



ARTESIAN WELL PLAN OF OPERATIONS

(for new well construction and repairs)



An Artesian Well Plan of Operations shall be filed with and approved by the Office of the State Engineer prior to commencing the drilling or repairing of an artesian well.

A detailed diagram of the proposed artesian well shall be attached to this plan.

I. FILING FEE: There is no filing fee for this form.

II. GENERAL / WELL OWNERSHIP:

Office of the State Engineer POD Number (Well Number) for well (if known): SJ-4301 POD 1
 Name of well owner: Enduring Resources IV, LLC
 Mailing address: 332 Road 3100
 City: Aztec State: NM Zip code: 87410
 Phone number: 505-386-8205 Andrea Felix E-mail: afelix@enduringresources.com

III. WELL DRILLER INFORMATION:

Well Driller contracted to provide drilling services: Mote Drilling Inc.
 New Mexico Well Driller License No.: 733 Expiration Date: 6-30-2019

IV. WELL INFORMATION:

- 1) Will this well be used for any type of monitoring program? no If yes, please describe in section V; applicant should be familiar with the need for specialty materials or design required for the monitoring program.
- 2) Will the well tap or penetrate brackish, saline, or otherwise poor quality water? Yes If yes, please provide additional detail in section V.
- 3) Depth of top of the anticipated artesian aquifer: 6263 feet below ground level (bgl).
- 4) Is a flowing artesian head anticipated? No
- 5) Will a pitless adapter be installed in the well? No
- 6) GPS Well Location: Latitude: 36 deg, 08 min, 39 sec
 Longitude: -107 deg, 34 min, 35 sec, NAD 83
- 7) Will permanent surface casing be installed? Yes If yes, provide details below. (Note: surface casing is shallow casing generally set above the confining unit overlying the artesian aquifer and is considered optional).
 - a) Diameter of borehole to be drilled for the surface casing: 17.50 inches.
 - b) Proposed surface casing depth: 350 feet below ground level.

STATE ENGINEER OFFICE
 AZTEC, NEW MEXICO
 2018 SEP 19 PM 3:25

Artesian Well Plan of Operations
 Revised October 6, 2017
 Page 1 of 4

- c) Surface casing material, grade: Steel J55
- d) Inside diameter (ID): 12.615 inches.
- e) Outside diameter (OD): 13.375 inches.
- f) Wall thickness: 0.380 inches.
- g) Casing joint connection type (note whether welded, glued, coupled, etc. If coupled, include outside diameter OD and the length in inches, and also the number of threads per inch.):
BTC connection, 14.375" OD, 10.625" long, 5 threads per inch
- h) Interval of proposed surface casing annular sanitary seal: 0 to 350 feet below ground level.
- i) Surface casing sanitary seal material:
Cement

- 8) Artesian casing (Note: artesian casing shall be set adequately into the confining unit overlying the artesian aquifer; in some designs this may also be the production casing; NMOSE inspection requirements apply to installing, grouting and testing the artesian casing):

- a) Diameter of borehole to be drilled for the artesian casing: 8.75 inches.
- b) Proposed artesian casing depth: 6736 feet below ground level.
- c) Artesian casing material, grade: Steel HCL-80
- d) Inside diameter (ID): 6.276 inches.
- e) Outside diameter (OD): 7.000 inches.
- f) Wall thickness: 0.362 inches.
- g) Casing joint connection type (note whether welded, glued, coupled, etc. If coupled, include outside diameter (OD) and the length in inches, and also the number of threads per inch.)
LTC connection, 7.875" OD, 9.000" long, 8 threads per inch
- h) Type and spacing of artesian casing centralizers:
bow spring, 2 per joint on bottom 3 jts, 1 per joint to 500' above Entrada, 1 every 3 joints to surface
- i) Manufacturer and model of float shoe: Weatherford Sure-Seal 3
- j) Method of annular grout placement: check one Pressure Grout ☐ Tremmie Pipe ☐
- k) Interval of proposed annular grout: 0 to 6,736 feet below ground level.
- l) Proposed annular grout mix: _____ gallons of water per 94 pound sack of Portland cement.
- m) Cement type proposed: _____
- n) Theoretical volume of annular grout required: _____
- o) Will the grout be: ☐ batch-mixed and delivered to the site
☐ mixed on site
- p) Grout additives requested, and percent by dry weight relative to cement: (See AWWA Standard A100-06 or Halliburton red book; common additives: calcium chloride, bentonite solution, pozzolan ash):

Artesian Well Plan of Operations
Revised October 6, 2017
Page 2 of 4

q) Additional notes and calculations:

9) Production casing (set through the artesian casing and into the artesian aquifer; may not be necessary if the artesian casing is used as the production casing):

- a) Will you be using a production casing within the artesian casing? No If yes, provide a description of the following in section V:
- i. Diameter of borehole to be drilled for production casing; casing joint connection type - note whether coupled, welded, glued, etc.; proposed production casing depth; and inside diameter, outside diameter, wall thickness, casing material, and casing material grade of production casing.
 - ii. List the proposed screened/ perforated interval(s) if you plan to use well screen or perforated casing.
 - iii. List the vertical intervals and seal or fill material if the annulus between the production casing and artesian casing/borehole is to be sealed/ filled.

V. ADDITIONAL INFORMATION: List additional information below, or on separate sheet(s):

If during the drilling of the well, conditions dictate the need for a cement stage tool, Enduring would intend to install that cement stage tool in the 7" casing at depth to be determined by those conditions. And that determination would be made on a well by well basis and will be coordinated with and approved by the State Engineer. Enduring does not anticipate a stage tool is necessary at this time.

STATE ENGINEER OFFICE
 ALBUQUERQUE, NM 87103
 2018 SEP 19 PM 3:27

VI. SIGNATURE:

I, Enduring NOTE
Andrea Felix / Craig Mobley, say that I have carefully read the foregoing Artesian Well Plan of Operations and any attachments, which are a part hereof; that I am familiar with the rules and regulations of the State Engineer pertaining to the plugging of wells and will comply with them, and that each and all of the statements in the Artesian Well Plan of Operations and attachments are true to the best of my knowledge and belief.



 Signature of Applicant



 Signature of Well driller

9/19/2018

 Date

9/19/18

 Date

Artesian Well Plan of Operations
 Revised October 6, 2017
 Page 3 of 4

VII. ACTION OF THE STATE ENGINEER:

This Artesian Well Plan of Operations is:

- ☒ Approved subject to the attached conditions. - SEE COMMENTS BELOW
☐ Not approved for the reasons provided on the attached letter.

Witness my hand and official seal this 28th day of SEPTEMBER, 2018

TOM BLAINE, P.E., State Engineer

By: Douglas H. Rappan, P.G.

DOUGLAS H. RAPPAHAN, P.G.
HYDROLOGY BUREAU



THIS ARTESIAN WELL PLAN OF OPERATIONS IS APPROVED SUBJECT TO:

- THE CONDITIONS OF THE NMDSI - APPROVED SJ-4301-P001 WR-07 APPLICATION FOR PERMIT TO DRILL A WELL WITH NO WATER RIGHT, ISSUED 8/27/2018.
- ANNOTATIONS MADE TO THIS ARTESIAN PLAN AND 9/18/2018 ENDURING RESOURCES DRILLING PLAN (NOTE PARTICULARLY THE VARIANCE-BASED REQUIREMENTS TO INSTALL CENTRALIZERS ON 7" PRODUCTION CASING TO DEPTH OF 300' AT INTERVAL OF AT LEAST ONE CENTRALIZER PER NOMINAL 42' JOINT OF 7" CASING. - THIS ANNOTATION HAS BEEN MADE TO ATTACHED COPY OF ENDURING RESOURCES 9/18/2018 DRILLING PLAN, AND ITEM IV.8) h. OF THIS NMDSI ARTESIAN WELL PLAN OF OPERATIONS

2018 SEP 19 PM 3:27
STATE ENGINEER OFFICE
AZTEC, NEW MEXICO

THIS APPROVAL IS GRANTED BASED ON REVIEW OF INFORMATION PROVIDED IN THE SUBMITTAL OF THIS ARTESIAN PLAN, ASSOCIATED ENDURING RESOURCES DRILLING PLAN(S), ENDURING RESOURCES 9/19/2018 REQUEST FOR VARIANCE, AND RELATED SUBMITTALS PROVIDED TO THE NMDSI REGARDING CASING, COMPLETING & GENERAL WELL DESIGN.

Artesian Well Plan of Operations
Revised October 6, 2017
Page 4 of 4

DHR



ENDURING RESOURCES IV, LLC
511 SIXTEENTH STREET, SUITE 700
DENVER, COLORADO 80202

STATE ENGINEER OFFICE
 AZTEC, NEW MEXICO

2018 SEP 19 PM 3:24

DRILLING PLAN: *Drill, complete, and equip water supply well in the Entrada formation*

WELL INFORMATION:

Name: North Escavda Unit 2207-16B WSW (SJ-4301 POD1)

State: New Mexico

County: Sandoval

Surface Elevation: 6,902 ft ASL (GL) 6,920 ft ASL (KB)
Surface Location: 16-22N-07W Sec-Twn-Rng 1185 ft FNL 1365 ft FEL
 36.144072 ° N latitude 107.576276 ° W longitude (NAD 83)
BH Location: 16-22N-07W Sec-Twn-Rng 1185 ft FNL 1365 ft FWL
 36.144072 ° N latitude 107.576276 ° W longitude (NAD 83)

Driving Directions: From the intersection of US Hwy 550 & US Hwy 64 in Bloomfield, NM: south on 550 for 48.9 miles to MM 103.1, right (south) on Atkins Road for 5.9 miles to 4-way intersection, right (west) onto existing roadway for 1.6 miles to fork in roadway, left (south) on existing road for 0.2 miles to existing 317H location, from south edge of 317H location continue for 0.2 miles on new access road to N Escavada Unit 2207-16B WSW.

GEOLOGIC AND RESERVOIR INFORMATION:

*- PROJECTED **

Prognosis:	Formation Tops	TVD (ft ASL)	TVD (ft KB)	MD (ft KB)	O / G / W	Pressure
	Ojo Alamo	6,850	70	70	W	normal
	Kirtland	6,630	290	290	W	normal
	Fruitland	6,520	400	400	G, W	sub
	Pictured Cliffs	6,220	700	700	G, W	sub
	Lewis	6,045	875	875	G, W	normal
	Chacra	5,880	1,040	1,040	G, W	normal
	Cliff House	5,495	1,425	1,425	G, W	sub
	Menefee	4,745	2,175	2,175	G, W	normal
	Point Lookout	3,820	3,100	3,100	G, W	normal
	Mancos	3,595	3,325	3,325	O, G	normal
	Gallup	3,395	3,525	3,525	O, G	normal
	Base Greenhorn	1,880	5,040	5,040	G, W	normal
	Dakota	1,830	5,090	5,090	G, W	normal
	Morrison	1,570	5,350	5,350	G, W	normal
	Todilto	750	6,170	6,170	G, W	normal
	Entrada	695	6,225	6,225	O, G, W	normal
	TOTAL DEPTH	195	6,725	6,725	O, G, W	normal

Surface: Nacimiento

Oil & Gas Zones: Several gas bearing zones will be encountered; target formation is the Entrada

Pressure: Normal (0.43 psi/ft) or sub-normal pressure gradient anticipated in all formations

Max. pressure gradient: 0.43 psi/ft Evacuated hole gradient: 0.22 psi/ft

Maximum anticipated BH pressure, assuming maximum pressure gradient: 2,680 psi

Maximum anticipated surface pressure, assuming partially evacuated hole: 1,320 psi

Temperature: Maximum anticipated BHT is 205° F or less

H₂S INFORMATION:

H₂S Zones: Encountering hydrogen-sulfide bearing zones is NOT anticipated.

Safety: Sensors and alarms will be placed in the substructure, on the rig floor, above the pits, and at the shakers.

LOGGING, CORING, AND TESTING:

Mud Logs: Cuttings sampling is required from surface casing depth to TD (collect samples every 20', approximately 1 pint of cuttings per sample); total gas chromatograph will be run from drillout of 13-3/8" casing to TD

MWD / LWD: Gamma Ray from drillout of 13-3/8" casing to TD

Open Hole Logs: Triple-Combo log from TD of 8-3/4" hole to surface

Testing: None planned

Coring: None planned

Cased Hole Logs: CBL on 7" casing from PBTD to surface

DRILLING RIG INFORMATION:

Contractor: Mo-Te Drilling

✓ **Rig No.:** Aztec 777

Draw Works: Loadcraft 1,000 hp

Mast: Loadcraft 116', 410,000 lbs

Top Drive: Tesco HMI-250 250 ton

Prime Movers: 2 CAT C-15

Pumps: 2 - HRSF-1000 (3,000 psi)

BOPE 1: Townsend Double Gate Ram (11" 3,000 psi)

BOPE 2: Annular Preventer (11" 3,000 psi)

Choke 3" x 3,000 psi

* **KB-GL (ft):** 18 ? **Drillout: Reservoir information may not be adjusted for KB**

BOPE REQUIREMENTS:

See attached diagram for details regarding BOPE specifications and configuration.

- 1) Rig will be equipped with upper and lower kelly cocks with handles available.
- 2) Inside BOP and TIW valves will be available to use on all sizes and threads of drill pipe used while drilling the well.
- 2) BOP accumulator will have enough capacity to open the HCR valve, close all rams and annular preventer, and retain minimum of 200 psi above precharge on the closing manifold without the use of closing pumps. The fluid reservoir capacity shall be at least double the usable fluid volume of the accumulator system capacity, and the fluid level shall be maintained at manufacturer's recommendation. There will be two additional sources of power for the closing pumps (electric and air). Sufficient nitrogen bottles will be available and will be recharged when pressure falls below manufacturer's recommended minimum.
- 3) BOP testing shall be conducted (a) when Initially installed, (b) whenever any seal is broken or repaired, (c) if the time since the previous test exceeds 30 days. Tests will be conducted using a test plug. BOP ram preventers will be tested to 3,000 psi for 10 minutes, and the annular preventer will be tested to 1,500 psi for 10 minutes. Ram and annular preventers will be tested to 250 psi for 5 minutes. Additionally, BOP and casing strings will be tested to .22 psi/ft (or 1,500 psi minimum) for 30 minutes, prior to drilling out 13-3/8". Rams and hydraulically operated remote choke line valve will be function tested daily at a minimum.
- 4) Remote valve for BOP rams, HCR, and choke shall be placed in a location that is readily available to the driller. The remote BOP valve shall be capable of closing and opening the rams.
- 5) Manual locking devices (hand wheels) shall be intalled on rams. A valve will be installed on the annular preventer's closing line as close as possible to the preventer to act as a locking device. The valve will be maintained in the open position and shall only be closed when there is no power to the accumulator.

FLUIDS AND SOLIDS CONTROL PROGRAM:

Fluid Measurement: Pumps shall be equipped with stroke counters with displays in the dog-house. Slow pump speed shall be recorded daily and after mudding up, at a minimum, on drilling report. A Pit Volume Totalizer will be installed and the readout will be displayed in the dog-house. Gas-detecting equipment will be installed at the shakers, and readouts will be available in the dog-house and the in the geologist's work-station.

Closed-Loop System: A fully, closed-loop system will be utilized. The system will consist of above-ground piping and above-ground storage tanks and bins. The system will not entail any earthen pits, below-grade storage, or drying pads. All equipment will be disassembled and removed from the site when drilling operations cease. The system will be capable of storing all fluids and generated cuttings and of preventing uncontrolled releases of the same. The system will be operated in an efficient manner to allow the recycling and reuse of as much fluid as possible and to minimize the amount of fluids and solids that require disposal.

Fluid Disposal: Fluids that cannot be reused, recycled, or returned to the supplier will be hauled to and disposed of at an approved disposal site (Industrial Ecosystem, Inc. or Envirotech, Inc.).

Solids Disposal: Drilling solids will be stored (until haul-off) on-site in separate containers with no other waste, debris, or garbage products. Waste solids will be hauled to and disposed of at an approved disposal site (Industrial Ecosystem, Inc. or Envirotech, Inc.).

Fluid Program: See "Detailed Drilling Plan" section for specifics.

DETAILED DRILLING PLAN:

SURFACE: Drill vertically to casing setting depth, run casing, install wellhead, cement casing to surface.

0 ft (MD)	to	350 ft (MD)	Hole Section Length:	350 ft
0 ft (TVD)	to	350 ft (TVD)	Casing Required:	350 ft

Note: Surface hole may be drilled, cased, and cemented with a smaller rig in advance of the drilling rig.

Fluid:	Type	MW (ppg)	FL (mL/30 min)	PV (cp)	YP (lb/100 sqft)	pH	Comments
	Fresh Water	8.4	N/C	2 - 8	2 - 12	9.0	Spud mud

Hole Size: 17-1/2"

Bit / Motor: Mill Tooth or PDC, no motor

MWD / Survey: No MWD, run deviation survey in 100' stations after drilling

Logging: None

Casing Specs:		Wt (lb/ft)	Grade	Conn.	Collapse (psi)	Burst (psi)	Tens. Body (lbs)	Tens. Conn (lbs)
Specs	13.375	54.5	J-55	STC	1,130	2,730	853,000	514,000
Loading					153	1,520	116,634	116,634
Min. S.F.					7.39	1.80	7.31	4.41

Assumptions: Collapse: fully evacuated casing with 8.4 ppg equivalent external pressure gradient

Burst: maximum anticipated surface pressure or maximum test pressure with 9.5 ppg fluid inside casing while drilling production hole and 8.4 ppg equivalent external pressure gradient

Tension: buoyed weight in 8.4 ppg fluid with 100,000 lbs over-pull

MU Torque (ft lbs): Minimum: 3,860 Optimum: 5,140 Maximum: 6,430

Casing Details: Guide shoe, single-valve float collar, 1 jt casing, double-valve float collar, casing to surface, 11" 5K API-certified wellhead

Centralizers: 2 centralizers per jt stop-banded 10' from each collar on bottom 3 jts, 1 centralizer per 2 jts to surface

Cement:	Type	Weight (ppg)	Yield (cuft/sk)	Water (gal/sk)	% Excess	Planned TOC (ft MD)	Total Cmt (sx)
	Class G	15.8	1.174	5.15	100%	0	414

Annular Capacity 0.6946 cuft/ft (17-1/2" hole x 13-3/8" casing annulus)

Calculated cement volumes assume gauge hole and the excess noted in table

Halliburton HALCEM surface cementing blend

PRODUCTION: Drill to TD following directional plan, run casing, cement casing to surface.

350 ft (MD)	to	6,725 ft (MD)	Hole Section Length:	6,375 ft
350 ft (TVD)	to	6,725 ft (TVD)	Casing Required:	6,725 ft

Fluid:	Type	MW (ppg)	FL (mL/30')	PV (cp)	YP (lb/100 ft ²)	pH	Comments
--------	------	----------	-------------	---------	------------------------------	----	----------

KCI Fluid	8.8 - 9.5	20	8 - 14	8 - 14	9.0 - 9.5	
-----------	-----------	----	--------	--------	-----------	--

Hole Size: 8-3/4"

Bit / Motor: PDC w/mud motor

MWD / Survey: MWD with GR, inclination, and azimuth (every 100' at minimum)

Logging: Collect cuttings samples in 20' intervals for entire section, GR MWD for entire section, Triple Combo OH logs

Procedure: NU BOPE and test (as noted above); pressure test 13-3/8" casing to 1,500 psi for 30 minutes. Drill vertically to TD. Steer as needed to keep well vertical. Keep DLS < 2 deg/100' and keep slide length < 10' until when making steering adjustments. Take surveys every 100' at a minimum. After reaching TD, make wiper trip(s) as dictated by hole conditions to condition hole for logs and casing running. TOH. Run OH logs from TD to surface. Run casing as described below. Space out casing as close to TD as possible. Pump cement as detailed below. Note cement volume circulated to surface.

Casing Specs:	Size (in)	Wt (lb/ft)	Grade	Conn.	Collapse (psi)	Burst (psi)	Tens. Body (lbs)	Tens. Conn (lbs)
Specs	7.000	26.0	HCL-80	LTC	7,800	7,240	532,000	485,000
Loading					2,937	4,979	251,412	251,412
Min. S.F.					2.66	1.45	2.12	1.93

Assumptions: Collapse: fully evacuated casing with 8.4 ppg equivalent external pressure gradient in the annulus
Burst: 4,000 psi maximum surface treating pressure with 11.2 ppg equivalent mud weight sand laden fluid during fracturing operations with 8.4 ppg equivalent external pressure gradient
Tension: buoyed weight in 8.8 ppg fluid with 100,000 lbs over-pull

MU Torque (ft lbs): Minimum: 3,830 Optimum: 5,110 Maximum: 6,390

Casing Details: Guide shoe, single-valve float collar, 1 jt casing, double-valve float collar, 1 jt casing, landing collar, casing to surface with 1 - 20' marker joint at the Dakota top

Centralizers: 2 centralizers per joint stop-banded 10' from each collar on bottom 3 joints, 1 centralizer per joint from TD to 500' above the Entrada top, 1 centralizer per joint to 300' (50' inside surface casing shoe) - SEE ANNEX-50 / APPROVED OS- AZTEC PLAN

Cement:	Type	Weight (ppg)	Yield (cuft/sk)	Water (gal/sk)	% Excess	Planned TOC (ft MD)	Total Cmt (sx)
Lead	G:POZ blend	12.3	1.987	10.16	40%	0	777
Tail	G:POZ blend	13.3	1.354	5.94	10%	3,525	731

Annular Capacity 0.6007 cuft/ft (13-3/8" casing x 7" casing annulus)

? CHECK -> 0.2812 cuft/ft (8-3/4" hole x 7" casing annulus)

Calculated cement volumes assume gauge hole and the excess noted in table

Halliburton ECONOCEM & EXTENDACEM cementing blend

FINISH WELL: ND BOP, NU WH with BPV and cap, RDMO.

Procedure: ND BOP. Install BPV in WH. Install cap with pressure gauge on WH. Frac stack to be installed at later date. RDMO.

COMPLETION AND PRODUCTION PLAN:

Completion: Pressure test 7" casing to 3,000 psig or maximum treating pressure, whichever is higher for 60 minutes. Run CBL to from TD to surface. Perforate Entrada. TIH with packer and break down Entrada perforations. Swab back load water and collect formation water sample. Perform complete water analysis. Perforations may be acidized or fracture

Production: Well will produce up 3-1/2" production tubing via ESP into water storage facility.

ESTIMATED START DATES:

Drilling: 10/1/2018

Completion: 10/11/2018

Production: 10/16/2018

Prepared by: Alec Bridge 5/4/2018

Updated by: Alec Bridge 9/18/2018 changed hole size from 12-1/4" to 8-3/4" as noted in variance request, updated 7" casing weight as noted in approved POD-1, updated rig information from MOTE-Aztec 920 to MOTE-Aztec 777, added SHL information

NEU 2207-168 WSW Wellbore Diagram_updated 09182018



ENDURING RESOURCES
332 County Road 3100 • Aztec, New Mexico 87410
Telephone (505) 636-9741 Fax (505) 334-1979

September 19, 2018

OSE
District Office V
100 Gossett Dr., Suite A
Aztec, NM 87410

Attention: Blaine Watson, District Supervisor

Re: Enduring Resources IV, LLC Approved Exploratory Well Permit SJ-4301 POD 1

Mr. Watson:

Enduring Resources IV, LLC is respectfully requesting a variance to NMAC 19.27.4.30 in regards to the Annular Space Requirements. Enduring is asking that the requirement stating the diameter of the borehole in which the annular seal is to be placed shall be at least four inches greater than the outside diameter of the outermost casing be waived.

Based on the similarity of this well to a standard oil & gas well, this request is made due to best practice procedures and the knowledge obtained with over 30 years of drilling experience in similar wells.

This will enable the ability to improve cement bond quality to pipe and to the formation, which will ensure safe and long life expectancy of the well and assure the isolation of all formations.

The change that will result by approval of this variance is to change the borehole size from the existing approved 12-1/4" X 7" to 8-3/4" X 7" which is a standard configuration used in the Oil & Gas Industry, please see enclosed borehole improvement plan justification, updated drilling plan, updated well bore diagram and updated Artesian Well Plan of Operations.

Enduring Resources will not move the drilling rig on location until September 28th, 2018 and it will take approximately 24 hours to rig up prior to commencing drilling operations. If this variance is not approved at the time drilling operations commence, Enduring will drill the well as originally permitted.

If you have any questions or need additional information please feel free to contact me at afelix@enduringresources.com or 505-386-8205.

Thank you,


Andrea Felix, RWA
Regulatory Manager

FILED
DISTRICT OFFICE
AZTEC, NEW MEXICO
2018 SEP 19 PM 3:24

SJ-4301 POD 1
Wellbore design improvement

Summary below with some comments:

SUMMARY OF COMPARISON CALCULATIONS			
HOLE SIZE x CASING SIZE	12-1/4" x 7"	8-3/4" x 7"	
% of Critical Velocity - Lead	24%	71%	8 bbl/min displacement rate
% of Critical Velocity - Tail	16%	33%	8 bbl/min displacement rate
Volume Lead Slurry (sx)	1,373	375	40% excess over gauge hole
Volume Tail Slurry (sx)	1,433	391	10% excess over gauge hole
Hole Volume (yds)	204	104	Total earth removed assuming gauge hole
Annular Velocity during Drilling (ft/min)	117.60	285.23	600 GPM with 5" Drill Pipe

- The % critical velocity during cementing assumes 8 BPM displacement for the lead and tail blends. As we noted earlier, the closer we can get to critical velocity, the better cement placement we will have.
- The cement volumes are totals for the jobs with different well constructions. Increasing the whole size from 8-3/4" to 12-1/4" will increase our cement volume by a factor of 3.67. More material, more cost, more pump time, more retarder, more opportunity for something to go wrong.
- The total hole volume will nearly double. That means twice as much waste to haul off (cuttings and waste mud).
- The annular velocity during drilling is right at the cusp of recommended 100 – 125 ft/min with 5" drill pipe and 600 GPM. 600+ GPM is attainable; however, we don't have much wiggle room to keep our velocity high if a mud pump goes down and we have to drill at reduced capacity.
- Any hole washout in the 12 1/4" hole would lower the % critical velocity and further degrade the cement placement.
- With the bigger hole we will be reducing the annular velocity of the cement and spacers while pumping. Due to the lower velocity we will see a negative impact on hole cleaning and displacement efficiency.
- Due to the lower velocity we will see greater issue with mud removal from the wellbore and removal of filter cake from the formations. Which will not allow our cement to bond as well to the formation to create a full seal of cement from the casing to the formation.
- Without reaching the higher velocities we have a greater chance of the different fluids fingering through each other and again leading not to getting all of the mud out of the hole
- Centralization is another concern. Since this hole size and pipe combination is not common the availability of centralizers is very limited. Without good centralization achieving a good cement bond completely around the pipe will be very difficult to achieve.

2018 SEP 19 PM 3: 24
MAIL ROOM
PZTEC, NEW MEXICO

District I
1625 N. French Dr., Hobbs, NM 88240
Phone:(575) 393-6161 Fax:(575) 393-0720
District II
811 S. First St., Artesia, NM 88210
Phone:(575) 748-1283 Fax:(575) 748-9720
District III
1000 Rio Brazos Rd., Aztec, NM 87410
Phone:(505) 334-6178 Fax:(505) 334-6170
District IV
1220 S. St Francis Dr., Santa Fe, NM 87505
Phone:(505) 476-3470 Fax:(505) 476-3462

State of New Mexico
Energy, Minerals and Natural Resources
Oil Conservation Division
1220 S. St Francis Dr.
Santa Fe, NM 87505

CONDITIONS

Action 300679

CONDITIONS

Operator: NEW MEXICO ENERGY MINERALS & NATURAL RESOURCE 1220 S St Francis Dr Santa Fe , NM 87504	OGRID: 264235
	Action Number: 300679
	Action Type: [IM-SD] Well File Support Doc (ENG) (IM-AWF)

CONDITIONS

Created By	Condition	Condition Date
pgoetze	None	1/7/2024