilling is possible. The seed mixture will be evenly and uniformly planted over the disturbed area (small/heavier seeds have a tendency to drop the bottom of the drill and are planted first). The holder shall take appropriate measures to ensure this does not occur. Where drilling is not possible, seed will be broadcast and the area shall be raked or chained to cover the seed. When broadcasting the seed, the pounds per acre are to be doubled. The seeding will be repeated until a satisfactory stand is established as determined by the authorized officer. Evaluation of growth will not be made before completion of at least one full growing season after seeding.

Species to be planted in pounds of pure live seed* per acre:

Species	lb/acre
Plains lovegrass (Eragrostis intermedia)	0.5
Sand dropseed (Sporobolus cryptandrus)	1.0
Sideoats grama (Bouteloua curtipendula)	5.0
Plains bristlegrass (Setaria macrostachya)	2.0

*Pounds of pure live seed:

Pounds of seed **x** percent purity **x** percent germination = pounds pure live seed