							MIN 7
	Jarísba	d Fi	eld Offi	ce			GURF P
Form 3160 -3 (March 2012)	00	DH	lobbs	OCr	FORM OMB 1 Expires (APPROV No. 1004-01	ED 137 2014
	UNITED STATES DEPARTMENT OF THE I	NTERIOR	OBBS	018	5. Lease Serial No.	Jelober 31,	2014
	BUREAU OF LAND MAN	AGEMEN	T HOIN	7.10.	NMLC0065375A	or Tribe	Name
A	PPLICATION FOR PERMIT TO	DRILL O	RREENTER	CEIN	A HIGH HIGH	or the	
la. Type of work:	✓ DRILL REENTE	ER	R	ion in	7. If Unit or CA Age	eement, N	lame and No.
lb. Type of Well:	Oil Well Gas Well Other	∠ S	ingle Zone 🔲 Multi	ole Zone	8. Lease Name and LEA UNIT 64H	Well No.	702802)
2. Name of Operator	LEGACY RESERVES OPERATING LP	(240	974)		9. API Well No.	. U	4735
3a. Address 303 W	est Wall St., Ste 1800 Midland TX 7970	3b. Phone N (432)689-	0. (include area code) -5287		10. Field and Pool, or	Explorato	" (37580)
4. Location of Well (Report location clearly and in accordance with any	y State require	ments.*)		11. Set., T. R.M. OF	SIk and St	ANEY STATES 3506
At surface NWS	E / 2270 FSL / 2619 FEL / LAT 32.55761	144 / LONG	G -103.496537		SEC 19 / T20S / R	35E / N	MP 135
At proposed prod.	zone NENW / 330 FNL / 2210 FWL / LAT	32.57949	1 / LONG -103.497	9909	12 County or Darich		13 State
 Distance in miles an 26 miles 	id direction from nearest town or post office*				LEA		NM
 Distance from prop location to nearest property or lease lin (Also to nearest dri 	osed* 2619 feet ne, ft. g. unit line. if any)	16. No. of 239.77	acres in lease	17. Spacin 240	g Unit dedicated to this	well	
8. Distance from property drill	used location*	19. Propose	ed Depth	20. BLM/	BIA Bond No. on file		
applied for, on this	lease, ft.	9800 feet	t / 17643 feet	FED: N	MB001015		
21. Elevations (Show 3689 feet	whether DF, KDB, RT, GL, etc.)	22 Approx 03/30/20	timate date work will sta	rt*	23. Estimated duration	on	
		24. Atta	achments				
The following, complete	ed in accordance with the requirements of Onshor	e Oil and Gas	s Order No.1, must be a	ttached to th	is form:		
1. Well plat certified by	y a registered surveyor.		4. Bond to cover t	he operatio	ns unless covered by an	existing	bond on file (see
 A Drilling Plan. A Surface Use Plan SUPO must be filed 	(if the location is on National Forest System with the appropriate Forest Service Office).	Lands, the	 Operator certific Such other site BLM. 	cation specific info	ormation and/or plans a	s may be	required by the
25. Signature		Name	e (Printed/Typed)			Date	
(Elect	ronic Submission)	Blay	ne Housh / Ph: (405	5)286-9320	6	01/31	/2018
Permitting Spe	cialist						
Approved by (Signature) (Electro	nic Submission)	Name	e (Printed/Typed) y Layton / Ph: (575)2	234-5959		Date 04/16	6/2018
ïtle		Offic	e				
Supervisor Multiple	Resources	CAR s legal or equ	uitable title to those right	ts in the sub	niect lease which would	entitle the	applicant to
onduct operations ther Conditions of approval	eon. , if any, are attached.	0	5		,		11
Title 18 U.S.C. Section 1 Itates any false, fictition	001 and Title 43 U.S.C. Section 1212, make it a cr is or fraudulent statements or representations as 1	time for any to any matter	person knowingly and within its jurisdiction.	willfully to n	nake to any department	or agency	of the United
(Continued on pa	ge 2)				*(Ins	tructior	is on page 2)
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	ADPROV	ED HI			M149T	H	
	Amprov	al Date	: 04/16/2018	/			
	- A Philor		0 11 10/2010				

INSTRUCTIONS

GENERAL: This form is designed for submitting proposals to perform certain well operations, as indicated on Federal and Indian lands and leases for action by appropriate Federal agencies, pursuant to applicable Federal laws and regulations. Any necessary special instructions concerning the use of this form and the number of copies to be submitted, particularly with regard to local, area, or regional procedures and practices, either are shown below or will be issued by, or may be obtained from local Federal offices.

ITEM 1: If the proposal is to redrill to the same reservoir at a different subsurface location or to a new reservoir, use this form with appropriate notations. Consult applicable Federal regulations concerning subsequent work proposals or reports on the well.

ITEM 4: Locations on Federal or Indian land should be described in accordance with Federal requirements. Consult local Federal offices for specific instructions.

ITEM 14: Needed only when location of well cannot readily be found by road from the land or lease description. A plat, or plats, separate or on the reverse side, showing the roads to, and the surveyed location of, the well, and any other required information, should be furnished when required by Federal agency offices.

ITEMS 15 AND 18: If well is to be, or has been directionally drilled, give distances for subsurface location of hole in any present or objective productive zone.

ITEM 22: Consult applicable Federal regulations, or appropriate officials, concerning approval of the proposal before operations are started.

NOTICES

The Privacy Act of 1974 and regulation in 43 CFR 2.48(d) provide that you be furnished the following information in connection with information required by this application.

AUTHORITY: 30 U.S.C. 181 et seq., 25 U.S.C. 396; 43 CFR 3160

PRINCIPAL PURPOSES: The information will be used to: (1) process and evaluate your application for a permit to drill a new oil, gas, or service well or to reenter a plugged and abandoned well; and (2) document, for administrative use, information for the management, disposal and use of National Resource Lands and resources including (a) analyzing your proposal to discover and extract the Federal or Indian resources encountered; (b) reviewing procedures and equipment and the projected impact on the land involved; and (c) evaluating the effects of the proposed operation on the surface and subsurface water and other environmental impacts. ROUTINE USE: Information from the record and/or the record will be transferred to appropriate Federal, State, and local or foreign agencies, when relevant to civil, criminal or regulatory investigations or prosecution, in connection with congressional inquiries and for regulatory responsibilities.

EFFECT OF NOT PROVIDING INFORMATION: Filing of this application and disclosure of the information is mandatory only if you elect to initiate a drilling or reentry operation on an oil and gas lease.

The Paperwork Reduction Act of 1995 requires us to inform you that:

The BLM collects this information to allow evaluation of the technical, safety, and environmental factors involved with drilling for oil and/or gas on Federal and Indian oil and gas leases. This information will be used to analyze and approve applications. Response to this request is mandatory only if the operator elects to initiate drilling or reentry operations on an oil and gas lease. The BLM would like you to know that you do not have to respond to this or any other Federal agency-sponsored information collection unless it displays a currently valid OMB control number.

BURDEN HOURS STATEMENT: Public reporting burden for this form is estimated to average 8 hours per response, including the time for reviewing instructions, gathering and maintaining data, and completing and reviewing the form. Direct comments regarding the burden estimate or any other aspect of this form to U.S. Department of the Interior, Bureau of Land Management (1004-0137), Bureau Information Collection Clearance Officer (WO-630), 1849 C Street, N.W., Mail Stop 401 LS, Washington, D.C. 20240.

(Continued on page 3)

(Form 3160-3, page 2)

Approval Date: 04/16/2018

Additional Operator Remarks

Location of Well

 SHL: NWSE / 2270 FSL / 2619 FEL / TWSP: 20S / RANGE: 35E / SECTION: 19 / LAT: 32.5576144 / LONG: -103.496537 (TVD: 0 feet, MD: 0 feet) PPP: NENW / 1329 FNL / 2234 FWL / TWSP: 20S / RANGE: 35E / SECTION: 18 / LAT: 32.576747 / LONG: -103.497923 (TVD: 9800 feet, MD: 16655 feet) PPP: SENW / 2641 FSL / 2266 FWL / TWSP: 20S / RANGE: 35E / SECTION: 18 / LAT: 32.573118 / LONG: -103.497823 (TVD: 9800 feet, MD: 15335 feet) PPP: SWNE / 2508 FNL / 2387 FWL / TWSP: 20S / RANGE: 35E / SECTION: 19 / LAT: 32.55897 / LONG: -103.497823 (TVD: 9800 feet, MD: 10127 feet) PPP: SESW / 0 FSL / 2328 FWL / TWSP: 20S / RANGE: 35E / SECTION: 18 / LAT: 32.565861 / LONG: -103.497622 (TVD: 9800 feet, MD: 12694 feet) BHL: NENW / 330 FNL / 2210 FWL / TWSP: 20S / RANGE: 35E / SECTION: 18 / LAT: 32.579491 / LONG: -103.4979090 (TVD: 9800 feet, MD: 17643 feet)

BLM Point of Contact

Name: Priscilla Perez Title: Legal Instruments Examiner Phone: 5752345934 Email: pperez@blm.gov

Approval Date: 04/16/2018

(Form 3160-3, page 3)

Review and Appeal Rights

A person contesting a decision shall request a State Director review. This request must be filed within 20 working days of receipt of the Notice with the appropriate State Director (see 43 CFR 3165.3). The State Director review decision may be appealed to the Interior Board of Land Appeals, 801 North Quincy Street, Suite 300, Arlington, VA 22203 (see 43 CFR 3165.4). Contact the above listed Bureau of Land Management office for further information.

WAFMSS

U.S. Department of the Interior BUREAU OF LAND MANAGEMENT

Application Data Report

04/23/2018 2.07

APD ID: 10400026682	Submission Date: 01
Operator Name: LEGACY RESERVES OPERATING LP	
Well Name: LEA UNIT	Well Number: 64H
Well Type: OIL WELL	Well Work Type: Drill

01/31/2018

Highlighted data reflects the most recent changes

Show Final Text

Section 1 - General

APD ID:	10400026682		Tie to previous NOS?		Submission Date: 01/31/2018
BLM Office:	CARLSBAD		User: Blayne Housh	Tit	e: Permitting Specialist
Federal/India	an APD: FED		Is the first lease penetrate	d for produc	tion Federal or Indian? FED
Lease numb	er: NMLC0065375A		Lease Acres: 239.77		
Surface acce	ess agreement in place?	•	Allotted?	Reservation	:
Agreement i	n place? NO		Federal or Indian agreeme	ent:	
Agreement r	number:				
Agreement r	name:				
Keep applica	ation confidential? YES				
Permitting A	gent? YES		APD Operator: LEGACY R	ESERVES O	PERATING LP
Operator let	ter of designation:	signed L	ea Unit 64H DOA 201801	30125931.pd	f

Operator Info

Operator Organization Name: LEG	ACY RESERVES OPERATING LP	
Operator Address: 303 West Wall S	st., Ste 1800	7 : 70701
Operator PO Box:		ZID: 79701
Operator City: Midland	State: TX	
Operator Phone: (432)689-5287		
Operator Internet Address:		

Section 2 - Well Information

Well in Master Development Plan? EXISTING	Mater Development Plan name:	: Lea Unit Master Dev Plan
Well in Master SUPO? NO	Master SUPO name:	
Well in Master Drilling Plan? NO	Master Drilling Plan name:	
Well Name: LEA UNIT	Well Number: 64H	Well API Number:
Field/Pool or Exploratory? Field and Pool	Field Name: LEA	Pool Name: BONE SPRING (OIL)

Is the proposed well in an area containing other mineral resources? USEABLE WATER

Page 1 of 3

Describe other minerals: Is the proposed well in a Helium production area? N Use Existing Well Pad? YES New surface disturbance? Y Type of Well Pad: MULTIPLE WELL Multiple Well Pad Name: LEA Number: 62H UNIT Well Class: HORIZONTAL Number of Legs: 1 Well Work Type: Drill Well Type: OIL WELL **Describe Well Type:** Well sub-Type: INFILL Describe sub-type: Distance to town: 26 Miles Distance to nearest well: 50 FT Distance to lease line: 2619 FT Reservoir well spacing assigned acres Measurement: 240 Acres UPDATED_LEA_UNIT_64H_C_102_PLAT_SIGNED_05_10_17_20180130071246.pdf Well plat: Agency_Lease_Plat_20180131135942.pdf Well work start Date: 03/30/2018 Duration: 45 DAYS

Section 3 - Well Location Table

Survey Type: RECTANGULAR

Describe Survey Type:

Datum: NAD83

Survey number:

Vertical Datum: NAVD88

	NS-Foot	NS Indicator	EW-Foot	EW Indicator	Twsp	Range	Section	Aliquot/Lot/Tract	Latitude	Longitude	County	State	Meridian	Lease Type	Lease Number	Elevation	DM	TVD
SHL Leg #1	227 0	FSL	261 9	FEL	20S	35E	19	Aliquot NWSE	32.55761 44	- 103.4965 37	LEA	NEW MEXI CO	NEW MEXI CO	F	FEE	368 9	0	0
KOP Leg #1	227 0	FSL	261 9	FEL	20S	35E	19	Aliquot NWSE	32.55761 44	- 103.4965 37	LEA	NEW MEXI CO	NEW MEXI CO	F	FEE	- 556 1	925 0	925 0
PPP Leg #1	250 8	FNL	238 7	FWL	20S	35E	19	Aliquot SWNE	32.55897	- 103.4974 31	LEA	NEW MEXI CO	NEW MEXI CO	S	STATE	- 611 1	101 27	980 0

Operator Name: LEGACY RESERVES OPERATING LP

Well Name: LEA UNIT

Well Number: 64H

	NS-Foot	NS Indicator	EW-Foot	EW Indicator	Twsp	Range	Section	Aliquot/Lot/Tract	Latitude	Longitude	County	State	Meridian	Lease Type	Lease Number	Elevation	MD	TVD
PPP Leg #1	0	FSL	232 8	FWL	20S	35E	18	Aliquot SESW	32.56586 1	- 103.4976 22	LEA	NEW MEXI CO	NEW MEXI CO	F	NMLC0 065375 A	- 611 1	126 94	980 0
PPP Leg #1	132 9	FNL	223 4	FWL	20S	35E	18	Aliquot NENW	32.57674 7	- 103.4979 23	LEA	NEW MEXI CO	NEW MEXI CO	F	NMLC0 065375 A	- 611 1	166 55	980 0
PPP Leg #1	264 1	FSL	226 6	FWL	20S	35E	18	Aliquot SENW	32.57311 8	- 103.4978 23	LEA	NEW MEXI CO	NEW MEXI CO	F	NMLC0 066147 D	- 611 1	153 [.] 35	980 0
EXIT Leg #1	330	FNL	221 0	FWL	20S	35E	18	Aliquot NENW	32.57949 1	- 103.4979 909	LEA	NEW MEXI CO	NEW MEXI CO	F	NMLC0 065375 A	- 611 1	176 43	980 0
BHL Leg #1	330	FNL	221 0	FWL	20S	35E	18	Aliquot NENW	32.57949 1	- 103.4979 909	LEA	NEW MEXI CO	NEW MEXI CO	F	NMLC0 065375 A	- 611 1	176 43	980 0



(432) 689-5200

January 22, 2018

Bureau of Land Management Division of Oil and Gas 620 E. Greene Street Carlsbad, NM 88220-6292 Attn: Land Law Examiner

> Re: Legacy Reserves Operating, L.P. Designation of Agent Lea Unit 64H 19-20S-35E NMPM Lea County, NM

To whom it may concern:

Legacy Reserves Operating, L.P. has contracted with Reagan Smith Energy Solutions, Inc. to assist in regulatory compliance associated with the Lea Unit 64H. Reagan Smith Energy Solutions, Inc. has the authority to act as Legacy Reserves Operating, L.P.'s agent to maintain regulatory compliance for the Lea Unit 64H. This includes the submittal of an APD, Communitization Agreement, Designations of Operator, Sundry Notices, and any other regulatory documents on behalf of Legacy Reserves Operating, L.P. in order to maintain regulatory compliance with the Bureau of Land Management in regard to the above referenced project.

Sincerely,

Matthew Dickson Legacy Reserves Operating, L.P.



U.S. Department of the Interior BUREAU OF LAND MANAGEMENT

APD ID: 10400026682

Operator Name: LEGACY RESERVES OPERATING LP

Well Name: LEA UNIT

Well Type: OIL WELL

Well Number: 64H

Well Work Type: Drill

Submission Date: 01/31/2018

Highlighted data reflects the most recent changes

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Section 1 - Geologic Formations

Formation			True Vertical	Measured			Producing
ID	Formation Name	Elevation	Depth	Depth	Lithologies	Mineral Resources	Formation
1	MANZANITA	3663	0	0		USEABLE WATER	No
2	RUSTLER	1982	1680	1680		NONE	No
3	TOP SALT	1942	1720	1720	SAĻT	NONE	No
4	BOTTOM SALT	513	3150	3150	SALT	NONE	No
5	CAPITAN REEF	513	3150	3150		NONE	No
6	SAN ANDRES	-1047	4710	4710		NONE	No
7	DELAWARE SAND	-2004	5666	5666	SANDSTONE	NATURAL GAS,OIL	No
8	BONE SPRING LIME	-4542	8205	8205	LIMESTONE	NATURAL GAS,OIL	No
9	AVALON SAND	-5097	8760	8760	SANDSTONE	NATURAL GAS,OIL	No
10	BONE SPRING 1ST	-5838	9501	9510		NATURAL GAS,OIL	Yes

Section 2 - Blowout Prevention

Pressure Rating (PSI): 3M

Rating Depth: 5600

Equipment: A 3M BOP will be used to drill from the surface casing shoe (~1800') to the intermediate casing shoe (~5600'). The BOP will be a 5M system, however the "A" section wellhead will be a 3M wellhead (see attached BOP Diagram). Requesting Variance? YES

Variance request: A variance to the requirement of a rigid steel line connecting to the choke manifold is requested. Specifications for the flex hose are provided with BOP schematic in exhibit section Testing Procedure: The BOPs will be tested by an independent service company to 250 psi low and 3000 psi high.

Choke Diagram Attachment:

McVay 4 Choke Manifold Diagram 20180130090426.pdf

BOP Diagram Attachment:

Well Number: 64H

McVay_4_Choke_Manifold_Diagram_20180130090426.pdf

McVay_4_BOP_Schematic_20180130090433.pdf

Cameron_Conventional_3_String_Wellhead_Schematic_20180130090440.pdf

Pressure Rating (PSI): 5M

Rating Depth: 9800

Equipment: Legacy Reserves plans to use a 13-5/8" 5000-psi working pressure BOP system consisting of a double ram BOP with one ram being pipe and one ram being blind, a 5000-psi annular type preventer, a 5000-psi choke manifold and 80 gallon accumulator with floor, five remote operating stations and an auxiliary power system. A rotating head will be utilized as needed. A drill string safety valve in the open position will be available on the rig floor. A mud gas separator will be available for use if needed. A 3M BOP will be used to drill from the surface casing shoe (~1800') to the intermediate casing shoe (~5600'). The BOP will be a 5M system, however the "A" section wellhead will be a 3M wellhead (see attached BOP Diagram). The BOP unit will be hydraulically operated. The BOP will be operated at least once per day while drilling and the blind rams will be operated when out of hole during trips. No abnormal pressure or temperature is expected while drilling. **Requesting Variance?** YES

Variance request: A variance to the requirement of a rigid steel line connecting to the choke manifold is requested.
 Specifications for the flex hose are provided with BOP schematic in exhibit section
 Testing Procedure: The BOPs will be tested by an independent service company to 250 psi low and 5000 psi high.

Choke Diagram Attachment:

McVay_4_Choke_Manifold_Diagram_20180130090129.pdf

BOP Diagram Attachment:

Flex_Hose_Specs_20180130090135.pdf

McVay_4_BOP_Schematic_20180130090143.pdf

Casing ID	String Type	Hole Size	Csg Size	Condition	Standard	Tapered String	Top Set MD	Bottom Set MD	Top Set TVD	Bottom Set TVD	Top Set MSL	Bottom Set MSL	Calculated casing length MD	Grade	Weight	Joint Type	Collapse SF	Burst SF	Joint SF Type	Joint SF	Body SF Type	Body SF
1	SURFACE	17.5	13.375	NEW	API	N	0	1800	0	1800	3689	1889	1800	J-55	54.5	STC	1.42	3.86	DRY	2.59	DRY	2.59
2	INTERMED IATE	12.2 5	9.625	NEW	API	N	0	3901	0	3901	3689	-212	3901	J-55	40	LTC	1.25	1.41	DRY	1.6	DRY	1.6
3	INTERMED IATE	12.2 5	9.625	NEW	API	N	3901	5600	3901	5600	-212	-1911	1699	HCK -55	40	LTC	1.45	1.27	DRY	4.23	DRY	4.23

Section 3 - Casing

Operator Name: LEGACY RESERVES OPERATING LP

Well Name: LEA UNIT

Well Number: 64H

Casing ID	String Type	Hole Size	Csg Size	Condition	Standard	Tapered String	Top Set MD	Bottom Set MD	Top Set TVD	Bottom Set TVD	Top Set MSL	Bottom Set MSL	Calculated casing length MD	Grade	Weight	Joint Type	Collapse SF	Burst SF	Joint SF Type	Joint SF	Body SF Type	Body SF
4	PRODUCTI ON	8.75	5.5	NEW	API	N	0	17643	0	9800	3689	- 13954	17643	P- 110	20	OTHER - BTC	2.17	1.26	DRY	1.6	DRY	1.6

Casing Attachments

Casing ID: 1

String Type: SURFACE

Inspection Document:

Spec Document:

Tapered String Spec:

Casing Design Assumptions and Worksheet(s):

Lea_Unit_64H_Casing_Design_20180130075640.pdf

Casing ID: 2 String Type: INTERMEDIATE

Inspection Document:

Spec Document:

Tapered String Spec:

Casing Design Assumptions and Worksheet(s):

Lea_Unit_64H_Casing_Design_20180130080139.pdf

Operator Name: LEGACY RESERVES OPERATING LP			
Well Name: LEA UNIT	Well Number: 64H	*	*

Casing Attachments

Casing ID: 3 String Type: INTERMEDIATE

Inspection Document:

Spec Document:

Tapered String Spec:

Casing Design Assumptions and Worksheet(s):

Lea_Unit_64H_Casing_Design_20180130081437.pdf

Casing ID: 4 String Type: PRODUCTION

Inspection Document:

Spec Document:

Tapered String Spec:

Casing Design Assumptions and Worksheet(s):

Lea_Unit_64H_Casing_Design_20180130081559.pdf

Section 4 - Cement

String Type	Lead/Tail	Stage Tool Depth	Top MD	Bottom MD	Quantity(sx)	Yield	Density	Cu Ft	Excess%	Cement type	Additives
SURFACE	Lead		0	1523	1100	1.93	13.5	2123	75	Class C cement	4% bwoc bentonite II + 2% bwoc Calcium Chloride + 0.25 lbs/sack Cello Flake + 0.005% bwoc Static Free + 0.005 gps FP-6L
SURFACE	Tail		1523	1800	200	1.34	14.8	268	75	Class C cement	1.5% bwoc Calcium Chloride + 0.005 Ibs/sack Static Free + 0.005 gps FP-6L

Operator Name: LEGACY RESERVES OPERATING LP

Well Name: LEA UNIT

Well Number: 64H

String Type	Lead/Tail	Stage Tool Depth	Top MD	Bottom MD	Quantity(sx)	Yield	Density	Cu Ft	Excess%	Cement type	Additives
PRODUCTION	Lead		0	3352	1600	2.38	11.9	3808	80	Poz (fly ash) Class H cement	10% bwoc bentonite II + 5% bwow sodium chloride + 5 pps LCM-1 + 0.005 lbs/sk Static Free + 0.005 gps FP-6L
PRODUCTION	Tail			1764 3	1700	1.62	13.2	2754	20	Class H	CSE-2 + 4% bwow sodium chloride + 3 pps LCM- 1 + 0.6% bwoc FL-25 + 0.005 gps FP- 6L + 0.005% bwoc Static Free
INTERMEDIATE	Lead		0	4900	1400	2.13	12.5	2982	80	Poz (fly ash) Class C cement	4% bwoc bentonite II + 5% bwoc MPA-5 + 0.25% bwoc FL- 52 + 5 Ibs/sack LCM-1 +0.125 Ibs/sk cello flake+ 0.005 Ibs/sk defoamer + 0.005 gpsFP-6L + 1.2% bwoc Sodium Metasilicate + 5% bwow Sodium Chloride
INTERMEDIATE	Tail		4900	5600	200	1.33	14.8	266	80	Class C cement	none
INTERMEDIATE	Lead		0	4900	1400	2.13	12.5	2982	80	Paz (fly ash) Class C	4% bwoc bentonite II + 5% bwoc MPA-5 + 0.25% bwoc FL- 52 + 5 Ibs/sack LCM-1 +0.125 Ibs/sk cello flake + 0.005 Ibs/sk defoamer + 0.005 gpsFP-6L + 1.2% bwoc Sodium Metasilicate + 5% bwow Sodium Chloride
INTERMEDIATE	Tail		4900	5600	200	1.33	14.8	266	80	Class C cement	none

Well Number: 64H

Section 5 - Circulating Medium

Mud System Type: Closed

Will an air or gas system be Used? NO

Description of the equipment for the circulating system in accordance with Onshore Order #2:

Diagram of the equipment for the circulating system in accordance with Onshore Order #2:

Describe what will be on location to control well or mitigate other conditions: Sufficient mud materials will be kept on location at all times in order to combat lost circulation or unexpected kicks. Mud logging program: 2 man unit from approximately after setting intermediate casing. No open hole logs, DSTs, or cores are planned.

Describe the mud monitoring system utilized: A Pason PVT system will be rigged up prior to spudding this well. A volume monitoring system that measures, calculates, and displays readings from the mud system on the rig to alert the rig crew of impending gas kicks and lost circulation. In order to effectively run casing, the mud viscosity and fluid loss properties may be adjusted.

Circulating Medium Table

Top Depth	Bottom Depth	Mud Type	Min Weight (Ibs/gal)	Max Weight (Ibs/gal)	Density (Ibs/cu ft)	Gel Strength (lbs/100 sqft)	НЧ	Viscosity (CP)	Salinity (ppm)	Filtration (cc)	Additional Characteristics
5600	9800	OTHER : Fresh water/brine	8.4	8.6							
1800	5600	OTHER : Brine water	9.8	10							
0	1800	SPUD MUD	8.4	8.9							
9800	1764 3	OTHER : Fresh water/brine	8.9	9.1							

Operator Name: LEGACY RESERVES OPERATING LP Well Name: LEA UNIT

Well Number: 64H

Section 6 - Test, Logging, Coring

List of production tests including testing procedures, equipment and safety measures: Mud logging program: 2 man unit from approximately after setting intermediate casing.

List of open and cased hole logs run in the well: MUDLOG

Coring operation description for the well:

No coring No open hole logs, DST's or cores are planned.

Section 7 - Pressure

Anticipated Bottom Hole Pressure: 4312

Anticipated Surface Pressure: 2156

Anticipated Bottom Hole Temperature(F): 162

Anticipated abnormal pressures, temperatures, or potential geologic hazards? NO

Describe:

Contingency Plans geoharzards description:

Contingency Plans geohazards attachment:

Hydrogen Sulfide drilling operations plan required? YES

Hydrogen sulfide drilling operations plan:

LEA_UNIT_64H_HS2_Plan_20180130083412.pdf

Section 8 - Other Information

Proposed horizontal/directional/multi-lateral plan submission:

Lea_Unit__64H_Design__1_Rpt_20180130083615.pdf Lea_Unit__64H_Design__1_AC_Rpt_20180130084030.pdf

Other proposed operations facets description:

Other proposed operations facets attachment:

Lea_Unit_64H_Drilling_Plan_20180130084052.pdf Lea_Unit__64H_GasCapturePlan_20180130084105.pdf

Other Variance attachment:

Flex_Hose_Specs_20180130134524.pdf















QUOTATION

Surface System Cameron Intl Corp CAM SURFACE SYS HQ - HOUSTON I CAMERON 3505 W SAM HOUSTON PKWY NORT HOUSTON TX 77043 USA	HQ H		Document number Page 1 of 6 Date Issued Payment Terms Terms and conditions Freight Terms	: US10/HT11/1489470-A : MAY 09 2017 : Net 30 Days s :As Attached/Included :FOB Ship Pt-PPD/Add-No Pro EX-WORKS - ODESSA, TX
Sold to : 22039905 LEGACY RESERVES LP P.O. Box 10848 MIDLAND TX 79702 USA			Ship To: 220 LEGACY RESERVI 303 W WALL STE MIDLAND TX 7970 USA	039905 ES LP 1400 01-5126
nside Sales Contact: Joycelyn M. FAI Dutside Sales Contact: David Treece/43	LLA/713-469-7221 2-337-5475		Email: joycel Email: david	lyn.failla@c-a-m.com .treece@c-a-m.com
	Customer Reference Valid From	:	CONVENTIONAL MAY 08 2017	

Valid To : JUN 09 2017 Project Reference :

WE APPRECIATE THE OPPORTUNITY OF SUBMITTING THIS QUOTATION FOR YOUR REQUIREMENT. SHOULD YOU REQUIRE ANY ADDITIONAL INFORMATION, PLEASE DO NOT HESITATE TO CONTACT US.

CONVENTIONAL 3-STRING

CASING PROGRAM: 13-3/8" X 9-5/8" X 5-1/2"

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Item	Material Number Description	Extended Weight	Qty UM	Unit Net Price USD	Extended Price USD
	Section A - CASING HEAD ASSY				
20	2161182-02-01 ASSY, CSG HEAD, IC-2-BP 13-5/8" API 3M X 13-3/8" SOW W/TWO 2" LPO'S API 6A 20TH ED., PSL-1; T/C P,U; M/C AA,DD-NL; PR-2 (PREPPED FOR STANDARD 'CR' LANDING B/	652 lb (SE)	1 EA	2,807.66	2,807.66
30	2057661-02-01 ASSY; TYPE 'CR' LANDING BASE FOR 13-5/8 FLG., 24 IN OD. BASE PLATE 850,000 LBS CAPACITY (MATL 36,000 YIELD)	257 lb	1 EA	1,297.66	1,297.66
40	021013-12 NIPPLE, API 2 IN LP, 6.00 IN LG SEAMLESS 5L GR B, 9.03 LB	4 lb	1 EA	24.33	24.33
50	2168084-10-31 VALVE, BALL, FLOATING, 2 IN (50 MM) X 1-1/2 IN (40 MM), B136-CS-43-CS FIGURE NUMBER, THREADED END (FXF), WKM, 3100 3000 PSI (206 BAR) MOP, 2719 PSI (187 BAR) MOP AT MAX TEMP, CARBON STEEL B	13 lb C5,	1 EA	102.89	102.89

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Item	Material Number Description	Extended Weight	Qty	UM	Unit Net Price USD	Extended Price USD
	CARBON STEEL/CHR PLATED BALL, CAR STEEL/ZINC PLATED STEM, ACETAL PLAS SEAT, WRENCH WITH LOCK DEVICE LESS API 607, B16.34, -20 F (-29 C) - +220 F (+104 C), ADJUSTABLE STEM PACKING	BON STIC S LOCK,				
60	007481-01 Bull Plug, 2" LP, TAPPED 1/2" NPT, 3.75" Long.	3 lb	1	EA	27.34	27.34
70	2738068-02 FITTING, VENT STRAIGHT 1/2 NPT SAFTY VENT, 4140 NACE / ZN PL TUNGSTEN CARBIDE BALL, 10,000 PSI MA	0 kg	1	EA	14.28	14.28
	Total Section A - CASING HEAD ASSY					4,274.16
	Section B - CASING SPOOL ASSY					
100	702001-57-02 RING GASKET, API TYPE R-57 LOW C STL OR SOFT IRON -PLATED /API 6A PSL 4, API MONOGRAM, REQUIRED	3 lb	1	EA	24.70	24.70
110	621650-03 ASSY: STUD & NUTS, 1.375 X 10.750" Long (B7 & 2H)	130 lb	20	EA	15.65	313.00
120	Y15000-23300001 CASING HANGER, IC-2, 13-5/8" X 9-5/8", API 6A 20TH ED., TEMP CLASS S, MATL CLASS AA,DD-NL, PSL 3, PR 2, GROUP 3. (-20F TO 150F MAX) (CARBOXYLATED NITRILE 70/80 DURO)	44 kg	1	EA	2,538.05	2,538.05
130	2216433-03-01 ASSY, SPOOL, TYPE 'IC-2-BP', 13-5/8 API 3K BTM X 11 API 5K FLGD TOP, W/TWO 2-1/16 API 5K SIDE STD'D OUTLETS W/2-1/16 API VR, TWO TYPE 'N' TIEDOWN SCREWS,W/'NX' BTM PREP, API 6A; 20TH ED; T/C U; M/C DD-NL; PSL 1; PR-2 (4130 MATERIAL)	1,446 lb	1	EA	4,769.22	4,769.22
140	640518-10 'NX' BUSHING, 13-5/8 NOM X 9-5/8	16 lb	1	EA	1,454.59	1,454.59



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Item	Material Number Description	Extended Weight	Qty	UM	Unit Net Price USD	Extended Price USD
	OD CSG, STD OR NACE SERVICE					
150	2222164-02-01 Valve Removal Plug, 2-1/16" 10K Max V W/1-1/2" Vee Tubing Thd, Api 6A 20Th Ed/ISO 10423, Matl Class DD-NL	l lb WP,	1	EA	74.93	74.93
160	2737400-01-01 ASSEMBLY, AOP COMMERCIAL GATE VAL 2-1/16 API 5,000 FLG X FLG, EXPANDING GATE, 6A 20TH EDITION, TEMP CLASS P+U, MATERIAL CLASS AA, PSL 1, PR 1	175 lb VE,	1	EA	746.80	746.80
170	142362-01-03-02 Flange, companion, 2-1/16" Api 5000 X 2" Api LP Thread, Api 6A 20th Edition, T/C: U, M/C: DD-NL, PSL 2	24 kg	2	EA	78.64	157.28
180	007481-01 BULL PLUG, 2" LP, TAPPED 1/2" NPT, 3.75" LONG.	3 lb	1	EA	27.34	27.34
190	2738068-02 FITTING, VENT STRAIGHT 1/2 NPT SAFTY VENT, 4140 NACE / ZN PL TUNGSTEN CARBIDE BALL, 10,000 PSI MAX	0 kg	1	EA	14.28	14.28
200	702001-24-02 RING GASKET, API TYPE R-24, LOW C STL OR SOFT IRON, PLATED, API 6A PSL 4, API MONOGRAM	2 lb	3	EA	5.13	15.39
210	Y51201-20220301 Stud W/Two Nuts, 7/8" X 6" Lg, B7/2H, Plated	12 lb	8	EA	3.27	26.16
	Total Section B - CASING SPOOL ASSY					10,161.74
	Section C - TUBING SPOOL	==				
240	702001-54-02 RING GASKET, API TYPE R-54, LOW C STL OR SOFT IRON, PLATED, API 6A PSL 4, API MONOGRAM	5 lb	1	EA	28.19	28.19

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Item	Material Number Description	Extended Weight	Qty	UM	Unit Net Price USD	Extended Price USD
250	621650-14 ASSY, STUD & NUTS, 1.875 X 14.750" Long (B7 & 2H)	180 lb	12	EA	35.18	422.16
260	Y15001-21002901 CASING HANGER, IC",-2, 11" X 5-1/2 API 6A 20TH ED, M/C AA, T/C S, PSL-3, PR2, GROUP-3/2	115 lb	1	EA	973.43	973.43
270	2309361-01-02 ASSY, SPOOL, TBG HEAD, TYPE 'C', 11 API 5K FLG BTM X 7-1/16 API 10K FLG TOP; W/ TWO 1-13/16 API 10K STD'D OUTLETS; W/ 1-13/16 API VR PREP; W/'NX' BTM PREP; API 6A 20TH ED; T/C: U; M/C: DD-NL; PSL-2, PR-2. (4130 LAS MATERIAL)	1,350 lb	1	EA	4,774.41	4,774.41
280	2348293-01-01 ASSY 11 X 5-1/2 'NT' BUSHING W/ DBL 'T'SEALS AND DBL 'S' SEALS, W/ INTERGRA BIT GUIDE (FOR STANDARD AND NACE SERVICE)	57 lb L	1	EA	942.17	942.17
290	141510-41-95-02 ASSEMBLY, FLS MANUAL GATE VALVE, 1-13/16 API 10,000 FLG, ISO 10423 AND API 6A 20TH EDITION, TEMP CLASS P+U, MATERIALS CLASS EE-1.5, PSL 2, PR 2	500 lb	2	EA	1,927.05	3,854.10
300	142359-01-03-02 Flange, companion, 1-13/16 Api 10,000 With 2" Api line pipe, 5000 pSi Wp Api 6A 20th Edition, temp class U, Matl class DD-NL, pSL 2	40 lb	2	EA	78.86	157.72
310	007481-01 Bull Plug, 2" LP, Tapped 1/2" NPT, 3.75" Long.	3 lb	1	EA	27.34	27.34
320	2738068-02 FITTING, VENT STRAIGHT 1/2 NPT SAFTY VENT, 4140 NACE / ZN PL TUNGSTEN CARBIDE BALL, 10,000 PSI MAX	0 kg	1	EA	14.28	14.28
330	702003-15-12 Ring Gasket, api type bx-151, low C Stl, plated, api 6a psl 4, api Monogram.	1 lb	4	EA	2.89	11.56

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Item	Materi Descri	ial Number ption	Extended Weight	Qty	UM	Unit Net Price USD	Extended Price USD
340	Y5120 STUD LG, A NUT, J	01-20120201 W/TWO NUTS, 3/4"-10 X 5-1/4" 193 B7 STUD/A 194 2H HVY HEX ZINC PLATED	16 lb	16	EA	3.77	60.32
	Total	Section C - TUBING SPOOL					11,265.68
Section	Summa	ary:					
	Total Total Total	Section A - CASING HEAD ASSY Section B - CASING SPOOL ASSY Section C - TUBING SPOOL				10	4,274.16 0,161.74 1,265.68
Price Su	mmary	:	Total F Total Quotation F	Price : Price :		25	5,701.58 USD 5,701.58 USD
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LSINVIA	TEDL	JELIVER I, IDA					

ESTIMATED DELIVERY: TBA EX-WORKS CAMERON ODESSA, TX AFTER RECEIPT OF ORDER; SUBJECT TO PRIOR SALE ******************

CAMERON DIVISION RESERVES THE RIGHT TO ISSUE A REVISED QUOTATION SHOULD THERE BE ANY DEVIATION OR ADDITIONS TO THIS QUOTATION.

DELIVERIES OFFERED HEREIN ARE BASED UPON MATERIAL AVAILABILITY AND MANUFACTURING CAPACITY AT TIME OF QUOTATION.

CAMERON DIVISION'S TERMS AND CONDITIONS OF SALE FORM A PART OF THIS QUOTATION AND SHALL APPLY TO ANY CONTRACT OF SALE.

PRICES QUOTED HEREIN ARE FIRM THROUGH DELIVERY IF ORDER IS PLACED WITHIN THE VALIDITY PERIOD OF THIS QUOTATION.

QUALIFICATION OF CAMERON WELD PROCEDURES INCLUDES HARDNESS TESTING OF THE WELD, BASE METAL AND HEAT-AFFECTED ZONE (HAZ) USING THE ROCKWELL B AND C SCALES. THIS IS CONSISTENT WITH OUR LONG ESTABLISHED AND SUCCESSFUL PAST PRACTICE. IT IS ALSO CONSISTENT WITH PREVIOUS EDITIONS OF NACE MR0175 AND WITH THE LATEST EDITION PROVIDED THAT THIS TESTING METHOD IS ACCEPTED BY THE BUYER.

CAMERON WILL CONTINUE TO USE ROCKWELL B AND C SCALES IN LIEU OF OTHER METHODS NOW LISTED IN NACE MR0175 / ISO 15156. BY ITS PURCHASE OF THESE PRODUCTS, THE BUYER ACKNOWLEDGES THE FOREGOING AND GIVES ITS CONSENT TO THE USE OF ROCKWELL B AND C HARDNESS TESTING FOR QUALIFICATION OF WELD PROCEDURES.



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AND CONDITIONS **FERMS**

1. CONTRACT ACCEPTANCE: Any written or oral purchase order rescired from Buser by Seller shall be constructed as a written acceptance of Selfe's offer o. and self and accondance with the terms and conditions of Sale's ACCEPTANCE. FITIS ORDER, IS EXPRESSLY CONDITIONED VERSUS ASSERVIT OTHE: EXPRESSLY TO NOTIFIONED VERSUS ASSERVIT OTHE: THIS CONTAINED HEREIN. The terms and conditions of Sale's proposal (if any) and acknowledgement shall prevail or or any conflicting to different terms in poer's order unsets Buser routes. Seller's proposal (if any) and acknowledgement address or within fere (11) by Safe Transformers and Sale's acknowledgement. Buser's standard streams of the results and conditions of Sale's acknowledgement. Buser's standard streams of purchase will not be considered and buser's purchase order or observise and not be exceeded as a whiter of the provision is conditions of sale. The failure of Seller to object to any provision in conditions will be exceeded as a whiter of the provision is conditions of sale.

2 QUOTATIONS AND PRICES Any product, service capability or manufacturing capability, which may be available as the first and the service of the process. The process process are adject to change without notice. The process and first and processable processation processes must be deterrible processable processation processes must be deterrible processation processes must be deterrible processable processes must be deterrible processable.

i of goods or the performance of services shall must be made by Seller, in which case Buy er n dubes, consular fees, insurance charges and e or production such payment n e price Custom 3 TAXES Any tax or other charge imposed by law on the sale be puild but the Buyer, unless the any specially provides that a shall reimbures. Seller for such payment as part of the purchase other comparable charges will be borne by Buy or

4 SHIPPING SCHEDULE AND DELIVERY: Shipment schedules are given as accurately as conditions permit and every effort will be made to make informents as scheduled. Selfer will not be responsible for elevations in the impleming ablending to the responsible for elevations in the impleming schedule. Be whether due to Axis of Cod, eden Nearen grown, many schedules and perry occasations in the impleming schedule. Be have due to the cases by one of the north perry occasation, supplies, the power or transportation. Recall able of the power or transportation, the additional inter any occasation of schedules are forward to the power or transportation. Recall able of the near and the cases by one Selfer's reasonable control. Nucleic of similar schedules are distinued and the control of the power or transportation. Recall able of the nearest power of rem watch to power or transportation. Recalled and the control of the power or transportation. Recalled and the control of the power or transportation. Recalled and the control of the power or transportation. Recalled and the control of the power or transportation. Recalled and the control of the power or transportation. Recalled and the control of the power or transportation. Recalled and the control of the power or transportation. Recalled and the control of the power or transportation. Recalled and the control of the power or transportation. Recalled and the control of the power or transportation. Recalled and the control of the power or transportation and the control of the power or transportation. Recalled and the control of the power or transportation and the control of the power or transportation. Recalled and the control of the power or transportation and the control of the power or transportation and the control of the power or transportation and the power or the power or transportation and the control of the power or transportation and the control of the power or transportation and the control of the power or transportation and the cower and the power or transportat

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canceled credit or 2 D 6 CANCELLATIONS AND RETURNS Purchase orders once placed by Buy et and accepted by Seller can only with Seller's written consent and upon terms which will save Seller from loss. No products may be returned adjustment without written permission from Seller's office authorized to issue such permission.

7 WARRANTIES Contractor variants that goods of its manufacture shall be free from defects in materials and revolvantants for a period of nex (1) year after being placed in service or eighteen (1) months from defects in materials and revolvantants) for a period of one (1) year after being placed in service or eighteen (1) months from defects in materials and revolvantants for a period of one (1) year after being placed in service or eighteen (1) months from defects in materials and revolvantants. The presence of the presence of the product of the presence of the product of the presence of the pres

applicable the United 8 ENGINEERING AND SERVICE Upon reguest. Selfer will provide engineering and or technical information regaring products and then uses and, if feasible, will provide personnel to assist Baye in effecting field unsultations and/or technical information. Earlier or assistance so provided, whether with or without charge, shall be advisory only service charged whether with or without charge, shall be advisory only 9 LABOR STANDARDS selfer hereby certifies that the devisory only service charged with the devisory only 9 LABOR STANDARDS selfer hereby certifies that does products were produced in accordance with all applic requirements of Seconds. A nod 12 of the Far Labor Standards Act as amended and of regulations and orders of the Us Statis Expandence of Labor issued under Seconds.

Seller's defects in such its must be made at S as regards latent de prior to shipment in products evcept ceptance of p conclusive e ing working | ac ac otherwise agreed in writing. final inspection and receiving point designated by Seller and shall inspect at the Seller's plant or shipping point of with operations. 10 INSPECTION Unless of plant or other shipping or re Buyer's representatives may a manner as will not interfere w.

11. DELIVERY AND ACCEPTANCE. Delivery shall be in accordance with the requirements in the Parchase Contriported in the creat Bayer at unable to accept delivery upon completion of the manufasture of the Goost in accordation with such requirements. Bayer agree that (i) this most affect of conserving shall pass to Bayer on date of Seller's invoice. (ii) Boyer with make portional with such requirements with such requirements and such adopt affect of such accerdance with such requirements.

12 EXPORT COMPLANCE: The Buy or shall provide the Selfer with relevant end-use: and-user and country of end-use functionation with speech to the goods: services, software or technology to be supplied hereander (collecture). Items these do in relatince on such information: the Steffer will supply software starburg the starburg and an inflame country information. The Steffer will supply software starburg to the starburg technology to be starburg to the Use of the Use of the Steffer will supply software starburg the starburg the starburg the starburg technology that starburg to reduse; including a shiptone the knowneys other than the US 3 may be compared with all tands and customes laws the due of starbords that and customes the starburg technology with all tands and customes laws which multi-starburg technology with all tands and starbords technology that and customes and starbords technology that and customes the starburg technology starburg technology that and customes the starburg technology technology to the starburg technology technol

13 TRANSPORTATION CHARGES ALLOWANCES CLAINS All press are FOB Seller's plant or other designated between Seller and Bares and an event of the Seller's quotation (if m) or in a vittime contrast which may exist regist is allowed and bares and the seller's quotation or a vittime neutrast statist and or a protein of the seller's plant or a vittime versa. Seller's quotation or a vittime neutrast statist and or a protein of the seller's quotation or a vittime neutrast statist and or a protein of the seller's plant or other designated by the seller seller's quotation or a vittime neutrast statist and or a protein of the statist or entrast statist and or approximation statist and bare and bare and the statistic plant or other designated by the seller server statist and to add print ordesignate the selected from the seller plant or entrast statist and to add ordes the seller is dediced from the seller plant or contrast statist and to add ordes the seller is dediced from the seller plant or contrast statist and to add order or and to spin the same statist. The molecular scalar shift in balances is any first and the same statist and the shift plant or contrast statist statist and the same statist and the same statist is any statistic statist statist and the same statist and the

regardless of who pays shipping costs. Seller endencors to pack or prepare all shipments so that they will not break, must or acteriorate in transit, then does not guarantee against such damage. Unless requested in writing bit, Buyer, no shipments instared by Seller against damage to foss it marini. Seller will pack to instance active an sossible in accordance with Buyer's written instructions but in such case Seller acts only as agein between the instance. Company and the Buyer and Estoremable in transition but in such case Seller acts only as agein between the instances company and the Buyer and estoremotion and hould be made to the carrier. All claims regarding shortness must be made within thirty (30) days for recepts of shipment and must be accompanied by the packing fusty) corting the shipment 14. INDEMNIFICATION AND LIMITATION OF LIABILITY:

A INDEMNIFICATION: Boost Group means Buyer, its patent (if any,) subsidiaries, affiliates, co-owners, co-statuers, and and storing, with whom Buyer has an economic interest with respect to the Work including Buyer's constorer and the trespective employees, provided a for the constraint of the constraint and the trespective angless, contrastors and subcontactors for the constraint of decision of these and the super to the Work including Buyer's contrastors and subcontactors to the constraint of the constraint of the constraint of the super to the super constraint of the constraint Selfs: In present (if any), hybeldarse, affinists, coortexions and absources (treppetint) and of any tier of level and absources and absources (treppetint) and straints (presentialists, approx, constraint and subcontactors and straints, respective straints, presentialists, and the respective the and of any tier of level and buse of non-use and straints (presentialists).

(1) Selfer shall release, defend avec, indemnify (collectively. Indemnify,) and hold Bayer Group Hamless from and again dimmits to the formatic, hosse, damages and causes of actions of whatever kind or nature (collectively Claims). For loss of admings to the property of the members of the Selfer Group over if such Claims arise from or attributable to the Negligen of the members of Bayer Group.

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to the property Negligence of mage to the loss of or dam attributable to and against all Claims for l such Claims arise from or harmless from au r Group even if s Buyer shall Indemnify and hold Seller Group h (luding the Work) of the members of the Buyer members of Seller Group (3) (incl

the r from and against all Claims for the death(s) of or arise from or attributable to the Negligence of t (4) Buyer shall Indemntfy and hold Seller Group harmless ((ies) to members of the Buyer Group even if such Claims Seller Group.

a behalf of Seller Group) I them by or on behalf of \$) of or damage(\$) to the ler Group. It is agreed by d against them by a third (5) Buy et (on its own behalf and on behalf of Buyer Group) and Sellert (on its own behalf and on b all indomnity and hold each other harmless from and against any and all (Laims asserted against it any third party for the death(s) for the corresting to(s) to such a third party, as well as loss (es) to property of stach a third party. A third party is a person or early not included in Buyer Group or Seller Buyer and Seller that their irrespective dath of indexton a control and in Buyer Group or Seller party: pursuant to this Atricle 14 (A) (5) shall be limited to their respective degree of Negligence.

of arrisin to th d hold the member or hydrocarbons) an f or attributable to (6) Notwithstanding any other provision contained in this Agreement. Buyer shall Indemnify and I Selber Group humatives from and against all Claims (including clean-up costs and loss (es) of oil, gas of from polyhour, containination, damping or synthling of any substance and even if arising out of c Nephpence of the members of the Selfer Group

B INDEMNITY FOR CONSEQUENTIAL DAMAGES UNDER NO CIRCUMSTANCES SHALL SELLER BE LIABLE CONSEQUENT. CONSEQUENTIAL INCIDENTIAL ENCIDENTIAL EXERPLANCE SHALL SELLER BE LIABLE CONSEQUENTIAL). AND ENCIDENTIAL INCIDENTIAL ENCIDENTIAL SUCCESSION FOR POLATION OF ANTICIPATED PROFITS. LOSS OF BUSINESS OPPORTUNIT. LOSS OF USE OF DAMAGES (GOIRGING OF ANTICIPATED PROFITS. LOSS OF BUSINESS OPPORTUNIT. LOSS OF USE OF EQUENTENT OR FALLITY NITO WICH CHIEFS BULIPMENT MAY BE LOCATED OR AT INSTALLATION. SYSTEM OR FALLITY NITO WICH SELLER'S BULIPMENT MAY BE LOCATED OR AT INSTALLATION. SYSTEM OR FALLITY NITO WICH SELLER'S BULIPMENT MAY BE CLOCATED OR AT INSTALLATION. SYSTEM OR FALLITY NITO WICH SELLER'S BULIPMENT MAY BE FOLDED OR AT INSTALLATION. SYSTEM OR FALLITY NITO WICH SELLER'S BULIPMENT MAY BE FERED CONSCOURT. AND HOLD SELLER GROUP MAN' BE FEREDORANDO WORK, AND BUVER AGRES TO INSTANDATA. DAMAGES EVEN IF ANSING OUT OF OR ATTRIBUTABLE TO THE MEGLIGENCE OF THE MEMBERS OF THE SELLER GROUP.

C LIMITATION OF LIABILITY EXCEPT AS OTHERWISE EXPRESSAV LIMITED IN THIS AGREEMENT IT IS THE EXPRESS INTENTION OF THE PARTIES SHILL RE (I) SUPPORTED BY TRUEWATTONS AND/OR LIABILITIES HRREN ASJUNED NT HE PARTIES SHILL RE (I) SUPPORTED BY TRUEWATCH, (II) MITHOUT LIABILITIES HRREN ASJUNED NT HE CAUSE OR CAUSES THEREOF INCLUDING, BUT AND THATIES I. D. PRESSTATISTICO OF THE PARTIES SHILL RE (I) SUPPORTED BY TRUEWATCH, (II) MITHOUT DD. PRESSTATISTICO OF THE RATIES SHILL RE (I) SUPPORTED BY TRUEWATCH, III USSEAMORTHINESS OF ANY VIESSEL OR VESSELS WHETHER OF NOT PRESSTATION. THE USSEAMORTHINESS OF ANY VIESSEL OR VESSELS WHETHER OF NOT PRESSTATION. THE USSEAMORTHINESS OF ANY VIESSEL OR VESSELS WHETHER OF NOT PRESSTATION. THE INTELED, BREACH OF OUT (I) TATIOTORY CONTRACTAL COMMON LAW OR DATEMENTIAL CONTINUES OF ANY VIESSEL OR WITHER OF NOT BREACH OF DUT VIESSE OF TRESSTATION OF THE DATE SHALL OF ANY PARTY USSES FOLLOW OF RESSTATION THE DATE SHALL OF OUT (I) OF ANY MARANTY EXPRESS OR OTHERWISE, STRUCT LIABILITY. CONDITION OF RUIN OR DEFECTIVE PREMISES EQUIPARENT CONDITIONS IS REACH OF DUT (I) THE LOJADING OR WILTING OR NOT LAND OF RESSONS OF CARGO. TORT: OR ANY PARTY USER ANY DARY VIESS. THE LOJADING OR UNLOADING OF PRESSONS OF CARGO. TORT: OR ANY TRATES. THE LOJADING OR UNLOADING OF PRESSONS OF CARGO. TORT: OR ANY TRATES. THE LOJADING OR UNLOADING OF PRESSONS OF CARGO. TORT: OR ANY TRATES. THE LOJADING OR UNLOADING OF PRESSONS OF CARGO. TORT: OR ANY TARTES. THE LOJADING OR UNLOADING OF PRESSONS OF CARGO. TORT: OR ANY TARTES. THE LOJADING OR UNLOADING OF PRESSONS OF CARGO. TORT: OR ANY TARTES. THE LOJADING OR UNLOADING OF PRESSONS OF CARGO. TORT: OR ANY TARTES. THE LOJADING OR UNLOADING OF PRESSONS OF CARGO. TORT: OR ANY TARTES. THE LOJADING OR UNLOADING OF RESSONS OF CARGO. TORT: OR ANY TARTES. THE LOJADING OR UNLOADING OF TRATES OF AND THE PRESSON OF CARGO OF AULT OF ANY PARTY VIESE THE CARGO. THE RUINES OF THE PARTY O

13 MODIFICATION, RESCISSION & WAVER. The terms herein may not be modified or reseinded nor any of its performance of the source or variety at his more present to the modified or reseinded nor any of its performance of the housen. These, Failure of Salter to usis an aviang and agreed by an authorized employee of the failer at his officient housen. These, Failure of Salter to usis an aviang and agreed by an authorized employee of the failer at housen. These, Failure of Salter to usis an aviang and agreed by an authorized end any of the sourcest or the failure of Salter to testice and of its rights hereunder shall not be contract or the failure of Salter to excise any of its rights hereunder shall not be contract or the failure of Salter to excise any of the restrict any of the restrict any of the restrict and the restrict and the restrict and the restrict any of the restrict any of the restrict and the restrict and the restrict any of the restrict and the restrict and the restrict and the restrict any of the restrict and restrict and the restrict and restrict and restrict and restrict and the restrict and the restrict and restrict and

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Intern	al Hydrost	atic Test Cert	ificate	
General Informa	ation	Ho	se Specif	ications
Customer	HOBBS	Hose Assembly Typ	ре	Rotary/Vibrator
MWH Sales Representative	CHARLES ASH	Certification		API 7K/FSL LEVEL2
Date Assembled	2/19/2017	Hose Grade		D
location Assembled	OKC	Hose Working Pres	sure	5000
Sales Order #	318810	Hose Lot # and Da	te Code	10958-08/13
Customer Purchase Order #	356945	Hose I.D. (Inches)		3.5"
Assembly Serial # (Pick Ticket #)	384842	Hose O.D. (Inches)		5.45"
Hose Assembly Length	20FT	Armor (yes/no)		NO
	Fit	tings		
End A			End E	3
Stem (Part and Revision #)	R3.5X64WB	Stem (Part and Revision	#)	R3.5X64WB
Stem (Heat #)	13105653	Stem (Heat #)		13105653
Ferrule (Part and Revision #)	RF3.5X5330	Ferrule (Part and Revis	ion #)	RF3.5X5330
Ferrule (Heat #)	34038185	Ferrule (Heat #)		3403818
Connection . Flange Hammer Union Part	4-1/16 5K	Connection (Part #)		4-1/16 5K
Connection (Heat #)		Connection (Heat #)		
Nut (Part #)		Nut (Part #)		
Nut (Heat #)		Nut (Heat #)		
Dies Used	5.62"	Dies Used		5.53"
	Hydrostatic Te	est Requirement	s	
Test Pressure (psi)	7,500	Hose assembly	was testea	with ambient water
Test Pressure Hold Time (minutes)	10 1/2		temperat	ure.
Date Tested	Teste	d By		Approved By
				-

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MHSI-008 Rev. 0.0 Proprietary

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	Midw	est Hose	
	& Spec	cialty, Inc.	
	Certificate	of Conformity	
Customer: HOBBS		Customer P.O.# 356945	
Sales Order # 318810		Date Assembled: 2/19/2017	
	Speci	fications	
Hose Assembly Type:	Rotary/Vibrator	Rig #	
Assembly Serial #	384842	Hose Lot # and Date Code	10958-08/13
Hose Working Pressure (psi)	5000	Test Pressure (psi)	7500
Hose Assembly Description:		TRH56D-645KH-645KH-20.00	' FT
Ve hereby certify that the abov o the requirements of the purc upplier: Aidwest Hose & Specialty, Inc. 1312 S I-35 Service Rd	e material supplied fo hase order and curren	or the referenced purchase orde nt industry standards.	r to be true according
Ve hereby certify that the abov o the requirements of the purc upplier: Midwest Hose & Specialty, Inc. 1312 S I-35 Service Rd Dklahoma City, OK 73129 Tomments:	e material supplied fo hase order and curren	or the referenced purchase orde nt industry standards.	r to be true according
Ve hereby certify that the abov o the requirements of the purc upplier: Aidwest Hose & Specialty, Inc. 312 S I-35 Service Rd Oklahoma City, OK 73129 Tomments:	e material supplied fa hase order and currer	or the referenced purchase ordent industry standards.	r to be true according

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MHSI-009 Rev.0.0 Proprietary





February 19, 2017

	h.N	W		
	Midw & Spec	est Hose rialty, Inc.		
Inter	nal Hydrosta	atic Test Certificate		
General Inform	nation	Hose Specif	fications	
Customer	HOBBS	Hose Assembly Type	Rotary/Vibrator	
MWH Sales Representative	CHARLES ASH	Certification	API 7K/FSL LEVEL2	
Date Assembled	2/19/2017	Hose Grade	D	
ocation Assembled	OKC	Hose Working Pressure	5000	
Sales Order #	318810	Hose Lot # and Date Code	10958-08/13	
Customer Purchase Order #	356945	Hose I.D. (Inches)	3.5"	
Assembly Serial # (Pick Ticket #)	384842	Hose O.D. (Inches)	5.45"	
Hose Assembly Length	20FT	Armor (yes/no)	NO	
and the second	Fit	tings	eren and the	
End A		End	3	
Stem (Part and Revision #)	R3.5X64WB	Stem (Part and Revision #)	R3.5X64WB	
Stem (Heat #)	13105653	Stem (Heat #)	13105653	
Ferrule (Part and Revision #)	RF3.5X5330	Ferrule (Part and Revision #)	RF3.5X5330	
Ferrule (Heat #)	34038185	Ferrule (Heat #)	3403818	
Connection . Flange Hammer Union Part	4-1/16 5K	Connection (Part #)	4-1/16 5K	
Connection (Heat #)		Connection (Heat #)		
		Nut (Part #)		
Nut (Part #)		Nut (Heat #)		
Nut (Part #) Nut (Heat #)				
Nut (Part #) Nut (Heat #) Dies Used	5.62"	Dies Used	5.53"	
Nut (Part #) Nut (Heat #) Dies Used	5.62" Hydrostatic Te	Dies Used	5.53"	
Nut (Part #) Nut (Heat #) Dies Used Fest Pressure (psi)	5.62" Hydrostatic Te 7,500	Dies Used est Requirements Hose assembly was tested	5.53" d with ambient water	

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MHSI-008 Rev. 0.0 Proprietary

	1.JV		
	Midw	est Hose	
	& Spec	cialty, Inc.	
	Certificate	of Conformity	
Customer: HOBBS		Customer P.O.# 356945	
Sales Order # 318810		Date Assembled: 2/19/2017	
	Speci	fications	
Hose Assembly Type:	Rotary/Vibrator	Rig #	
Assembly Serial #	384842	Hose Lot # and Date Code	10958-08/13
Hose Working Pressure (psi)	5000	Test Pressure (psi)	7500
Hose Assembly Description:		TRH56D-645KH-645KH-20.00	' FT
Ve hereby certify that the abov o the requirements of the purc upplier: Aidwest Hose & Specialty, Inc. 1312 S I-35 Service Rd	e material supplied fu hase order and currer	or the referenced purchase orde nt industry standards.	r to be true according
Ve hereby certify that the abov o the requirements of the purc upplier: Aidwest Hose & Specialty, Inc. 312 S I-35 Service Rd Oklahoma City, OK 73129 Tomments:	e material supplied fo hase order and curren	or the referenced purchase orde nt industry standards.	r to be true according
Ve hereby certify that the abov o the requirements of the purc upplier: Aidwest Hose & Specialty, Inc. 312 S I-35 Service Rd Oklahoma City, OK 73129	e material supplied fo hase order and currer	or the referenced purchase orde nt industry standards.	r to be true according
/e hereby certify that the abov o the requirements of the purch upplier: Iidwest Hose & Specialty, Inc. 312 S I-35 Service Rd klahoma City, OK 73129 omments:	e material supplied fo hase order and currer	or the referenced purchase orde nt industry standards. Dote	r to be true according

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QUOTATION

Surface System
Cameron Intl Corp
CAM SURFACE SYS HQ - HOUSTON HQ
CAMERON
3505 W SAM HOUSTON PKWY NORTH
HOUSTON TX 77043
USA

Document number	:US10/HT11/1489470-A
Page 1 of 6	
Date Issued	:MAY 09 2017
Payment Terms	: Net 30 Days
Terms and conditions	:As Attached/Included
Freight Terms	:FOB Ship Pt-PPD/Add-No Pro
U	EX-WORKS - ODESSA, TX

22039905

Email: joycelyn.failla@c-a-m.com

Sold to : 22039905 LEGACY RESERVES LP P.O. Box 10848 MIDLAND TX 79702 USA

	Customer Reference	:
Outside Sales Contact:	David Treece/432-337-5475	
Inside Sales Contact:	Joycelyn M. FAILLA/713-469-7221	

Email: david.treece@c-a-m.com e : CONVENTIONAL : MAY 08 2017 : JUN 09 2017

Ship To:

USA

LEGACY RESERVES LP

303 W WALL STE 1400

MIDLAND TX 79701-5126

: JUN 09 2017 :

WE APPRECIATE THE OPPORTUNITY OF SUBMITTING THIS QUOTATION FOR YOUK REQUIREMENT. SHOULD YOU REQUIRE ANY ADDITIONAL INFORMATION, PLEASE DO NOT HESITATE TO CONTACT US.

Valid From

Project Reference

Valid To

CONVENTIONAL 3-STRING

CASING PROGRAM: 13-3/8" X 9-5/8" X 5-1/2"

Item	Material Number Description	Extended Weight	Qty	UM	Unit Net Price USD	Extended Price USD
	Section A - CASING HEAD ASSY	= =				
20	2161182-02-01 ASSY, CSG HEAD, IC-2-BP 13-5/8" API 3M X 13-3/8" SOW W/TWO 2" LPO'S API 6A 20TH ED., PSL-1; T/C P,U; M/C AA,DD-NL; PR-2 (PREPPED FOR STANDARD 'CR' LANDING B/	652 lb ASE)	1	EA	2,807.66	2,807.66
30	2057661-02-01 ASSY; TYPE 'CR' LANDING BASE FOR 13-5/8 FLG., 24 IN OD. BASE PLATE 850,000 LBS CAPACITY (MATL 36,000 YIELD)	257 lb	1	EA	1,297.66	1,297.66
40	021013-12 NIPPLE, API 2 IN LP, 6.00 IN LG SEAMLESS 5L GR B, 9.03 LB	4 lb	1	EA	24.33	24.33
50	2168084-10-31 VALVE, BALL, FLOATING, 2 IN (50 MM) X 1-1/2 IN (40 MM), B136-CS-43-CS FIGURE NUMBER, THREADED END (FXF), WKM, 3100 3000 PSI (206 BAR) MOP, 2719 PSI (187 BAR) MOP AT MAX TEMP, CARBON STEEL E	13 lb C5, BODY,	1	EA	102.89	102.89



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Item	Material Number Description	Extended Weight	Qty	UM	Unit Net Price USD	Extended Price USD
	CARBON STEEL/CHR PLATED BALL, CARB STEEL/ZINC PLATED STEM, ACETAL PLAS SEAT, WRENCH WITH LOCK DEVICE LESS API 607, B16.34, -20 F (-29 C) - +220 F (+104 C), ADJUSTABLE STEM PACKING	SON TIC LOCK,				
60	007481-01 Bull Plug, 2" LP, Tapped 1/2" NPT, 3.75" Long.	3 lb	1	EA	27.34	27.34
70	2738068-02 FITTING, VENT STRAIGHT 1/2 NPT SAFTY VENT, 4140 NACE / ZN PL TUNGSTEN CARBIDE BALL, 10,000 PSI MAX	0 kg	1	EA	14.28	14.28
	Total Section A - CASING HEAD ASSY					4,274.16
	Section B - CASING SPOOL ASSY	===				
100	702001-57-02 RING GASKET, API TYPE R-57 LOW C STL OR SOFT IRON -PLATED /API 6A PSL 4, API MONOGRAM, REQUIRED	3 lb	1	EA	24.70	24.70
110	621650-03 ASSY: STUD & NUTS, 1.375 X 10.750" Long (B7 & 2H)	130 lb	20	EA	15.65	313.00
120	Y15000-23300001 CASING HANGER, IC-2, 13-5/8" X 9-5/8", API 6A 20TH ED., TEMP CLASS S, MATL CLASS AA,DD-NL, PSL 3, PR 2, GROUP 3. (-20F TO 150F MAX) (CARBOXYLATED NITRILE 70/80 DURO)	44 kg	1	EA	2,538.05	2,538.05
130	2216433-03-01 ASSY, SPOOL, TYPE 'IC-2-BP', 13-5/8 API 3K BTM X 11 API 5K FLGD TOP, W/TWO 2-1/16 API 5K SIDE STD'D OUTLETS W/2-1/16 API VR, TWO TYPE 'N' TIEDOWN SCREWS,W/'NX' BTM PREP, API 6A; 20TH ED; T/C U; M/C DD-NL; PSL 1; PR-2 (4130 MATERIAL)	1,446 lb	1	EA	4,769.22	4,769.22
140	640518-10 'NX' Bushing, 13-5/8 Nom X 9-5/8	16 lb	1	EA	1,454.59	1,454.59



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Item	Material Number Description	Extended Weight	Qty	UM	Unit Net Price USD	Extended Price USD
	OD CSG, STD OR NACE SERVICE					
150	2222164-02-01 Valve Removal Plug, 2-1/16" 10K Max W W/1-1/2" Vee Tubing Thd, Api 6A 20Th Ed/ISO 10423, Matl Class DD-NL	1 lb VP,	1	EA	74.93	74.93
160	2737400-01-01 ASSEMBLY, AOP COMMERCIAL GATE VALV 2-1/16 API 5,000 FLG X FLG, EXPANDING GATE, 6A 20TH EDITION, TEMP CLASS P+U, MATERIAL CLASS AA, PSL 1, PR 1	175 lb VE,	1	EA	746.80	746.80
170	142362-01-03-02 FLANGE, COMPANION, 2-1/16" API 5000 X 2" API LP THREAD, API 6A 20TH EDITION, T/C: U, M/C: DD-NL, PSL 2	24 kg	2	EA	78.64	157.28
180	007481-01 Bull Plug, 2" LP, TAPPED 1/2" NPT, 3.75" Long.	3 lb	1	EA	27.34	27.34
190	2738068-02 Fitting, vent straight 1/2 NPT Safty vent, 4140 Nace / Zn PL Tungsten carbide ball, 10,000 PSI Max	0 kg	1	EA	14.28	14.28
200	702001-24-02 Ring Gasket, api type R-24, low C Stl or Soft Iron, plated, api 6a PSL 4, api Monogram	2 lb	3	EA	5.13	15.39
210	Y51201-20220301 Stud W/TWO NUTS, 7/8" X 6" LG, B7/2H, Plated	12 lb	8	EA	3.27	26.16
	Total Section B - CASING SPOOL ASSY					10,161.74
	Section C - TUBING SPOOL					
240	702001-54-02 Ring Gasket, api type R-54, low C STL or Soft Iron, plated, api 6a PSL 4, api Monogram	5 lb	1	EA	28.19	28.19



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Item	Material Number Description	Extended Weight	Qty	UM	Unit Net Price USD	Extended Price USD
250	621650-14 ASSY, STUD & NUTS, 1.875 X 14.750" Long (B7 & 2H)	180 lb	12	EA	35.18	422.16
260	Y15001-21002901 CASING HANGER, IC",-2, 11" X 5-1/2 API 6A 20TH ED, M/C AA, T/C S, PSL-3, PR2, GROUP-3/2	115 lb	1	EA	973.43	973.43
270	2309361-01-02 ASSY, SPOOL, TBG HEAD, TYPE 'C', 11 API 5K FLG BTM X 7-1/16 API 10K FLG TOP; W/ TWO 1-13/16 API 10K STD'D OUTLETS; W/ 1-13/16 API VR PREP; W/'NX' BTM PREP; API 6A 20TH ED; T/C: U; M/C: DD-NL; PSL-2, PR-2. (4130 LAS MATERIAL)	1,350 lb	1	EA	4,774.41	4,774.41
280	2348293-01-01 ASSY 11 X 5-1/2 'NT' BUSHING W/ DBL 'T'SEALS AND DBL 'S' SEALS, W/ INTERGRA BIT GUIDE (FOR STANDARD AND NACE SERVICE)	57 lb	1	EA	942.17	942.17
290	141510-41-95-02 ASSEMBLY, FLS MANUAL GATE VALVE, 1-13/16 API 10,000 FLG, ISO 10423 AND API 6A 20TH EDITION, TEMP CLASS P+U, MATERIALS CLASS EE-1.5, PSL 2, PR 2	500 lb	2	EA	1,927.05	3,854.10
300	142359-01-03-02 FLANGE, COMPANION, 1-13/16 API 10,000 WITH 2" API LINE PIPE, 5000 PSI WP API 6A 20TH EDITION, TEMP CLASS U, MATL CLASS DD-NL, PSL 2	40 lb	2	EA	78.86	157.72
310	007481-01 Bull Plug, 2" LP, TAPPED 1/2" NPT, 3.75" Long.	3 lb	1	EA	27.34	27.34
320	2738068-02 Fitting, vent straight 1/2 NPT Safty vent, 4140 Nace / ZN PL Tungsten carbide Ball, 10,000 PSI Max	0 kg	1	EA	14.28	14.28
330	702003-15-12 Ring Gasket, api type bx-151, low C STL, plated, api 6a psl 4, api Monogram.	1 lb	4	EA	2.89	11.56



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Item	Mater Descri	ial Number iption	Extended Weight	Qty	UM	Unit Net Price USD	Extended Price USD
340	Y512 STUD LG, A NUT,	01-20120201 9 W/TWO NUTS, 3/4"-10 X 5-1/4" 193 B7 STUD/A194 2H HVY HEX ZINC PLATED	16 lb	16	EA	3.77	60.32
	Total	Section C - TUBING SPOOL					11,265.68
Section	n Summ	ary:					
	Total	Section A - CASING HEAD ASSY					4,274.16
	Total	Section B - CASING SPOOL ASSY				10	0,161.74
	Total	Section C - TUBING SPOOL				1	1,265.68
Price S	ummary	y :	Total Total Quotation	Price : Price :		2:	5,701.58 USD 5,701.58 USD
*****	******	****					
ESTIM EX-W	IATED I ORKS C	DELIVERY: TBA AMERON ODESSA, TX				,	

AFTER RECEIPT OF ORDER; SUBJECT TO PRIOR SALE

CAMERON DIVISION RESERVES THE RIGHT TO ISSUE A REVISED QUOTATION SHOULD THERE BE ANY DEVIATION OR ADDITIONS TO THIS QUOTATION.

DELIVERIES OFFERED HEREIN ARE BASED UPON MATERIAL AVAILABILITY AND MANUFACTURING CAPACITY AT TIME OF QUOTATION.

CAMERON DIVISION'S TERMS AND CONDITIONS OF SALE FORM A PART OF THIS QUOTATION AND SHALL APPLY TO ANY CONTRACT OF SALE.

PRICES QUOTED HEREIN ARE FIRM THROUGH DELIVERY IF ORDER IS PLACED WITHIN THE VALIDITY PERIOD OF THIS QUOTATION.

QUALIFICATION OF CAMERON WELD PROCEDURES INCLUDES HARDNESS TESTING OF THE WELD, BASE METAL AND HEAT-AFFECTED ZONE (HAZ) USING THE ROCKWELL B AND C SCALES. THIS IS CONSISTENT WITH OUR LONG ESTABLISHED AND SUCCESSFUL PAST PRACTICE. IT IS ALSO CONSISTENT WITH PREVIOUS EDITIONS OF NACE MR0175 AND WITH THE LATEST EDITION PROVIDED THAT THIS TESTING METHOD IS ACCEPTED BY THE BUYER.

CAMERON WILL CONTINUE TO USE ROCKWELL B AND C SCALES IN LIEU OF OTHER METHODS NOW LISTED IN NACE MR0175 / ISO 15156. BY ITS PURCHASE OF THESE PRODUCTS, THE BUYER ACKNOWLEDGES THE FOREGOING AND GIVES ITS CONSENT TO THE USE OF ROCKWELL B AND C HARDNESS TESTING FOR QUALIFICATION OF WELD PROCEDURES.



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TERMS AND CONDITIONS

1 CONTRACT ACCEPTANCE: Any written or oral purchase order received from Buyer by Seller shall be construed as a written acceptance of Seller's offer to sell and shall be filled in accendance with the terms and conditioned of selle set forth berein. SELLER's ACCEPTANCE FOR THIS ROBERTS EXPENSIVE (CONTRINCED ON BUYER'S ASSENT TO THE TERMS CONTANED HEREIN. The terms and conditiones of Seller's proposal (if any) and acknowledgement shall pervaid over any conliciting different terms and conditiones of Seller's standard terms of purchase within fifteen (15) days from receipt of Seller's acknowledgement. Bayers standard terms of purchase within the consistence on Buyer's purchase order or otherwise shall not be considered for to Seller's terms and conditiones of seller to object to any provision in conflic herewith whether consumed on Buyer's purchase order or otherwise shall not be construed as a waiver of the provisions hereof nor as an acceptance thereof.

2 QUOTATIONS AND PRICES Any product service capability or manufacturing capability which may be available the time quotation is made is subject to provide the process quoted are subject to change without noise. The prece in effect the time of shipment including any escalation formula will apply, nucless a vial quotation ere written agreement to contrary, visits between Bayer and Selter. All precess shown are to U.S. dollars and are FOB. Selter's shipping point Se-reserves the right to place a service charge on past due accounts at the highest may provide the saw, any documentation pertaining to truesability requirements for non-materials or products or documentation material by law. Any documentation processes must be idemified by the Bayer at the tume of quotation (if any) or at the time of order placement. Cial Inor lle be

3 TAVES. Any tax or other charge imposed by law on the sale or production of goods be paid by the Buer, unless the law specifically provides that such payment must be a shall reimburse Selfer for such payment as part of the purchase price Custom dutes, o other comparable charges will be borne by Bayer. ds or the performance of services shall made by Seller, in which case Buyer consular fees, insurance charges and

4 SHIPPING SCHEDULE AND DELIVERY. Shipment schedules are given as accurately as conductors permit and even effort will be made to make shipments as schedule. Seller vill not be responsible for deviations in meeting shipping schedule. The provide the schedule of the s

6 CANCELLATIONS AND RETURNS Purchase orders once placed by Bayer and accepted by Seller can be canceld only with Seller's writter oncollinated upon terms which will serv Seller from loss. No products may be returned for readilor adjustment without written permission from Seller's office authorized to issue such permission.
7 WARKANTES Contractor warrants that pools of its manufacture shall be free from defects in materials and workinauship for a period of one (1) year all the being placed in service or eighteen (18) month from deficies in materials and the case of products or parts using in the service and within the pressure range for which the goods were manufactured in the case of products or parts only for discovers and within the pressure range for which the goods were manufactured in the case of products or parts only provides to quark desine to indefine the service and within the pressure range for which the goods were manufactured in the case of products or parts desine to correctly in thalking. Contractor is and which the pressure range for using the case of reducts of such defects and within the pressure of such defects and if in contractor is now held, of contractor is nowed. Its habits the Contractor is and when the product or replace the advect of such defects and if the contractor is and provide and expresses what means to contractor is and the within the warrant. The product stage set of products is provide. FO B to contractor within the product or struct table is an order or the defective part or product for preduct or prepared by the contractor within the service of such defective parts on product for on defective parts of products with have been in any way into provide for a struct table in any one product of products to the defective part of products with have been in any way into comtractor is using any of a contractor's independent of contractor. (I) the product of products is any one for way for comtractor junction and contractions (I) products which have the pression of products

L'or technical information regai ecting field installations and/or t charge, shall be advisory only field

ed in accordance if regulations and e with of Il applicable if the United

8 ENGINEERING AND SERVICE Lipon request Saller will provide engineering and/or to its products and their uses and if feasible, will provide personnel to assist Buy or in effecting service. Any such information, service or assistance so provided whether with or without chary 9 LABOR STANDARDS. Saller hereby certifies that these produces the produced in a requirements of Section 6.7 and 10 of the Fait Liboo Standards Act as amended and of regula Statist Department of Labor issued under Section 14 thereof 10 INSPECTION: Unless otherwise agreed in writing, final inspection and acceptance of pro-plant or other shipping or receiving point designated by Saller and shall be conclusive exe Boyer's representatives any support at the Saller's plant or shipping point during working be mainter as will not interfere with operations. nd acceptance of 11 be conclusive 11 during working of products must be n e except as regards ng hours prior to shi e made at Seller's rds latent defects shipment in such

11 DELIVERY AND ACCEPTANCE: Delivery shall be in a provided in the event Bayer is unable to ascept delivery upon with such requirements. Bayer agrees that (i) take and risk of or (ii) Bayer will make payments within thim; days after date of delivery is made in accordance with such requirements. accordance with the requirements in the Purchase Contract in completion of the manufacture of the Goods in accordance ownership shall past to Bayter on dote of Seller's trinoite, and if such invoice. Seller shall retain custodial risk of loss until

12. EXPORT COMPLIANCE: The Biological provide the Seller with relevant end-use, end-user and country of end-use information with respect to the goods, services, self-active and the sender is collectively. Thems is Based on and an endouse on use, information the Seller will supply such herm incompliance with applicable trade and change in a collare, end-user of the United Sates of America. The Seller suitains and the Bioler acknowledges that an endouse on each information and seller self-active accounts of end-user instead on endouse the U.S. or other country. Of the U.S. or other country, the endouse of prohibited by populable trade and existents in whether it less of the U.S. or other country. The Base and couloms they first-filler will supply such herm is complicated under the U.S. which in the cert of 1986 to endouse. Seller's shall notif, Bayer. The Bayer appears in particular that in shall not use and shall not permit any third party to use such as the contract which could be design. The ANSPORTATION CHARGES, ALLOWANCES, CLAMS, All press as FO B. Seller's plana or other design of firstplit is allowed unless stude in Seller's quantities of an vitation contract statis that all or a portion of transportation allowed. If the quoted or contractual press unclude stransportation, Seller statis that all or a portion of transportation allowed. If the quoted presseries plana or other designated shipping point. No firight is allowed unless stude in Seller's quantities of an vitation contract statis that all or a portion of transportation allowed. If the quoted presseries plana or other designated shipping point, with more accounting of the portion of transportation allowed. If the quoted presseries plana or other designated by the molective transportation. Seller states are plant to design and theoremony target allowed allowed when an any interactive and plane in the design the design transportation. The seller's particle stransportation, to classical the to be deduced from the seller plane or commances in any fil

regardless of who pays shipping costs. Seller endences to pack or prepare all shipments so that they will not break, rust or destribute in transit, but does not guarantee against such durage. Unless requested in writing by the Bayer, no shipments are invared by Seller against durage or loss in transit. Seller will plote insurance as marking by the Bayer, no shipment Buy er's writen instructions but in such cases. Seller acts only as againt between the insurance company and the Bayer and assumets no lability whatsoever. Any claims for shipping loss, becadage or durage (okyone or concealed) are Bayer and assumets no lability whatsoever. Any claims for shipping loss, becadage or durage (okyone or concealed) are Bayer and assumets no lability whatsoever. Any claims for shipping loss, becadage or durage (okyone or concealed) are Bayer and assumets no lability and should be made to the currier All claims regarding shortage must be made whith thirty, (20) days from receipt of shipment and must be accompanned by the packing labity covering the shipment 14 INDENINFICATION AND LIMITATION OF LIABILITY.

A INDEMNIFICATION: Buyer Group means Buyer, its parent (if any), subsidiaries, affiaires, to-owners, co-ventur partners and any entity with whom Buyer has an economic interest with respect to the Work heading Buyer's customer its and their respective reployees, prevonnel, directive, to moved sevanits, representatives, agents, constactors subcontrasteror (respectively, and of any tier of level and who are not included within the Scher Group). Solier Group Seller, its parent of any, subsidiaries, affiliates, co-owners and its and their respective Employees, personal, directive officers, borrowed e-mins, representatives agents, co-owners and its and their respective Employees, personal, directive officers, borrowed e-mins, representatives agents, co-owners and its and their respective Employees, personal, directive officers on included within the Bayer Group). Negligence means sole, joint or concurrent, active, passive, goos or will minconduct

(1) Seller shall release, defend, save, indemnif, (collective). Indemnif, all Claims, demands, losses, damages and causes of action of whatever / damage to the property of the members of the Seller Group even if such of the members of Bay er Group.) and hold Buyer Group Hannless from and against kind or nature (collectively Claims), for loss of or t Claims arise from or attributable to the Negligence

(2) Seller shall Indemnify and h (ies) to members of the Seller (Buyer Group. hold Buyer Group harmless Group even if such Claims s from e from or unst all Claums v attributable t ns for the to the N the death(s) c Negligence of or or personal injury of the members of

(3) Buyer shall Indemnify and hold Seller Group harmless from and against a (including the Work) of the members of the Buyer Group even if such Chains the members of Seller Group st all Claims for loss ims arise from or attr s of or dama tributable to nage to the property to the Negligence of

(4) Buyer shall Indemnify and hold Seller Group harmless (ies) to members of the Buyer Group even if such Claims Seller Group. s from and against all Claims from or attributable t to the N the death(s) of 2 Negligence of of or personal injury f the members of

(5) Buyer (on its own behalf and on behalf of Buyer Group) and Seller (on its own behalf indemnify and hold each other humbers from and against are, and all Chains asserted, a within party. For the deathsy of or personal injury (ics) to such a third party, as well as it property of such a third party. A third party is a person equity is a person equity on its harded in Buyer Group Buyer and Seller thorize respective dues for furthermity to each other respective degree of NegBigen party pursuant to this Article 14 (A) (5) shall be limited to their respective degree of NegBigen alf and on behalf of Seller Group) ed against them by or on behalf of as lots (ts) of or damage(s) to the wap or Seller Group It is agreed by ms asserted against them by a third gence.

(6) Notwithstanding any other provision contained in this Agreement. Bayer shall Indemnify and hold the members Selter Geopharmkess from and against all Chans (including clean-up costs and loss (es) of oil, gass of hydrocarboes) arisis from pollution, containmation, damping or spilling of any substance and even if arising out of or attributable to Negligence of the members of the Selter Group. sing

B INDEMNITY FOR CONSEQUENTIAL DAMAGES UNDER NOCIRCUNSTANCES SHALL SELLER BE LIABLE FOR ANY SPECIAL CONSEQUENTIAL INCIDENTAL EXEMPLARY OR PUNITIVE DAMAGES (addicated) CONSEQUENTIAL AS DEFINED BY THE LAWS COVERNING THIS PURCHASE DOBLER NOR FOR ANY LOS OF ANTICIPATED PROFITS. LOSS OF BUSINESS OPPORTUNITY. LOSS OF USE OF EQUIVALENT OR OF ANY INSTALLATION. SYSTEM OR FACILITY INTO WHICH SELLER'S EQUIVALENT ANY BE LOCATED OR AT WHICH MENDERS OF THE SELLER GROUP MANY BE FERFORMING WORK AND BUFFER AGREES TO TODENNITY AND HOLD SELLER GROUP MARKILESS FROM AND AGAINST ANY CLAIMS. FOR SUCH CONSEQUENTIAL DAMAGES EVEN IF ARSING OUT OF OR ATTRIBUTABLE TO THE NEGLIGENCE OF THE MEMBERS OF THE SELLER GROUP.

C LIMITATION OF LIABILITY EXCEPT AS OTHERWISE EXPRESSLY LIMITED IN THIS AGREEMENT IT IS THE EXPRESS INTENTION OF THE PARTIES HEREID THAT ALL INDEMNITY OBLICATIONS AND/OR LIABILITIES IEREBY ASSUMED BY THE PARTIES SHALL BE (I) SUPPORTED BY INSERVANCE. (ii) WITHOUT UNIT, (iii) AND WITHOUT REGARD DITHE CAUSE OR CAUSES THEROF, INCLUDING, BUT NOT DITHE UNSERVAROTININESS OF ANY VISEL ON VESSEL ON VESSEL SWITHEROF, INCLUDING, BUT NOT DITHE UNSERVAROTININESS OF ANY ARCEAFT, BERACH OF DITHE CAUSE ON CONTRACTUAL COMMON LAW OR INFLIED, BERACH OF CONDITIONS, WHETHER SUCH CONDITIONS OF WARKING, BUT NOT DIRECULSTON, THE UNSERVAROTININESS OF ANY ARCEAFT, BERACH OF DRY ESSELS ANTHEROF, INCLUDING, BUT NON LAW OR INFLIED, BERACH OF CONTRACT, BERACH OF DRY ISTATUDAY CONTRACTUAL COMMON LAW OR OF DIVERSING OR APPURTENANCES OF ANY PARTY INFORMATION OF WARKING IS AND CONDITION IS PREEXISTING AND ON LATENT, MARY OR ON THERMISE, THE LOADING OR UNADADING OF PERSONS OR CARGO, TORT, OR THE REGLIGENCE OR FAILT OF ANY PARTY AS DEFINED AT THE BEGINNING OF THIS ARCLE IN OR THE INCOMO I CAULT OF ANY PARTY AND ANY OTHER THEORY OF ILGAL LIABILITY Selfs's total responsibility for any claims, damages, losses or liability artising out of or related to its performance of this contrast or the products or services covered bersumder shall not exceed the purchase proc

15. MODIFICATION, RESCISSION & WAIVER. The terms herein may not be medified or rescinded nor any of provisions waived unless such medification, rescussion or varier is universe upon the performance of any set is a state of the industry. Texas and conditions of the contract or the failure of Scher to exercise any of its rights hereinder shall not be contract to the failure of Scher to exercise any of its rights hereinder shall not be contract with events and conditions of the contract or the failure of Scher to exercise any of its rights hereinder shall not be contract with regret to any uncreased periods of the contract or the failure of Scher to exercise any of its rights hereinder shall not be contract with regret to any uncreased periods of the contract or funce performance of the terms and conditions. All forders much be accepted to any uncreased periods of Scher to right and duties of the performance of Texas. Any disputes hickness hereof shall be gorened by and construct according to be interval laws of the counter of Texas. c) of its ovice of f any of instruct ist upon of these c parties vs of the vs of the

REV08/06

Intl Cor



Inter	Midw & Spec	est Hose cialty, Inc.	te
General Inform	nation	Hose Spe	cifications
Customer	HOBBS	Hose Assembly Type	Rotary/Vibrator
MWH Sales Representative	CHARLES ASH	Certification	API 7K/FSL LEVEL
Date Assembled	2/19/2017	Hose Grade	D
Location Assembled	OKC	Hose Working Pressure	5000
Sales Order #	318810	Hose Lot # and Date Code	10958-08/13
Customer Purchase Order #	356945	Hose I.D. (Inches)	3.5"
Assembly Serial # (Pick Ticket #)	384842	Hose O.D. (Inches)	5.45"
Hose Assembly Length	20FT	Armor (yes/no)	NO
	Fit	tings	
End A		E	nd B
Stem (Part and Revision #)	R3.5X64WB	Stem (Part and Revision #)	R3.5X64WB
Stem (Heat #)	13105653	Stem (Heat #)	13105653
Ferrule (Part and Revision #)	RF3.5X5330	Ferrule (Part and Revision #)	RF3.5X5330
Ferrule (Heat #)	34038185	Ferrule (Heat #)	3403818
Connection . Flange Hammer Union Part	4-1/16 5K	Connection (Part #)	4-1/16 5K
Connection (Heat #)		Connection (Heat #)	
Nut (Part #)		Nut (Part #)	
Nut (Heat #)		Nut (Heat #)	
Dies Used	5.62"	Dies Used	5.53"
and the second	Hydrostatic Te	est Requirements	
Total Design	7,500	Hose assembly was te	sted with ambient water
Test Pressure (psi)	And and a second s		

MHSI-008 Rev. 0.0 Proprietary

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	-	VV		
	Midw & Spec	est Hose cialty, Inc.		
	0		5 B 5 1 1 1 1	
	Certificate	of Conformity	$\sim 5 + \gamma = 7$	
Customer: HOBBS		Customer P.O.# 356945		
Sales Order # 318810		Date Assembled: 2/19/2017		
	Speci	fications		
Hose Assembly Type:	Rotary/Vibrator	Rig #		
Assembly Serial #	384842	Hose Lot # and Date Code	10958-08/13	
Hose Working Pressure (psi)	5000	Test Pressure (psi)	7500	
Hose Assembly Description:		TRH56D-645KH-645KH-20.00' FT		
Ve hereby certify that the abov o the requirements of the purch upplier: Aidwest Hose & Specialty, Inc. 1312 S I-35 Service Rd	e material supplied fo hase order and currer	or the referenced purchase orde nt industry standards.	r to be true according	
Ve hereby certify that the abov o the requirements of the purc upplier: Aidwest Hose & Specialty, Inc. 1312 S I-35 Service Rd Dklahoma City, OK 73129 Tomments:	e material supplied fo hase order and currer	or the referenced purchase orde nt industry standards.	r to be true according	
Ve hereby certify that the abov o the requirements of the purch upplier: Aidwest Hose & Specialty, Inc. 1312 S I-35 Service Rd Dklahoma City, OK 73129 Tomments:	e material supplied fo hase order and currer	or the referenced purchase orde nt industry standards.	r to be true according	
Ve hereby certify that the abov o the requirements of the purch upplier: Aidwest Hose & Specialty, Inc. 312 S I-35 Service Rd Oklahoma City, OK 73129 Tomments: Approved b	e material supplied fo hase order and currer	or the referenced purchase orde nt industry standards. Date	r to be true according	

MHSI-009 Rev.0.0 Proprietary









QUOTATION

Ship To:

USA

LEGACY RESERVES LP

303 W WALL STE 1400

MIDLAND TX 79701-5126

Surface System
Cameron Intl Corp
CAM SURFACE SYS HQ - HOUSTON HQ
CAMERON
3505 W SAM HOUSTON PKWY NORTH
HOUSTON TX 77043
USA

Document number	:US10/HT11/1489470-A
Page 1 of 6	
Date Issued	:MAY 09 2017
Payment Terms	: Net 30 Days
Terms and conditions	:As Attached/Included
Freight Terms	:FOB Ship Pt-PPD/Add-No Pro
0	EX-WORKS - ODESSA, TX

Sold to : 22039905 LEGACY RESERVES LP P.O. Box 10848 MIDLAND TX 79702 USA

	Customer Ref
Outside Sales Contact:	David Treece/432-337-5475
Inside Sales Contact:	Joycelyn M. FAILLA/713-469-7221

Email: joycelyn.failla@c-a-m.com Email: david.treece@c-a-m.com

22039905

Customer Reference	:	CONVENTIONAL
Valid From	:	MAY 08 2017
Valid To	:	JUN 09 2017
Project Reference	:	

WE APPRECIATE THE OPPORTUNITY OF SUBMITTING THIS QUOTATION FOR YOUR REQUIREMENT. SHOULD YOU REQUIRE ANY ADDITIONAL INFORMATION, PLEASE DO NOT HESITATE TO CONTACT US.

CONVENTIONAL 3-STRING

CASING PROGRAM: 13-3/8" X 9-5/8" X 5-1/2"

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ltem	Material Number Description	Extended Weight	Qty UM	Unit Net Price USD	Extended Price USD
	Section A - CASING HEAD ASSY				
20	2161182-02-01 ASSY, CSG HEAD, IC-2-BP 13-5/8" API 3M X 13-3/8" SOW W/TWO 2" LPO'S API 6A 20TH ED., PSL-1; T/C P,U; M/C AA,DD-NL; PR-2 (PREPPED FOR STANDARD 'CR' LANDING B/	652 lb ASE)	1 EA	2,807.66	2,807.66
30	2057661-02-01 ASSY; TYPE 'CR' LANDING BASE FOR 13-5/8 FLG., 24 IN OD. BASE PLATE 850,000 LBS CAPACITY (MATL 36,000 YIELD)	257 lb	1 EA	1,297.66	1,297.66
40	021013-12 NIPPLE, API 2 IN LP, 6.00 IN LG SEAMLESS 5L GR B, 9.03 LB	4 lb	1 EA	24.33	24.33
50	2168084-10-31 VALVE, BALL, FLOATING, 2 IN (50 MM) X 1-1/2 IN (40 MM), B136-CS-43-CS FIGURE NUMBER, THREADED END (FXF), WKM, 310 3000 PSI (206 BAR) MOP, 2719 PSI (187 BAR) MOP AT MAX TEMP, CARBON STEEL E	13 lb C5, BODY,	1 EA	102.89	102.89



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Item	Material Number Description	Extended Weight	Qty	UM	Unit Net Price USD	Extended Price USD
	CARBON STEEL/CHR PLATED BALL, CAR STEEL/ZINC PLATED STEM, ACETAL PLAS SEAT, WRENCH WITH LOCK DEVICE LESS API 607, B16.34, -20 F (-29 C) - +220 F (+104 C), ADJUSTABLE STEM PACKING	BON STIC S LOCK,				
60	007481-01 Bull Plug, 2" LP, Tapped 1/2" NPT, 3.75" Long.	3 lb	1	EA	27.34	27.34
70	2738068-02 FITTING, VENT STRAIGHT 1/2 NPT SAFTY VENT, 4140 NACE / ZN PL TUNGSTEN CARBIDE BALL, 10,000 PSI MA	0 kg	I	EA	14.28	14.28
	Total Section A - CASING HEAD ASSY					4,274.16
	Section B - CASING SPOOL ASSY					
100	702001-57-02 RING GASKET, API TYPE R-57 LOW C STL OR SOFT IRON -PLATED /API 6A PSL 4, API MONOGRAM, REQUIRED	3 lb	1	EA	24.70	24.70
110	621650-03 ASSY: STUD & NUTS, 1.375 X 10.750" Long (B7 & 2H)	130 lb	20	EA	15.65	313.00
120	Y 15000-23300001 CASING HANGER, IC-2, 13-5/8" X 9-5/8", API 6A 20TH ED., TEMP CLASS S, MATL CLASS AA,DD-NL, PSL 3, PR 2, GROUP 3. (-20F TO 150F MAX) (CARBOXYLATED NITRILE 70/80 DURO)	44 kg	1	EA	2,538.05	2,538.05
130	2216433-03-01 ASSY, SPOOL, TYPE 'IC-2-BP', 13-5/8 API 3K BTM X 11 API 5K FLGD TOP, W/TWO 2-1/16 API 5K SIDE STD'D OUTLETS W/2-1/16 API VR, TWO TYPE 'N' TIEDOWN SCREWS,W/'NX' BTM PREP, API 6A; 20TH ED; T/C U; M/C DD-NL; PSL 1; PR-2 (4130 MATERIAL)	1,446 lb	1	EA	4,769.22	4,769.22
140	640518-10 'NX' Bushing, 13-5/8 Nom X 9-5/8	16 lb	1	EA	1,454.59	1,454.59



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Item	Material Number Description	Extended Weight	Qty	UM	Unit Net Price USD	Extended Price USD
	OD CSG, STD OR NACE SERVICE					
150	2222164-02-01 Valve Removal Plug, 2-1/16" 10K Max V W/1-1/2" Vee Tubing Thd, Api 6A 20Th Ed/ISO 10423, Matl Class DD-NL	1 lb VP,	1	EA	74.93	74.93
160	2737400-01-01 ASSEMBLY, AOP COMMERCIAL GATE VAL 2-1/16 API 5,000 FLG X FLG, EXPANDING GATE, 6A 20TH EDITION, TEMP CLASS P+U, MATERIAL CLASS AA, PSL 1, PR 1	175 lb VE,	1	. EA	746.80	746.80
170	142362-01-03-02 Flange, companion, 2-1/16" Api 5000 X 2" Api LP Thread, Api 6A 20Th Edition, T/C: U, M/C: DD-NL, PSL 2	24 kg	2	EA	78.64	157.28
180	007481-01 Bull Plug, 2" LP, TAPPED 1/2" NPT, 3.75" Long.	3 lb	1	EA	27.34	27.34
190	2738068-02 Fitting, vent straight 1/2 npt Safty vent, 4140 nace / Zn pl Tungsten carbide ball, 10,000 psi Max	0 kg	1	EA	14.28	14.28
200	702001-24-02 RING GASKET, API TYPE R-24, LOW C STL OR SOFT IRON, PLATED, API 6A PSL 4, API MONOGRAM	2 lb	3	EA	5.13	15.39
210	Y51201-20220301 Stud W/TWO NUTS, 7/8" X 6" LG, B7/2H, Plated	12 lb	8	EA	3.27	26.16
	Total Section B - CASING SPOOL ASSY					10,161.74
	Section C - TUBING SPOOL					
240	702001-54-02 Ring Gasket, api type R-54, low C STL or Soft Iron, plated, api 6a PSL 4, api Monogram	5 lb	1	EA	28.19	28.19



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Item	Material Number Description	Extended Weight	Qty	UM	Unit Net Price USD	Extended Price USD
250	621650-14 Assy, stud & nuts, 1.875 X 14.750" Long (B7 & 2H)	180 lb	12	EA	35.18	422.16
260	Y15001-21002901 CASING HANGER, IC",-2, 11" X 5-1/2 API 6A 20TH ED, M/C AA, T/C S, PSL-3, PR2, GROUP-3/2	115 lb	1	EA	973.43	973.43
270	2309361-01-02 ASSY, SPOOL, TBG HEAD, TYPE 'C', 11 API 5K FLG BTM X 7-1/16 API 10K FLG TOP; W/ TWO 1-13/16 API 10K STD'D OUTLETS; W/ 1-13/16 API VR PREP; W/'NX' BTM PREP; API 6A 20TH ED; T/C: U; M/C: DD-NL; PSL-2, PR-2. (4130 LAS MATERIAL)	1,350 lb	1	EA	4,774.41	4,774.41
280	2348293-01-01 ASSY 11 X 5-1/2 'NT' BUSHING W/ DBL 'T'SEALS AND DBL 'S' SEALS, W/ INTERGRA BIT GUIDE (FOR STANDARD AND NACE SERVICE)	57 lb	1	EA	942.17	942.17
290	141510-41-95-02 ASSEMBLY, FLS MANUAL GATE VALVE, 1-13/16 API 10,000 FLG, ISO 10423 AND API 6A 20TH EDITION, TEMP CLASS P+U, MATERIALS CLASS EE-1.5, PSL 2, PR 2	500 lb	2	EA	1,927.05	3,854.10
300	142359-01-03-02 FLANGE, COMPANION, 1-13/16 API 10,000 WITH 2" API LINE PIPE, 5000 PSI WP API 6A 20TH EDITION, TEMP CLASS U, MATL CLASS DD-NL, PSL 2	40 lb	2	EA	78.86	157.72
310	007481-01 BULL PLUG, 2" LP, TAPPED 1/2" NPT, 3.75" LONG.	3 lb	1	EA	27.34	27.34
320	2738068-02 Fitting, vent straight 1/2 NPT Safty vent, 4140 Nace / ZN PL Tungsten carbide Ball, 10,000 PSI Max	0 kg	1	EA	14.28	14.28
330	702003-15-12 RING GASKET, API TYPE BX-151, LOW C STL, PLATED, API 6A PSL 4, API MONOGRAM.	I lb	4	EA	2.89	11.56



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Item	Mater Descr	ial Number iption	Extended Weight	Qty	UM	Unit Net Price USD	Extended Price USD		
340	Y512 Stue Lg, A Nut,	01-20120201 9 W/TWO NUTS, 3/4"-10 X 5-1/4" 193 B7 STUD/A194 2H HVY HEX ZINC PLATED	16 lb	16	EA	3.77	60.32		
	Total	Section C - TUBING SPOOL					11,265.68		
Sectio	n Summ	ary:							
	Total	Section A - CASING HEAD ASSY				4,274.16			
	Total	Section B - CASING SPOOL ASSY			10	10,161.74			
	Total	Section C - TUBING SPOOL				1	1,265.68		
Price S	Summar	y :							
			Tota	Price :		2:	5,701.58 USD		
			Total Quotation	Price :		2:	5,701.58 USD		
****	*****	****							
ESTIN EX-W AFTE	AATED ORKS C R RECE	DELIVERY: TBA PAMERON ODESSA, TX IPT OF ORDER: SUBJECT TO PRIOR SAI	ĿE			x			

AFTER RECEIPT OF ORL

CAMERON DIVISION RESERVES THE RIGHT TO ISSUE A REVISED QUOTATION SHOULD THERE BE ANY DEVIATION OR ADDITIONS TO THIS QUOTATION.

DELIVERIES OFFERED HEREIN ARE BASED UPON MATERIAL AVAILABILITY AND MANUFACTURING CAPACITY AT TIME OF QUOTATION.

CAMERON DIVISION'S TERMS AND CONDITIONS OF SALE FORM A PART OF THIS QUOTATION AND SHALL APPLY TO ANY CONTRACT OF SALE.

PRICES QUOTED HEREIN ARE FIRM THROUGH DELIVERY IF ORDER IS PLACED WITHIN THE VALIDITY PERIOD OF THIS QUOTATION.

QUALIFICATION OF CAMERON WELD PROCEDURES INCLUDES HARDNESS TESTING OF THE WELD, BASE METAL AND HEAT-AFFECTED ZONE (HAZ) USING THE ROCKWELL B AND C SCALES. THIS IS CONSISTENT WITH OUR LONG ESTABLISHED AND SUCCESSFUL PAST PRACTICE. IT IS ALSO CONSISTENT WITH PREVIOUS EDITIONS OF NACE MR0175 AND WITH THE LATEST EDITION PROVIDED THAT THIS TESTING METHOD IS ACCEPTED BY THE BUYER.

CAMERON WILL CONTINUE TO USE ROCKWELL B AND C SCALES IN LIEU OF OTHER METHODS NOW LISTED IN NACE MR0175 / ISO 15156. BY ITS PURCHASE OF THESE PRODUCTS, THE BUYER ACKNOWLEDGES THE FOREGOING AND GIVES ITS CONSENT TO THE USE OF ROCKWELL B AND C HARDNESS TESTING FOR QUALIFICATION OF WELD PROCEDURES.



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TERMS AND CONDITIONS

1 CONTRACT ACCEPTANCE: Any written or oral purchase order received from Buyer by Seller shall be construed as written acceptance of Seller's offer to sell and shall be filled in acceptance with the terms and conditions of sale set for 16 fill bereas. SELLER SACCEPTANCE OF THIS ORGER IS EXPRESEXY CONSIDIONED ON BUYERS ASSENT TO fill TERMS CONTAINED IEEEIN. The terms and conditions of Seller's proposal (if any) and acknowledgement shall period or use any conflicting of a different terms in Buyer's order unless Buyer provides Seller's users and conditions of Seller's scheme terms of purchases will not be considered at counteroffer to Seller's terms and conditions of seller's bandwid terms of purchases will not be considered at counteroffer to Seller's terms and conditions of seller. The failure of Seller's bandwid terms of purchases will not be considered at counteroffer to Seller's terms and conditions of seller. The failure of Seller's bandwid terms of purchases will not be considered at counteroffer to Seller's terms and conditions of seller. The failure of Seller's bandwid terms of purchases will not be considered at an acceptance thereof nor an an acceptance thereof. 8 5

QUOTATIONS AND PRICES. Any product, service capability or manufacturing capability which may be available at etimes a quotation is made is subject to prore sale. Praces quoted are subject to change without motice. The proce in effect at e inne of shipment including any exclusion formula will apply, understa a valid quotation or written agreement to the murary exists between Bayer and Selfer. All preces shown are in U.S. dollarst and are F.O.B. Selfer's shipping point. Selfer stores the right to place a service charge on past due accounts at the highest rate permitted by haw. Any occumentation training to traceability, requirements for raw materials or products or documentation required for any routicne respectation excesses must be identified by the Bayer at the tume of quotation (if any) or at the tume of order placement.

3 TAVES. Any tax or other charge imposed by law on the sale or production of goods to paid by the Buyer, unless the law specifically provides that such payment must be r shall reinburss Selfer for such payment as part of the purchase price. Custom dutes, other comparable charges will be borne by Bay er. Is or the performance of services shall made by Seller. in which case Buyer consular fees, insurance charges and

4. SHIPPING SCHEDULE AND DELIVERY: Shipnent schedules are given as accurately as condutions permit and even effort will be trade to make shipness as scheduled. Selfer will not be responsible for deviations in metricing shipping schedule, whether due to Arst of Cod, orders bearing priority mungs established pursuant to have deviations in the shipping schedule, whether due to Arst of Cod, orders bearing priority mungs established pursuant to have difference with workness local labor shorings. For, Bodd schedures bearing priority mungs established pursuant to have difference with workness or guarantee bear of a schedule of the strategiest priority mungs established pursuant to have difference with workness or guarantee bears and the schedule of the schedules of the schedules of a schedule of the schedule of the schedules of the schedules of a schedule of the schedules of the schedules of a schedule of the schedules are based to react the right of the schedules of the schedules of the schedules are schedules of the schedules are schedules of the schedules are based or schedules will be calcitated from the schedule of the schedules are schedules are based on schedules will be calcitated from the schedules are based on Schedules are the right of pherene in no schedule to the presentative must be identified by any or and the schedules are based on schedules are the neglet of the schedule and the schedules are based on schedules will be calcitated from the schedules are based on fully and code pherene in no def from Bayer's transmitter must be identified by any or and be addedied of an any or and be addedied of a schedules or the negle the schedules are the schedule or the negle of

5 TERMS OF PAYMENT Terms Seller's order acknowledgment 0 B are 30 days from date 0 dh 25 stated in the quotation

6 CANCELLATIONS AND RETURNS. Purchase orders once only with Seller's written consent and upon terms which will save adjustment without written permission from Seller's office authorie placed by e Seller from rized to issue be returned be canceled for credit or

m Buyer and accepted by 3 m loss. No products may bue such permission.

7 WARAATIES. Contractor warrants that pools of its manufacture shall be free from defects in materials and workmanashig for a period of one (1) year after being placed in service or regioner. (5) months from deficient, which they poster and produces or parts not whelly of Contractor's number in the product or regioner. (5) months from the event of its resovery from the manufacture of such products or parts desired in surrains. In this layers, we material was and the operational wear are not overed by this warrain. In the event that Company factors of such defect in the contractor's induction the product or regular replacement due to operational wear are notovered by this warrain. In the event that Company factors or a defect in the product or regular period specified above. Company shall as Contractor's request shall replace the regulate the full price paid by Contractor's requests what point or explace the regulate the result of the responsible for any costs related to removal, transportation and the defective part of point depress calls and the defective part of points of the defective part of the responsible for any stability of the defective part of points of the defective part of points of the stability of the damages resulting of the defective part of points of the defective part of points. The point depression of the defective part deserver of the stability of the damages resulting of the defective part deserver of the stability of the stability of the damages result with now the responsible for (1) failures of the defective part of the order or strict liability of the stability of th

8 ENGINEERING AND SERVICE: Upon request. Seller will provide engineering and its products and their uses and, if feasible, will provide personnel to assist Bayer in effor service. Any such information, service or assistance so provided, whether with or without service. For technical information regarding seting field installations and/or field charge, shall be advisory only

9 LABOR STANDARDS Seller hereby certifies that these requirements of Section 6, 7 and 12 of the Fair Labor Standards States Department of Labor issued under Section 14 thereof products were produced in accordance s Act as amended and of regulations and e with orders of 1 applicable f the United

10. I plant Buye 10. INSPECTION. Unless otherwise a fant or other shipping or receiving p buyer's representatives may inspect at nanner as will not interfere with operat e agreed in writing. final inspection and g point designated by Seller and shall at the Seller's plant or shipping point i d acceptance of products must be made at be conclusive except as regards latent -during working hours prior to shipment at Seller's t defects t in such

11 DELIVERY AND ACCEPTANCE: Delivers shall be in accordance with provided in the event Bayer is unable to accept delivery upon completion of u with such requirements. Bayer agrees that (i) the and risk of ownership shall p with bayer will make powments within thirty days after date of such invoice delivery is made in accordance with such requirements ith the require of the manufac Il pass to Buye Seller shall i internents in the Purchase Contract ifacture of the Goods in accordance uper on date of Seller's invoice, and all retain custodial risk of loss until

12 EXPORT COMPLIANCE: The Buyer shall provide the Safler with relevant end-use: end-user and country of end-use information with respect to the goods, services, software or technology, to be supplied berunder (collearned). The end of the supplied berunder (collearned) and the relation of the United Sates of America. The Safer cautions and the Boyer scalework with applicable trade and endowing or end-use; finding and supplier the tweet or country, or end use in (relating a Safer with Sayper Safe) herein to compliance with applicable trade and endowing the order of the U.S. The Safer value of the Value of the U.S. The Safer value of the Value of the U.S. The Safer value of the U.S. The Safer value of the Value of the U.S. The Safer value of the Value of the U.S. The Safer value of the Value of

13. TRANSPORTATION CHARGES. ALLOWANCES, CLAIMS. All process are FO B. Seller's plant or other designated shipping point. No freight is allowed unless stued in Seller's quotation (if any) or in a written contrast tabut that all or a portion between Seller and Buyer at the time of shipping. If Seller's quotation (if any) or in a written contrast tabut all or a portion between Seller and Buyer at the time of shipping. If Seller's quotation (if any) or in a written contrast tabut all or a portion territy tail allowed. all proces are FO B. Seller's plant or other designated shipping point with most economical methods and the seller's quotation of a written contrast tabut all or a portion territy and to ship in the manuer it dense most economical. Added costs due to special routing requested by Beller to be detected from the seller to the due to frammer it dense most economical added costs due to special routing requested by Seller to be detected from the seller to the due to frammer it dense most economical methods transportation, no deduction will be made in the due of due to the theore of high proves. Fields restricts the right to charge table in the theorem sheets and part warehouses. Fields restricts the right to the strange for portion de Seller's variebuse. Seller's serves table routing requested frequences are to sheet stransportation. The deduction will be made in the theorem where sales are made from the Seller's variebuse. Seller's serves table routing requested frequences frequences frequences for the seller's variebuse. Seller's serves tables to be word frequences frequences are related to a set of the set of the

regardless of who pays shipping costs. Seller endeavors to pack or prepare all shipments so that they will not break, rust or deteriorate in transif, but does not guarantee against such durings. Unless requested in writing by the Bayer, no shipments are insured by Seller against durings or loss in transit. Seller will place insurance as rearly as possible macconduce va-buyer's written instructions but in such case. Seller acts only as agent between the insurance company and the Bayer and assumets ion lability whatsoever. Any claims for shipping loss, becauge or durings (obvious or concealed) are Bayer and assumets ion lability whatsoever. Any claims for shipping loss, becauge or durings (obvious or concealed) are Bayer and responsibility and should be made to the currier. All claims regarding shorages must be made within thirty (30) days from receipt of shipment and must be accompanied by the packing lat(s) covering the shipment 14 INDEMNIFICATION AND LIMITATION OF LIABILITY:

A INDEMNIFICATION: Bayer Group means Bayer, its parent (if any), subsidiaries, affiliates, co-envners, co-reintures, partners and any entity with whom Bayer has an economic interest with respect to the Work including Buyer's customer and its and their respective employees, prosonel, directory, officers, berowed servanis, trypesenalities, agents, contractors as subcontractors (respective) and of nus tier of level and who are not included within the Sher employees, personnel, directors, Soller, its parent (if any), subsidiaries, affiliates, conversions and and their respective employees, personnel, directors, Soller, its parent (if any), subsidiaries, affiliates, conversions and and beir respective), and of any tier or level and who are not included within the Sher employees, personnel directors, solliers, borrowed servanis, representatives, agents, contractors with experimentaries agents, contractors and subcontractors (respectively, and of any tier or level and who are not included within the Sher efforts). Negligence means sole, joint or consurrent, active, passive, gross or willid misconduct

(1) Seller all claims, damage to of the mean shall release, defend, save, indemnifi (collectively. Indemnifi,) and hold Buyer Group Harmless from and against demands. Iosses, damages and causes of action of whatever kind or nature (collectively. Claims.). for loss of or Use property of the members of the Seller Group even if such Claims arise from or attributable to the Negligence there of Buyer Group.

(2) Seller shall Indemnify and hold Buyer Group harmless (ies) to members of the Seller Group even if such Claims Buyer Group. from and against all Claims for the death(s) of or personal injury arise from or attributable to the Negligence of the members of

(3) Buyer shall Indemnify and hold Seller Group harmless from and against all Claims I (including the Work) of the members of the Buyer Group even if such Claims arise from the members of Seller Group for loss of or damage to the property m or attributable to the Negligence of

(4) Buyer shall Indemnify and hold Seller Group harmless (ies) to members of the Buyer Group even if such Claims Seller Group s from n and against a t all Claims tuributable to to the Negligence of E Pe members of

(5) Buyer (on its own behalf and on behalf of Buyer Group) and Seller (on its own behalf and on behalf of Seller Group) shall indemnify and hold each other harmbest from and against area by a croar behalf of any third party for the death(s) of cr presental injur (ice) to such a third party, as well as loss (es) of cr dimange(s) to (es) to such a third party. Such a behalf and the death(s) of cr dimange(s) to (es) to such a third party for the death(s) of cr dimange(s) to the party in the death(s) of cr dimange(s) to the death(s) of cr dimange(s) to the death(s) of extended in Buyer Group Seller Group). It is agreed by Buyer and Seller that is respective dwn of indimanty, as which respective dwn of indimanty is userbackers with respect to Claims asserted against them by a third party pursuant to this Article 14 (A) (5) shall be limited to beir respective degree of Negligence.

(6) Notwithstanding any other p Seller Group harmless from and a from pollution, contamination, d Neghgence of the members of the other provision contained in this Agreement. Buyer shall Indemnify and nurd against all Claims (including clean-up costs and toss (es) of Oil, gas or tion, dumping or spilling of any substance and even if arising out of s of the Seller Group d hold the members or hydrocarbons) arisi f or attributable to t ing

B INDENNITY FOR CONSEQUENTIAL DAMAGES UNDER NOCIRCUNSTANCES SHALL SELLER BE LIABLE FOR ANY SPECIAL CONSEQUENTIAL INCIDENTIAL EXEMPLARY OR PUNITIVE DAMAGES (colorance) CONSEQUENTIAL IN SOFFICED BY THE LAWS COVERNION THIS PURCHASE ORDER INOR FOR ANY LOSS OF ANTCHATED PROFILS LOSS OF BUSINESS OPPORTUNITY. LOSS OF USE OF EQUIPMENT OR OF ANY INSTALLATION, SYSTEM OR FACILITY INTO WHICH SELLER'S EQUIPMENT MAY BE LOCATED OR AT WHICH MENBERS OF THE SELLER GROUP MARY BE PERFORMING WORK AND BUYER AGREES TO NUDENNITY. AND HOLD SELLER GROUP MARY LESS FROM AND AGAINST ANY CLAMIS FOR SUCH CONSEQUENTIAL DAMAGES EVEN IF ARSING OUT OF OR ATTRIBUTABLE TO THE NEGLIGENCE OF THE MEMBERS OF THE SELLER GROUP.

C LIMITATION OF LIABILITY EXCEPT AS OTHERWISE EXPRESSLY LIMITED IN THIS AGREEMENT IT IS THE EXPRESS INTENTION OF THE PARTIES HERETO THAT ALL INDEMNITY OBLICATIONS ANDOR THE EXPRESS INTENTION OF THE PARTIES SHALL BE (a) SUPPORTED BY INSURANCE, (a) WITHOT LIABILITES INFREMY ASSUMED BY THE PARTIES SHALL BE (a) SUPPORTED BY INSURANCE, (a) WITHOT INT, (ii) AND WITHOUT RECARD TO THE CAUSE OR CAUSES THEREOF, INCLUDING BUT NOT LIMITED INARIMORTHNESS OF ANY VESSEL OR VESSELS (WHETHER OR NOT PRENISTING). THE UNARIMORTHNESS OF ANY VESSEL OR VESSELS (WHETHER OR NOT PRENISTING). THE UNARIMORTHNESS OF ANY VESSEL OR VESSELS (WHETHER OR NOT PRENISTING). THE UNARIMORTHNESS OF ANY VESSEL OR VESSELS (WHETHER OR NOT PRENISTING). THE UNARIMORTHNESS OF ANY MERCAT. BREACH OF DUTY (STATUTORY CONFLACTUAL COMMON LAW OR INPLED), BREACH OF CONTRACT, BREACH OF DUTY (STATUTORY CONFLACTUAL COMMON LAW OR INPLED), BREACH OF CONTRACT, CONDITION OR WARRANTY (EXPRESS OR INPLED), BREACH OF CONTRACT, BREACH OF DUTY (STATUTORY CONFLACTUAL COMMON LAW OR INPLED), BREAKING ON ANY MERCING OR WING OR UNICADING OF CONDITION IS PREEXISTING AND ON LATENT. TANEEN TO DE LAW OR WHETTIER OR NOT SAND OF FERSIONS OR CARGO TORT, OR THE NECLIGENCE OR FAULT OF ANY PARTY (AS DEFINING ON UNICADING OF FERSIONS OR CARGO TORT, OR THE NECLIGENCE OR FAULT OF ANY PARTY (AS DEFINED AT THE BEGINNING OF THIS ARTICLE 14 OR ANY OTHER THEORY OF LEGAL UNBLIFT. SCHORED AT BEGINNING OF THIS ARTICLE 14 OR ANY OTHER THEORY OF LEGAL VIES COMPARIANCE OR INCLUSED AT BERGINNING OF THIS ARTICLE 14 OR ANY OTHER THEORY OF LEGAL AND ING OR UNICADING WE AND ADDRESS I IsbiDIN ASTIG ON OF VERIAL OR ANY PARTY (AS DEFINED AT THE BEGINNING OF THIS ARTICLE 14 OR ANY OTHER THEORY OF LEGAL AND ING COMPARIANCE OF THE PRENIS BERGING SONG CARGO INCLUSS IN INCLUDING OR UNICADING OR UNICADING BERGING SONG OR CARGO THIS ARTICLE 14 OR ANY PARTY OR DEFINING ON THE AND AND A BERGING SONG AND A THE SCHORE OF AND A THE DEFINING AND A DEFI

15 MODIFICATION, RESCISSION & WAIVER. The terms herein may not be modified or rescinded nor any of its provisions waived unless such modification, rescussed or waiver is in writing and signed by an authorized employee of Seller at its office in Houston. Treas: Failure of Seller to instant any one or more instances upon the performance of any of the terms and conditions of the contract or the failure of Seller to exercise any of its rights hereinder shall be consurved as a waiser or relinquishment of any such term. conclusion, or right hereinder shall be an alterological of a subsist or failure of Seller to exercise any of its rights hereinder shall be to be subsisted as a waiser or relinquishment of any such term, conclusion, or right hereinder shall be affect. Seller, right to insist upon the construct as a discrete or funder performance of these strict performance and compliance with regard to any unccestuid periods of this contract or funder performance of these terms and conditions. All orders must be ascepted by an authorized employee of Seller. The rights and duties of the prime and construction and efficie of all provisions hereof shall be specified by and construct acording to be interval laws of the Sauce of Tesas. Am of dupines which raise under this agreement shall be venued in the District Court of Harris County. Tesas or in the Southern District of Tesas.

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Surface Casing									٩
				Burst				Dry	Mud
Size	Grade	#/ft	Collapse	(Internal Yield)	Tensile	Coupling	Length	Weight	Weight
								98,100	
13.375"	J-55	54.5	1130 psi	2730 psi	514 kips	STC	1800'	lbs	8.5 ppg

Collapse: $DF_c = 1.25$

Base Assumptions

- Complete internal evacuation of the casing, utilizing a collapse force equivalent to the mud gradient (0.44 psi/ft) in which the casing will be ran.
- Cementing operations in which, utilizes a collapse force equivalent to the gradient of the planned cement slurry (0.77 psi/ft) and an internal force equivalent to the fresh water displacement fluid (0.433 psi/ft).

Collapse Calculations: Collapse Rating / Collapse Force

Complete Evacuation: 1,130psi / [(0.44psi/ft)(1,800')] = **1.42**

Cementing Operations: 1,130psi / [(0.77psi/ft – 0.433psi/ft)(1800')] = **1.86**

Burst: $DF_B = 1.25$

Base Assumption

• Casing pressure test as per Onshore Oil and Gas Order No. 2 (0.22 psi/ft or 1500 psi), utilizing an external force equivalent to the mud gradient (0.44 psi/ft) in which the casing will be ran.

Burst Calculations: Internal Yield Rating / Internal Force

Casing Pressure Test: 2,730psi / [(1500psi)-(0.44 psi/ft)(1,800')] = **3.86**

Tensile: $DF_T = 1.6$

Base Assumption

• A downward force of 100,000 lb. overpull is applied at the base of the casing along with the weight and not considering the effects of buoyancy.

Tensile Calculations: Joint Strength / Axial Load

Overpull: 514 kips / (100,000 lbs. + 98,100 lbs.) = **2.59**

Intermediate Casing

				Burst				Dry	
Size	Grade	#/ft	Collapse	(Internal Yield)	Tensile	Coupling	Length	Weight	Mud Weight
9.625"	J-55	40	2570 psi	3950 psi	520 kips	LTC	4000'	160,000 lb	10.0 ppg
9.625"	НСК-55	40	4230 psi	3950 psi	694 kips	LTC	1600'	64,000 lb	10.0 ppg

Collapse: $DF_c = 1.25$

Base Assumptions

- Complete internal evacuation of the casing, utilizing a collapse force equivalent to the mud gradient (0.52 psi/ft) in which the casing will be ran.
- Cementing operations in which, utilizes a collapse force equivalent to the gradient of the planned cement slurry (0.77 psi/ft) and an internal back-up force equivalent to the fresh water displacement fluid (0.433 psi/ft).

Collapse Calculations: Collapse Rating / Collapse Force

Complete Evacuation: J-55: 2570psi / [(0.52psi/ft)(4,000')] = **1.25** HCK-55: 4230psi / [(0.52psi/ft)(5,600')] = **1.45**

Cementing Operations: J-55: 2570psi / [(0.77psi/ft - 0.433psi/ft)(4000')] = **1.91** HCK-55: 4230psi / [(0.77psi/ft - 0.433psi/ft)(5600')] = **2.24**

Burst: $DF_B = 1.25$

Base Assumption

- Casing pressure test as per Onshore Oil and Gas Order No. 2 (0.22 psi/ft or 1500 psi), utilizing an internal force equivalent to the displacement fluid of 8.6 ppg and external force equivalent to 8.4 ppg.
- Gas kick at the casing shoe, in which a 0.7 psi/ft shoe test is assumed, and 0.2 psi/ft gas gradient is assumed.

Burst Calculations: Internal Yield Rating / Burst Force

Casing Pressure Test: J-55: 3950psi / [(1500psi +1789 psi) - (1747psi)] = **2.56** HCK-55: 3950psi / [(1500psi +2504 psi) - (2446psi)] = **2.54** Gas Kick:

J-55: 3950psi / [(0.7psi/ft)(5600')-(0.2psi/ft)(5600')] = **1.41** HCK-55: 3950psi / [(0.7psi/ft)(5600')-(0.2psi/ft)(4000')] = **1.27**

Tensile: $DF_T = 1.6$

Base Assumption

• A downward force of 100,000 lb. overpull is applied at the base of the casing along with the weight of the string and not considering the effects of buoyancy.

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Tensile Calculations: Joint Strength / Axial Load

Overpull: J-55: 520 kips / (100,000 lbs. + 224,00 lbs.) = **1.6** HCK-55: 694 kips / (100,000 lbs. + 64,100 lbs.) = **4.23**

Production Casing

Burst							Dry		
Size	Grade	#/ft	Collapse	(Internal Yield)	Tensile	Coupling	Length	Weight	Mud Weight
5.5"	P-110	20	11080 psi	12360 psi	641 kips	BTC	18,300'	366,000 lb	9.1 ppg

Collapse: $DF_c = 1.25$

Base Assumptions

- Cementing operations in which utilizes a collapse force equivalent to the gradient of the planned cement slurry (0.77 psi/ft) and an internal back-up force equivalent to the fresh water displacement fluid (0.433 psi/ft).
- Production operations in which the pipe is completely evacuated with an external force equivalent to the pore pressure gradient (0.52 psi/ft).

Collapse Calculations: Collapse Rating / Collapse Force

Cementing Operations: 11,080psi / [(0.66psi/ft-0.433 psi/ft)(10,500'TVD)] = **3.13**

Production Operations: 11080psi / (10,500' TVD)(0.52psi/ft) = **2.03**

Burst: $DF_B = 1.25$

Base Assumption

- Frac pressure utilizing an internal force of 9500 psi along with a frac fluid gradient equivalent to 0.468 psi/ft and an external force equal to the minimum fluid gradient (0.433 psi/ft) in which the casing will be ran.
- Production operations in which the casing is completely filled with a gas equivalent gradient of 0.2 psi/ft and an external force equivalent to pore pressure of 0.5 psi/ft.

Burst Calculations: Internal Yield Rating / Burst Force

Frac Pressure: 12,360psi / [(9500 psi)+ (0.468 – 0.433psi/ft)(10,500'TVD)] = **1.28**

Production Operations: 12,360psi / [(0.5 psi/ft – 0.2 psi/ft)(10,500'TVD)] = **3.92**

Tensile: $DF_T = 1.6$

Base Assumption

• A downward force of 100,000 lb. overpull is applied at the base of the casing along with the weight of the string and considering the effects of buoyancy (factor =0.86).

Tensile Calculations: Joint Strength / Axial Load

Overpull: 641,000 lbs /[(100,000 lbs.) + (366,000 lbs.)(0.86)] = **1.6**

Surface Co	asing							•	
				Burst				Dry	Mud
Size	Grade	#/ft	Collapse	(Internal Yield)	Tensile	Coupling	Length	Weight	Weight
								98,100	
13.375"	J-55	54.5	1130 psi	2730 psi	514 kips	STC	1800'	lbs	8.5 ppg

Collapse: $DF_c = 1.25$

Base Assumptions

- Complete internal evacuation of the casing, utilizing a collapse force equivalent to the mud gradient (0.44 psi/ft) in which the casing will be ran.
- Cementing operations in which, utilizes a collapse force equivalent to the gradient of the planned cement slurry (0.77 psi/ft) and an internal force equivalent to the fresh water displacement fluid (0.433 psi/ft).

Collapse Calculations: Collapse Rating / Collapse Force

Complete Evacuation: 1,130psi / [(0.44psi/ft)(1,800')] = **1.42**

Cementing Operations: 1,130psi / [(0.77psi/ft – 0.433psi/ft)(1800')] = **1.86**

Burst: $DF_B = 1.25$

Base Assumption

• Casing pressure test as per Onshore Oil and Gas Order No. 2 (0.22 psi/ft or 1500 psi), utilizing an external force equivalent to the mud gradient (0.44 psi/ft) in which the casing will be ran.

Burst Calculations: Internal Yield Rating / Internal Force

Casing Pressure Test: 2,730psi / [(1500psi)-(0.44 psi/ft)(1,800')] = **3.86**

Tensile: $DF_T = 1.6$

Base Assumption

 A downward force of 100,000 lb. overpull is applied at the base of the casing along with the weight and not considering the effects of buoyancy.

Tensile Calculations: Joint Strength / Axial Load

Overpull: 514 kips / (100,000 lbs. + 98,100 lbs.) = **2.59**

Intermediate Casing

				Burst				Dry	
Size	Grade	#/ft	Collapse	(Internal Yield)	Tensile	Coupling	Length	Weight	Mud Weight
9.625"	J-55	40	2570 psi	3950 psi	520 kips	LTC	4000'	160,000 lb	10.0 ppg
9.625"	HCK-55	40	4230 psi	3950 psi	694 kips	LTC	1600'	64,000 lb	10.0 ppg

Collapse: $DF_c = 1.25$

Base Assumptions

- Complete internal evacuation of the casing, utilizing a collapse force equivalent to the mud gradient (0.52 psi/ft) in which the casing will be ran.
- Cementing operations in which, utilizes a collapse force equivalent to the gradient of the planned cement slurry (0.77 psi/ft) and an internal back-up force equivalent to the fresh water displacement fluid (0.433 psi/ft).

Collapse Calculations: Collapse Rating / Collapse Force

Complete Evacuation: J-55: 2570psi / [(0.52psi/ft)(4,000')] = **1.25** HCK-55: 4230psi / [(0.52psi/ft)(5,600')] = **1.45**

Cementing Operations: J-55: 2570psi / [(0.77psi/ft - 0.433psi/ft)(4000')] = **1.91** HCK-55: 4230psi / [(0.77psi/ft - 0.433psi/ft)(5600')] = **2.24**

Burst: $DF_B = 1.25$

Base Assumption

- Casing pressure test as per Onshore Oil and Gas Order No. 2 (0.22 psi/ft or 1500 psi), utilizing an internal force equivalent to the displacement fluid of 8.6 ppg and external force equivalent to 8.4 ppg.
- Gas kick at the casing shoe, in which a 0.7 psi/ft shoe test is assumed, and 0.2 psi/ft gas gradient is assumed.

Burst Calculations: Internal Yield Rating / Burst Force

Casing Pressure Test: J-55: 3950psi / [(1500psi +1789 psi) - (1747psi)] = **2.56** HCK-55: 3950psi / [(1500psi +2504 psi) - (2446psi)] = **2.54** Gas Kick:

J-55: 3950psi / [(0.7psi/ft)(5600')-(0.2psi/ft)(5600')] = **1.41** HCK-55: 3950psi / [(0.7psi/ft)(5600')-(0.2psi/ft)(4000')] = **1.27**

Tensile: $DF_T = 1.6$

Base Assumption

• A downward force of 100,000 lb. overpull is applied at the base of the casing along with the weight of the string and not considering the effects of buoyancy.

Tensile Calculations: Joint Strength / Axial Load

Overpull: J-55: 520 kips / (100,000 lbs. + 224,00 lbs.) = **1.6** HCK-55: 694 kips / (100,000 lbs. + 64,100 lbs.) = **4.23**

Production Casing

		Burst						Dry			
Size	Grade	#/ft	Collapse	(Internal Yield)	Tensile	Coupling	Length	Weight	Mud Weight		
5.5"	P-110	20	11080 psi	12360 psi	641 kips	BTC	18,300'	366,000 lb	9.1 ppg		

Collapse: $DF_c = 1.25$

Base Assumptions

- Cementing operations in which utilizes a collapse force equivalent to the gradient of the planned cement slurry (0.77 psi/ft) and an internal back-up force equivalent to the fresh water displacement fluid (0.433 psi/ft).
- Production operations in which the pipe is completely evacuated with an external force equivalent to the pore pressure gradient (0.52 psi/ft).

Collapse Calculations: Collapse Rating / Collapse Force

Cementing Operations: 11,080psi / [(0.66psi/ft-0.433 psi/ft)(10,500'TVD)] = **3.13**

Production Operations: 11080psi / (10,500' TVD)(0.52psi/ft) = **2.03**

Burst: $DF_B = 1.25$

Base Assumption

- Frac pressure utilizing an internal force of 9500 psi along with a frac fluid gradient equivalent to 0.468 psi/ft and an external force equal to the minimum fluid gradient (0.433 psi/ft) in which the casing will be ran.
- Production operations in which the casing is completely filled with a gas equivalent gradient of 0.2 psi/ft and an external force equivalent to pore pressure of 0.5 psi/ft.

Burst Calculations: Internal Yield Rating / Burst Force

Frac Pressure: 12,360psi / [(9500 psi)+ (0.468 - 0.433psi/ft)(10,500'TVD)] = **1.28**

Production Operations: 12,360psi / [(0.5 psi/ft – 0.2 psi/ft)(10,500'TVD)] = **3.92**

Tensile: $DF_T = 1.6$

Base Assumption

• A downward force of 100,000 lb. overpull is applied at the base of the casing along with the weight of the string and considering the effects of buoyancy (factor =0.86).

Tensile Calculations: Joint Strength / Axial Load

Overpull: 641,000 lbs /[(100,000 lbs.) + (366,000 lbs.)(0.86)] = **1.6**

Surface Co	asing							•	
				Burst				Dry	Mud
Size	Grade	#/ft	Collapse	(Internal Yield)	Tensile	Coupling	Length	Weight	Weight
								98,100	
13.375"	J-55	54.5	1130 psi	2730 psi	514 kips	STC	1800'	lbs	8.5 ppg

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Collapse Calculations: Collapse Rating / Collapse Force

Complete Evacuation: 1,130psi / [(0.44psi/ft)(1,800')] = **1.42**

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Burst: $DF_B = 1.25$

Base Assumption

• Casing pressure test as per Onshore Oil and Gas Order No. 2 (0.22 psi/ft or 1500 psi), utilizing an external force equivalent to the mud gradient (0.44 psi/ft) in which the casing will be ran.

Burst Calculations: Internal Yield Rating / Internal Force

Casing Pressure Test: 2,730psi / [(1500psi)-(0.44 psi/ft)(1,800')] = **3.86**

Tensile: $DF_T = 1.6$

Base Assumption

• A downward force of 100,000 lb. overpull is applied at the base of the casing along with the weight and not considering the effects of buoyancy.

Tensile Calculations: Joint Strength / Axial Load

Overpull: 514 kips / (100,000 lbs. + 98,100 lbs.) = **2.59**

Intermediate Casing

				Burst				Dry	
Size	Grade	#/ft	Collapse	(Internal Yield)	Tensile	Coupling	Length	Weight	Mud Weight
9.625"	J-55	40	2570 psi	3950 psi	520 kips	LTC	4000'	160,000 lb	10.0 ppg
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Collapse: $DF_c = 1.25$

Base Assumptions

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- Cementing operations in which, utilizes a collapse force equivalent to the gradient of the planned cement slurry (0.77 psi/ft) and an internal back-up force equivalent to the fresh water displacement fluid (0.433 psi/ft).

Collapse Calculations: Collapse Rating / Collapse Force

Complete Evacuation: J-55: 2570psi / [(0.52psi/ft)(4,000')] = **1.25** HCK-55: 4230psi / [(0.52psi/ft)(5,600')] = **1.45**

Cementing Operations: J-55: 2570psi / [(0.77psi/ft - 0.433psi/ft)(4000')] = **1.91** HCK-55: 4230psi / [(0.77psi/ft - 0.433psi/ft)(5600')] = **2.24**

Burst: $DF_B = 1.25$

Base Assumption

- Casing pressure test as per Onshore Oil and Gas Order No. 2 (0.22 psi/ft or 1500 psi), utilizing an internal force equivalent to the displacement fluid of 8.6 ppg and external force equivalent to 8.4 ppg.
- Gas kick at the casing shoe, in which a 0.7 psi/ft shoe test is assumed, and 0.2 psi/ft gas gradient is assumed.

Burst Calculations: Internal Yield Rating / Burst Force

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Casing Pressure Test:

J-55: 3950psi / [(1500psi +1789 psi) - (1747psi)] = 2.56

HCK-55: 3950psi / [(1500psi +2504 psi) - (2446psi)] = 2.54

Gas Kick:

J-55: 3950psi / [(0.7psi/ft)(5600')-(0.2psi/ft)(5600')] = 1.41

HCK-55: 3950psi / [(0.7psi/ft)(5600')-(0.2psi/ft)(4000')] = 1.27
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Tensile: $DF_T = 1.6$

Base Assumption

• A downward force of 100,000 lb. overpull is applied at the base of the casing along with the weight of the string and not considering the effects of buoyancy.

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Tensile Calculations: Joint Strength / Axial Load

Overpull: J-55: 520 kips / (100,000 lbs. + 224,00 lbs.) = **1.6** HCK-55: 694 kips / (100,000 lbs. + 64,100 lbs.) = **4.23**

Production Casing

				Burst	Dry				
Size	Grade	#/ft	Collapse	(Internal Yield)	Tensile	Coupling	Length	Weight	Mud Weight
5.5"	P-110	20	11080 psi	12360 psi	641 kips	BTC	18,300'	366,000 lb	9.1 ppg

Collapse: $DF_c = 1.25$

Base Assumptions

- Cementing operations in which utilizes a collapse force equivalent to the gradient of the planned cement slurry (0.77 psi/ft) and an internal back-up force equivalent to the fresh water displacement fluid (0.433 psi/ft).
- Production operations in which the pipe is completely evacuated with an external force equivalent to the pore pressure gradient (0.52 psi/ft).

Collapse Calculations: Collapse Rating / Collapse Force

Cementing Operations: 11,080psi / [(0.66psi/ft-0.433 psi/ft)(10,500'TVD)] = **3.13**

Production Operations: 11080psi / (10,500' TVD)(0.52psi/ft) = **2.03**

Burst: $DF_B = 1.25$

Base Assumption

- Frac pressure utilizing an internal force of 9500 psi along with a frac fluid gradient equivalent to 0.468 psi/ft and an external force equal to the minimum fluid gradient (0.433 psi/ft) in which the casing will be ran.
- Production operations in which the casing is completely filled with a gas equivalent gradient of 0.2 psi/ft and an external force equivalent to pore pressure of 0.5 psi/ft.

Burst Calculations: Internal Yield Rating / Burst Force

Frac Pressure: 12,360psi / [(9500 psi)+ (0.468 – 0.433psi/ft)(10,500'TVD)] = **1.28**

Production Operations: 12,360psi / [(0.5 psi/ft – 0.2 psi/ft)(10,500'TVD)] = **3.92**

Tensile: $DF_T = 1.6$

Base Assumption

• A downward force of 100,000 lb. overpull is applied at the base of the casing along with the weight of the string and considering the effects of buoyancy (factor =0.86).

Tensile Calculations: Joint Strength / Axial Load

Overpull: 641,000 lbs /[(100,000 lbs.) + (366,000 lbs.)(0.86)] = **1.6**

Surface Co	asing								
				Burst				Dry	Mud
Size	Grade	#/ft	Collapse	(Internal Yield)	Tensile	Coupling	Length	Weight	Weight
								98,100	
13.375"	J-55	54.5	1130 psi	2730 psi	514 kips	STC	1800'	lbs	8.5 ppg

Collapse: $DF_c = 1.25$

Base Assumptions

- Complete internal evacuation of the casing, utilizing a collapse force equivalent to the mud gradient (0.44 psi/ft) in which the casing will be ran.
- Cementing operations in which, utilizes a collapse force equivalent to the gradient of the planned cement slurry (0.77 psi/ft) and an internal force equivalent to the fresh water displacement fluid (0.433 psi/ft).

Collapse Calculations: Collapse Rating / Collapse Force

Complete Evacuation: 1,130psi / [(0.44psi/ft)(1,800')] = **1.42**

Cementing Operations: 1,130psi / [(0.77psi/ft – 0.433psi/ft)(1800')] = **1.86**

Burst: $DF_B = 1.25$

Base Assumption

• Casing pressure test as per Onshore Oil and Gas Order No. 2 (0.22 psi/ft or 1500 psi), utilizing an external force equivalent to the mud gradient (0.44 psi/ft) in which the casing will be ran.

Burst Calculations: Internal Yield Rating / Internal Force

Casing Pressure Test: 2,730psi / [(1500psi)-(0.44 psi/ft)(1,800')] = **3.86**

Tensile: $DF_T = 1.6$

Base Assumption

 A downward force of 100,000 lb. overpull is applied at the base of the casing along with the weight and not considering the effects of buoyancy.

Tensile Calculations: Joint Strength / Axial Load

Overpull: 514 kips / (100,000 lbs. + 98,100 lbs.) = **2.59**

Intermediate Casing

				Dry					
Size	Grade	#/ft	Collapse	(Internal Yield)	Tensile	Coupling	Length	Weight	Mud Weight
9.625"	J-55	40	2570 psi	3950 psi	520 kips	LTC	4000'	160,000 lb	10.0 ppg
9.625"	HCK-55	40	4230 psi	3950 psi	694 kips	LTC	1600'	64,000 lb	10.0 ppg

Collapse: $DF_c = 1.25$

Base Assumptions

- Complete internal evacuation of the casing, utilizing a collapse force equivalent to the mud gradient (0.52 psi/ft) in which the casing will be ran.
- Cementing operations in which, utilizes a collapse force equivalent to the gradient of the planned cement slurry (0.77 psi/ft) and an internal back-up force equivalent to the fresh water displacement fluid (0.433 psi/ft).

Collapse Calculations: Collapse Rating / Collapse Force

Complete Evacuation: J-55: 2570psi / [(0.52psi/ft)(4,000')] = **1.25** HCK-55: 4230psi / [(0.52psi/ft)(5,600')] = **1.45**

Cementing Operations: J-55: 2570psi / [(0.77psi/ft - 0.433psi/ft)(4000')] = **1.91** HCK-55: 4230psi / [(0.77psi/ft - 0.433psi/ft)(5600')] = **2.24**

Burst: $DF_B = 1.25$

Base Assumption

- Casing pressure test as per Onshore Oil and Gas Order No. 2 (0.22 psi/ft or 1500 psi), utilizing an internal force equivalent to the displacement fluid of 8.6 ppg and external force equivalent to 8.4 ppg.
- Gas kick at the casing shoe, in which a 0.7 psi/ft shoe test is assumed, and 0.2 psi/ft gas gradient is assumed.

Burst Calculations: Internal Yield Rating / Burst Force

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Casing Pressure Test:

J-55: 3950psi / [(1500psi +1789 psi) - (1747psi)] = 2.56

HCK-55: 3950psi / [(1500psi +2504 psi) - (2446psi)] = 2.54

Gas Kick:

J-55: 3950psi / [(0.7psi/ft)(5600')-(0.2psi/ft)(5600')] = 1.41

HCK-55: 3950psi / [(0.7psi/ft)(5600')-(0.2psi/ft)(4000')] = 1.27
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Tensile: $DF_T = 1.6$

Base Assumption

• A downward force of 100,000 lb. overpull is applied at the base of the casing along with the weight of the string and not considering the effects of buoyancy.

Tensile Calculations: Joint Strength / Axial Load

Overpull: J-55: 520 kips / (100,000 lbs. + 224,00 lbs.) = **1.6** HCK-55: 694 kips / (100,000 lbs. + 64,100 lbs.) = **4.23**

Production Casing

				Burst	Dry				
Size	Grade	#/ft	Collapse	(Internal Yield)	Tensile	Coupling	Length	Weight	Mud Weight
5.5"	P-110	20	11080 psi	12360 psi	641 kips	BTC	18,300'	366,000 lb	9.1 ppg

Collapse: $DF_c = 1.25$

Base Assumptions

- Cementing operations in which utilizes a collapse force equivalent to the gradient of the planned cement slurry (0.77 psi/ft) and an internal back-up force equivalent to the fresh water displacement fluid (0.433 psi/ft).
- Production operations in which the pipe is completely evacuated with an external force equivalent to the pore pressure gradient (0.52 psi/ft).

Collapse Calculations: Collapse Rating / Collapse Force

Cementing Operations: 11,080psi / [(0.66psi/ft-0.433 psi/ft)(10,500'TVD)] = **3.13**

Production Operations: 11080psi / (10,500' TVD)(0.52psi/ft) = **2.03**

Burst: $DF_B = 1.25$

Base Assumption

- Frac pressure utilizing an internal force of 9500 psi along with a frac fluid gradient equivalent to 0.468 psi/ft and an external force equal to the minimum fluid gradient (0.433 psi/ft) in which the casing will be ran.
- Production operations in which the casing is completely filled with a gas equivalent gradient of 0.2 psi/ft and an external force equivalent to pore pressure of 0.5 psi/ft.

Burst Calculations: Internal Yield Rating / Burst Force

Frac Pressure: 12,360psi / [(9500 psi)+ (0.468 – 0.433psi/ft)(10,500'TVD)] = **1.28**

Production Operations: 12,360psi / [(0.5 psi/ft – 0.2 psi/ft)(10,500'TVD)] = **3.92**

Tensile: $DF_T = 1.6$

Base Assumption

• A downward force of 100,000 lb. overpull is applied at the base of the casing along with the weight of the string and considering the effects of buoyancy (factor =0.86).

Tensile Calculations: Joint Strength / Axial Load

Overpull: 641,000 lbs /[(100,000 lbs.) + (366,000 lbs.)(0.86)] = **1.6**

Surface Co	asıng							4	
				Burst				Dry	Mud
Size	Grade	#/ft	Collapse	(Internal Yield)	Tensile	Coupling	Length	Weight	Weight
								98,100	
13.375"	J-55	54.5	1130 psi	2730 psi	514 kips	STC	1800'	lbs	8.5 ppg

Collapse: $DF_c = 1.25$

Base Assumptions

- Complete internal evacuation of the casing, utilizing a collapse force equivalent to the mud gradient (0.44 psi/ft) in which the casing will be ran.
- Cementing operations in which, utilizes a collapse force equivalent to the gradient of the planned cement slurry (0.77 psi/ft) and an internal force equivalent to the fresh water displacement fluid (0.433 psi/ft).

Collapse Calculations: Collapse Rating / Collapse Force

Complete Evacuation: 1,130psi / [(0.44psi/ft)(1,800')] = **1.42**

Cementing Operations: 1,130psi / [(0.77psi/ft – 0.433psi/ft)(1800')] = **1.86**

Burst: $DF_B = 1.25$

Base Assumption

• Casing pressure test as per Onshore Oil and Gas Order No. 2 (0.22 psi/ft or 1500 psi), utilizing an external force equivalent to the mud gradient (0.44 psi/ft) in which the casing will be ran.

Burst Calculations: Internal Yield Rating / Internal Force

Casing Pressure Test: 2,730psi / [(1500psi)-(0.44 psi/ft)(1,800')] = **3.86**

Tensile: $DF_T = 1.6$

Base Assumption

• A downward force of 100,000 lb. overpull is applied at the base of the casing along with the weight and not considering the effects of buoyancy.

Tensile Calculations: Joint Strength / Axial Load

Overpull: 514 kips / (100,000 lbs. + 98,100 lbs.) = **2.59**

Intermediate Casing

				Burst		Dry			
Size	Grade	#/ft	Collapse	(Internal Yield)	Tensile	Coupling	Length	Weight	Mud Weight
9.625"	J-55	40	2570 psi	3950 psi	520 kips	LTC	4000'	160,000 lb	10.0 ppg
9.625"	HCK-55	40	4230 psi	3950 psi	694 kips	LTC	1600'	64,000 lb	10.0 ppg

Collapse: $DF_c = 1.25$

Base Assumptions

- Complete internal evacuation of the casing, utilizing a collapse force equivalent to the mud gradient (0.52 psi/ft) in which the casing will be ran.
- Cementing operations in which, utilizes a collapse force equivalent to the gradient of the planned cement slurry (0.77 psi/ft) and an internal back-up force equivalent to the fresh water displacement fluid (0.433 psi/ft).

Collapse Calculations: Collapse Rating / Collapse Force

Complete Evacuation: J-55: 2570psi / [(0.52psi/ft)(4,000')] = **1.25** HCK-55: 4230psi / [(0.52psi/ft)(5,600')] = **1.45**

Cementing Operations: J-55: 2570psi / [(0.77psi/ft - 0.433psi/ft)(4000')] = **1.91** HCK-55: 4230psi / [(0.77psi/ft - 0.433psi/ft)(5600')] = **2.24**

Burst: $DF_B = 1.25$

Base Assumption

- Casing pressure test as per Onshore Oil and Gas Order No. 2 (0.22 psi/ft or 1500 psi), utilizing an internal force equivalent to the displacement fluid of 8.6 ppg and external force equivalent to 8.4 ppg.
- Gas kick at the casing shoe, in which a 0.7 psi/ft shoe test is assumed, and 0.2 psi/ft gas gradient is assumed.

Burst Calculations: Internal Yield Rating / Burst Force

Casing Pressure Test: J-55: 3950psi / [(1500psi +1789 psi) - (1747psi)] = **2.56** HCK-55: 3950psi / [(1500psi +2504 psi) - (2446psi)] = **2.54** Gas Kick:

J-55: 3950psi / [(0.7psi/ft)(5600')-(0.2psi/ft)(5600')] = **1.41** HCK-55: 3950psi / [(0.7psi/ft)(5600')-(0.2psi/ft)(4000')] = **1.27**
Base Assumption

• A downward force of 100,000 lb. overpull is applied at the base of the casing along with the weight of the string and not considering the effects of buoyancy.

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Tensile Calculations: Joint Strength / Axial Load

Production Casing

				Burst				Dry	
Size	Grade	#/ft	Collapse	(Internal Yield)	Tensile	Coupling	Length	Weight	Mud Weight
5.5"	P-110	20	11080 psi	12360 psi	641 kips	BTC	18,300'	366,000 lb	9.1 ppg

Collapse: $DF_c = 1.25$

Base Assumptions

- Cementing operations in which utilizes a collapse force equivalent to the gradient of the planned cement slurry (0.77 psi/ft) and an internal back-up force equivalent to the fresh water displacement fluid (0.433 psi/ft).
- Production operations in which the pipe is completely evacuated with an external force equivalent to the pore pressure gradient (0.52 psi/ft).

Collapse Calculations: Collapse Rating / Collapse Force

Cementing Operations: 11,080psi / [(0.66psi/ft-0.433 psi/ft)(10,500'TVD)] = **3.13**

Production Operations: 11080psi / (10,500' TVD)(0.52psi/ft) = **2.03**

Burst: $DF_B = 1.25$

Base Assumption

- Frac pressure utilizing an internal force of 9500 psi along with a frac fluid gradient equivalent to 0.468 psi/ft and an external force equal to the minimum fluid gradient (0.433 psi/ft) in which the casing will be ran.
- Production operations in which the casing is completely filled with a gas equivalent gradient of 0.2 psi/ft and an external force equivalent to pore pressure of 0.5 psi/ft.

Burst Calculations: Internal Yield Rating / Burst Force

Frac Pressure: 12,360psi / [(9500 psi)+ (0.468 – 0.433psi/ft)(10,500'TVD)] = **1.28**

Production Operations: 12,360psi / [(0.5 psi/ft - 0.2 psi/ft)(10,500'TVD)] = **3.92**

Tensile: $DF_T = 1.6$

Base Assumption

• A downward force of 100,000 lb. overpull is applied at the base of the casing along with the weight of the string and considering the effects of buoyancy (factor =0.86).

Tensile Calculations: Joint Strength / Axial Load

Overpull: 641,000 lbs /[(100,000 lbs.) + (366,000 lbs.)(0.86)] = **1.6**

DRILLING PLAN LEA UNIT 63H LEGACY RESERVES OPERATING LP SHL: Unit K, Section 19 BHL: Unit C, Section 18 T20S-R35E, Lea County, New Mexico

To satisfy requirements of Onshore Oil and Gas Order No. 1, Legacy Reserves Operating LP submits the following for your consideration:

- I.
 Location:
 SHL:
 2270' FSL & 2610' FWL, Sec.19, T20S-R35E (First Take: 2310 FNL & 1750 FWL)

 BHL:
 330' FNL & 1750' FWL, Sec. 18, T20S-R35E (Last Take)
- 2. *Elevations:* 3,689' GL

3.	Geological Name of Surface Formation:	Quaternary alluvium deposits
4.	Drilling Tools and Associated Equipment:	Rotary drilling rig using fluid as a means for removal of solid cuttings from the well.

5. *Proposed Drilling Depth:* 18,314' MD 10,500' TVD

6. Estimated Tops of Geological Markers:

Rustler	1,680'	Delaware	5,666'
Top Salt	1,720'	Bone Spring Lime	8,205'
Bottom Salt	3,150'	Avalon	8,760'
Top of Capitan Reef	3,150'	1 st . Bone Spring	9,501'
Capitan Reef Bottom	4,710'	2 nd . Bone Spring	10,034
San Andres	4,710'		

7. Possible mineral bearing formations:

Primary: Bone Spring (oil); Secondary: Delaware (oil), Avalon (oil), fresh water (~125')

8. Proposed Mud System:

Depth	Mud Wt.	Visc	Fluid Loss	Type Mud
0' to 1800'	8.4-8.9	30-32	NC	Fresh water gel spud mud
1800' to 5600'	9.8-10	28-29	NC	Brine water
5600' to 10,500'	8.4-8.6	28-29	NC	Fresh water/brine, use hi-viscosity
				Weeps to clean hole
10,500' to 18,314'	8.9-9.1	28-29	18-20	Fresh water/brine

Sufficient mud materials will be kept on location at all times in order to combat lost circulation or unexpected kicks. A Pason PVT system will be rigged up prior to spudding this well. A volume monitoring system that measures, calculates and displays readings from the mud system on the rig to alert the rig crew of impending gas kicks and lost circulation. In order to effectively run open hole logs and casing, the mud viscosity and fluid loss properties may be adjusted.

9. Proposed Drilling Plan:

Set surface and intermediate casing and cement to surface. Drill 8-3/4" to ~10,500', Kick off and drill 8-3/4" hole to TD of ~18,314'. Set 5-1/2" casing from surface to TD (~ 18,314'). Cement 5-1/2" production casing back to surface.

10. Casing Information:

String	Hole size Depth Casing OD		Casing OD	Collar	Weight	Grade
Surface 17-1/2" 1800		1800' MD	New 13-3/8"	STC	54.5#	J-55
Intermediate	12-1/4"	3901' MD	New 9-5/8"	LTC	40#	J-55
Intermediate	12-1/4"	5600' MD	New 9-5/8"	LTC	40#	HCK-55
Production	8-3/4"	18,314' MD	New 5-1/2"	BTC	20#	P-110
<u>13-3/8", J-55:</u>		9-5/8	", J-55			
Collapse Factor	r: 1.42	Collar	Collapse Factor:			
Burst Factor:	3.86	Burst	Burst Factor:			
Tension Factor	: 2.59	Tensi	on Factor:	1.6		
9-5/8". HCK-55		5-1/2	". P-110			
Collapse Factor	r: 1.45	Collar	ose Factor:	2.03		
Burst Factor:	1.27	Burst Factor:		1.28		
Tension Factor	: 4.23	Tensi	on Factor:	1.6		

11. Cementing Information:

Surface Casing (75% excess on lead & 75% excess on tail to design for cement top at surface):

Lead: 1100 sxs class C cement + 4% bwoc bentonite II + 2% bwoc Calcium Chloride + 0.25 lbs/sack Cello Flake + 0.005% bwoc Static Free + 0.005 gps FP-6L (13.50 ppg, 1.93 cfps, 9.71 gps wtr).

Tail: 200 sxs class C cement + 1.5% bwoc Calcium Chloride + 0.005 lbs/sack Static Free + 0.005 gps FP-6L (14.80 ppg, 1.34 cfps, 6.35 gps wtr).

Intermediate Casing

In the event that circulation is lost (> 50%) while drilling the 12-1/4" intermediate hole in the Capitan Reef at +/-4000', we will plan to install a DV tool and external casing packer within 200' of the top depth where lost circulation occurred and will pump a two-stage cement job with the potential to add an additional DV tool for a three-stage cement job. If there is no lost circulation a single stage cementing procedure will be followed. Legacy plans to cement to surface regardless of whether a single stage, 2-stage or 3-stage procedure is implemented.

No DV tool (80% excess on lead & 80% excess on tail to design for cement top at surface)

Lead: 1400 sx (35:65) poz (fly ash) class C cement+ 4% bwoc bentonite II + 5% bwoc MPA-5 + 0.25% bwoc FL- 52 + 5 lbs/sack LCM-1 + 0.125 lbs/sk cello flake+ 0.005 lbs/sk defoamer + 0.005 gps FP-6L + 1.2% bwoc Sodium Metasilicate + 5% bwow Sodium Chloride (12.5 ppg, 2.13 cfps, 8.81 gps wtr)

Tail: 200 sx class C cement (14.80 ppg, 1.33 cfps, 6.35 gps wtr)

With (1) DV Tool (100% excess on lead & 100% excess on tail to design for cement top at surface)

Assuming DV tool set at 3950' but if the setting depth changes, cement volumes will be adjusted proportionately.

Stage 1

Lead: 400 sx (35:65) paz (fly ash) class C cement+ 4% bwoc Bentonite II+ 5% bwoc MPA-5 + 0,25% bwoc FL-52 + 5 lbs/sack LCM-1 + 0.125 lbs/sk cello flake+ 0.005 lbs/sk defoamer + 0.005 gps FP-6L + 1.2% bwoc Sodium Metasilicate + 5% bwow Sodium Chloride (12.5 ppg, 2.13 cfps, 8.81 gps wtr)

Tail: 200 sx class C cement (14.80 ppg, 1.33 cfps, 6.35 gps wtr)

Stage 2

Lead: 1100 sx (35:65) paz (fly ash) class C cement+ 4% bwoc bentonite II + 5% bwoc MPA-5 + 0,25% bwoc FL-52 + 5 lbs/sack LCM-1 + 0.125 lbs/sk Cello Flake+ 0.005 lbs/sk Static Free+ 0.005 gps FP-6L + 1.2% bwoc Sodium Metasilicate + 5% bwow Sodium Chloride (12.5 ppg, 2.13 cfps, 8.81 gps wtr)

Tail: 200 sx class C cement (14.80 ppg, 1.33 cfps, 6.35 gps wtr)

With (2) DV Tools (100% excess on lead & 100% excess on tail to design for cement top at surface)

Assuming one DV tool set at 3950' and one DV tool set at 1800' but if the setting depths change, cement volumes will be adjusted proportionately.

Stage 1

Lead: 400 sx (35:65) paz (fly ash) class C cement+ 4% bwoc Bentonite II+ 5% bwoc MPA-5 + 0,25% bwoc FL-52 + 5 lbs/sack LCM-1 + 0.125 lbs/sk cello flake+ 0.005 lbs/sk defoamer + 0.005 gps FP-6L + 1.2% bwoc Sodium Metasilicate + 5% bwow Sodium Chloride (12.5 ppg, 2.13 cfps, 8.81 gps wtr)

Tail: 200 sx class C cement (14.80 ppg, 1.33 cfps, 6.35 gps wtr)

Stage 2

Lead: 600 sx (35:65) paz (fly ash) class C cement+ 4% bwoc bentonite II + 5% bwoc MPA-5 + 0,25% bwoc FL-52 + 5 lbs/sack LCM-1 + 0.125 lbs/sk Cello Flake+ 0.005 lbs/sk Static Free+ 0.005 gps FP-6L + 1.2% bwoc Sodium Metasilicate + 5% bwow Sodium Chloride (12.5 ppg, 2.13 cfps, 8.81 gps wtr)

<u>Tail:</u> 200 sx class C cement (14.80 ppg, 1.33 cfps, 6.35 gps wtr)

Stage 3

Lead: 600 sx (35:65) paz (fly ash) class C cement+ 4% bwoc bentonite II + 5% bwoc MPA-5 + 0,25% bwoc FL-52 + 5 lbs/sack LCM-1 + 0.125 lbs/sk Cello Flake+ 0.005 lbs/sk Static Free+ 0.005 gps FP-6L + 1.2% bwoc Sodium Metasilicate + 5% bwow Sodium Chloride (12.5 ppg, 2.13 cfps, 8.81 gps wtr)

Tail: 200 sx class C cement (14.80 ppg, 1.33 cfps, 6.35 gps wtr)

Production Casing (80% excess on lead & 20% excess on tail to design for cement top at surface):

- Lead: 1600 sxs (50:50) poz (fly ash) class H cement + 10% bwoc bentonite II + 5% bwow sodium chloride + 5 pps LCM-1 + 0.005 lbs/sk Static Free + 0.005 gps FP-6L (11.90 ppg, 2.38 cf/sx, 13.22 gps wtr).
- Tail:
 1700 sxs Class H (15:61:11) poz (fly ash): class H cement: CSE-2 + 4% bwow sodium chloride + 3 pps LCM-1 + 0.6% bwoc FL-25 + 0.005 gps FP-6L + 0.005% bwoc Static Free (13.20 ppg, 1.62 cf/sx, 9.45 gps wtr).

12. Pressure Control Eqpt/BOP:

Legacy Reserves plans to use a 13-5/8" 5000-psi working pressure BOP system consisting of a double ram BOP with one ram being pipe and one ram being blind, a 5000-psi annular type preventer, a 5000-psi choke manifold and 80 gallon accumulator with floor, five remote operating stations and an auxiliary power system. A rotating head will be utilized as needed. A drill string safety valve in the open position will be available on the rig floor. A mud gas separator will be available for use if needed.

A 3M BOP will be used to drill from the surface casing shoe (~1800') to the intermediate casing shoe (~5600'). The BOP will be a 5M system, however the "A" section wellhead will be a 3M wellhead (see attached BOP Diagram).

The BOP unit will be hydraulically operated. The BOP will be operated at least once per day while drilling and the blind rams will be operated when out of hole during trips. No abnormal pressure or temperature is expected while drilling.

The BOPs will be tested by an independent service company to 250 psi low and 5000 psi high.

13. Testing, Logging, and Coring Program:

- A. Mud logging program: 2 man unit from approximately after setting intermediate casing.
- B. No open hole logs, DST's or cores are planned.

14. Potential Hazards

No abnormal pressures or temperatures are expected during the drilling of this well. If H2S is encountered the operator will comply with provisions of Onshore Order 6. Since there will be an H2S Safety package on location, attached is an "H2S Drilling Operations Plan". Adequate flare lines will be installed on the mud/gas separator so gas may be flared safely. All personnel will be familiar with all aspects of safe operations of equipment being used. Lost circulation may occur and a cement contingency plan is included in this plan along with mud materials to be kept on location at all times in order to combat lost circulation or unexpected kicks. Estimated BHP: 4620 psi, estimated BHT: 162°F.

15. Road and Location

Road and location construction will begin after BLM approval of the APD. Drilling is expected to take 30-35 days and an additional 10 days for the completion.

16. Additional Requirements of Project:

Completion: The targeted Bone Spring pay zone will be perforated and stimulated in multiple stages using acid and hydraulic fracturing treatments. Fresh water used in the drilling and completion of this well will be transferred from off-site via temporary flowlines and stored in frac tanks on the location.

Surface Casing

				Burst				Dry	Mud
Size	Grade	#/ft	Collapse	(Internal Yield)	Tensile	Coupling	Length	Weight	Weight
								98,100	
13.375"	J-55	54.5	1130 psi	2730 psi	514 kips	STC	1800'	lbs	8.5 ppg

Collapse: $DF_c = 1.25$

Base Assumptions

- Complete internal evacuation of the casing, utilizing a collapse force equivalent to the mud gradient (0.44 psi/ft) in which the casing will be ran.
- Cementing operations in which, utilizes a collapse force equivalent to the gradient of the planned cement slurry (0.77 psi/ft) and an internal force equivalent to the fresh water displacement fluid (0.433 psi/ft).

Collapse Calculations: Collapse Rating / Collapse Force

Complete Evacuation: 1,130psi / [(0.44psi/ft)(1,800')] = **1.42**

Cementing Operations: 1,130psi / [(0.77psi/ft - 0.433psi/ft)(1800')] = **1.86**

Burst: $DF_B = 1.25$

Base Assumption

• Casing pressure test as per Onshore Oil and Gas Order No. 2 (0.22 psi/ft or 1500 psi), utilizing an external force equivalent to the mud gradient (0.44 psi/ft) in which the casing will be ran.

Burst Calculations: Internal Yield Rating / Internal Force

Casing Pressure Test: 2,730psi / [(1500psi)-(0.44 psi/ft)(1,800')] = **3.86**

Tensile: $DF_T = 1.6$

Base Assumption

• A downward force of 100,000 lb. overpull is applied at the base of the casing along with the weight and not considering the effects of buoyancy.

Tensile Calculations: Joint Strength / Axial Load

Overpull: 514 kips / (100,000 lbs. + 98,100 lbs.) = **2.59**

Intermediate Casing

				Burst				Dry	
Size	Grade	#/ft	Collapse	(Internal Yield)	Tensile	Coupling	Length	Weight	Mud Weight
9.625"	J-55	40	2570 psi	3950 psi	520 kips	LTC	4000'	160,000 lb	10.0 ppg
9.625"	HCK-55	40	4230 psi	3950 psi	694 kips	LTC	1600'	64,000 lb	10.0 ppg

Collapse: $DF_c = 1.25$

Base Assumptions

- Complete internal evacuation of the casing, utilizing a collapse force equivalent to the mud gradient (0.52 psi/ft) in which the casing will be ran.
- Cementing operations in which, utilizes a collapse force equivalent to the gradient of the planned cement slurry (0.77 psi/ft) and an internal back-up force equivalent to the fresh water displacement fluid (0.433 psi/ft).

Collapse Calculations: Collapse Rating / Collapse Force

Complete Evacuation: J-55: 2570psi / [(0.52psi/ft)(4,000')] = **1.25** HCK-55: 4230psi / [(0.52psi/ft)(5,600')] = **1.45**

Cementing Operations: J-55: 2570psi / [(0.77psi/ft - 0.433psi/ft)(4000')] = **1.91** HCK-55: 4230psi / [(0.77psi/ft - 0.433psi/ft)(5600')] = **2.24**

Burst: $DF_B = 1.25$

Base Assumption

- Casing pressure test as per Onshore Oil and Gas Order No. 2 (0.22 psi/ft or 1500 psi), utilizing an internal force equivalent to the displacement fluid of 8.6 ppg and external force equivalent to 8.4 ppg.
- Gas kick at the casing shoe, in which a 0.7 psi/ft shoe test is assumed, and 0.2 psi/ft gas gradient is assumed.

Burst Calculations: Internal Yield Rating / Burst Force

```
Casing Pressure Test:

J-55: 3950psi / [(1500psi +1789 psi) - (1747psi)] = 2.56

HCK-55: 3950psi / [(1500psi +2504 psi) - (2446psi)] = 2.54

Gas Kick:

J-55: 3950psi / [(0.7psi/ft)(5600')-(0.2psi/ft)(5600')] = 1.41

HCK-55: 3950psi / [(0.7psi/ft)(5600')-(0.2psi/ft)(4000')] = 1.27
```

Base Assumption

• A downward force of 100,000 lb. overpull is applied at the base of the casing along with the weight of the string and not considering the effects of buoyancy.

Tensile Calculations: Joint Strength / Axial Load

Production Casing

				Burst				Dry	
Size	Grade	#/ft	Collapse	(Internal Yield)	Tensile	Coupling	Length	Weight	Mud Weight
5.5"	P-110	20	11080 psi	12360 psi	641 kips	BTC	18,300'	366,000 lb	9.1 ppg

Collapse: $DF_c = 1.25$

Base Assumptions

- Cementing operations in which utilizes a collapse force equivalent to the gradient of the planned cement slurry (0.77 psi/ft) and an internal back-up force equivalent to the fresh water displacement fluid (0.433 psi/ft).
- Production operations in which the pipe is completely evacuated with an external force equivalent to the pore pressure gradient (0.52 psi/ft).

Collapse Calculations: Collapse Rating / Collapse Force

Cementing Operations: 11,080psi / [(0.66psi/ft-0.433 psi/ft)(10,500'TVD)] = **3.13**

Production Operations: 11080psi / (10,500' TVD)(0.52psi/ft) = **2.03**

Burst: $DF_B = 1.25$

Base Assumption

- Frac pressure utilizing an internal force of 9500 psi along with a frac fluid gradient equivalent to 0.468 psi/ft and an external force equal to the minimum fluid gradient (0.433 psi/ft) in which the casing will be ran.
- Production operations in which the casing is completely filled with a gas equivalent gradient of 0.2 psi/ft and an external force equivalent to pore pressure of 0.5 psi/ft.

Burst Calculations: Internal Yield Rating / Burst Force

Frac Pressure: 12,360psi / [(9500 psi)+ (0.468 – 0.433psi/ft)(10,500'TVD)] = **1.28**

Production Operations: 12,360psi / [(0.5 psi/ft - 0.2 psi/ft)(10,500'TVD)] = **3.92**

Tensile: $DF_T = 1.6$

Base Assumption

• A downward force of 100,000 lb. overpull is applied at the base of the casing along with the weight of the string and considering the effects of buoyancy (factor =0.86).

Tensile Calculations: Joint Strength / Axial Load

Overpull: 641,000 lbs /[(100,000 lbs.) + (366,000 lbs.)(0.86)] = **1.6**

Surface Co	asing							•	*
				Burst				Dry	Mud
Size	Grade	#/ft	Collapse	(Internal Yield)	Tensile	Coupling	Length	Weight	Weight
								98,100	
13.375"	J-55	54.5	1130 psi	2730 psi	514 kips	STC	1800'	lbs	8.5 ppg

Collapse: $DF_c = 1.25$

Base Assumptions

- Complete internal evacuation of the casing, utilizing a collapse force equivalent to the mud gradient (0.44 psi/ft) in which the casing will be ran.
- Cementing operations in which, utilizes a collapse force equivalent to the gradient of the planned cement slurry (0.77 psi/ft) and an internal force equivalent to the fresh water displacement fluid (0.433 psi/ft).

Collapse Calculations: Collapse Rating / Collapse Force

Complete Evacuation: 1,130psi / [(0.44psi/ft)(1,800')] = **1.42**

Cementing Operations: 1,130psi / [(0.77psi/ft – 0.433psi/ft)(1800')] = **1.86**

Burst: $DF_B = 1.25$

Base Assumption

• Casing pressure test as per Onshore Oil and Gas Order No. 2 (0.22 psi/ft or 1500 psi), utilizing an external force equivalent to the mud gradient (0.44 psi/ft) in which the casing will be ran.

Burst Calculations: Internal Yield Rating / Internal Force

Casing Pressure Test: 2,730psi / [(1500psi)-(0.44 psi/ft)(1,800')] = **3.86**

Tensile: $DF_T = 1.6$

Base Assumption

• A downward force of 100,000 lb. overpull is applied at the base of the casing along with the weight and not considering the effects of buoyancy.

Tensile Calculations: Joint Strength / Axial Load

Overpull: 514 kips / (100,000 lbs. + 98,100 lbs.) = **2.59**

Intermediate Casing

				Burst				Dry	
Size	Grade	#/ft	Collapse	(Internal Yield)	Tensile	Coupling	Length	Weight	Mud Weight
9.625"	J-55	40	2570 psi	3950 psi	520 kips	LTC	4000'	160,000 lb	10.0 ppg
9.625"	HCK-55	40	4230 psi	3950 psi	694 kips	LTC	1600'	64,000 lb	10.0 ppg

Collapse: $DF_c = 1.25$

Base Assumptions

- Complete internal evacuation of the casing, utilizing a collapse force equivalent to the mud gradient (0.52 psi/ft) in which the casing will be ran.
- Cementing operations in which, utilizes a collapse force equivalent to the gradient of the planned cement slurry (0.77 psi/ft) and an internal back-up force equivalent to the fresh water displacement fluid (0.433 psi/ft).

Collapse Calculations: Collapse Rating / Collapse Force

Complete Evacuation: J-55: 2570psi / [(0.52psi/ft)(4,000')] = **1.25** HCK-55: 4230psi / [(0.52psi/ft)(5,600')] = **1.45**

Cementing Operations: J-55: 2570psi / [(0.77psi/ft - 0.433psi/ft)(4000')] = **1.91** HCK-55: 4230psi / [(0.77psi/ft - 0.433psi/ft)(5600')] = **2.24**

Burst: $DF_B = 1.25$

Base Assumption

- Casing pressure test as per Onshore Oil and Gas Order No. 2 (0.22 psi/ft or 1500 psi), utilizing an internal force equivalent to the displacement fluid of 8.6 ppg and external force equivalent to 8.4 ppg.
- Gas kick at the casing shoe, in which a 0.7 psi/ft shoe test is assumed, and 0.2 psi/ft gas gradient is assumed.

Burst Calculations: Internal Yield Rating / Burst Force

```
Casing Pressure Test:

J-55: 3950psi / [(1500psi +1789 psi) - (1747psi)] = 2.56

HCK-55: 3950psi / [(1500psi +2504 psi) - (2446psi)] = 2.54

Gas Kick:

J-55: 3950psi / [(0.7psi/ft)(5600')-(0.2psi/ft)(5600')] = 1.41

HCK-55: 3950psi / [(0.7psi/ft)(5600')-(0.2psi/ft)(4000')] = 1.27
```

Base Assumption

• A downward force of 100,000 lb. overpull is applied at the base of the casing along with the weight of the string and not considering the effects of buoyancy.

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Tensile Calculations: Joint Strength / Axial Load

Production Casing

				Burst				Dry	
Size	Grade	#/ft	Collapse	(Internal Yield)	Tensile	Coupling	Length	Weight	Mud Weight
5.5"	P-110	20	11080 psi	12360 psi	641 kips	BTC	18,300'	366,000 lb	9.1 ppg

Collapse: $DF_c = 1.25$

Base Assumptions

- Cementing operations in which utilizes a collapse force equivalent to the gradient of the planned cement slurry (0.77 psi/ft) and an internal back-up force equivalent to the fresh water displacement fluid (0.433 psi/ft).
- Production operations in which the pipe is completely evacuated with an external force equivalent to the pore pressure gradient (0.52 psi/ft).

Collapse Calculations: Collapse Rating / Collapse Force

Cementing Operations: 11,080psi / [(0.66psi/ft-0.433 psi/ft)(10,500'TVD)] = **3.13**

Production Operations: 11080psi / (10,500' TVD)(0.52psi/ft) = **2.03**

Burst: $DF_B = 1.25$

Base Assumption

- Frac pressure utilizing an internal force of 9500 psi along with a frac fluid gradient equivalent to 0.468 psi/ft and an external force equal to the minimum fluid gradient (0.433 psi/ft) in which the casing will be ran.
- Production operations in which the casing is completely filled with a gas equivalent gradient of 0.2 psi/ft and an external force equivalent to pore pressure of 0.5 psi/ft.

Burst Calculations: Internal Yield Rating / Burst Force

Frac Pressure: 12,360psi / [(9500 psi)+ (0.468 - 0.433psi/ft)(10,500'TVD)] = **1.28**

Production Operations: 12,360psi / [(0.5 psi/ft – 0.2 psi/ft)(10,500'TVD)] = **3.92**

Tensile: $DF_T = 1.6$

Base Assumption

• A downward force of 100,000 lb. overpull is applied at the base of the casing along with the weight of the string and considering the effects of buoyancy (factor =0.86).

Tensile Calculations: Joint Strength / Axial Load

Overpull: 641,000 lbs /[(100,000 lbs.) + (366,000 lbs.)(0.86)] = **1.6**

Surface Co	asing								•
				Burst				Dry	Mud
Size	Grade	#/ft	Collapse	(Internal Yield)	Tensile	Coupling	Length	Weight	Weight
								98,100	
13.375"	J-55	54.5	1130 psi	2730 psi	514 kips	STC	1800'	lbs	8.5 ppg

Collapse: $DF_c = 1.25$

Base Assumptions

- Complete internal evacuation of the casing, utilizing a collapse force equivalent to the mud gradient (0.44 psi/ft) in which the casing will be ran.
- Cementing operations in which, utilizes a collapse force equivalent to the gradient of the planned cement slurry (0.77 psi/ft) and an internal force equivalent to the fresh water displacement fluid (0.433 psi/ft).

Collapse Calculations: Collapse Rating / Collapse Force

Complete Evacuation: 1,130psi / [(0.44psi/ft)(1,800')] = **1.42**

Cementing Operations: 1,130psi / [(0.77psi/ft – 0.433psi/ft)(1800')] = **1.86**

Burst: $DF_B = 1.25$

Base Assumption

• Casing pressure test as per Onshore Oil and Gas Order No. 2 (0.22 psi/ft or 1500 psi), utilizing an external force equivalent to the mud gradient (0.44 psi/ft) in which the casing will be ran.

Burst Calculations: Internal Yield Rating / Internal Force

Casing Pressure Test: 2,730psi / [(1500psi)-(0.44 psi/ft)(1,800')] = **3.86**

Tensile: $DF_T = 1.6$

Base Assumption

• A downward force of 100,000 lb. overpull is applied at the base of the casing along with the weight and not considering the effects of buoyancy.

Tensile Calculations: Joint Strength / Axial Load

Overpull: 514 kips / (100,000 lbs. + 98,100 lbs.) = **2.59**

Intermediate Casing

				Burst		Dry				
Size	Grade	#/ft	Collapse	(Internal Yield)	Tensile	Coupling	Length	Weight	Mud Weight	
9.625"	J-55	40	2570 psi	3950 psi	520 kips	LTC	4000'	160,000 lb	10.0 ppg	
9.625"	HCK-55	40	4230 psi	3950 psi	694 kips	LTC	1600'	64,000 lb	10.0 ppg	

Collapse: $DF_c = 1.25$

Base Assumptions

- Complete internal evacuation of the casing, utilizing a collapse force equivalent to the mud gradient (0.52 psi/ft) in which the casing will be ran.
- Cementing operations in which, utilizes a collapse force equivalent to the gradient of the planned cement slurry (0.77 psi/ft) and an internal back-up force equivalent to the fresh water displacement fluid (0.433 psi/ft).

Collapse Calculations: Collapse Rating / Collapse Force

Complete Evacuation: J-55: 2570psi / [(0.52psi/ft)(4,000')] = **1.25** HCK-55: 4230psi / [(0.52psi/ft)(5,600')] = **1.45**

Cementing Operations: J-55: 2570psi / [(0.77psi/ft - 0.433psi/ft)(4000')] = **1.91** HCK-55: 4230psi / [(0.77psi/ft - 0.433psi/ft)(5600')] = **2.24**

Burst: $DF_B = 1.25$

Base Assumption

- Casing pressure test as per Onshore Oil and Gas Order No. 2 (0.22 psi/ft or 1500 psi), utilizing an internal force equivalent to the displacement fluid of 8.6 ppg and external force equivalent to 8.4 ppg.
- Gas kick at the casing shoe, in which a 0.7 psi/ft shoe test is assumed, and 0.2 psi/ft gas gradient is assumed.

Burst Calculations: Internal Yield Rating / Burst Force

```
Casing Pressure Test:

J-55: 3950psi / [(1500psi +1789 psi) - (1747psi)] = 2.56

HCK-55: 3950psi / [(1500psi +2504 psi) - (2446psi)] = 2.54

Gas Kick:

J-55: 3950psi / [(0.7psi/ft)(5600')-(0.2psi/ft)(5600')] = 1.41

HCK-55: 3950psi / [(0.7psi/ft)(5600')-(0.2psi/ft)(4000')] = 1.27
```

Base Assumption

• A downward force of 100,000 lb. overpull is applied at the base of the casing along with the weight of the string and not considering the effects of buoyancy.

Tensile Calculations: Joint Strength / Axial Load

Production Casing

				Burst		Dry			
Size	Grade	#/ft	Collapse	(Internal Yield)	Tensile	Coupling	Length	Weight	Mud Weight
5.5"	P-110	20	11080 psi	12360 psi	641 kips	BTC	18,300'	366,000 lb	9.1 ppg

Collapse: $DF_c = 1.25$

Base Assumptions

- Cementing operations in which utilizes a collapse force equivalent to the gradient of the planned cement slurry (0.77 psi/ft) and an internal back-up force equivalent to the fresh water displacement fluid (0.433 psi/ft).
- Production operations in which the pipe is completely evacuated with an external force equivalent to the pore pressure gradient (0.52 psi/ft).

Collapse Calculations: Collapse Rating / Collapse Force

Cementing Operations: 11,080psi / [(0.66psi/ft-0.433 psi/ft)(10,500'TVD)] = **3.13**

Production Operations: 11080psi / (10,500' TVD)(0.52psi/ft) = **2.03**

Burst: $DF_B = 1.25$

Base Assumption

- Frac pressure utilizing an internal force of 9500 psi along with a frac fluid gradient equivalent to 0.468 psi/ft and an external force equal to the minimum fluid gradient (0.433 psi/ft) in which the casing will be ran.
- Production operations in which the casing is completely filled with a gas equivalent gradient of 0.2 psi/ft and an external force equivalent to pore pressure of 0.5 psi/ft.

Burst Calculations: Internal Yield Rating / Burst Force

Frac Pressure: 12,360psi / [(9500 psi)+ (0.468 – 0.433psi/ft)(10,500'TVD)] = **1.28**

Production Operations: 12,360psi / [(0.5 psi/ft – 0.2 psi/ft)(10,500'TVD)] = **3.92**

Tensile: $DF_T = 1.6$

Base Assumption

• A downward force of 100,000 lb. overpull is applied at the base of the casing along with the weight of the string and considering the effects of buoyancy (factor =0.86).

Tensile Calculations: Joint Strength / Axial Load

Overpull: 641,000 lbs /[(100,000 lbs.) + (366,000 lbs.)(0.86)] = **1.6**

Surface Co	asing								+
				Burst				Dry	Mud
Size	Grade	#/ft	Collapse	(Internal Yield)	Tensile	Coupling	Length	Weight	Weight
								98,100	
13.375"	J-55	54.5	1130 psi	2730 psi	514 kips	STC	1800'	lbs	8.5 ppg

Collapse: $DF_c = 1.25$

Base Assumptions

- Complete internal evacuation of the casing, utilizing a collapse force equivalent to the mud gradient (0.44 psi/ft) in which the casing will be ran.
- Cementing operations in which, utilizes a collapse force equivalent to the gradient of the planned cement slurry (0.77 psi/ft) and an internal force equivalent to the fresh water displacement fluid (0.433 psi/ft).

Collapse Calculations: Collapse Rating / Collapse Force

Complete Evacuation: 1,130psi / [(0.44psi/ft)(1,800')] = **1.42**

Cementing Operations: 1,130psi / [(0.77psi/ft – 0.433psi/ft)(1800')] = **1.86**

Burst: $DF_B = 1.25$

Base Assumption

• Casing pressure test as per Onshore Oil and Gas Order No. 2 (0.22 psi/ft or 1500 psi), utilizing an external force equivalent to the mud gradient (0.44 psi/ft) in which the casing will be ran.

Burst Calculations: Internal Yield Rating / Internal Force

Casing Pressure Test: 2,730psi / [(1500psi)-(0.44 psi/ft)(1,800')] = **3.86**

Tensile: $DF_T = 1.6$

Base Assumption

• A downward force of 100,000 lb. overpull is applied at the base of the casing along with the weight and not considering the effects of buoyancy.

Tensile Calculations: Joint Strength / Axial Load

Overpull: 514 kips / (100,000 lbs. + 98,100 lbs.) = **2.59**

Intermediate Casing

				Burst		Dry				
Size	Grade	#/ft	Collapse	(Internal Yield)	Tensile	Coupling	Length	Weight	Mud Weight	
9.625"	J-55	40	2570 psi	3950 psi	520 kips	LTC	4000'	160,000 lb	10.0 ppg	
9.625"	НСК-55	40	4230 psi	3950 psi	694 kips	LTC	1600'	64,000 lb	10.0 ppg	

Collapse: $DF_c = 1.25$

Base Assumptions

- Complete internal evacuation of the casing, utilizing a collapse force equivalent to the mud gradient (0.52 psi/ft) in which the casing will be ran.
- Cementing operations in which, utilizes a collapse force equivalent to the gradient of the planned cement slurry (0.77 psi/ft) and an internal back-up force equivalent to the fresh water displacement fluid (0.433 psi/ft).

Collapse Calculations: Collapse Rating / Collapse Force

Complete Evacuation: J-55: 2570psi / [(0.52psi/ft)(4,000')] = **1.25** HCK-55: 4230psi / [(0.52psi/ft)(5,600')] = **1.45**

Cementing Operations: J-55: 2570psi / [(0.77psi/ft - 0.433psi/ft)(4000')] = **1.91** HCK-55: 4230psi / [(0.77psi/ft - 0.433psi/ft)(5600')] = **2.24**

Burst: $DF_B = 1.25$

Base Assumption

- Casing pressure test as per Onshore Oil and Gas Order No. 2 (0.22 psi/ft or 1500 psi), utilizing an internal force equivalent to the displacement fluid of 8.6 ppg and external force equivalent to 8.4 ppg.
- Gas kick at the casing shoe, in which a 0.7 psi/ft shoe test is assumed, and 0.2 psi/ft gas gradient is assumed.

Burst Calculations: Internal Yield Rating / Burst Force

```
Casing Pressure Test:

J-55: 3950psi / [(1500psi +1789 psi) - (1747psi)] = 2.56

HCK-55: 3950psi / [(1500psi +2504 psi) - (2446psi)] = 2.54

Gas Kick:

J-55: 3950psi / [(0.7psi/ft)(5600')-(0.2psi/ft)(5600')] = 1.41

HCK-55: 3950psi / [(0.7psi/ft)(5600')-(0.2psi/ft)(4000')] = 1.27
```

Base Assumption

• A downward force of 100,000 lb. overpull is applied at the base of the casing along with the weight of the string and not considering the effects of buoyancy.

Tensile Calculations: Joint Strength / Axial Load

Production Casing

					Dry				
Size	Grade	#/ft	Collapse	(Internal Yield)	Tensile	Coupling	Length	Weight	Mud Weight
5.5"	P-110	20	11080 psi	12360 psi	641 kips	BTC	17,600'	352,000 lb	9.1 ppg

Collapse: $DF_c = 1.25$

Base Assumptions

- Cementing operations in which utilizes a collapse force equivalent to the gradient of the planned cement slurry (0.77 psi/ft) and an internal back-up force equivalent to the fresh water displacement fluid (0.433 psi/ft).
- Production operations in which the pipe is completely evacuated with an external force equivalent to the pore pressure gradient (0.52 psi/ft).

Collapse Calculations: Collapse Rating / Collapse Force

Cementing Operations: 11,080psi / [(0.66psi/ft-0.433 psi/ft)(9,800'TVD)] = **4.98**

Production Operations: 11080psi / (9,800' TVD)(0.52psi/ft) = **2.17**

Burst: $DF_B = 1.25$

Base Assumption

- Frac pressure utilizing an internal force of 9500 psi along with a frac fluid gradient equivalent to 0.468 psi/ft and an external force equal to the minimum fluid gradient (0.433 psi/ft) in which the casing will be ran.
- Production operations in which the casing is completely filled with a gas equivalent gradient of 0.2 psi/ft and an external force equivalent to pore pressure of 0.5 psi/ft.

Burst Calculations: Internal Yield Rating / Burst Force

Frac Pressure: 12,360psi / [(9500 psi)+ (0.468 – 0.433psi/ft)(9,800'TVD)] = **1.26**

Production Operations: 12,360psi / [(0.5 psi/ft – 0.2 psi/ft)(9,800'TVD)] = **4.2**

Tensile: $DF_T = 1.6$

Base Assumption

• A downward force of 100,000 lb. overpull is applied at the base of the casing along with the weight of the string and considering the effects of buoyancy (factor =0.86).

Tensile Calculations: Joint Strength / Axial Load

Overpull: 641,000 lbs /[(100,000 lbs.) + (352,000 lbs.)(0.86)] = **1.6**

Surface Co	asing								•
				Burst				Dry	Mud
Size	Grade	#/ft	Collapse	(Internal Yield)	Tensile	Coupling	Length	Weight	Weight
								98,100	
13.375"	J-55	54.5	1130 psi	2730 psi	514 kips	STC	1800'	lbs	8.5 ppg

Collapse: $DF_c = 1.25$

Base Assumptions

- Complete internal evacuation of the casing, utilizing a collapse force equivalent to the mud gradient (0.44 psi/ft) in which the casing will be ran.
- Cementing operations in which, utilizes a collapse force equivalent to the gradient of the planned cement slurry (0.77 psi/ft) and an internal force equivalent to the fresh water displacement fluid (0.433 psi/ft).

Collapse Calculations: Collapse Rating / Collapse Force

Complete Evacuation: 1,130psi / [(0.44psi/ft)(1,800')] = **1.42**

Cementing Operations: 1,130psi / [(0.77psi/ft – 0.433psi/ft)(1800')] = **1.86**

Burst: $DF_B = 1.25$

Base Assumption

• Casing pressure test as per Onshore Oil and Gas Order No. 2 (0.22 psi/ft or 1500 psi), utilizing an external force equivalent to the mud gradient (0.44 psi/ft) in which the casing will be ran.

Burst Calculations: Internal Yield Rating / Internal Force

Casing Pressure Test: 2,730psi / [(1500psi)-(0.44 psi/ft)(1,800')] = **3.86**

Tensile: $DF_T = 1.6$

Base Assumption

• A downward force of 100,000 lb. overpull is applied at the base of the casing along with the weight and not considering the effects of buoyancy.

Tensile Calculations: Joint Strength / Axial Load

Overpull: 514 kips / (100,000 lbs. + 98,100 lbs.) = **2.59**

Intermediate Casing

				Burst	Dry				
Size	Grade	#/ft	Collapse	(Internal Yield)	Tensile	Coupling	Length	Weight	Mud Weight
9.625"	J-55	40	2570 psi	3950 psi	520 kips	LTC	4000'	160,000 lb	10.0 ppg
9.625"	HCK-55	40	4230 psi	3950 psi	694 kips	LTC	1600'	64,000 lb	10.0 ppg

Collapse: $DF_c = 1.25$

Base Assumptions

- Complete internal evacuation of the casing, utilizing a collapse force equivalent to the mud gradient (0.52 psi/ft) in which the casing will be ran.
- Cementing operations in which, utilizes a collapse force equivalent to the gradient of the planned cement slurry (0.77 psi/ft) and an internal back-up force equivalent to the fresh water displacement fluid (0.433 psi/ft).

Collapse Calculations: Collapse Rating / Collapse Force

Complete Evacuation: J-55: 2570psi / [(0.52psi/ft)(4,000')] = **1.25** HCK-55: 4230psi / [(0.52psi/ft)(5,600')] = **1.45**

Cementing Operations: J-55: 2570psi / [(0.77psi/ft - 0.433psi/ft)(4000')] = **1.91** HCK-55: 4230psi / [(0.77psi/ft - 0.433psi/ft)(5600')] = **2.24**

Burst: $DF_B = 1.25$

Base Assumption

- Casing pressure test as per Onshore Oil and Gas Order No. 2 (0.22 psi/ft or 1500 psi), utilizing an internal force equivalent to the displacement fluid of 8.6 ppg and external force equivalent to 8.4 ppg.
- Gas kick at the casing shoe, in which a 0.7 psi/ft shoe test is assumed, and 0.2 psi/ft gas gradient is assumed.

Burst Calculations: Internal Yield Rating / Burst Force

Casing Pressure Test: J-55: 3950psi / [(1500psi +1789 psi) - (1747psi)] = **2.56** HCK-55: 3950psi / [(1500psi +2504 psi) - (2446psi)] = **2.54** Gas Kick: J-55: 3950psi / [(0.7psi/ft)(5600')-(0.2psi/ft)(5600')] = **1.41** HCK-55: 3950psi / [(0.7psi/ft)(5600')-(0.2psi/ft)(4000')] = **1.27**

Base Assumption

• A downward force of 100,000 lb. overpull is applied at the base of the casing along with the weight of the string and not considering the effects of buoyancy.

4 4

Tensile Calculations: Joint Strength / Axial Load

Production Casing

				Burst		Dry			
Size	Grade	#/ft	Collapse	(Internal Yield)	Tensile	Coupling	Length	Weight	Mud Weight
5.5"	P-110	20	11080 psi	12360 psi	641 kips	BTC	17,600'	352,000 lb	9.1 ppg

Collapse: $DF_c = 1.25$

Base Assumptions

- Cementing operations in which utilizes a collapse force equivalent to the gradient of the planned cement slurry (0.77 psi/ft) and an internal back-up force equivalent to the fresh water displacement fluid (0.433 psi/ft).
- Production operations in which the pipe is completely evacuated with an external force equivalent to the pore pressure gradient (0.52 psi/ft).

Collapse Calculations: Collapse Rating / Collapse Force

Cementing Operations: 11,080psi / [(0.66psi/ft-0.433 psi/ft)(9,800'TVD)] = **4.98**

Production Operations: 11080psi / (9,800' TVD)(0.52psi/ft) = **2.17**

Burst: $DF_B = 1.25$

Base Assumption

- Frac pressure utilizing an internal force of 9500 psi along with a frac fluid gradient equivalent to 0.468 psi/ft and an external force equal to the minimum fluid gradient (0.433 psi/ft) in which the casing will be ran.
- Production operations in which the casing is completely filled with a gas equivalent gradient of 0.2 psi/ft and an external force equivalent to pore pressure of 0.5 psi/ft.

Burst Calculations: Internal Yield Rating / Burst Force

Frac Pressure: 12,360psi / [(9500 psi)+ (0.468 – 0.433psi/ft)(9,800'TVD)] = **1.26**

Production Operations: 12,360psi / [(0.5 psi/ft – 0.2 psi/ft)(9,800'TVD)] = **4.2**

Tensile: $DF_T = 1.6$

Base Assumption

• A downward force of 100,000 lb. overpull is applied at the base of the casing along with the weight of the string and considering the effects of buoyancy (factor =0.86).

Tensile Calculations: Joint Strength / Axial Load

Overpull: 641,000 lbs /[(100,000 lbs.) + (352,000 lbs.)(0.86)] = **1.6**

Surface Co	asing (•	4
				Burst				Dry	Mud
Size	Grade	#/ft	Collapse	(Internal Yield)	Tensile	Coupling	Length	Weight	Weight
								98,100	
13.375"	J-55	54.5	1130 psi	2730 psi	514 kips	STC	1800'	lbs	8.5 ppg

Collapse: $DF_c = 1.25$

Base Assumptions

- Complete internal evacuation of the casing, utilizing a collapse force equivalent to the mud gradient (0.44 psi/ft) in which the casing will be ran.
- Cementing operations in which, utilizes a collapse force equivalent to the gradient of the planned cement slurry (0.77 psi/ft) and an internal force equivalent to the fresh water displacement fluid (0.433 psi/ft).

Collapse Calculations: Collapse Rating / Collapse Force

Complete Evacuation: 1,130psi / [(0.44psi/ft)(1,800')] = **1.42**

Cementing Operations: 1,130psi / [(0.77psi/ft – 0.433psi/ft)(1800')] = **1.86**

Burst: $DF_B = 1.25$

Base Assumption

• Casing pressure test as per Onshore Oil and Gas Order No. 2 (0.22 psi/ft or 1500 psi), utilizing an external force equivalent to the mud gradient (0.44 psi/ft) in which the casing will be ran.

Burst Calculations: Internal Yield Rating / Internal Force

Casing Pressure Test: 2,730psi / [(1500psi)-(0.44 psi/ft)(1,800')] = **3.86**

Tensile: $DF_T = 1.6$

Base Assumption

• A downward force of 100,000 lb. overpull is applied at the base of the casing along with the weight and not considering the effects of buoyancy.

Tensile Calculations: Joint Strength / Axial Load

Overpull: 514 kips / (100,000 lbs. + 98,100 lbs.) = **2.59**

Intermediate Casing

					Dry					
Size	Grade	#/ft	Collapse	(Internal Yield)	Tensile	Coupling	Length	Weight	Mud Weight	
9.625"	J-55	40	2570 psi	3950 psi	520 kips	LTC	4000'	160,000 lb	10.0 ppg	
9.625"	HCK-55	40	4230 psi	3950 psi	694 kips	LTC	1600'	64,000 lb	10.0 ppg	

Collapse: $DF_c = 1.25$

Base Assumptions

- Complete internal evacuation of the casing, utilizing a collapse force equivalent to the mud gradient (0.52 psi/ft) in which the casing will be ran.
- Cementing operations in which, utilizes a collapse force equivalent to the gradient of the planned cement slurry (0.77 psi/ft) and an internal back-up force equivalent to the fresh water displacement fluid (0.433 psi/ft).

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Burst: $DF_B = 1.25$

Base Assumption

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- Gas kick at the casing shoe, in which a 0.7 psi/ft shoe test is assumed, and 0.2 psi/ft gas gradient is assumed.

Burst Calculations: Internal Yield Rating / Burst Force

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Base Assumption

• A downward force of 100,000 lb. overpull is applied at the base of the casing along with the weight of the string and not considering the effects of buoyancy.

Tensile Calculations: Joint Strength / Axial Load

				Burst		Dry			
Size	Grade	#/ft	Collapse	(Internal Yield)	Tensile	Coupling	Length	Weight	Mud Weight
5.5"	P-110	20	11080 psi	12360 psi	641 kips	BTC	17,600'	352,000 lb	9.1 ppg

1

Collapse: $DF_c = 1.25$

Base Assumptions

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- Production operations in which the pipe is completely evacuated with an external force equivalent to the pore pressure gradient (0.52 psi/ft).

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Production Operations: 11080psi / (9,800' TVD)(0.52psi/ft) = **2.17**

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Production Operations: 12,360psi / [(0.5 psi/ft – 0.2 psi/ft)(9,800'TVD)] = **4.2**

Tensile: $DF_T = 1.6$

Base Assumption

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Tensile Calculations: Joint Strength / Axial Load

Overpull: 641,000 lbs /[(100,000 lbs.) + (352,000 lbs.)(0.86)] = **1.6**

<u>Surface Co</u>		•							
Size	Grade	#/ft	Collanse	Burst (Internal Yield)	Tensile	Coupling	Length	Dry Weight	Mud
SILC	Grade		conapse	(internal field)	Tensile	couping	Length	98,100	weight
13.375"	J-55	54.5	1130 psi	2730 psi	514 kips	STC	1800'	lbs	8.5 ppg

Collapse: $DF_c = 1.25$

Base Assumptions

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Burst Calculations: Internal Yield Rating / Internal Force

Casing Pressure Test: 2,730psi / [(1500psi)-(0.44 psi/ft)(1,800')] = **3.86**

Tensile: $DF_T = 1.6$

Base Assumption

 A downward force of 100,000 lb. overpull is applied at the base of the casing along with the weight and not considering the effects of buoyancy.

Tensile Calculations: Joint Strength / Axial Load

Overpull: 514 kips / (100,000 lbs. + 98,100 lbs.) = **2.59**

Intermediate Casing

				Burst				Dry	
Size	Grade	#/ft	Collapse	(Internal Yield)	Tensile	Coupling	Length	Weight	Mud Weight
9.625"	J-55	40	2570 psi	3950 psi	520 kips	LTC	4000'	160,000 lb	10.0 ppg
9.625"	HCK-55	40	4230 psi	3950 psi	694 kips	LTC	1600'	64,000 lb	10.0 ppg

Collapse: $DF_c = 1.25$

Base Assumptions

- Complete internal evacuation of the casing, utilizing a collapse force equivalent to the mud gradient (0.52 psi/ft) in which the casing will be ran.
- Cementing operations in which, utilizes a collapse force equivalent to the gradient of the planned cement slurry (0.77 psi/ft) and an internal back-up force equivalent to the fresh water displacement fluid (0.433 psi/ft).

Collapse Calculations: Collapse Rating / Collapse Force

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Cementing Operations: J-55: 2570psi / [(0.77psi/ft - 0.433psi/ft)(4000')] = **1.91** HCK-55: 4230psi / [(0.77psi/ft - 0.433psi/ft)(5600')] = **2.24**

Burst: $DF_B = 1.25$

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- Gas kick at the casing shoe, in which a 0.7 psi/ft shoe test is assumed, and 0.2 psi/ft gas gradient is assumed.

Burst Calculations: Internal Yield Rating / Burst Force

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Casing Pressure Test:

J-55: 3950psi / [(1500psi +1789 psi) - (1747psi)] = 2.56

HCK-55: 3950psi / [(1500psi +2504 psi) - (2446psi)] = 2.54

Gas Kick:

J-55: 3950psi / [(0.7psi/ft)(5600')-(0.2psi/ft)(5600')] = 1.41

HCK-55: 3950psi / [(0.7psi/ft)(5600')-(0.2psi/ft)(4000')] = 1.27
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Base Assumption

• A downward force of 100,000 lb. overpull is applied at the base of the casing along with the weight of the string and not considering the effects of buoyancy.

Tensile Calculations: Joint Strength / Axial Load



				
Interr	Midw & Spec	est Hose cialty, Inc. ntic Test Certi	ficate	
General Informa	ation	Hose Specifications		
Customer	HOBBS	Hose Assembly Type		Rotary/Vibrator
MWH Sales Representative	CHARLES ASH	Certification		API 7K/FSL LEVEL2
Date Assembled	2/19/2017	Hose Grade		D
ocation Assembled	OKC	Hose Working Pressure		5000
Gales Order #	318810	Hose Lot # and Date Code		10958-08/13
Customer Purchase Order #	356945	Hose I.D. (Inches)		3.5"
Assembly Serial # (Pick Ticket #)	384842	Hose O.D. (Inches)		5.45"
Hose Assembly Length	20FT	Armor (yes/no)		NO
a strange and strange	Fit	tings		
End A			End B	
Stem (Part and Revision #)	R3.5X64WB	Stem (Part and Revision #)		R3.5X64WB
Stem (Heat #)	13105653	Stem (Heat #)		13105653
errule (Part and Revision #)	RF3.5X5330	Ferrule (Part and Revision #)		RF3.5X5330
Ferrule (Heat #)	34038185	Ferrule (Heat #)		3403818
Connection . Flange Hammer Union Part	4-1/16 5K	Connection (Part #)		4-1/16 5K
Connection (Heat #)		Connection (Heat #)		
Nut (Part #)		Nut (Part #)		
Nut (Heat #)		Nut (Heat #)		
Dies Used	5.62"	Dies Used		5.53"
and have been stated and the	Hydrostatic Te	st Requirements		V.
Fest Pressure (psi)	7,500	Hose assembly w	as tested w	ith ambient water
Test Pressure Hold Time (minutes)	10 1/2	temperatu		е.
Date Tested	Teste	d By	Ap	proved By
2/19/2017	R		his jess the	

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	1	W -*•		
	Midw & Spec	est Hose cialty, Inc.		
	Certificate	of Conformity		
Customer: HOBBS		Customer P.O.# 356945		
Sales Order # 318810		Date Assembled: 2/19/2017		
	Specif	fications		
Hose Assembly Type:	Rotary/Vibrator	Rig #		
Assembly Serial #	384842	Hose Lot # and Date Code	10958-08/13	
Hose Working Pressure (psi)	5000	Test Pressure (psi)	7500	
Hose Assembly Description:		TRH56D-645KH-645KH-20.00)' FT	
We hereby certify that the abov to the requirements of the purc Supplier: Midwest Hose & Specialty, Inc. 3312 S I-35 Service Rd Oklahoma City, OK 73129	e material supplied fo hase order and curren	or the referenced purchase orde nt industry standards.	r to be true according	
We hereby certify that the abov to the requirements of the purc Supplier: Midwest Hose & Specialty, Inc. 3312 S I-35 Service Rd Oklahoma City, OK 73129 Comments:	e material supplied for hase order and current	or the referenced purchase orde nt industry standards.	r to be true according	
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U.S. Department of the Interior BUREAU OF LAND MANAGEMENT

APD ID: 10400026682 Operator Name: LEGACY RESERVES OPERATING LP	Submission Date: 01/31/2018	Highlighted data reflects the most
Well Name: LEA UNIT	Well Number: 64H	Show Final Text
Well Type: OIL WELL	Well Work Type: Drill	

Section 1 - Existing Roads

Will existing roads be used? YES Existing Road Map: Vicinity_Plat_20180130085535.pdf

Existing Road Purpose: ACCESS, FLUID TRANSPORT

ROW ID(s)

ID:

Do the existing roads need to be improved? NO

Existing Road Improvement Description:

Existing Road Improvement Attachment:

Section 2 - New or Reconstructed Access Roads

Will new roads be needed? NO

Section 3 - Location of Existing Wells

Existing Wells Map? YES

Attach Well map:

Lea_Unit_64H_Proximity_Exhibit_01_16_17_20180130084716.pdf

Row(s) Exist? YES

SUPO Data Report

04/23/2018

Well Name: LEA UNIT

Well Number: 64H

Existing Wells description:

Section 4 - Location of Existing and/or Proposed Production Facilities

Submit or defer a Proposed Production Facilities plan? DEFER

Estimated Production Facilities description: In the event the well is found productive, a 4" surface poly flowline (125 psi with oil/gas/water) will be laid along the existing roadway, for 4239.1' to the satellite battery located in the SW/4NW/4 of section 12, T. 20S, R. 34E. All permanent (six months or longer) aboveground structures constructed or intalled on location and not subject to safety requirements will be painted to BLM specifications.

Section 5 - Location and Types of Water Supply

Water Source Table

Water source use type: INTERMEDIATE/PRODUCTION CASING, STIMULATION, SURFACE CASING Describe type:

Source latitude:

Source datum:

Water source permit type: WATER WELL

Source land ownership: PRIVATE

Water source transport method: TRUCKING

Source transportation land ownership: FEDERAL

Water source volume (barrels): 18000

Source volume (gal): 756000

Water source and transportation map:

Water_Transportation_Plat_20180130085438.pdf

Water source comments:

New water well? NO

New Water Well Info

Well latitude:	Well Longitude:	Well datum:
Well target aquifer:		
Est. depth to top of aquifer(ft):	Est thickness of aquifer:	
Aquifer comments:		
Aquifer documentation:		
Well depth (ft):	Well casing type:	

Water source type: GW WELL

Source longitude:

Source volume (acre-feet): 2.3200758

Well Name: LEA UNIT

Well Number: 64H

Well casing outside diameter (in.):	Well casing inside diameter (in.):
New water well casing?	Used casing source:
Drilling method:	Drill material:
Grout material:	Grout depth:
Casing length (ft.):	Casing top depth (ft.):
Well Production type:	Completion Method:
Water well additional information:	
State appropriation permit:	

Additional information attachment:

Section 6 - Construction Materials

Construction Materials description: CONSTRUCTION MATERIALS: CALICHE WILL BE USED TO CONSTRUCT THISWELL PAD Any construction material that may be required for surfacing of the drill pad will be from a contractor having a permitted source of materials within the general area. No construction materials will be removed from Federal lands without prior approval from the appropriate surface management agency. See attached for source information. **Construction Materials source location attachment:**

Construciton_Material_Plat_20180130085422.pdf

Section 7 - Methods for Handling Waste

Waste type: DRILLING

Waste content description: Drilling fluids (flowback, water, cuttings)

Amount of waste: 20000 barrels

Waste disposal frequency : Daily

Safe containment description: Drilling fluids will be contained in steel mud tanks.

Safe containmant attachment:

Waste disposal type: HAUL TO COMMERCIAL Disposal location ownership: PRIVATE FACILITY Disposal type description:

Disposal location description: NMOCD approved disposal site in Halfway, NM.

Reserve Pit

Reserve Pit being used? NO

Temporary disposal of produced water into reserve pit?

Reserve pit length (ft.) Reserve pit width (ft.)

Reserve pit depth (ft.)

Reserve pit volume (cu. yd.)

Is at least 50% of the reserve pit in cut?

Well Name: LEA UNIT

Well Number: 64H

Reserve pit liner

Reserve pit liner specifications and installation description

Cuttings Area

Cuttings Area being used? NO Are you storing cuttings on location? NO

Description of cuttings location

Cuttings area length (ft.)

Cuttings area depth (ft.)

Cuttings area width (ft.)

uttings area depth (ft.)

Cuttings area volume (cu. yd.)

Is at least 50% of the cuttings area in cut?

WCuttings area liner

Cuttings area liner specifications and installation description

Section 8 - Ancillary Facilities

Are you requesting any Ancillary Facilities?: NO Ancillary Facilities attachment:

Comments:

Section 9 - Well Site Layout

Well Site Layout Diagram:

Rig_4_Schematic_20180123121930.pdf 64H_Pad_Plat_20180130085350.pdf Comments:

Section 10 - Plans for Surface Reclamation

Type of disturbance: New Surface Disturbance

Multiple Well Pad Name: LEA UNIT

Multiple Well Pad Number: 62H

Recontouring attachment:

Drainage/Erosion control construction: To mitigate erosion and protect the natural drainage areas, erosion control methods (e.g. cut and fill ratios of 3:1) will be implemented during the construction and production phases of this project. The slopes of the well pad may be reserved or replanted per agreement with the landowner. Erosion mitigation such as silt fences and hay bales will be located as necessary around the well pad.

Well Name: LEA UNIT

Well Number: 64H

Drainage/Erosion control reclamation: • The original landform will be restored for all disturbed areas including well pads, production facilities, roads, pipelines, and utility corridors. • A self-sustaining, vigorous, diverse, native (or otherwise approved) plant community will be established on the site, with a density sufficient to control erosion and invasion by non-native plants and to re-establish wildlife habitat or forage production. At a minimum, the established plant community will consist of species included in the seed mix and/or desirable species occurring in the surrounding natural vegetation. • Erosion features are equal to or less than surrounding area and erosion control is sufficient so that water naturally infiltrates into the soil and gullying, headcutting, slumping, and deep or excessive rills (greater than 3 inches) are not observed. • The site will be free of State- or county-listed noxious weeds, oil field debris and equipment, and contaminated soil. Invasive and non-native weeds are controlled.

Well pad proposed disturbance	Well pad interim reclamation (acres): 0 Well pad long term disturbance	
(acres): 1.03 Road proposed disturbance (acres): 0	Road interim reclamation (acres): 0	(acres): 1.03 Road long term disturbance (acres): 0
Powerline proposed disturbance (acres): 0 Pipeline proposed disturbance	Powerline interim reclamation (acres): 0 Pipeline interim reclamation (acres): 0	Powerline long term disturbance (acres): 0 Pipeline long term disturbance
(acres): 0	Other interim reclamation (acres): 0	(acres): 0
Other proposed disturbance (acres): 0	Total interim reclamation: 0	Other long term disturbance (acres): 0
Total proposed disturbance: 1.03		Total long term disturbance: 1.03

Reconstruction method: Final reclamation to achieve restoration of the original landform and a natural vegetative community. The original landform will be restored for all disturbed areas including well pads, production facilities, roads, pipelines, and utility corridors.

Topsoil redistribution: Topsoil will be redistributed after the well pad has been returned to original contours, or as close as practical.

Soil treatment: No soil treatment will be needed.

Existing Vegetation at the well pad:

Existing Vegetation at the well pad attachment:

Existing Vegetation Community at the road:

Existing Vegetation Community at the road attachment:

Existing Vegetation Community at the pipeline:

Existing Vegetation Community at the pipeline attachment:

Existing Vegetation Community at other disturbances:

Existing Vegetation Community at other disturbances attachment:

Non native seed used? NO

Non native seed description:

Seedling transplant description:

Will seedlings be transplanted for this project? NO

Operator Name: LEGACY RESERVES OPERATING LP Well Name: LEA UNIT

Well Number: 64H

Seedling transplant description attachment:

Will seed be harvested for use in site reclamation? NO Seed harvest description: Seed harvest description attachment:

Seed Management

Seed Table	
Seed type:	Seed source:
Seed name:	
Source name:	Source address:
Source phone:	
Seed cultivar:	
Seed use location:	
PLS pounds per acre:	Proposed seeding season:

Seed Summary		Total pounds/Acre:
Seed Type	Pounds/Acre	

Seed reclamation attachment:

Operator Contact/Respon	sible Official Contact Info
First Name:	Last Name:
Phone:	Email:
Seedbed prep:	
Seed BMP:	
Seed method:	

Existing invasive species? NO

Existing invasive species treatment description:

Existing invasive species treatment attachment:

Weed treatment plan description: Weeds will be mowed regularly to prevent them from becoming dominant within the project area
Weed treatment plan attachment:

Well Name: LEA UNIT

Well Number: 64H

Monitoring plan description: The project location will be periodically monitored by Legacy Reserves Operating, LP's staff that are responsible for infrastructure maintenance. **Monitoring plan attachment:**

Success standards: Develop sufficient plant and root coverage to maximize erosion and sediment control.

Pit closure description: No pit will be utilized for this project.

Pit closure attachment:

Section 11 - Surface Ownership

Disturbance type: WELL PAD

Describe:

Surface Owner: PRIVATE OWNERSHIP

Other surface owner description:

BIA Local Office:

BOR Local Office:

COE Local Office:

DOD Local Office:

NPS Local Office:

State Local Office:

Military Local Office:

USFWS Local Office:

Other Local Office:

USFS Region:

USFS Forest/Grassland:

USFS Ranger District:

Well Number: 64H

 Fee Owner: Smith & Sons, Inc.
 Fee Owner Address: Box 1046 Eunice, NM 88231

 Phone: (575)390-2642
 Email:

 Surface use plan certification: YES
 Surface use plan certification document:

 Signed_Affidavit_of_notification_20180131115717.pdf
 Surface access agreement or bond: Agreement

 Surface Access Agreement Need description: A Surface Use Agreement has been established
 Surface Access Bond BLM or Forest Service:

 BLM Surface Access Bond number:
 USFS Surface access bond number:

Section 12 - Other Information

Right of Way needed? NO ROW Type(s): Use APD as ROW?

ROW Applications

SUPO Additional Information:

Use a previously conducted onsite? YES

Previous Onsite information: ON-SITE PERFORMED ON 8/16/15 RESULTED IN PROPOSED LOCATION BEING OK WHERE STAKED. IT WAS AGREED TO TURN THE LOCATION TO A V-DOOR EAST. IT WAS ALSO AGREED TO MOVE AND PLACE THE TOP SOIL TO THE NORTH, AND THE INTERIM RECLAMATION WILL BE THE NORTH, EAST, SOUTH, AND WEST PORTION OF THIS PAD. PRESENT AT ON-SITE: CRAIG SPARKMAN-LEGACY RESERVES OPERATING, L.P. TRISH BADBEAR-BLM CASSANDRA BROOKS-BLM CHRISTOPHER FREEMAN-CEHMM DOUG BURGER-LEGACY LAND & ENVIRONMENTAL SOLUTIONS KELLY POINDEXTER-WEST COMPANY OF MIDLAND-SURVEYORS

Other SUPO Attachment

Lea_64H_APD_Payment_Receipt_20180130085804.pdf

 Section 3 - Unlined Pits 	
Would you like to utilize Unlined Pit PWD options? NO	
Produced Water Disposal (PWD) Location:	
PWD surface owner:	PWD disturbance (acres):
Unlined pit PWD on or off channel:	
Unlined pit PWD discharge volume (bbl/day):	
Unlined pit specifications:	
Precipitated solids disposal:	
Decribe precipitated solids disposal:	
Precipitated solids disposal permit:	
Unlined pit precipitated solids disposal schedule:	
Unlined pit precipitated solids disposal schedule attachme	nt:
Unlined pit reclamation description:	
Unlined pit reclamation attachment:	
Unlined pit Monitor description:	
Unlined pit Monitor attachment:	
Do you propose to put the produced water to beneficial us	e?
Beneficial use user confirmation:	
Estimated depth of the shallowest aquifer (feet):	
Does the produced water have an annual average Total Dis that of the existing water to be protected?	solved Solids (TDS) concentration equal to or less than
TDS lab results:	
Geologic and hydrologic evidence:	
State authorization:	
Unlined Produced Water Pit Estimated percolation:	
Unlined pit: do you have a reclamation bond for the pit?	
Is the reclamation bond a rider under the BLM bond?	
Unlined pit bond number:	
Unlined pit bond amount:	
Additional bond information attachment:	
Section 4 - Injection	
Would you like to utilize Injection PWD options? NO	
Produced Water Disposal (PWD) Location:	
PWD surface owner:	PWD disturbance (acres):
Injection PWD discharge volume (bbl/day):	
Injection well mineral owner:	

Injection well type: Injection well number: Assigned injection well API number? Injection well new surface disturbance (acres): Minerals protection information: Mineral protection attachment: Underground Injection Control (UIC) Permit? UIC Permit attachment:

Section 5 - Surface Discharge

Would you like to utilize Surface Discharge PWD options? NO

Produced Water Disposal (PWD) Location: PWD surface owner: Surface discharge PWD discharge volume (bbl/day): Surface Discharge NPDES Permit? Surface Discharge NPDES Permit attachment: Surface Discharge site facilities information: Surface discharge site facilities map:

Section 6 - Other

Would you like to utilize Other PWD options? NO

Produced Water Disposal (PWD) Location: PWD surface owner: Other PWD discharge volume (bbl/day): Other PWD type description: Other PWD type attachment: Have other regulatory requirements been met? Other regulatory requirements attachment:

Injection well name:

Injection well API number:

PWD disturbance (acres):

PWD disturbance (acres):



Bond Information

Federal/Indian APD: FED

BLM Bond number: NMB001015

BIA Bond number:

Do you have a reclamation bond? NO

Is the reclamation bond a rider under the BLM bond?

Is the reclamation bond BLM or Forest Service?

BLM reclamation bond number:

Forest Service reclamation bond number:

Forest Service reclamation bond attachment:

Reclamation bond number:

Reclamation bond amount:

Reclamation bond rider amount:

Additional reclamation bond information attachment:





Section 1 - General

Would you like to address long-term produced water disposal? NO

Section 2 - Lined Pits

Would you like to utilize Lined Pit PWD options? NO Produced Water Disposal (PWD) Location: PWD surface owner: Lined pit PWD on or off channel: Lined pit PWD discharge volume (bbl/day): Lined pit specifications: Pit liner description: Pit liner manufacturers information: Precipitated solids disposal: Decribe precipitated solids disposal: Precipitated solids disposal permit: Lined pit precipitated solids disposal schedule: Lined pit precipitated solids disposal schedule attachment: Lined pit reclamation description: Lined pit reclamation attachment: Leak detection system description: Leak detection system attachment: Lined pit Monitor description: Lined pit Monitor attachment: Lined pit: do you have a reclamation bond for the pit? Is the reclamation bond a rider under the BLM bond? Lined pit bond number: Lined pit bond amount: Additional bond information attachment:

PWD disturbance (acres):

• United States Department of the Interior Bureau of Land Management	Receipt		
620 E. GREENE CARLSBAD, NM 88220 -6292 Phone: (575) 234-5972	No:	3756257	
Transaction #: 3862137 Date of Transaction: 02/03/2017			

Jac of Hansaction. 02/05/2017	
CUSTOMER:	
LEGACY RESERVES OPERATING LP 303 W WALL ST STE 1800 MIDLAND,TX 79701-5106 US	

LINE #	QTY	DESCRIPTION	REMARKS	UNIT PRICE	TOTAL
1	1.00	OIL & GAS / APPLICATION FOR PERMIT TO DRILL (APD) / APD FEE	LEA UNIT 64H	9610.00	9610.00
			TO	TAL: \$	9,610.00

PAYMENT INFORMATION					
1	AMOUNT:	9610.00 POSTMARKED: 02/02/2017			
D.	TYPE:	CHECK	RECEIVED:	02/03/2017	
	CHECK NO:	1128181			
	NAME:	LEGACY RESERVES OPERATING LP			
		MIDLAND TX 79701-5106 US			

REMARKS	

This receipt was generated by the automated BLM Collections and Billing System and is a paper representation of a portion of the official electronic record contained therein.