BEFORE THE STATE CORPORATION COMMISSION
OF THE STATE OF KANSAS

Before Commissioners: Pat Apple, Chair
Jay Scott Emler
Shari Feist Albrecht

In the Matter of the Application of CASILLAS PETROLEUM CORPORATION for an Order, pursuant to K.A.R. § 82-3-140, Certifying the Pleasant Prairie Unit MEOR Project in Haskell and Finney Counties, Kansas, as a Qualified Tertiary Recovery Project to the Kansas Department of Revenue	Docket No. 17-CONS-3512-CMSC License No. 34997 Conservation Division

APPLICATION

Casillas Petroleum Corporation ("Casillas Petroleum") submits this Application, pursuant to K.A.R. § 82-3-140, for an Order certifying the Pleasant Prairie Unit MEOR Project in Haskell and Finney Counties, Kansas, as a qualified tertiary recovery project to the Kansas Department of Revenue. In support of its Application, Casillas Petroleum states as follows:

1. Casillas Petroleum Corporation is an Oklahoma corporation and is duly authorized to do business in Kansas. Casillas Petroleum's business address is 401 South Boston Avenue, Suite 2400, Tulsa, Oklahoma 74103. The State Corporation Commission for the State of Kansas (the "Commission") has issued Casillas Petroleum operator's license #34997, which license is in full force and effect.

2. Casillas Petroleum owns and is the operator of oil and gas leases in Haskell and Finney Counties, Kansas, covering the area that is the subject of this Application known as the Pleasant Prairie Unit. The Pleasant Prairie Unit was unitized by the Commission effective June 1, 1966, for production from the St. Louis formation.

3. The Pleasant Prairie Unit is comprised of the following lands in Haskell and Finney Counties, Kansas:

<u>Township 26 South, Range 34 West</u>

Section 17:	SW/4; W/2 SE/4
Section 18:	SE/4; E/2 SW/4
Section 19:	All
Section 20:	All
Section 29:	All
Section 30:	N/2; SE/4; E/2 SW/4
Section 31:	E/2; E/2 SW/4
Section 32:	All
Section 33:	W/2 NW/4; SW/4; W/2 SE/4

<u>Township 27 South, Range 34 West</u>

Section 4:	N/2; SW/4; W/2 SE/4
Section 5:	All
Section 6:	NE/4; E/2 SE/4
Section 8:	NE/4; E/2 NW/4; E/2 SE/4
Section 9:	W/2

(the "Unit Area"), totaling approximately 6,400 acres, more or less.

4. Casillas Petroleum proposes to conduct a project that will utilize anaerobic microbes to enhance oil recovery from the Pleasant Prairie Unit to be known as the Pleasant Prairie Unit MEOR Project. A complete description of the tertiary recovery project proposed by Casillas Petroleum, and all of the information supporting that planned project, is contained in the project description that is attached hereto as Exhibit A and incorporated herein by reference.

5. The proposed project falls under the federal tertiary method of micro emulsion flooding and is a process that described in subparagraphs (1) through (9) of 10 C.F.R. § 212.78(c), as in effect on June 1, 1979. Casillas Petroleum is requesting an exemption from severance tax for oil produced from the Pleasant Prairie Field pursuant to K.S.A. § 79-4217(b)(2)(C).

6. All of the lands located within one-half (1/2) mile of the Pleasant Prairie Unit are operated by Casillas Petroleum. In addition, there are no unleased mineral owners within a one-half (1/2) mile radius of the Pleasant Prairie Unit.

7. Casillas Petroleum will cause the Notice of Application to be published once in The Wichita Eagle newspaper, The Garden City Telegram newspaper in Finney County, Kansas, and The Haskell County Monitor-Chief newspaper in Haskell County, Kansas.

8. Casillas Petroleum requests that after proper notice and hearing, if required by applicable law, rules and regulations, the Commission issue an Order granting this Application.

WHEREFORE, Casillas Petroleum Corporation ("Casillas Petroleum") prays that this Application be docketed by the Commission and that, if no written protest is received by the Commission within fifteen (15) days after Notice of the Application is published, the Commission administratively grant this Application and issue an Order certifying the project described herein to the Kansas Department of Revenue as in compliance with the requirement for an exemption from severance tax pursuant to K.S.A. § 79-4217(b)(2)(C), and for such other and further relief as the Commission deems necessary and proper.

David E. Bengtson (#12184)
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Wichita, KS 67206-6620
(316) 265-8800
FAX: (316) 265-1349

Attorneys for Casillas Petroleum Corporation

VERIFICATION

STATE OF KANSAS)
) ss:
COUNTY OF SEDGWICK)

David E. Bengtson, of lawful age, being first duly sworn upon oath states:

That he is the attorney for the Applicant named in the foregoing Application and is duly authorized to make this verification; that he has read the foregoing Application and knows the contents thereof and that the facts set forth therein are true and correct to the best of his information and belief.

David E. Bengtson

SUBSCRIBED AND SWORN to before me this 9th day of March, 2017.

Notary Public

My Appointment Expires:

KAY L. ADAMS
NOTARY PUBLIC
STATE OF KANSAS
My Appt. Exp. 11-3-2018

CORE/3002309.0002/131709638.1

CASILLAS
PETROLEUM CORP

KCC Lic #: 34997

Pleasant Prairie Unit MEOR Project

Haskell and Finney Counties, Kansas

3/9/17

EXHIBIT A

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Pleasant Prairie Unit (PPU) MEOR Project
Finney and Haskell Counties, KS

Project Scope:
This project consists of utilizing anaerobic microbes to enhance oil recovery. This project falls under the Federal tertiary method of microemulsion flooding. Casillas Petroleum Corporation is requesting the 7-year severance tax exemption allowed for implementing tertiary recovery in the Pleasant Prairie Unit.

General Information:
The Pleasant Prairie Unit is located in southwestern Finney County and northwestern Haskell County, Kansas. The nearest city, Garden City, is 20 miles northeast. The unit area consists of approximately 6,453 acres. It was originally developed by Helmerich and Payne in the 1950's and 1960's with the St. Louis formation being the primary target reservoir. The unit reached peak production in January of 1961 at 5,500 BOPD and experienced a 12% yr-over-yr decline while in primary recovery.

Unitization of the area was effective June 1, 1966. At this point the Pleasant Prairie Unit was averaging 2,466 BOPD with remaining primary reserves estimated at 7,687,719 BO. Cumulative production from the unit area at time of unitization was 10,609,281 BO, for an estimated ultimate primary recovery of 18,297,000 BO.

Waterflooding in the PPU began sometime in the mid to late 1960's and still exists today. The EUR with secondary recovery applied is 20,767,173 BO. Calculated OOIP is 35,761,368 BO.

Current daily production from the PPU is 320 BOPD and 13,500 BWPD.

Reservoir Characteristics:
The top of the Mississippi at Pleasant Prairie averages 5,050' TVD. The Mississippian formation currently being waterflooded in the PPU is the St. Louis. The St. Louis is a carbonate consisting of limestone, dolomite, and anhydrite. The St. Louis is broken into 3 different intervals, St. Louis "A", St. Louis "B", and St. Louis "C". The primary intervals of interest for this project are the St. Louis "B" and the St. Louis "C". The St. Louis A"" is negligible in PPU due to its limited areal extent. The "B" and "C" zones are by far the most productive and vary from a few feet to as much as 24' in thickness. Porosities range from less than 1% to 18% and permeabilities range from 0.01 MD to 4,920 MD. Vertical and horizontal fracturing is present throughout the St. Louis. Reservoir volume is estimated to be 99,692 productive acre-feet. Oil gravity is 34^0 API when corrected to 60^0F, and the reservoir temperature is 131^0F.

MEOR Process:
The Microbial Enhanced Oil Recovery (MEOR) process that will be utilized in the Pleasant Prairie Unit consist of blends of facultative anaerobic microorganisms injected into the formation. The microorganisms used for this project are naturally occurring, non-pathogenic, non-toxic, non-carcinogenic, and environmentally friendly. These microorganisms, once injected downhole, can move on their own. At two-tenths of a micron in size, the microorganisms can fit into tight pore spaces where residual oil is still trapped. The microbes will feed on carbon sources such as phosphates, nitrates, hydrocarbons, etc. The byproduct the microbes produce are biosurfactants and fatty acids. These biosurfactants behave as nonionic and weak anionic surfactants. A reduction in interfacial surface tension up to 90% can be realized resulting in significant reduction in capillary forces thereby releasing residual oil. Once released, the oil droplets will migrate through the natural fractures via the sweeping

efficiency of the injected water and be produced out one of the producing wells. Another benefit of the microbes feeding frenzy is their ability to break the carbon chains of heavier oil molecule which in turn decreases the viscosity of the oil molecule allowing it to flow more easily through the rock matrix. This process will also contribute to the increased production as well as the overall ultimate recovery factor.

PPU MEOR Candidate Identification:

Extensive preliminary studies were conducted to determine the viability of utilizing the MEOR process in the PPU. Water samples were taken from each satellite facility and tests were performed to determine the compatibility and residence time of the microbes in the formation water. This testing determined that the environment of the PPU reservoir is extremely favorable to the success of the microbes.

PPU Infrastructure Overview:

The Pleasant Prairie Unit currently consists of 46 producers, 10 injectors, and 9 satellite facilities. A simplistic description of the PPU infrastructure process is as follows: the producers produce to a satellite facility, which in turn sends the produced water to the injector facilities, which is then pumped downhole into the reservoir. Exhibit 1 displays the PPU infrastructure map.

MEOR Operational Procedure & Costs:

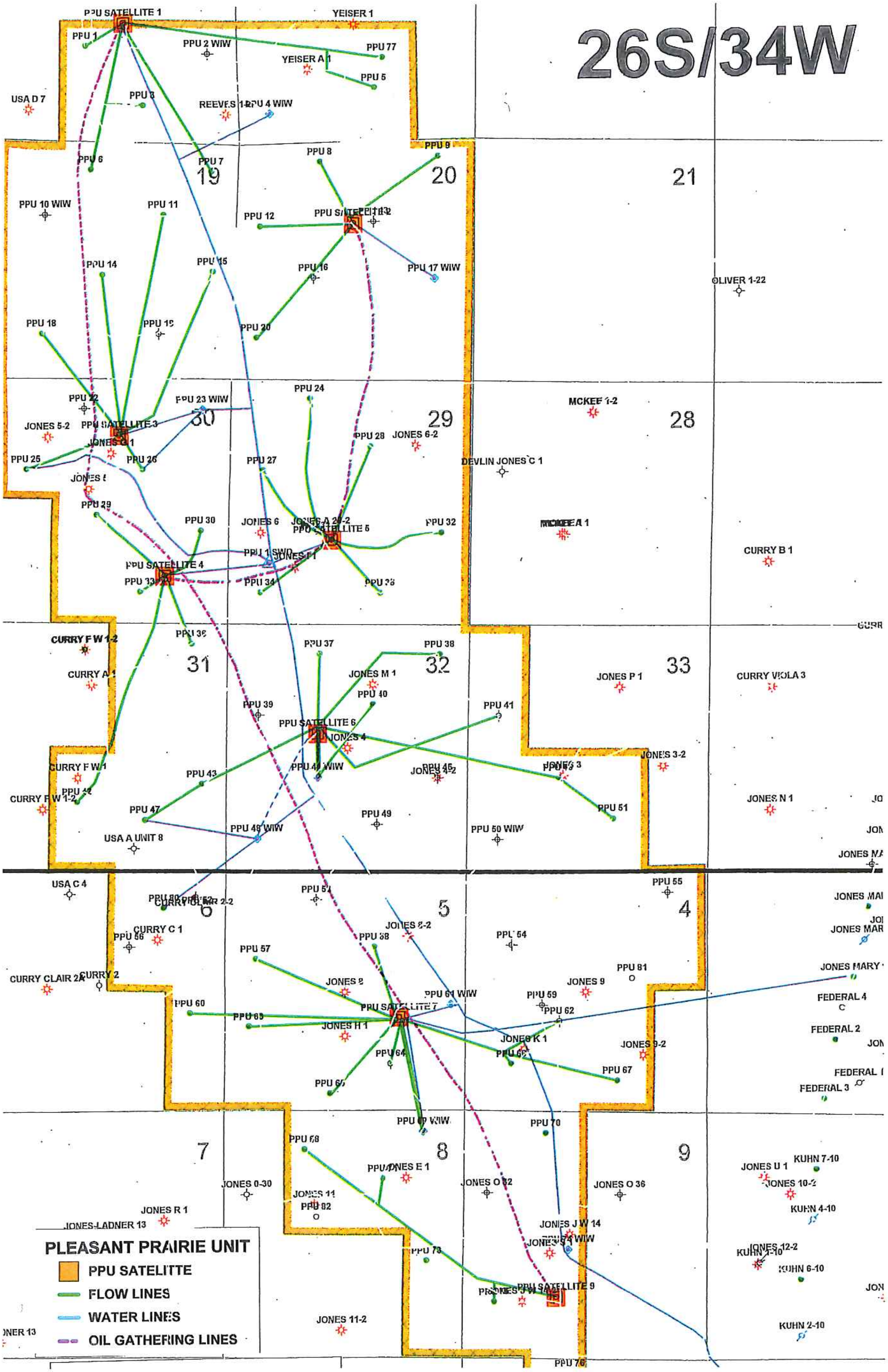
The MEOR process will begin with inoculating the injections wells. This process will be done by injecting the blend of microbes into the gun barrel and water tanks at each of the satellite facilities. The microbes will colonize and reproduce in these vessels. They will then be transported from these facilities to each of the injector well's facilities. These microbes will be injected into the injection tanks 1–2 times/month depending on the water volume, residence time, tank volumes, affability, etc. Reproduction and replenishment will ensure that the microbes have a concentration of 1,000,000 cells per milliliter at all times. As the blended colonies are established in the injection system the injected fluid will, at each injector, carry 1,000,000 cell/ml constantly into the formation. At this time, Casillas does not plan to increase the water injection volume.

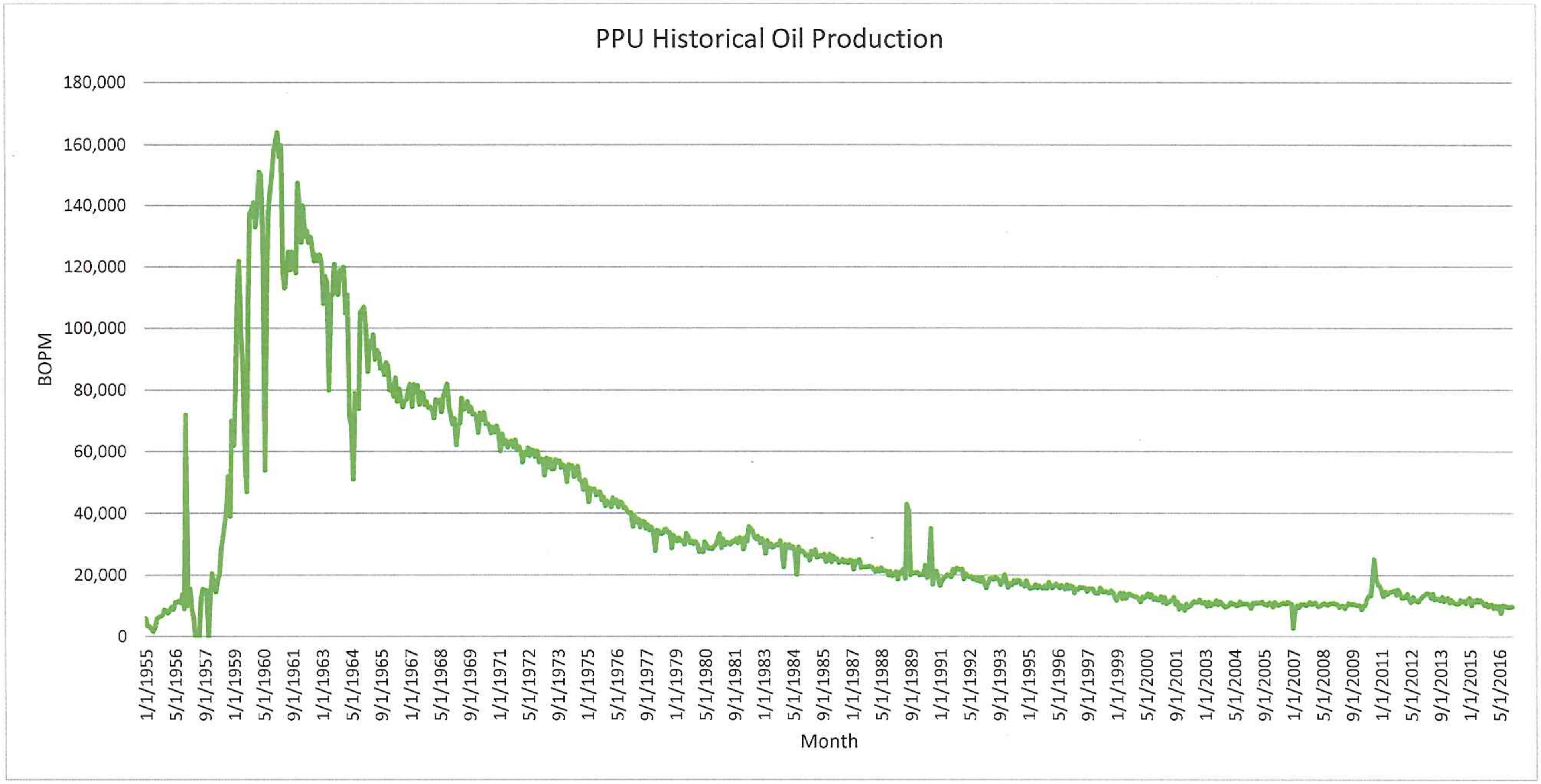
Initial cost will be negligible since PPU is operationally setup as a waterflood. We will incur cost for the initial inoculation and monthly replenishment of the microbes. Estimated monthly cost for this project is $8,000/mo for a total cost of $96,000/yr.

Anticipated Uplift/Recovery:

As stated before, the EUR with secondary recovery applied is 20,767,173 BO. This equates to a recovery factor of 58%. We conservatively estimate that we will be able to recover an additional 10% of the OOIP resulting in an addition of 3,576,136 BO recovered. The new EUR with tertiary recovery applied is 24,343,310 BO.

We anticipate that it will take 24 months from implementation for the unit to reach peak production from the application of the MEOR process. We expect to see an increase in daily oil production as the microbes are distributed throughout the formation. Our oil cut should increase as the oil droplets are released from the pore throats of the matrix porosity. We plan to initiate the project April 1, 2017.


26S/34W
PLEASANT PRAIRIE UNIT
PPU SATELITTE
FLOW LINES
WATER LINES
OIL GATHERING LINES
19
20
21
30
29
28
31
32
33
6
5
4
7
8
9
PPU SATELLITE 1
YEISER 1
PPU 1
PPU 2 WIW
PPU 77
YEISER A 1
PPU 5
USA D 7
PPU 3
REEVES 1
PPU 4 WIW
PPU 9
PPU 8
PPU 6
PPU 7
PPU 10 WIW
PPU 11
PPU 12
PPU 14
PPU 15
PPU 16
PPU 17 WIW
OLIVER 1-22
PPU 18
PPU 20
PPU 24
PPU 22
PPU 23 WIW
MCKEE 1-2
JONES 5-2
PPU SATELLITE 3
PPU 28
JONES 6-2
PPU 25
PPU 26
PPU 27
DEVLIN JONES C 1
PPU 29
PPU 30
JONES 6
PPU SATELLITE 5
PPU 32
MCKEE A 1
PPU SATELLITE 4
PPU 1 SWD
CURRY B 1
PPU 34
CURRY F W 1-2
PPU 37
PPU 38
CURRY A 1
JONES M 1
JONES P 1
CURRY VIOLA 3
PPU 39
PPU 40
PPU 41
PPU SATELLITE 6
JONES 4
JONES 3-2
CURRY F W 1
PPU 43
PPU 44 WIW
JONES 3
PPU 51
JONES N 1
CURRY F W 1-2
PPU 47
PPU 49
PPU 48 WIW
USA A UNIT 8
PPU 50 WIW
USA C 4
PPU 55
CURRY C 1
PPU 56
PPU 58
PPU 54
CURRY CLAIR 2A
CURRY 2
PPU 57
JONES 2
PPU 81
JONES 9
PPU 61 WIW
PPU 59
PPU 60
PPU SATELLITE 7
PPU 62
JONES H 1
JONES K 1
JONES 9-2
PPU 64
PPU 66
PPU 67
PPU 65
FEDERAL 4
FEDERAL 2
FEDERAL 3
PPU 70
PPU 68
JONES E 1
JONES 0-30
PPU 82
JONES O 36
JONES U 1
KUHN 7-10
JONES 10-2
KUHN 4-10
JONES R 1
JONES-LADNER 13
JONES J W 14
PPU 73
KUHN 6-10
PPU SATELLITE 9
JONES 11-2
KUHN 2-10
PPU 76



PPU Historical Oil Production
BOPM
180,000
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
1/1/1955
5/1/1956
9/1/1957
1/1/1959
5/1/1960
9/1/1961
1/1/1963
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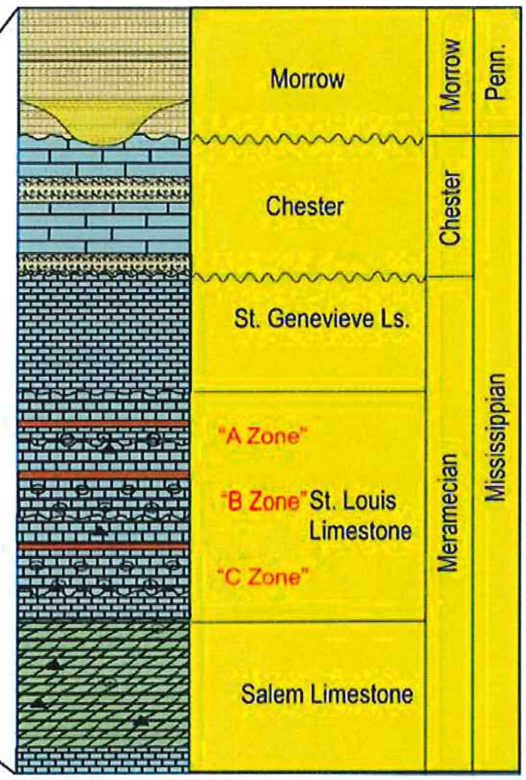
9/1/2005
1/1/2007
5/1/2008
9/1/2009
1/1/2011
5/1/2012
9/1/2013
1/1/2015
5/1/2016
Month

Well Name	Type	Status	Lease No.	County	Legal	Well Name	Type	Status	Lease No.	County	Legal
PPU 01 WIW	Injector	Operating	157817	Finney	18 26S 34W	PPU 44 WIW	Injector	Operating	157817	Finney	32 26S 34W
PPU 03	Producer - Oil	Producing	157877	Finney	18 26S 34W	PPU 46	Producer - Oil	Producing	157817	Finney	33 26S 34W
PPU 04 WIW	Injector	Operating	157817	Finney	17 26S 34W	PPU 47	Producer - Oil	Producing	157817	Finney	31 26S 34W
PPU 05	Producer - Oil	Producing	157817	Finney	17 26S 34W	PPU 48 WIW	Injector	Operating	157817	Finney	32 26S 34W
PPU 07	Producer - Oil	Producing	157817	Finney	19 26S 34W	PPU 51	Producer - Oil	Producing	157817	Finney	33 26S 34W
PPU 08	Producer - Oil	Producing	157817	Finney	20 26S 34W	PPU 53	Producer - Oil	TA	157817	Haskell	5 27S 34W
PPU 09	Producer - Oil	Producing	157817	Finney	20 26S 34W	PPU 57	Producer - Oil	Producing	157817	Haskell	5 27S 34W
PPU 1 SWD	Injector	Operating	157811	Finney	29 26S 34W	PPU 58	Producer - Oil	Producing	157817	Haskell	5 26S 34W
PPU 11	Producer - Oil	Producing	157817	Finney	19 26S 34W	PPU 59	Producer - Oil	TA	157817	Haskell	4 27S 34W
PPU 12	Producer - Oil	Producing	157817	Finney	20 26S 34W	PPU 60	Producer - Oil	Producing	157817	Haskell	6 27S 34W
PPU 13	Producer - Oil	Producing	157817	Finney	20 26S 34W	PPU 61 WIW	Injector	Operating	157817	Haskell	5 27S 34W
PPU 14	Producer - Oil	Producing	157817	Finney	19 26S 34W	PPU 62	Producer - Oil	Producing	157817	Haskell	4 27S 34W
PPU 15	Producer - Oil	Producing	157817	Finney	19 26S 34W	PPU 63	Producer - Oil	Producing	157817	Haskell	5 27S 34W
PPU 16 WIW	Injector	Operating	157817	Finney	20 26S 34W	PPU 65	Producer - Oil	Producing	157817	Haskell	5 27S 34W
PPU 17 WIW	Injector	Operating	157817	Finney	20 26S 34W	PPU 66	Producer - Oil	Producing	157817	Haskell	4 27S 34W
PPU 18	Producer - Oil	Producing	157817	Finney	19 26S 34W	PPU 67	Producer - Oil	Producing	157817	Haskell	4 27S 34W
PPU 19	Producer - Oil	Producing	157817	Finney	19 26S 34W	PPU 68	Producer - Oil	Producing	157817	Haskell	8 27S 34W
PPU 20	Producer - Oil	Producing	157817	Finney	20 26S 34W	PPU 69 WIW	Injector	TA	157817	Haskell	8 27S 34W
PPU 22	Producer - Oil	Producing	157817	Finney	30 26S 34W	PPU 70	Producer - Oil	Producing	157817	Haskell	9 27S 34W
PPU 23 WIW	Injector	Operating	157817	Finney	30 26S 34W	PPU 71	Producer - Oil	Producing	157817	Haskell	8 27S 34W
PPU 24	Producer - Oil	Producing	157817	Finney	29 26S 34W	PPU 73	Producer - Oil	TA	157817	Haskell	8 27S 34W
PPU 25	Producer - Oil	Producing	157817	Finney	30 26S 34W	PPU 74 WIW	Injector	TA	157817	Haskell	9 27S 34W
PPU 26 WIW	Injector	Operating	157817	Finney	30 26S 34W	PPU 75	Producer - Oil	Producing	157817	Haskell	9 27S 34W
PPU 27	Producer - Oil	Producing	157817	Finney	29 26S 34W	PPU 76	Producer - Oil	Producing	157817	Haskell	16 27S 34W
PPU 28	Producer - Oil	Producing	157817	Finney	29 26S 34W	PPU 77 WIW	Injector	Operating	157817	Finney	17 26S 34W
PPU 29	Producer - Oil	Producing	157817	Finney	30 26S 34W	PPU 85A	Producer - Oil	Producing	157817	Finney	29 26S 34W
PPU 30	Producer - Oil	Producing	157817	Finney	30 26S 34W	PPU 94	Producer - Oil	TA	157817	Finney	19 26S 34W
PPU 31	Producer - Oil	Producing	157817	Finney	29 26S 34W	PPU 97	Producer - Oil	TA	157817	Finney	33 26S 34W
PPU 32	Producer - Oil	Producing	157817	Finney	29 26S 34W						
PPU 33	Producer - Oil	Producing	157817	Finney	30 26S 34W						
PPU 34	Producer - Oil	Producing	157817	Finney	29 26S 34W						
PPU 35	Producer - Oil	Producing	157817	Finney	29 26S 34W						
PPU 36	Producer - Oil	Producing	157817	Finney	31 26S 34W						
PPU 37	Producer - Oil	Producing	157817	Finney	32 26S 34W						
PPU 38	Producer - Oil	Producing	157817	Finney	32 26S 34W						
PPU 40	Producer - Oil	TA	157817	Finney	32 26S 34W						
PPU 41	Producer - Oil	TA	157817	Finney	33 26S 34W						
PPU 42	Producer - Oil	Producing	157817	Finney	31 26S 34W						
PPU 43	Producer - Oil	TA	157817	Finney	31 26S 34W						

Southwest Kansas Stratigraphy

System	Series	Stratigraphic Unit
Permain	Leonardian	B/Stn Corral Nippewalla
	Wolfcampian	Chase Council Grove
Pennsylvanian	Virgilian	Admire Wabaunsee Shawnee Douglas
	Missourian	Lansing Kansas City Pleasanton
	Desmoinesian	Marmaton Cherokee
	Atokan	Atoka
	Morrowan	Morrow
Mississippian	Chesterian	Chester
	Meramecian	Ste. Genevieve
		St. Louis
		Salem
		Warsaw
	Osagian	Osage
	Kinderhookian	Gilmore City Ls. Hannibal Sh



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Water Analysis Form

Operator :	Casillas	Date :	12/29/2016
Lease :	Flint Hills	County :	Haskell
Wellid :	#1	State :	KS

Lab Measurements

Oxygen	0.0	mg/L	Specific Gravity	1.0600	
Carbon Dioxide	840	mg/L	Total Dissolved Solids (TDS) Calc.	98,397	mg/L
Bicarbonate	1,000	mg/L	Barium	1	mg/L
Hydrogen Sulfide	950.0	mg/L	Sulfate	304	mg/L
pH	6.7		Chloride	60,000	mg/L
Temperature	70	°F	Total Hardness	15,000	mg/L
Iron	0	mg/L	Calcium Hardness	6,000	mg/L

Cations (+)	mg/L	mEq/L	Anions (-)	mg/L	mEq/L
Barium (Ba)	1	0.01	Bicarbonate (HCO_3)	1,000	16.39
Calcium (Ca)	2,400	120.00	Chloride (Cl)	60,000	1690.14
Magnesium (Mg)	2,195	179.93	Sulfate (SO_4)	304	6.33
Sodium (Na) Calc.	32,497	1412.93	Bacteria	SRB	APB
Iron (Fe) Total	0.00	<10	Cells/mL	n/a	n/a

Solubility Calculations

Compound	mEq/L	mg/L		Scale Formation Potential
Barium Sulfate	0.01	1.70		Negative
Calcium Carbonate	16.39	1,328.52		Positive
Calcium Sulfate	#REF!	#REF!		#REF!

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Water Analysis Form

Operator :	Casillas	Date :	12/29/2016
Lease :	Satellite	County :	Haskell
Wellid :	#5	State :	KS

Lab Measurements

Oxygen	0.0	mg/L	Specific Gravity	1.0800	
Carbon Dioxide	1,040	mg/L	Total Dissolved Solids (TDS) Calc.	97,376	mg/L
Bicarbonate	400	mg/L			
Hydrogen Sulfide	250.0	mg/L	Barium	0	mg/L
pH	5.9		Sulfate	899	mg/L
Temperature	74	°F	Chloride	60,000	mg/L
Iron	0	mg/L	Total Hardness	22,000	mg/L
			Calcium Hardness	8,800	mg/L

Cations (+)	mg/L	mEq/L	Anions (-)	mg/L	mEq/L
Barium (Ba)	0	0.00	Bicarbonate (HCO_3)	400	6.56
Calcium (Ca)	3,520	176.00	Chloride (Cl)	60,000	1690.14
Magnesium (Mg)	3,220	263.89	Sulfate (SO_4)	899	18.73
Sodium (Na) Calc.	29,337	1275.53	Bacteria	SRB	APB
Iron (Fe) Total	0.00	<10	Cells/mL	n/a	n/a

Solubility Calculations

Compound	mEq/L	mg/L		Scale Formation Potential
Barium Sulfate	0.00	0.00		Negative
Calcium Carbonate	6.56	531.41		Positive
Calcium Sulfate	12.17	828.53		Negative

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Water Analysis Form

Operator :	Casillas	Date :	12/29/2016
Lease :	Satellite #6 WIW 44	County :	Haskell
Wellid :		State :	KS

Lab Measurements

Oxygen	0.0	mg/L	Specific Gravity	1.0600	
Carbon Dioxide	1,160	mg/L	Total Dissolved Solids (TDS) Calc.	114,477	mg/L
Bicarbonate	650	mg/L	Barium	1	mg/L
Hydrogen Sulfide	250.0	mg/L	Sulfate	775	mg/L
pH	5.9		Chloride	70,000	mg/L
Temperature	74	°F	Total Hardness	19,000	mg/L
Iron	0	mg/L	Calcium Hardness	7,600	mg/L

Cations (+)	mg/L	mEq/L	Anions (-)	mg/L	mEq/L
Barium (Ba)	1	0.01	Bicarbonate (HCO_3)	650	10.66
Calcium (Ca)	3,040	152.00	Chloride (Cl)	70,000	1971.83
Magnesium (Mg)	2,780	227.91	Sulfate (SO_4)	775	16.15
Sodium (Na) Calc.	37,230	1618.71	Bacteria	SRB	APB
Iron (Fe) Total	0.00	<10	Cells/mL	n/a	n/a

Solubility Calculations

Compound	mEq/L	mg/L		Scale Formation Potential
Barium Sulfate	0.01	1.70		Negative
Calcium Carbonate	10.66	863.54		Positive
Calcium Sulfate	5.49	373.71		Negative

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Water Analysis Form

Operator :	Casillas	Date :	12/29/2016
Lease :	Satellite	County :	Haskell
Wellid :	#7	State :	KS

Lab Measurements

Oxygen	0.0	mg/L	Specific Gravity	1.0800	
Carbon Dioxide	1,080	mg/L	Total Dissolved Solids (TDS) Calc.	113,355	mg/L
Bicarbonate	450	mg/L	Barium	2	mg/L
Hydrogen Sulfide	250.0	mg/L	Sulfate	825	mg/L
pH	5.9		Chloride	70,000	mg/L
Temperature	74	°F	Total Hardness	25,000	mg/L
Iron	0	mg/L	Calcium Hardness	10,000	mg/L

Cations (+)	mg/L	mEq/L	Anions (-)	mg/L	mEq/L
Barium (Ba)	2	0.03	Bicarbonate (HCO_3)	450	7.38
Calcium (Ca)	4,000	200.00	Chloride (Cl)	70,000	1971.83
Magnesium (Mg)	3,659	299.88	Sulfate (SO_4)	825	17.19
Sodium (Na) Calc.	34,419	1496.49	Bacteria	SRB	APB
Iron (Fe) Total	0.00	<10	Cells/mL	n/a	n/a

Solubility Calculations

Compound	mEq/L	mg/L		Scale Formation Potential
Barium Sulfate	0.03	3.40		Positive
Calcium Carbonate	7.38	597.84		Positive
Calcium Sulfate	9.81	667.80		Negative

JGL microbes at work solutions

Water Analysis Form

Operator : Casillas

Date : 12/29/2016

Lease : SWD

County : Haskell

Wellid : # 1

State : KS

Lab Measurements

Oxygen	0.0	mg/L	Specific Gravity	1.0600	
Carbon Dioxide	920	mg/L	Total Dissolved Solids (TDS) Calc.	104,342	mg/L
Bicarbonate	650	mg/L	Barium	2	mg/L
Hydrogen Sulfide	100.0	mg/L	Sulfate	739	mg/L
pH	6.0		Chloride	65,000	mg/L
Temperature	74	°F	Total Hardness	31,000	mg/L
Iron	0	mg/L	Calcium Hardness	12,400	mg/L

Cations (+)	mg/L	mEq/L	Anions (-)	mg/L	mEq/L
Barium (Ba)	2	0.03	Bicarbonate (HCO_3)	650	10.66
Calcium (Ca)	4,960	248.00	Chloride (Cl)	65,000	1830.99
Magnesium (Mg)	4,537	371.85	Sulfate (SO_4)	739	15.40
Sodium (Na) Calc.	28,455	1237.16	Bacteria	SRB	APB
Iron (Fe) Total	0.00	<10	Cells/mL	n/a	n/a

Solubility Calculations

Compound	mEq/L	mg/L		Scale Formation Potential
Barium Sulfate	0.03	3.40		Positive
Calcium Carbonate	10.66	863.54		Positive
Calcium Sulfate	4.74	322.66		Negative

microbes at work
solutions

Water Analysis Form

Operator :	Casillas	Date :	12/29/2016
Lease :	WIW	County :	Haskell
Wellid :	17	State :	KS

Lab Measurements

Oxygen	0.0	mg/L	Specific Gravity	1.1000	
Carbon Dioxide	1,160	mg/L	Total Dissolved Solids (TDS) Calc.	104,870	mg/L
Bicarbonate	550	mg/L	Barium	0	mg/L
Hydrogen Sulfide	0.0	mg/L	Sulfate	671	mg/L
pH	5.8		Chloride	65,000	mg/L
Temperature	74	°F	Total Hardness	26,000	mg/L
Iron	0	mg/L	Calcium Hardness	10,400	mg/L

Cations (+)	mg/L	mEq/L	Anions (-)	mg/L	mEq/L
Barium (Ba)	0	0.00	Bicarbonate (HCO_3)	550	9.02
Calcium (Ca)	4,160	208.00	Chloride (Cl)	65,000	1830.99
Magnesium (Mg)	3,805	311.88	Sulfate (SO_4)	671	13.98
Sodium (Na) Calc.	30,684	1334.11	Bacteria	SRB	APB
Iron (Fe) Total	0.00	<10	Cells/mL	n/a	n/a

Solubility Calculations

Compound	mEq/L	mg/L		Scale Formation Potential
Barium Sulfate	0.00	0.00		Negative
Calcium Carbonate	9.02	730.69		Positive
Calcium Sulfate	4.96	337.82		Negative

microbes at work
solutions

Water Analysis Form

Operator :	Casillas	Date :	12/29/2016
Lease :	WIW	County :	Haskell
Wellid :	23	State :	KS

Lab Measurements

Oxygen	0.0	mg/L	Specific Gravity	1.0800	
Carbon Dioxide	960	mg/L	Total Dissolved		
Bicarbonate	500	mg/L	Solids (TDS) Calc.	122,324	mg/L
Hydrogen Sulfide	150.0	mg/L	Barium	6	mg/L
pH	5.8		Sulfate	751	mg/L
Temperature	74	°F	Chloride	75,000	mg/L
Iron	0	mg/L	Total Hardness	20,000	mg/L
			Calcium Hardness	8,000	mg/L

Cations (+)	mg/L	mEq/L	Anions (-)	mg/L	mEq/L
Barium (Ba)	6	0.09	Bicarbonate (HCO_3)	500	8.20
Calcium (Ca)	3,200	160.00	Chloride (Cl)	75,000	2112.68
Magnesium (Mg)	2,927	239.90	Sulfate (SO_4)	751	15.65
Sodium (Na) Calc.	39,940	1736.53	Bacteria	SRB	APB
Iron (Fe) Total	0.00	<10	Cells/mL	n/a	n/a

Solubility Calculations

Compound	mEq/L	mg/L		Scale Formation Potential
Barium Sulfate	0.09	10.19		Positive
Calcium Carbonate	8.20	664.26		Positive
Calcium Sulfate	7.45	507.06		Negative

JGL microbes at work solutions

Water Analysis Form

Operator :	Casillas	Date :	12/29/2016
Lease :	WIW	County :	Haskell
Wellid :	74	State :	KS

Lab Measurements

Oxygen	0.0	mg/L	Specific Gravity	1.1000	
Carbon Dioxide	1,200	mg/L	Total Dissolved Solids (TDS) Calc.	120,574	mg/L
Bicarbonate	300	mg/L	Barium	0	mg/L
Hydrogen Sulfide	0.0	mg/L	Sulfate	587	mg/L
pH	5.7		Chloride	75,000	mg/L
Temperature	74	°F	Total Hardness	28,000	mg/L
Iron	0	mg/L	Calcium Hardness	11,200	mg/L

Cations (+)	mg/L	mEq/L	Anions (-)	mg/L	mEq/L
Barium (Ba)	0	0.00	Bicarbonate (HCO_3)	300	4.92
Calcium (Ca)	4,480	224.00	Chloride (Cl)	75,000	2112.68
Magnesium (Mg)	4,098	335.87	Sulfate (SO_4)	587	12.23
Sodium (Na) Calc.	36,109	1569.96	Bacteria	SRB	APB
Iron (Fe) Total	0.00	<10	Cells/mL	n/a	n/a

Solubility Calculations

Compound	mEq/L	mg/L		Scale Formation Potential
Barium Sulfate	0.00	0.00		Negative
Calcium Carbonate	4.92	398.56		Positive
Calcium Sulfate	7.31	497.67		Negative

	USA B	WIW 23	WIW 17	WIW 74	Sat #5 SWD-1	WIW 44 Sat #6	WIW 61 Sat #7
JGL #	1216.016	1216.059	1216.060	1216.061	1216.062	1216.063	1216.064
Sample Date	12/6/16	12/29/16	12/29/16	12/29/16	12/29/16	12/29/16	12/29/16
Filter Weight	0.0847	0.0806	0.0853	0.0790	0.0795	0.0740	0.0847
Cum. Volume	500	1,150	10	1300	200	1200	600
Time	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Plugging Index	33.7	16.6	1347.0	12.2	68.8	12.0	22.7
Empty Dish Wt	18.6570	34.7920	19.4780	18.2510	28.2090	16.4690	15.1120
Dry Wt	18.8100	34.9630	19.5980	18.3890	28.3260	16.5870	15.2330
Iso Alcohol	18.8000	34.8920	19.5880	18.3490	28.3260	16.5570	15.2330
Chloroform	18.7910	34.8910	19.5870	18.3490	28.3230	16.5560	15.2230
Toluene	18.7840	34.8840	19.5780	18.3480	28.3200	16.5530	15.2160
Acetic Acid	18.7810	34.8800	19.5740	18.3400	28.3180	16.5500	15.2140
HCl	18.7720	34.8740	19.5710	18.3300	28.3100	16.5430	15.2100
% Oils	14.6	78.5	28.8	67.8	0.0	68.2	0.0
% Paraffins	13.2	1.1	2.9	0.0	8.0	2.3	27.5
% Asphaltenes	10.2	7.7	25.9	1.7	8.0	6.8	19.3
% Calcium Compounds	4.4	4.4	11.5	13.6	5.3	6.8	5.5
% Iron Compounds	13.2	6.6	8.6	16.9	21.3	15.9	11.0
% Inerts	44.4	1.5	22.2	0.0	57.3	0.0	36.6
% TOTALS	100.0	100.0	100	100	100	100	100
mg Oils	0.010	0.071	0.010	0.040	0.000	0.030	0.000
mg Paraffins	0.009	0.001	0.001	0.000	0.003	0.001	0.010
mg Asphaltenes	0.007	0.007	0.009	0.001	0.003	0.003	0.007
mg Calcium Compounds	0.003	0.004	0.004	0.008	0.002	0.003	0.002
mg Iron Compounds	0.009	0.006	0.003	0.010	0.008	0.007	0.004
mg Inerts	0.030	0.001	0.008	0.000	0.021	0.000	0.013
TOTAL mg	0.0683	0.0904	0.0347	0.0590	0.0375	0.0440	0.0363
Oils mg/L	20.0	61.7	1000.0	30.8	0.0	25.0	0.0
Paraffins mg/L	18.0	0.9	100.0	0.0	15.0	0.8	16.7
Asphaltenes mg/L	14.0	6.1	900.0	0.8	15.0	2.5	11.7
Caclium mg/L	6.0	3.5	400.0	6.2	10.0	2.5	3.3
Irons mg/L	18.0	5.2	300.0	7.7	40.0	5.8	6.7
Inerts mg/L	60.6	1.2	770.0	0.0	107.5	0.0	22.2
TOTAL Solids mg/L	136.6	78.6	3470.0	45.4	187.5	36.7	60.5
Water Level							