



RAILROAD COMMISSION OF TEXAS

HEARINGS DIVISION

PROPOSAL FOR DECISION

OIL AND GAS DOCKET NO. 06-0290629

THE APPLICATION OF BP AMERICA PRODUCTION COMPANY, TO AMEND FIELD RULES FOR THE OAK HILL (COTTON VALLEY) FIELD, GREGG, HARRISON, PANOLA, AND RUSK COUNTIES, TEXAS

HEARD BY: Paul Dubois – Technical Examiner
Laura Miles-Valdez – Hearings Examiner

HEARING DATE: October 15, 2014

APPEARANCES:

REPRESENTING:

APPLICANT:

William Hayenga
Keith Masters, P.E.

BP America Production Company

OBSERVER:

Andy Trevino

Valence Operating Company

PROCEDURAL HISTORY

Application Filed:	July 18, 2014
Notice of Hearing:	September 26, 2014
Date of Hearing:	October 15, 2014
Proposal For Decision Issued:	April 9, 2015



STATEMENT OF THE CASE

BP America Production Company (BP) seeks to amend field rules for the Oak Hill (Cotton Valley) Field in Gregg, Harrison, Panola, and Rusk Counties, Texas. The current field rules were most recently amended on December 2, 2014, (Oil and Gas Docket No. 06-0291054). BP seeks to amend and make permanent the field rules as follows:

1. Reduce the lease-line spacing from 467 feet to 330 feet;
2. Reduce the dual lease line spacing provision for all take points in a horizontal well, measured perpendicular from the lateral to the lease line, from 467 feet to 330 feet;
3. Reduce the dual lease line spacing provision for the first and last take points on a horizontal well to the nearest lease line from 330 feet to 200 feet;
4. Eliminate the between well spacing requirement for all wells;
5. Add a 50-foot box rule provision for horizontal wells; and
6. Eliminate the requirement to file proration unit plats with Form P-15.

All operators in the field received notice of BP's application at least 10 days prior to the hearing; the application was not protested. Valence Operating Company was represented at the hearing as an observer in support of the application. At the hearing the Examiners requested certain late-filed exhibits be submitted by BP. Late-filed Exhibit Nos. 25 through 29 were received on October 23, 2014.

The Examiners recommend that BP's application be approved with exceptions. Based on the evidence in the record, the field rules should be amended to grant item nos. 3 through 6, as detailed above. However, BP's request to reduce the lease line spacing from 467 feet to 330 feet should be denied (nos. 1 and 2, above). The evidence in the record does not demonstrate the proposed spacing rules are necessary to prevent waste or to provide operators an opportunity to recover their fair share of reserves. To the contrary, the record demonstrates that current spacing rules prevent waste and protect correlative rights by providing all operators an equal opportunity to recover their fair share of hydrocarbons. Reducing the lease line spacing will also result in a significant increase in the proportion of off-lease drainage. Further, BP's request is not consistent with the traditional application of spacing and density pairings. BP has failed to support a departure from these pairings by presenting proof that these changes are necessary to prevent waste and protect correlative rights. A spacing exception to Statewide Rule 37 is an appropriate

and available remedy to prevent waste or confiscation for an individual well in a unique situation.¹

This Proposal For Decision (PFD) contains several Attachments, all of which are based upon BP's record evidence; the Examiners have made annotations to BP's exhibits for illustrative purposes.

APPLICABLE LAW

In considering the appropriateness of modifying lease line spacing, the Examiners consider the sometimes competing interests of prevention of waste and protection of correlative rights. Mineral owners may develop their resources based on the rule of capture. Under this rule, the only recourse available to offset property owners is to drill wells to capture as much oil and gas as possible before it is drained by another. The natural consequence of the rule of capture is over-drilling resulting in physical waste (production practices that reduce the total ultimate recovery of oil and gas from any reservoir) and economic waste (drilling of unnecessary wells and production in excess of reasonable market demand.) By regulating well spacing (16 Tex. Admin. Code § 3.37, Statewide Spacing Rule) and well density (16 Tex. Admin. Code § 3.38, Well Densities) the Commission's rules work to prevent waste and protecting correlative rights.

In *Browning Oil Co. v. Luecke*², the Third Court of Appeals gives guidance on this issue, noting:

- Correlative rights afford each landowner the reasonable opportunity to produce his or her fair share of the recoverable oil and gas beneath his land.
- However, correlative rights are qualified. In exercising their right to a fair share, landowners must submit to limitations that provide each owner the opportunity to recover his or her fair share. That is, a mineral owner has a duty to refrain from exercising his or her privilege in a manner that injures the common source of supply.
- These limitations take the form of Statewide Rules (in particular, for well spacing and well density), production allowables, and field rules.
- To maximize recovery of a field, well spacing rules prescribe the minimum distances between wells, in addition to the distances between wells and

¹ Tex. Admin. Code § 3.37 (Statewide Spacing Rule)

² *Browning Oil Co., Inc. v. Luecke*, 38 S.W.3d 632 (Tex. App. - Austin, 2000, pet. denied)

tracts of land or lease lines, for the purpose of limiting the number of wells and locating the wells in particular positions.

- Well density rules establish the surface area (in acres) that wells in a field can efficiently drain; and the density (in acres) that is assigned to an individual well as its proration unit.

Further, the owner of mineral rights is entitled to his "fair share" of hydrocarbons from a common reservoir, pool, or source of supply. That is, the mineral owner of a 40-acre tract in a field is entitled to the opportunity to recover his fair share of minerals in the field. The owner is not entitled to all hydrocarbons underlying his particular 40-acre tract, but the fair equivalent quantity of hydrocarbons under a similar 40 acres in the field. Thus, in a field with 40-acre proration units, a mineral owner of a 40-acre tract of land may drill one well. The mineral owner is entitled to all of the hydrocarbons produced from the well, regardless of whether the recovered hydrocarbons are drained from his leasehold or that of an offset mineral owner, or both.

DISCUSSION OF THE EVIDENCE

Evidence and testimony in the case was provided by Mr. Keith Masters, P.E., consulting engineer. The Oak Hill (Cotton Valley) Field is located on the Sabine Uplift in East Texas. The field was discovered on November 17, 1976, and has grown to include portions of Gregg, Harrison, Panola, and Rusk Counties. The October 2014 proration schedules carry 1,896 gas wells and four oil wells. BP operates 91 gas wells in the field and intends to develop the field with horizontal wells going forward. The field has produced nearly 2.4 trillion cubic feet of gas and 8.2 million barrels of condensate. There are a number of other Cotton Valley fields in the nearby area.

Field rules for the Oak Hill (Cotton Valley) Field were first established on May 31, 1977 (Special Order No. 06-67,176), and have been amended 17 times. The field rules initially specified 640-acre density and 1,320-foot lease line spacing. Over time, standard and optional unit sizes have been implemented and lease line spacing has been reduced. The current optional unit size is 40 acres, and the current lease line spacing is 467 feet. The first and last take points of a horizontal drainhole may be 330 feet from the nearest lease line.

The correlative interval for the Oak Hill (Cotton Valley) Field is from 8,670 feet to 10,469 feet below ground surface. The Taylor Sand member of the Cotton Valley Formation occurs stratigraphically in the lower Cotton Valley Formation and is the dominant productive member. The Taylor Sand includes several tight sand units that are continuous across a broad area and represent an offshore sand bar and barrier island depositional environment. The upper part of the Cotton Valley Formation contains heterogeneous and

lenticular near shore and fluvial deposits, some of which are productive, but are generally discontinuous.

The field currently has 40-acre optional units and a lease line spacing requirement of 467 feet.³ Radial drainage of 40 acres would result in a drainage radius of about 745 feet. Thus, Mr. Masters stated that a well located 467 feet from a lease line will drain 5.15 acres of the offsetting lease, or about 13 percent of the 40-acre unit (Attachment A).⁴ Mr. Masters went on to say that this is a theoretical situation based on radial drainage, not based on an actual fracture stimulated well such as those in the subject field. The Cotton Valley does not exhibit radial drainage. The effective drainage pattern of a fracture stimulated well in the sandstone Cotton Valley Formation is elongated—an oval, or cigar shape—as a function of the fracture length being much greater than the fracture width of an individual fracture treatment.

Fracture Pattern

Wells in the Oak Hill (Cotton Valley) Field require fracture stimulation to be economically productive. Mr. Masters stated that fracture stimulation yields typical fracture half-lengths of about 1,000 feet.⁵ Two Society of Petroleum Engineers (SPE) studies published in 1997 and 2005, also indicate fracture half-lengths of at least 1,000 feet were to be expected in the Cotton Valley Formation, and the fractures tend to propagate on an azimuth of about North 71° East.⁶ Testimony by Arco Oil & Gas Company in a 1988 field rule hearing reported the effective fracture half-length in the Oak Hill (Cotton Valley) Field to be 905 feet, which was evidence used at that time to set the lease line spacing at 933 feet.⁷

Mr. Masters used the stage length of a hydraulic fracture treatment in a horizontal well as a surrogate to estimate the half-width of an individual fracture treatment—which Mr.

³ 467 feet is the standard lease line spacing for a well on a 40-acre unit [16 Tex. Admin. Code §3.38(b)(2)]. Assuming a rectangular 40-acre unit has a length twice its width, 467 feet is half the length of one of the short sides of the unit. This is the traditional standard relationship between density and lease line spacing used by the Commission for commonly used unit sizes.

⁴ Exh. No. 11.

⁵ A fracture "half-length" is the radial distance from the wellbore to the outer tip of a fracture propagated from the well by hydraulic fracturing. That is, two fracture half lengths each extending horizontally 1,000 feet from the fractured wellbore, would yield a total fractured length of 2,000 feet.

⁶ Exh. Nos. 28 & 29.

⁷ Exh. No. 27, pp. 4-5. "Oil & Gas Docket No. 6-91,652; Commission Called Hearing to Consider Any Reasons Why Certain Cotton Valley Fields Should Not Be Consolidated in a Single Field, Gregg and Rusk Counties, Texas." Proposal for Decision dated March 4, 1988. Final Order entered on April 12, 1988.

Masters refers to as the "drainage vector." Mr. Masters' rationale for this proxy is that operators seek to efficiently fracture as much of the wellbore as possible while minimizing cost (*i.e.*, minimizing the number of fracture stimulation treatments). He calculated the stage length by dividing the total length of a horizontal wellbore (from first take point to last take point⁸) by the number of fracture stimulation stages performed on the lateral. In the Oak Hill (Cotton Valley) Field, Mr. Masters estimates the stage length to be about 380 feet, one half of which, or 190 feet, is the drainage vector.

Thus, the horizontal fracture pattern for stimulation treatment in the tight sandstone formation is an oval or cigar-shaped area about 2,000 feet long and 380 feet wide (20.05 acres). From an overhead view, a single fracture stimulation in a vertical or horizontal well would appear to cover a 20-acre, cigar-shaped area. A horizontal well with multiple fracture stages would appear as a row of cigar-shaped areas lying side-by-side in parallel (Attachment B).⁹ The SPE literature also supports an effective stage half-width of 200 to 250 feet.¹⁰

BP provided a number of demonstrative exhibits depicting various well spacing scenarios, effective fracture stimulation areas, and lease line configurations. Many of these exhibits also quantified the amount of off-lease drainage that may occur in each particular situation.

Reduce Lease Line Spacing from 467 Feet to 330 Feet

In situations where the fracture orientation is *parallel* to the lease line, Mr. Masters argues that physical waste may occur when the lease line spacing is in excess of the drainage vector of a stimulated wellbore or take point. With the current 467-foot lease line spacing and a 40-acre unit, a 1,000-foot fracture half-length will drain none of the offsite tract and may result in waste on 5.69 acres on the lease (Attachment C, note shaded area).¹¹ Reducing the lease line spacing to 330 feet will eliminate the physical waste in this situation and result in off lease drainage of less than 1 acre (Attachment C). BP believes 330 feet to be an appropriate distance to reduce physical waste.

On the other hand, Mr. Masters argues that in situations where the fracture orientation is *perpendicular* to the lease line, a 1,000-foot fracture half-length will extend

⁸ A "Take Point" in a horizontal drainhole well is any point along a horizontal drainhole where oil and/or gas can be produced into the wellbore from the reservoir/field interval.

⁹ Exh. No. 15.

¹⁰ Exh. No. 29.

¹¹ Exh. No. 13.

533 feet beyond the adjoining lease line if the well is located at the current lease line spacing of 467 feet, resulting in theoretical off-lease drainage of 12.64 acres, or 32 percent of a 40-acre unit (Attachment D).¹² BP believes 330 feet to be an appropriate spacing, although it will increase the drainage from the off-lease tract to 14.79 acres, or about 37 percent of a 40-acre unit (Attachment D).

Reduce First and Last Take Point Spacing from 330 Feet to 200 Feet

The current field rules provide for a 330-foot lease line spacing distance for the first and last take points on a horizontal well. BP argues that with the estimated 190-foot drainage vector, the current 330-foot spacing provision may result in waste. For example, in a theoretical scenario, a 140-foot strip of land beyond the drainage vector would not be drained in situations where the fracture orientation is perpendicular to the lease line. Thus, BP believes a 200-foot lease line spacing distance for the first and last take points on horizontal wells will reduce waste and protect correlative rights.

BP's Exhibit Nos. 19, 20, and 21, demonstrate that reducing the first and last take point lease line spacing from 330 feet to 200 feet will not increase the ultimate off-lease drainage scenario. In such a case with 1,000-foot fracture half-lengths, the 330-foot lease line spacing would result in off-lease drainage of 14.79 acres (37.0 percent of a 40-acre unit), the same area that would be drained with the proposed 200-foot take point spacing provision.

Based on this analysis, Mr. Masters concludes that reducing the first and last take point spacing distance for horizontal wells from 330 feet to 200 feet will prevent waste and will not further impact an offsetting mineral owner's rights.

EXAMINERS' OPINION

Requested Amendments Supported by the Evidence

BP stated its intent to continue to develop the Oak Hill (Cotton Valley) Field with horizontal wells, and the field rule amendments it seeks will further this objective. Specifically, the Examiners conclude that BP has demonstrated that the following requested amendments will prevent waste, protect correlative rights, and promote the orderly development of the field:

- Establish 200-foot lease line spacing provisions for the first and last take points on horizontal wells (Attachment E);

¹² Exh. No. 26.

- Eliminate the between well spacing requirement for all wells;
- Add a horizontal well provision for a 50-foot box rule; and,
- Eliminate the requirement to file proration unit plats with Form P-15.

Elimination of the between well spacing requirement will provide operators with flexibility with locating horizontal wells in a field that has already had extensive development with vertical wells, such as the Oak Hill (Cotton Valley) Field. Similarly, a 50-foot box rule allows for a minimal amount of drift in long horizontal laterals without being in violation with Statewide Rule 37. Finally, elimination of the requirement to file individual proration unit plats relieves operators of an administrative burden to continually resurvey tracts during redevelopment.

Requested Amendments Not Supported by the Evidence

It is patently counter-intuitive to reduce the lease line spacing from 467 feet to 330 feet when the entirety of the evidence offered by BP—at the hearing and through late-filed exhibits—unequivocally proves that the effective fracture stimulation in the Oak Hill (Cotton Valley) Field extends 1,000 feet from the wellbore. BP has not demonstrated that reducing lease line spacing from 467 feet to 330 feet is necessary to prevent waste or protect correlative rights. Therefore, the Examiners conclude the following: (1) the proposed lease line spacing provisions are contrary to the standard practice of paired spacing and density provisions; (2) the current field rule spacing provisions are appropriate for the field density and sufficient to prevent waste and to protect correlative rights; (3) the proposed field rules will disparately increase drainage from off-lease tracts; and (4) on an individual well basis, an available and appropriate remedy to prevent waste or confiscation is through an exception to Statewide Rule 37.

1. Standard Spacing and Density Pairings Are the Traditional Field Rule Scheme

As affirmed by the *Browning* Court, the Commission has historically balanced the competing interests of preventing waste and protecting correlative rights by adopting rules governing the spacing and density of wells in a field. While the interests of preventing waste and protecting correlative rights do not need to be balanced equally, they should be balanced consistently, a feat accomplished with standard pairings of spacing and density provisions.

The long-standing standard lease line spacing for a 40-acre unit is 467 feet, a spacing provision that provides for a degree of off-lease drainage in a theoretical radial drainage scenario (Attachment A). In fact, there is a geometric relationship between associating 40 acres with a 467-foot lease line spacing provision, and the Commission has used the same geometric relationship (see footnote no. 2 on page 5) to establish other

standard spacing and density pairings (e.g., 933 feet for 160 acres, 660 feet for 80 acres, and 330 feet for 20 acres). These standard spacing and density pairings create a model, in a generic and theoretical manner, for maximum off-lease drainage of about 26 percent when a well is located on a lease corner adjacent to two lease lines (Attachment A, inset). To the Examiners knowledge, the Commission has never adopted a position of what constitutes an appropriate or maximally acceptable proportion of off-lease to total drainage. Based on its use with the standard pairings, the Examiners consider this ratio (26 percent off-lease area drained to total drainage area) to represent a point of reference from which specific justification for variance from the standard pairings is warranted—justification which must be demonstrated by an applicant.

BP seeks to reduce the lease line spacing from 467 feet to 330 feet. BP is not seeking a corresponding reduction in optional proration unit size from 40 acres to 20 acres. Therefore, the proposed lease line spacing is not consistent with the standard spacing and density pairings traditionally adopted by the Commission.

BP argues that other Cotton Valley Formation fields have similar spacing rules to those desired for the subject field, and this is a basis for adopting the proposed rules in the Oak Hill (Cotton Valley) Field. The evidence does not support this contention. As indicated on BP's Exhibit No. 10 (Attachment F), which summarizes field rules for 10 Cotton Valley fields, including the subject Oak Hill (Cotton Valley) Field. Of those 10 fields, the Examiners note that seven currently have optional unit size and lease line spacing provisions *consistent* with Statewide Rule 38 and the Commission's traditional application of spacing and density pairings—467 feet for a 40 acre optional unit, and 330 feet for a 20 acre optional unit. The Oak Hill (Cotton Valley) Field is one of these, which is currently consistent with convention.

Three of the fields listed on Exhibit No. 10 (Attachment F) currently have spacing (330 feet) and density (40 and 80 acres) provisions which are *not consistent* with the traditional application of spacing and density pairings. While these three fields—the Bethany (Cotton Valley), Bethany, East (Cotton Valley), and Waskom (Cotton Valley) Fields—are associated with the Cotton Valley Formation, no evidence was introduced at the hearing to indicate (or even suggest) these fields might be adjacent or otherwise in a competitive spatial relationship with the Oak Hill (Cotton Valley) Field. In fact, BP's Exhibit No. 1 identifies several fields adjacent to Oak Hill (Cotton Valley) Field, but the Bethany and Waskom fields are not among them. The evidence demonstrates that most (7 out of 10) Cotton Valley Formation fields currently utilize the standard lease line spacing and density pairings.

Finally, in its letter to the Examiners dated December 8, 2014, BP's attorney introduces the recent field rule case in the Spraberry (Trend Area) Field, in which lease line spacing was reduced from 467 to 330 feet, the justification for which was, in part, that other

nearby and correlative fields already had such spacing.¹³ The letter fails to mention, however, that the applicant in that case, Pioneer Natural Resources USA, Inc., first conducted a comprehensive and exhaustive study to characterize the fracture stimulation drainage patterns in the Spraberry (Trend Area) Field, through which it determined that such drainage was generally limited to a fracture stimulation half-length of 330 feet—the corresponding lease line spacing distance for a 20-acre unit provided for in the Spraberry (Trend Area) Field rules; the Spraberry rules are consistent with the standard spacing and density pairings. Further, the studied target zones in the Spraberry (Trend Area) Field are shale, not sandstone like the Taylor member of the Cotton Valley Formation, as is the case here. No evidence was offered to suggest similar petrophysical rock properties or response to fracture stimulation. In fact, BP's Exhibit No. 29 describes differing fracture geometries between sandstone and shale.

2. The Current 467-Foot Lease Line Spacing Is Sufficient and Appropriate

The evidence in the record clearly demonstrates the Cotton Valley Formation does not exhibit radial drainage. Instead, economic production of the Cotton Valley Formation requires fracture stimulation, which results in an elongated drainage area. Still, the Commission has routinely applied the standard spacing and density pairing provisions in fields with eccentric drainage patterns.

To demonstrate its argument that the current 467-foot lease line spacing encourages waste, BP's Exhibit No. 13 (Attachment C) indicates a 124-foot wide strip of undrained land between the lease line and the drainage area—an undrained area of about 5.69 acres. BP argues that reducing the lease line spacing to 330 feet would eliminate this waste. This may be true. However, as shown on BP's Exhibit No. 26 (Attachment D), the current field rules already provide for 12.64 acres of off-lease drainage, which is more than sufficient to provide operators the opportunity to recover their fair share of hydrocarbons. Thus the proposed lease line spacing provision is not necessary to prevent waste, and may, in fact, harm the correlative rights of adjacent mineral owners by increasing off-lease drainage.

The Examiners note that the example diagrams in the exhibits and attachments are conceptual. Stimulated fractures in the Cotton Valley Formation propagate along an azimuth of about North 71° East. In most cases, the lease lines are likely not parallel or perpendicular to the fracture orientation. Field rules are not intended to anticipate and resolve all potential waste or correlative rights concerns that arise from tract size and geometry. Rather, an operator may seek an exception to the statewide spacing and density rules to obtain that relief. The evidence in the record demonstrates the existing

¹³ See Oil and Gas Docket Nos. 7C-0291169 and 7C-0291171; the Application of Pioneer Natural Resources USA, Inc. to Amend Field Rules for the Spraberry (Trend Area) Field in Various Counties, Texas. Final Order entered on December 2, 2014.

lease line spacing provisions are appropriate and sufficient to prevent waste and protect correlative rights in this field.

3. The Proposed Field Rules Disparately Impact Off-Lease Drainage

Attachment G illustrates the current spacing rule with a well drilled 467 feet from two lease lines, one perpendicular to the fracture orientation and one parallel to it, and Attachment H illustrates the proposed spacing rule with 330-foot spacing. Attachments G and H represent the scenarios in which off-lease drainage from a fracture stimulated vertical well is maximized. Attachments G and H demonstrate that the net effect to drainage of the proposed field rules is to increase the area of off-lease drainage while decreasing the area of on-lease drainage as follows:

Drainage	Current Lease Line Spacing (467 feet)	Proposed Lease Line Spacing (330-feet)	Change
On lease area drained - in acres - as a percentage of a 40-acre unit	27.35 acres 68 percent	24.79 acres 62 percent	- 2.56 acres - 6 percent
Off lease area drained - in acres - as a percentage of a 40-acre unit	12.64 acres 32 percent	15.19 acres 38 percent	+ 2.55 acres + 6 percent

As stated above, the standard spacing and density pairings anticipate a maximum off-lease drainage of 26 percent (Attachment A). The current field spacing rules provide for a maximum off-lease drainage of 32 percent, and the proposed spacing rules increase the off-lease drainage potential to 38 percent.

The off-lease impacts are similar when lease line spacing is reduced for take points in horizontal wells. As shown on Attachment E, reducing the lease line spacing for all take points in a horizontal well from 467 feet to 330 feet may increase the off-lease drainage by about 1.2 acres per stage and decrease on-lease drainage by the same amount. BP's Exhibit No. 14 indicated horizontal wells in the field have been completed with 6 to 17 stages. With the proposed 330-lease line spacing, such horizontal wells may drain an additional 7 to 20 acres from off-lease tracts.

4. An Exception to Statewide Rule 37 Is the Appropriate and Available Remedy

The Examiners conclude the record does not support reducing the lease line spacing from 467 feet to 330 feet as requested by BP. In the event of unique conditions on or under a lease, or if the enforcement of rules will operate to destroy the right of a

mineral owner to recover its fair share of minerals, the Examiners believe the appropriate remedy would be to seek an exception to Statewide Rule 37. Such application could take into consideration: (1) the preferred fracture stimulation and drainage orientation of the Cotton Valley Formation; and (2) the particular tract geometry and availability—or lack thereof—of regular locations for optimal drainage. Moreover, unlike field rule cases, obtaining an exception to Statewide Rule 37 allows for notice and participation of affected mineral interest owners on offset tracts, which in turn protects correlative rights.

FINDINGS OF FACT

1. Proper notice of this hearing was issued.
2. The Oak Hill (Cotton Valley) Field is an associated gas field and was discovered on November 17, 1976, at a depth of 10,212 feet, in Rusk County, Texas.
3. Field rules were adopted by the Railroad Commission in Special Order No. 6-67,176, effective May 31, 1977. The field rules have been amended several times, most recently on December 2, 2014, in Docket No. 06-0291504, and include the following provisions:
 - a. 160-acre standard proration units and 40-acre optional units;
 - b. 467-foot lease line and between well spacing;
 - c. Take point provisions for horizontal wells, including 330-foot lease line spacing for first and last take points and 467-foot perpendicular spacing between all take points and a lease line;
4. The standard minimum lease line spacing requirement for a 40-acre unit is 467 feet. The current optional unit size and lease line spacing provision for the Oak Hill (Cotton Valley) Field are consistent with long-established Commission practice.
5. The theoretical radial drainage from a 40-acre unit 467 feet from a lease line will result in draining an off-lease area of 5.15 acres, or about 13 percent of the 40-acre unit. A theoretical maximum off-lease drainage of about 26 percent may occur when a well is located 467 feet from two perpendicular lease lines.
6. The Taylor Sand in the lower portion of the Cotton Valley Formation is the dominant productive member and is continuous across the area. The upper part of the Cotton Valley Formation contains heterogeneous and lenticular

near shore and fluvial deposits, some of which are productive, but which are generally not continuous across large areas.

7. Fracture stimulation treatments in the Oak Hill (Cotton Valley) Field and other Cotton Valley Formation fields result in fracture half-lengths of about 1,000 feet, a fact corroborated by expert testimony, articles published by the Society of Petroleum Engineers, and prior Commission findings, all offered as evidence by BP.
8. Fracture stimulated wells in the Oak Hill (Cotton Valley) Field exhibit a single-stage fracture pattern with an oval or cigar shape that is about 2,000 feet long and 380 feet wide (20.05 acres) and oriented on an azimuth of North 71° East.
9. A well draining a 40-acre unit with a whole fracture length of 2,000 feet will have a drainage vector of 343 feet.
 - a. When the lease line is parallel to the fracture orientation, a well located 467 feet from a lease line may strand hydrocarbons, causing waste, under 5.69 acres of the lease (14 percent of a 40-acre unit).
 - b. When the lease line is perpendicular to the fracture orientation, a well located 467 feet from a lease line may drain hydrocarbons from under 12.64 acres from the offset lease (32 percent of a 40-acre unit).
 - c. The net drainage area gain is 6.95 acres (17 percent of a 40-acre unit) under current field rules.
 - d. When the lease line is parallel to the fracture orientation, a well located 330 feet from a lease line will not strand hydrocarbons, but instead may drain hydrocarbons from under 0.69 acres of the offset lease.
 - e. When the lease line is perpendicular to the fracture orientation, a well located 330 feet from a lease line may drain hydrocarbons from under 14.79 acres from the offset lease (32 percent of a 40-acre unit).
 - f. The net drainage area gain is 15.19 acres (38 percent of a 40-acre unit) under the proposed 330-foot lease line spacing provision.
10. Reducing the lease line spacing for all take points in a horizontal well from 467 feet to 330 feet will allow for an increase in off-lease drainage by about

1.2 acres per stage, and a decrease in the on-lease drainage by the same amount.

11. The net result of the proposed spacing rules would be to extend an operator's reach onto an offset tract.
12. A 200-foot spacing provision between the first and last take points of a horizontal lateral and the nearest lease line is an appropriate measure to prevent the waste of hydrocarbons in the field.
13. Elimination of all between well spacing requirements is appropriate for the field.
14. Elimination of the requirement to file proration unit plats can ease the administrative burden on operators when drilling new horizontal wells in older vertical fields.
15. A 50-foot box rule is appropriate for the field.

CONCLUSIONS OF LAW

1. Resolution of the subject application is a matter committed to the jurisdiction of the Railroad Commission of Texas. Tex. Nat. Res. Code § 81.051
2. All notice requirements have been satisfied. 16 Tex. Admin. Code §1.45
3. Reducing the lease line spacing for first and last take points on horizontal wells from 330 feet to 200 feet will prevent waste.
4. Eliminating between well spacing requirements and the requirement to file proration plats, and adding a 50-foot box rule will promote the orderly development of the field.
5. BP America Production Company has failed to demonstrate that reducing the lease line spacing for all take points in a horizontal well from 467 feet to 330 feet is necessary to prevent waste and protect correlative rights.

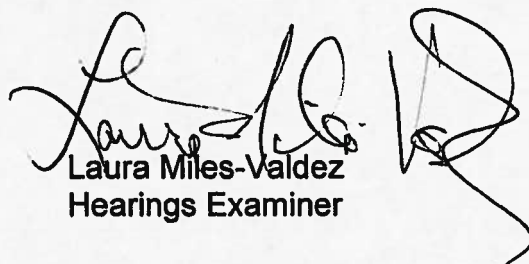
EXAMINERS' RECOMMENDATION

Based on the above findings of fact and conclusions of law, the Examiners recommend that the Commission **DENY** amending the field rules to reduce the lease line spacing distance to 330 feet (Nos. 1 and 2 listed on page 2). The Examiners recommend the Commission **GRANT** the other permanent field rule amendments as requested by BP America Production Company for the Oak Hill (Cotton Valley) Field.

Respectfully submitted,



Paul Dubois
Technical Examiner



Laura Miles-Valdez
Hearings Examiner

ATTACHMENT A

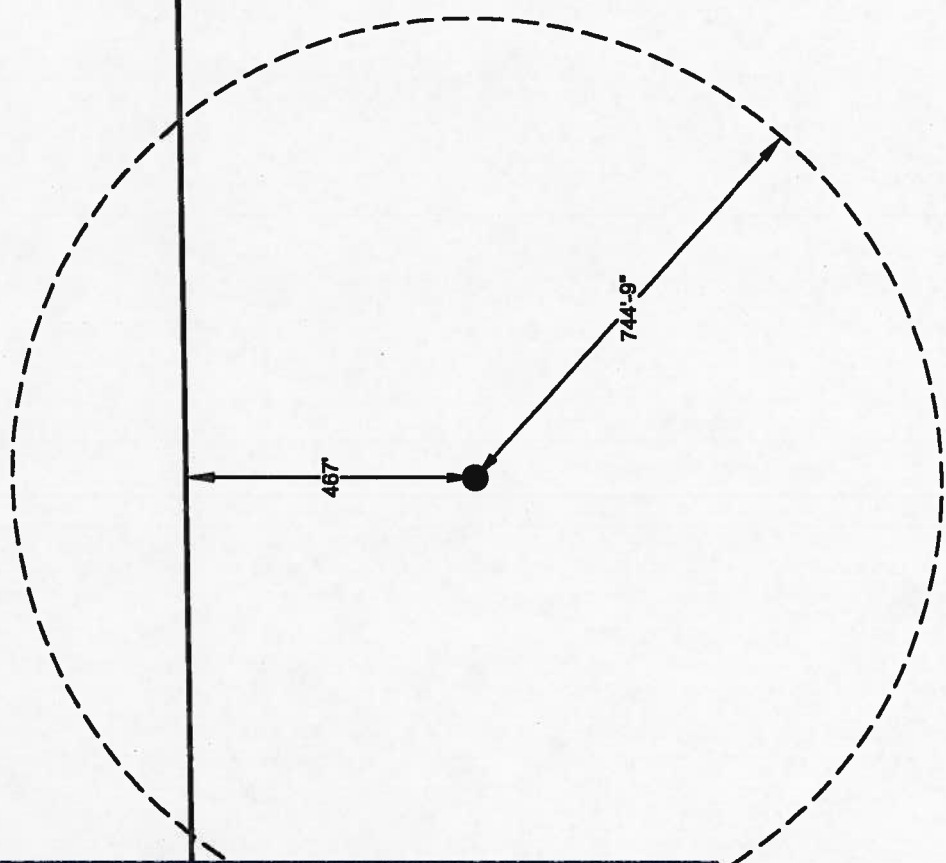
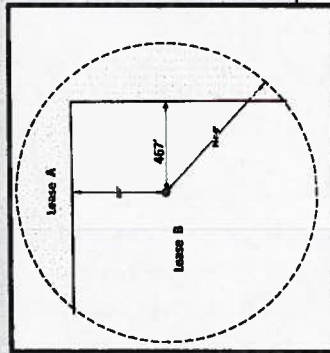
EXAMINERS' NOTES

A radial drainage area of 40 acres can be represented by a circle with a radius of 745 feet.

467 feet is the standard lease line spacing for a 40-acre unit.

For a well located 467 feet from the lease line (current field rules), 5.15 acres (13 percent) of the 40 acre drainage area will be off lease (right).

For a well located 467 feet from TWO lease lines, slightly less than 10.3 acres (26 percent) of the 40 acre drainage area will be from off lease (below).



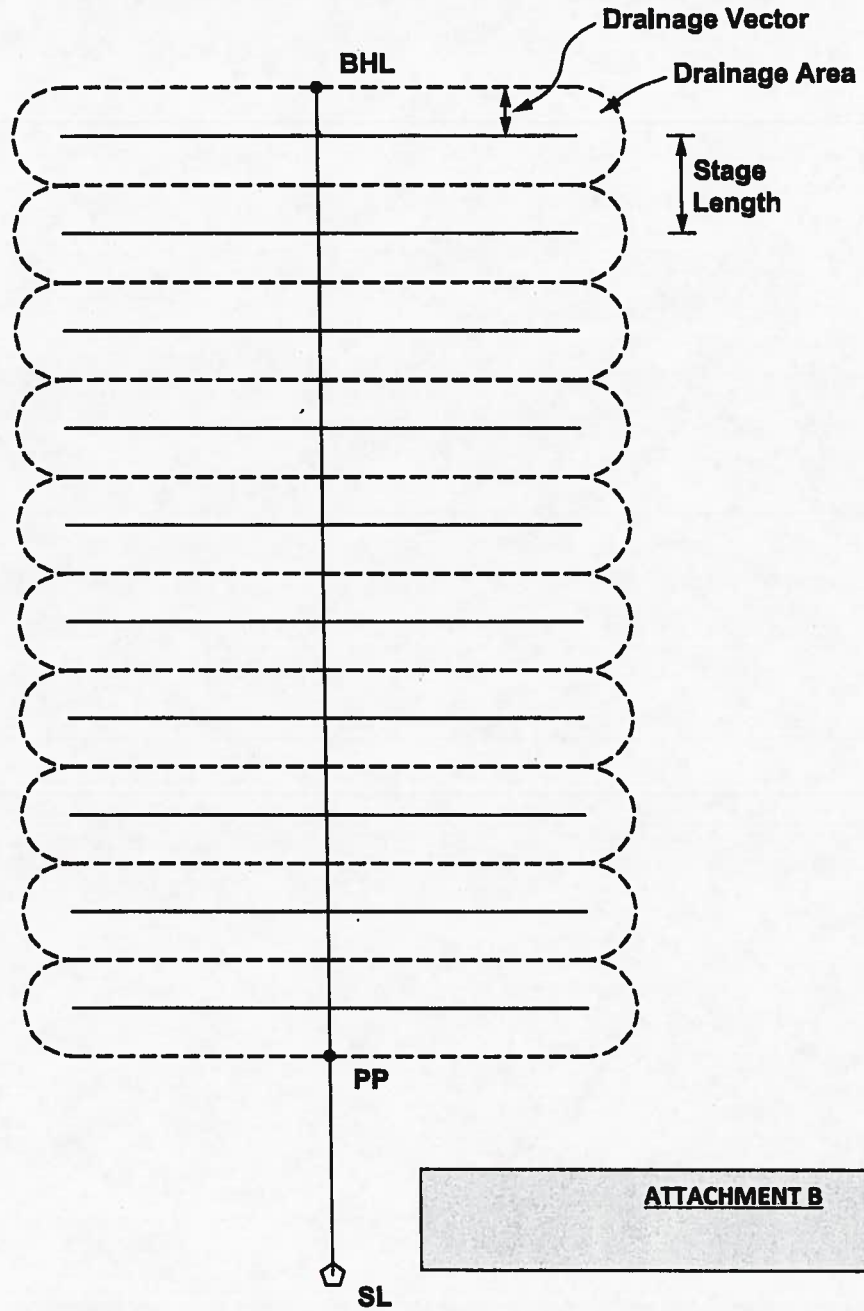
Theoretical Drainage Area
Lease A: 5.15 Acres
Lease B: 34.85 Acres

Scale: 1" = 300'

O&G Docket No. 06-0290629
October 15, 2014

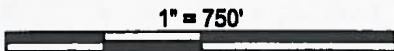
BP America Production Company
Exhibit No. 11

Typical Drainage Area Horizontal Cotton Valley Well



If Stage Length = 380'
 And Frac Half Length = 500'
 Drainage Area Per Stage = 11.30 Ac.

If Stage Length = 380'
 And Frac Half Length = 1000'
 Drainage Area Per Stage = 20.05 Ac.

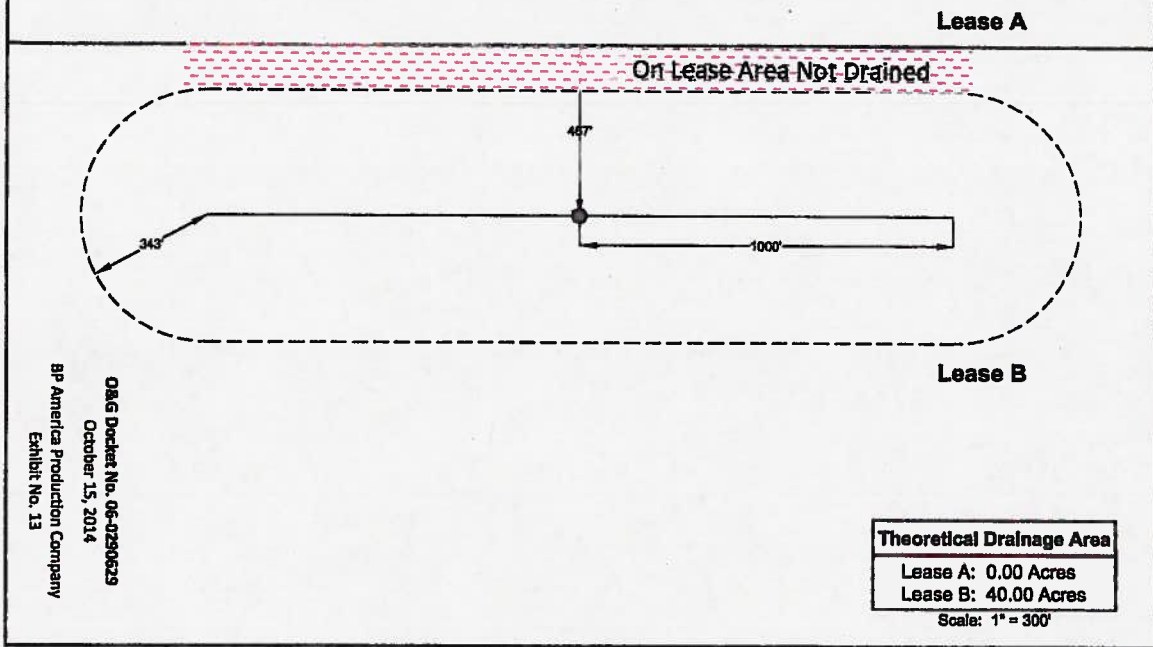


ATTACHMENT B

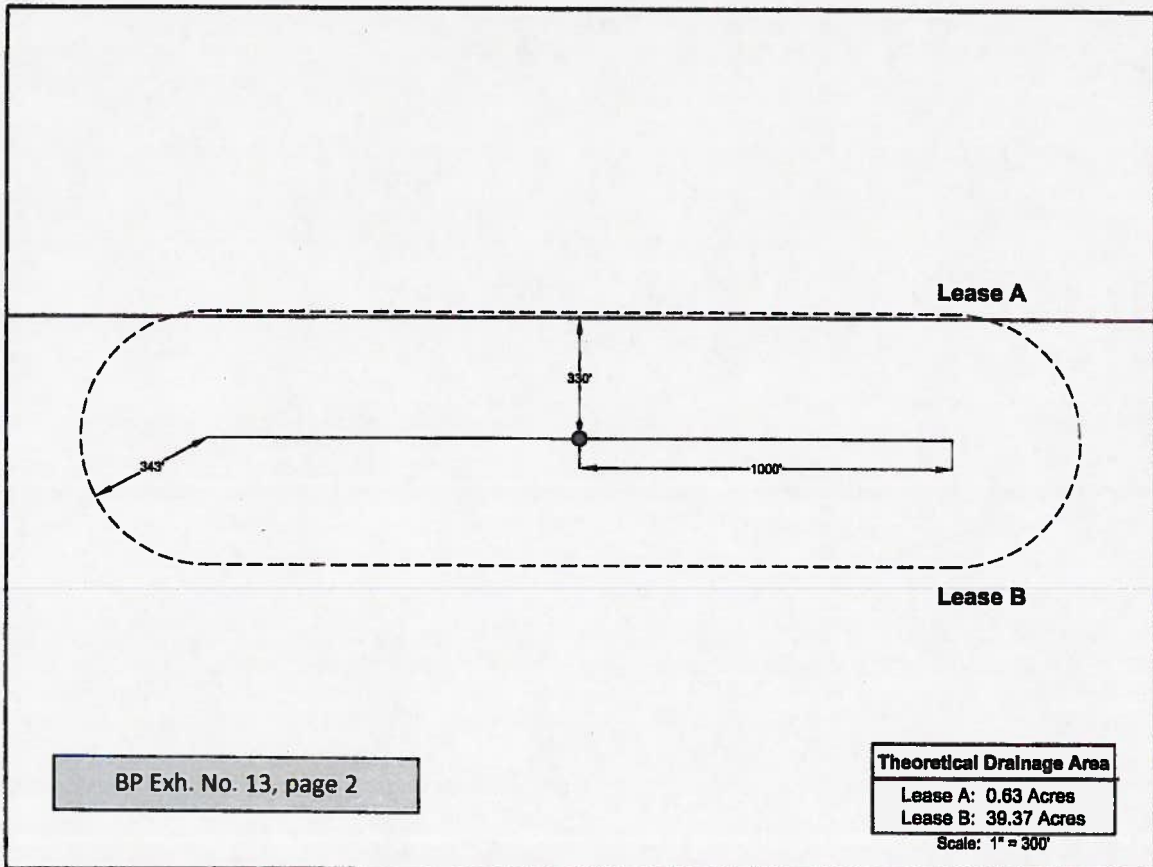
O&G Docket No. 06-0290629
 October 15, 2014
 BP America Production Company
 Exhibit No. 15

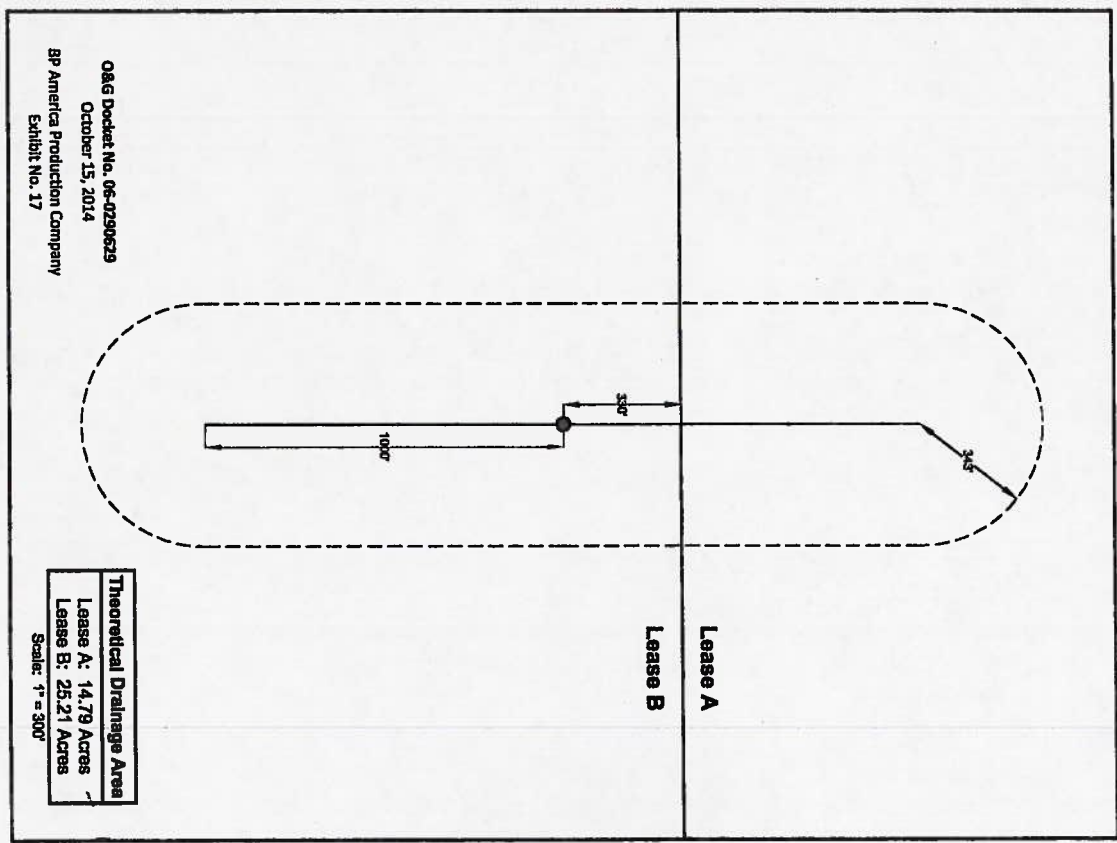
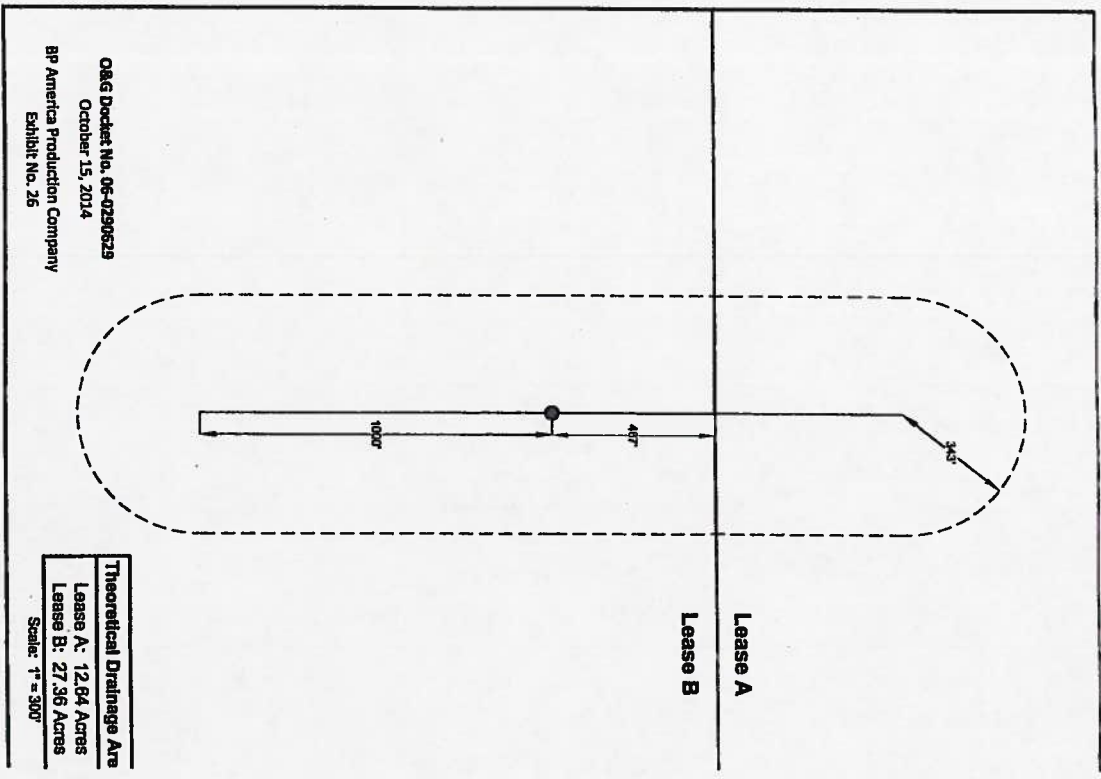
EXAMINERS' NOTES

On Lease Area Not Drained = $(2,000' \times 124') / (43,560 \text{ ft}^2/\text{acre}) = 5.69 \text{ acres}$ (14% of a 40 acre unit)



← Fracture Orientation → ATTACHMENT C





← **Fracture Orientation** →

ATTACHMENT D

Typical Drainage Area Horizontal Cotton Valley Well

ATTACHMENT E

EXAMINERS' NOTES

Current Spacing Rules for Horizontal Wells (blue):

330 feet - first and last take points to a lease line.

467 feet - all take points to a lease line when measured perpendicular to the lateral

Proposed Spacing Rules for Horizontal Wells (red):

200 feet - first and last take points to a lease line. NOTE: Examiners recommend this change be *approved*.

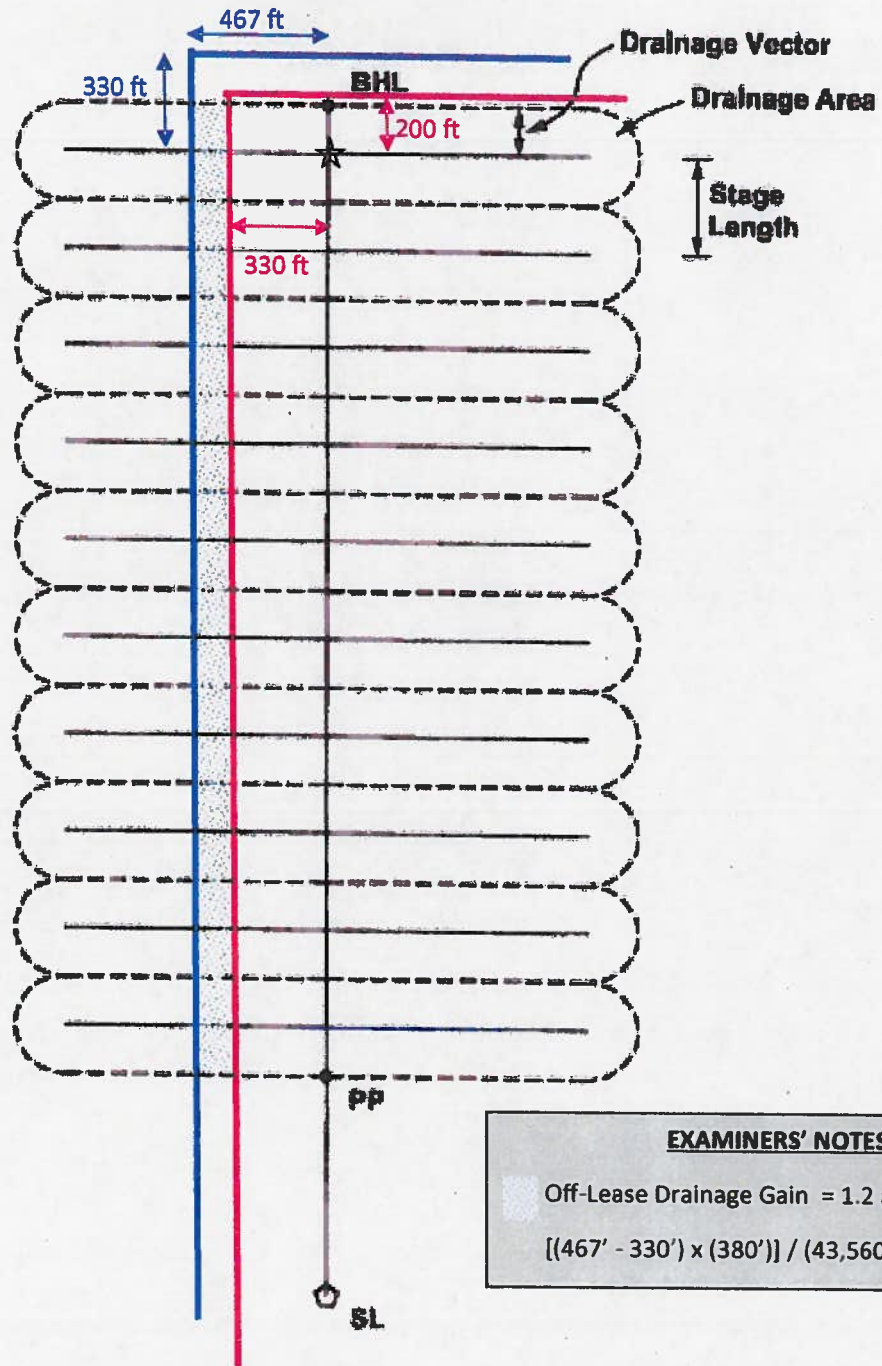
330 feet - all take points to a lease line when measured perpendicular to the lateral. NOTE: Examiners recommend this change be *denied*.

Last Take Point = ☆

Frac Stage Length = 380'

Drainage Vector = 190'

Drainage Area = 20.05 acres per Frac Stage



EXAMINERS' NOTES

Off-Lease Drainage Gain = 1.2 acres / stage

$[(467' - 330') \times (380')] / (43,560 \text{ sq ft/acre})$

**If Stage Length = 380'
And Frac Half Length = 500'**

Drainage Area Per Stage = 11.30 Ac.

**If Stage Length = 380'
And Frac Half Length = 1000'**

Drainage Area Per Stage = 20.05 Ac.

1" = 750'

SUMMARY OF EXISTING FIELD RULES
Selected Cotton Valley Fields

Field	Spacing (ft.)		Density (Ac.)		Take Point	Off-Lease Penetration	No Perf Zone	Box Rule	Stacked Laterals	Allocation Formula	
	Lease Line	Between Well	Base	Optional							
★ Beckville (Cotton Valley)	330	---	0	640	20	Y	Y	Y	Y	Y	25% wells 75% deliverability
Bethany (Cotton Valley)	330	---	0	640	80	Y	Y	Y	Y	Y	95% acreage 5% deliverability
Bethany, East (Cotton Valley)	330	---	0	640	40	Y	Y	Y	Y	Y	5% wells 95% deliverability
★ Blocker (Cotton Valley)	467	---	933	640	40	Y	N	N	N	N	95% acreage 5% deliverability
★ Carthage (Cotton Valley)	330	---	0	320	20	Y	Y	Y	Y	Y	100% acreage
★ Carthage, North (Cotton Valley)	330	---	0	40	20	Y	Y	Y	Y	N	5% wells 95% deliverability
★ Oak Hill (Cotton Valley)	467	330	467	160	40	Y	Y	Y	N	N	95% acreage 5% deliverability
Waskom (Cotton Valley)	330	---	0	640	40	Y	Y	Y	Y	Y	10% deliverability 90% acreage
★ Willow Springs (Cotton Valley)	467	---	600	160	40	Y	Y	N	N	N	100% acreage
★ Woodlawn (Cotton Valley)	330	---	0	640	20	Y	Y	Y	Y	Y	95% deliverability 5% wells

330'/200' dual lease line spacing pending in Docket # 06-0289580

330'/200' dual lease line spacing and other amendments pending in Docket 06-0290630

amendment proposed in Docket 06-0291054

amendments proposed in Docket 06-0290629

ATTACHMENT F

EXAMINERS' NOTES

The standard lease line spacing for a 40-acre unit is 467 feet.
The standard lease line spacing for a 20-acre unit is 330 feet.

★ Fields listed in the exhibit with spacing and density provisions in agreement with standard norms.

Spacing and density provisions for 7 of the 10 Fields listed are currently in agreement with standard norms, including the subject Oak Hill (Cotton Valley) Field.

O&G Docket No. 06-0290629
October 15, 2014

BP America Production Company
Exhibit No. 10

ATTACHMENT G

EXAMINERS' NOTES

Current Field Rules: 467-foot lease line spacing and 40-acre unit drained

On Lease Area Drained = $[(1467' \times 343' \times 2) + \frac{1}{2} \pi (343')^2] / (43,560 \text{ ft}^2/\text{acre}) =$

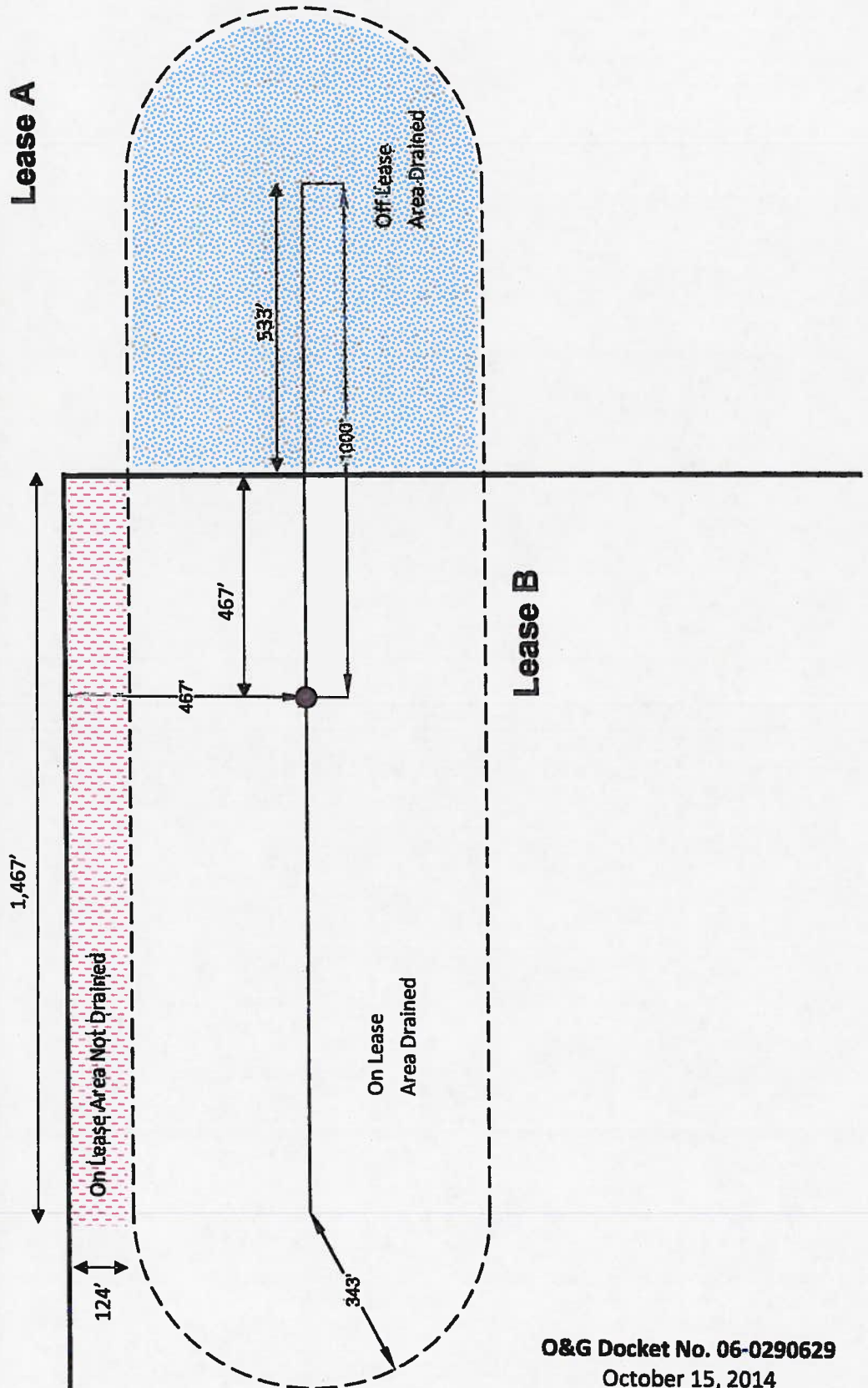
Off Lease Area Drained = $[(533' \times 343' \times 2) + \frac{1}{2} \pi (343')^2] / (43,560 \text{ ft}^2/\text{acre}) =$

On Lease Area Not Drained = $(1467' \times 124') / (43,560 \text{ ft}^2/\text{acre}) =$

27.35 acres (68% of a 40 acre unit)

12.64 acres (32% of a 40 acre unit)

4.18 acres (10% of a 40 acre unit)



O&G Docket No. 06-0290629
October 15, 2014

BP America Production Company
Exhibit No. 13 Page 1

ATTACHMENT H

EXAMINERS' NOTES

Proposed Field Rules: 330-foot lease line spacing and 40-acre unit drained

On Lease Area Drained = $[1330' \times (343' + 330') + \frac{1}{2} \pi (343')^2] / (43,560 \text{ ft}^2/\text{acre}) =$ 24.79 acres (62% of a 40 acre unit)

Off Lease Area Drained = $[(1330' \times 13') + 670' \times (343' \times 2) + \frac{1}{2} \pi (343')^2] / (43,560 \text{ ft}^2/\text{acre}) =$ 15.19 acres (38% of a 40 acre unit)

On Lease Area Not Drained = 0 acres

